The Tipping Point: **Vulnerability and Adaptive Capacity**

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Conference Chair's Welcome to ISDRS 2015

Dear ISDRC delegates,

It is our great pleasure to welcome you to the 21st International Conference of the International Sustainable Development Society at Deakin University, Geelong. It is only the second time in ISDRS's history that this conference has returned to the southern hemisphere, and the very first time to make it as far as Australia! We warmly hope that your participation at the conference and stay in Geelong and Melbourne will prove to be a very productive and enjoyable time!

This conference marks the start of a new decade of continued interrogations in sustainable development. Our theme this year addresses The Tipping Point: Vulnerability and Adaptive Capacity, reframing the 'tip' as a point of hope and positive transformation, wherein sustainability, sustainable behaviour and choices become the norm, rather than the exception. In this trans-disciplinary conferences, we bring together a constellation of worldviews and engagements to critique the tip through wide-ranging contexts and lens, including but not limited to urbanism, corporate investments, governance and advocacy, deep ecology, cultural heritage, agriculture and land management, social sustainability, climate vulnerabilities, and architecture and design.

Deakin University is proud to host this conference, and the Geelong Waterfront Campus, located on the foreshore of Corio Bay in the central business district of Geelong is one of the most attractive destinations to debate the finer points of the 21ISDRC. We hope you will have the opportunity to discover the stunning natural attractions around Geelong and Melbourne, and wish you all a very exciting stay in this beautiful region!

With warm regards,

Dr. Yamini Narayanan, Conference Chair, 21ISDRS
Alfred Deakin Research Institute,
Faculty of Arts & Education
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Systemic structural constellations as a paradigm change or tipping point for sustainability

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ABSTRACT

The last decades have made true that human and social science are limited in prediction, planning and pinpoint governance. This becomes very obvious in the light of sustainability. Humans have gained so much knowledge about the world and cause-effect relations, but are not able to transfer it into practice and action commonly. Thus, new methodologies and tools should be integrated in human and social science in order to foster sustainability. Today's business management acts more and more in multi-causal and inter- and transdisciplinary contexts that require new and innovative methods. The integration of systemic structural constellations in research and teaching allows complex relationships, multi-level challenges and sustainability transdisciplinary teaching and learning and to make the importance of sustainability for businesses tangible and visible. Thus, it provides essential knowledge for business contexts. In systemic structural constellations, systems can be simulated by spatial arrangements of persons or symbols. The success of the method is assign to action research and can be described by the systematic spatial locations and perception of decision-makers. System constellations permit both, a deep look into the informal structures and relationships of institutions and social structures as well as the testing of interventions or different solution options with regard to their effects. In complex contexts, such as sustainability and resilience, learning progress can be achieved on the knowledge level as well as the level of action. So, transdisciplinary research processes can be rapid problem identification and problem structuring to allow direct problem solving in cooperation between science and practice and enable the direct transdisciplinary integration.

1   INTRODUCTION

The last decades have made true that human and social science are limited in prediction, planning and pinpoint governance. This becomes very obvious in the light of sustainability. Humans have gained so much knowledge about the world and cause-effect relations, but are not able to transfer it into practice and action commonly. Thus, new methodologies and tools should be integrated in human and social science in order to foster sustainability. Today's business management acts more and more in multi-causal and inter- and trans-disciplinary contexts that require new and innovative methods. The integration of systemic structural constellations in research and teaching allows complex relationships, multi-level challenges and sustainability transdisciplinary teaching and learning and to make the importance of sustainability for businesses tangible and visible. Thus, it provides essential knowledge for business contexts.

In systemic structural constellations, systems can be simulated by spatial arrangements of persons or symbols. The success of the method is assign to action research [1], and can be described by the systematic spatial locations and perception of decision-makers [2, 3]. System constellations permit both, a deep look into the informal structures and relationships of institutions and social structures as well as the testing of interventions or different solution options with regard to their effects [4]. The paper will give an insight into the transdisciplinary potency of the method and identify key findings and configuration options for use in transdisciplinary teaching and research.

2   OBJECTIVES/METHODOLOGY/SCOPE

According to Wade [5: 194] structural constellations "provide powerful and creative ways to clarifying and resolving complex, possibly intractable issues associated with organisations", systems or social actors. Using systemic constellation the pattern of relationships, structures, interaction, implicit knowledge and hidden or underlying dynamics and influences within a system can made obvious by a way of representing. It is also a way of focussing mass of information and data, details and opinions and pointing aspects within a new dimension. Wade [5: 194] is also highlighting that "apart from bringing clarity, constellations give opportunities to experiment with possible options in a safe environment to aid decision-making." Constellations work has mixed roots [6], like in family systems therapy, e.g. psychodrama and group interaction [7-11], solution focused concepts [12, 13], existential-phenomenology approaches [14, 15]. Today there is a wide application of this method in different contexts like psychology, medicine, pedagogy, business management, etc. However, there are some aspects in common while working with structural constellations. Structural constellations also base on systems theory highlighting the idea that systems are mainly self-regulating entities always seeking for balance and able to change or transform. Certain elements have a key role for balancing a system, so these items are system-relevant.

A key challenge for scientific approaches and models is the search for those system-relevant elements, like the ethos of an industry, supporting principles, pattern, deep structures or resilience of a sector. Nevertheless, conventional scientific approaches and practices appear to be limited as they often not really and comprehensively explain reality, ongoing behaviour, strategic decisions or resilience of a system. Resilience does not only include (a) the extent of change or transformation while preserving the system structure and performance, but also (b) the extent of the self-organization of a system without regulating intervention (internal or external) and especially (c) the extent to learning and adaptability, willingness to experiment and implement new solutions [16]. Flexible learning processes are essential for survival and vital for systems when facing new challenges. However, resilience is not necessarily a desirable state, because even system configurations can be highly resilient, which are harmful to the common good (e.g. path dependence) [17].

As there is a wide variety of structural constellations in practice, the method is not arbitrary, but has a certain frame. In general there are three different roles in structural constellations: a facilitator or process manager or constellator, an issue-holder and a group of people willing to participate as representatives in a constellation. In science it is also possible to work with students as representatives in teaching contexts. Systemic structural constellations are able to highlight research questions and test assumptions in order to understand a problem more deeply. Moreover, interventions can be tested or new research propositions or hypothesises can be developed. The constellator and the issue-holder have a short conservation clarifying what the exact issues is, what kind of goal should be reached and what key elements should be involved in the constellation process. The next step is the selection of the people who should represent the core elements of the specific system. It is normally done by the issue-holder. Therefore, following the own intuition the issue-holder asks single persons representing a particular element of the system. All people can reject the request, so that the issue-holder has to ask other persons being part of the group. Finally, all representatives are selected and agreed to join the constellation. By the way, every person has the possibility to ask to leave the constellation and can be replaced by another person. Then the issue-holder places all representatives in the room. That special grouping is called structural constellation as a spatial view is given showing arrangements, distances, and directions and underlying dynamics of the situation are more visible. In case of personal concerns the issue-holder is also represented by another person (mostly in the first time bevor stepping into the constellation herself/himself).

Once placed, the representatives provide important data on the system [18]. The constellator either asks to follow their moving impulses or takes some time before asking the representatives. Essential

for the process is to describe the body perception, emotions or emerging images, sayings or sentences without any interpretation and evaluation. The use of nonviolent communication should be a goal. The representative should say everything that makes a difference and occurs on the places they stand - even if it does not make sense to them. Body signals should be recognised attentively by the constellator (e.g. looking down at the ground, in the air, etc.) as they might have potential information for the ongoing process. After having a first image of the system the ongoing processes and intervention differ from school to school and constellator to constellator. The representations can move according their own impulses, they can talk with each other during this search process, the constellator can guide the process by suggesting changes in position or recommending to say particular words and sentences. During the process some representatives can be removed or added or those representations that were just selected but not constellated can be integrated within the process either by asking or by assigning a place. You can work with open elements or hide the meaning or representation of elements. In hidden representations the constellator should at least pass a sheet of paper on which al meanings of representations are given to the audience. Otherwise it palls during the constellation process.

How representation works exactly is still under research and not understood yet. However, Gehlert [19: 1] stresses that "Greenberg, Horne and Zeillinger (GHZ) published papers in which they demonstrated entanglement and quantum information transfer in multi-particle systems". He concludes further [19: 5]: "GHZ experiments represent arbitrarily multipartite quantum fields. If the assumption is now made, that living organisms represent macroscopic quantum fields, due to their metastable, electromagnetic structure of their basis elements (atoms, molecules, synapses) and that they interact with each other, then the way systemic constellations work could be analogously put into relation. All currently observed phenomena, in the context of systemic constellations, could be comprehensible be explained and this, on the basis of natural sciences." That means multi-particle systems are also quantum fields and information are spread and available immediately. The author argues also that just the observer interprets all information himself/herself and all interpretation are context related.

It is important to state that there are differences between family and organisational systems. The key dynamics of family systems cannot be easily transferred to organisational or business systems. There are differences in underlying dynamics as well as mediating or moderating elements. According to König [20] the following aspects have to be considered in particular when working in business context as well as in management research and teaching:

1. *Belonging or affiliation and exclusion criteria.*
   Organizational affiliation is acquired temporary and may be terminated by either side. People are basically exchangeable, just this causes the transpersonal continuity of organisations.
2. *Seniority within the system and compared to other systems.*
   In family systems there are vertical and horizontal structures, hierarchical and temporal logics. Horizontal orders cannot be changed in family systems whereas vertical structures can be changed by starting a family. In companies vertical structures and positioning regarding seniority are temporarily and just focussed on the professional role of a person; positions are assigned not given naturally.
3. *Hierarchy of positions and roles in an organisation.*
   Hierarchies are influenced by different aspects in organisation. Leadership, responsibilities, duties, competency, experience and time of membership within an organisation are of high importance in management contexts. Ambiguities always cost energy. Hidden hierarchies should be avoided. In addition, there is further micro-, meso- and macro-level effects influencing the organisational reality.
4. *Modalities of giving and taking and related power relations, relationships and obligations.*

Altruism and love is the main system logic of families. The central logics in organisational contexts are profits and wages (money). The balance of giving and taking is more related to family, whereas the main compensation in organisation is based on bartering. This kind of exchange or justice can be done over several generations in family systems – an idea anchored within the externalities of economic activities as well.

5. *Commitment and performance and their recognition – the more engagement, the more having to say.*
   Organisations have to face change permanently, thus, they should honour special engagement of their members. Therefore it is of high importance to assign performance where it generated. Otherwise, long-time performance of members has to be honoured as well. Yet, the priority of higher performance and capabilities has to be considered.

6. *Functionality internally and externally. The latter is awarded a more dominant position.*
   In business contexts it would make more sense, not to give certain notions of orders in constellations but use the constellation work to raise and to proof the understanding and functionality of leadership etc. on the basis of the organisational members and the given information. König [20] highlights that the difference between inside and outside is just one relevant distinction among others. He stresses further to develop further distinctions for making the situation and consequences visibly and noticeably (in order to find solutions; enhancing the space of options).

7. *Transience. If an organisational system loses its task, there must also be the possibility of resolving it.*
   There is a big categorical difference concerning time in family and organisation. The temporal order of the family is thus directly coupled with our lifetime, whereas organisations do not have this limitation. The two types of systems have different time horizons.

In general, it is crucial to distinguish different levels in organizational contexts having an influence on the current situation or problem as well as the solution. As in business contexts people are part of the main transaction and exchange processes there is always a personal level effective. Yet, beside the personal issues there is an organisational level that constellators should have always in mind as well as the more complex system level (compared to family systems) because there are much more moderating factors and interrelations:

A) People level
   - How is the situation influenced by personal patterns of the employees having their origin in the history of life experiences or dynamics in the families? Are these patterns possibly re-enacted within the organization, or how do these pattern influence organizational events?
   - Do relationship conflicts or problematic patterns of communication among employees or between departments have an influence?
   - …

B) Organisational level
   - Does the organization have functional structures? Or may occurring relationship difficulties express fundamental problems of the system?
   - Do all people have their appropriate place?
   - Are leadership and management responsibilities practiced adequately?
   - What is the role of management systems?
   - How is innovation managed and integrated within the organization?
   - How about culture?
   - …

C) Systems level

- Have there been any changes in the environment (e.g. market, competitors, customers, and stakeholder) the organization has to adopt or deal with? Are there any changes expected?
- How about history or the founders of a company?
- How are cultural differences managed and integrated (within multinational companies)?
- Are the existing management systems functional and appropriate for the whole value chain?
- How is change managed, is transformation dealt?
- …

Illustrating a specific example from the water industry, a systemic structural constellation should clarify how network engagement can be fostered in a special area and how the companies or the network should be addressed or focussed on. So, it was a real world problem or challenge. The constellation was made with a company representative working in a management position. Representatives were experienced students and associates from the University of Bremen. The constellation was made in late September 2014 as one in a constellation series.

3   RESULTS

The method appears as a very powerful tool in explaining and transferring of multi causalities in systems and offers itself as a complement to traditional methods. Findings, implementation options, conclusions, etc. resulting from work with systemic constellations are often not attainable by a pure study of documents, interviews or an empirical survey, at least not in a comparable speed.

Systemic constellations can be used by people, organisations, science, etc. to focus on diverse issues highlighting solutions, reflexions or options, like communication, team motivation, restructuring, decision making, strategic issues, ethical questions, and sustainability conflicts or dilemmas. Representations can be used for revealing new perspectives on all issues addressed as business, politics, religion, cultures, war and crimes, philosophy, etc. Systemic constellations are an effective way to teach complex relationships, multi-level challenges and to learn how tacit knowledge can be made tangible and visible. There are several advantages for teaching and researching.

Use in teaching	Use in research
Arrangement of systemic competence	Search for structures and patterns
Visualization of contents	Relationship Analysis
Spatial language as a quick orientation	Illustration of stress fields
Action Learning	Knowledge of the deep structures of systems
Connecting science and practice	Changing patterns of knowledge
Motivate learning contents by diverse senses	Forming hypotheses or research propositions
Supervision	Testing and simulation of interventions

Highlighting the power of the method an example from the water industry is represented: The main goal was to establish a water network to bundle power for fostering sustainability issues. Therefore, a new network should be grounded, however, it was not clear, who should be part of it, how to start with and what the exact message should be. The origin idea was to foster sustainability or water in a sustainable context. The final message was that sustainability is far too open and it would weaken the pure water idea of clear water.

The constellation process was organised like this: the issue-holder selected representations and placed them into the room. All representatives had the possibility to speak about their emotions and movements. Water was a free element moving as it felt. All other representatives were asked to move or to signal the wish to move or to change position. After a structured beginning, the elements were allowed to talk with each other to strengthen the dynamics. Every discussion and movement showed

that there is a shared mission missing, so that it would not be a good idea to found a new network promoting a good idea with selected partners in the beginning. Within the process it was also work the fear of change showing that the companies have to initiate firm internal change processes as well. The representatives signalled that there have to be a clear positive change for the particular companies.

Small companies: "It is not our idea, but we find the new impulse and idea great."

Big company (nearby): "It is not my idea, but I see that there has to be done something. Somebody has to transport the idea; that is not my job."

Sustainability: "I had so much fear when all the possible changes like fracking etc. were addressed. I have to protect the water and must do something."

During the process it became clear that all companies have a different idea of the network initiative and its goals. So, the best way to start with the network was not the establishment of the network with selected partners based on a given idea, but starting a communication process concerning the role of water for the companies and the embedment of this pure resource in the context of a sustainable development. In this example, the application of the systemic structure constellation and the cooperative reflection process have prevented the spread of a Trojan horse as well as pointed out further insights into the resilience and the ethos of the water industry.
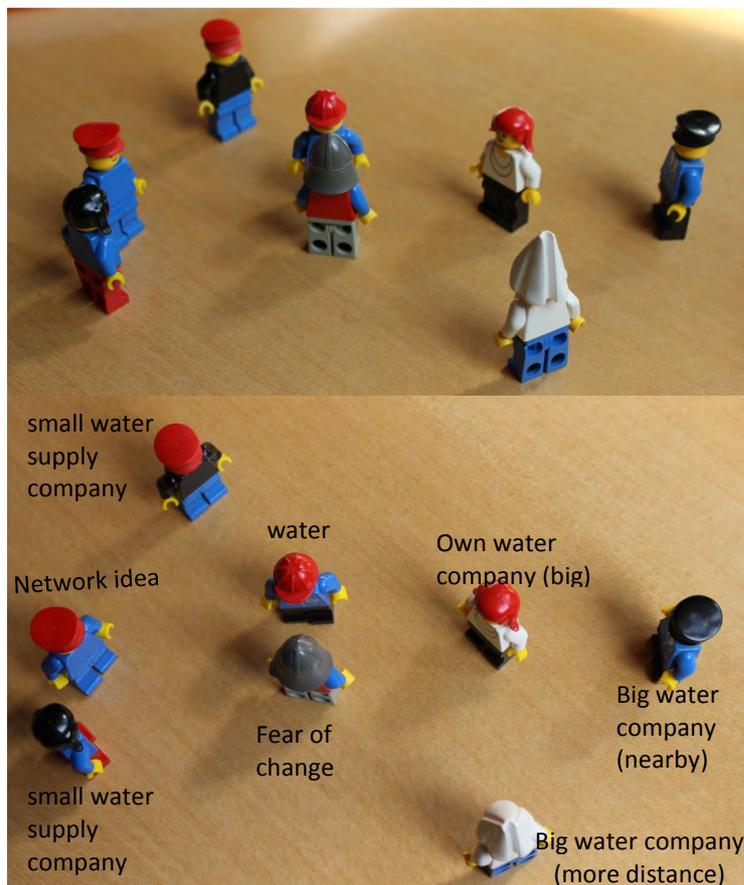
Figure 1: Initial image

The final image shows that there is still a different orientation of the big water companies, so they have to clarify particular aspects with each other. Sustainability is more focussed on the small water companies and the network idea meaning that the original idea and small companies should clarify their understanding of sustainability and develop a clear vision. The fear of change is still among big water companies, so they have to change on an organisational level as well. The ethos of the water

industry is closely connected with pure and natural water as one of the most crucial resources. In addition, companies have a strict cost orientation, want to keep given structures and infrastructures and do not want to overload their companies with diluted sustainability issues.
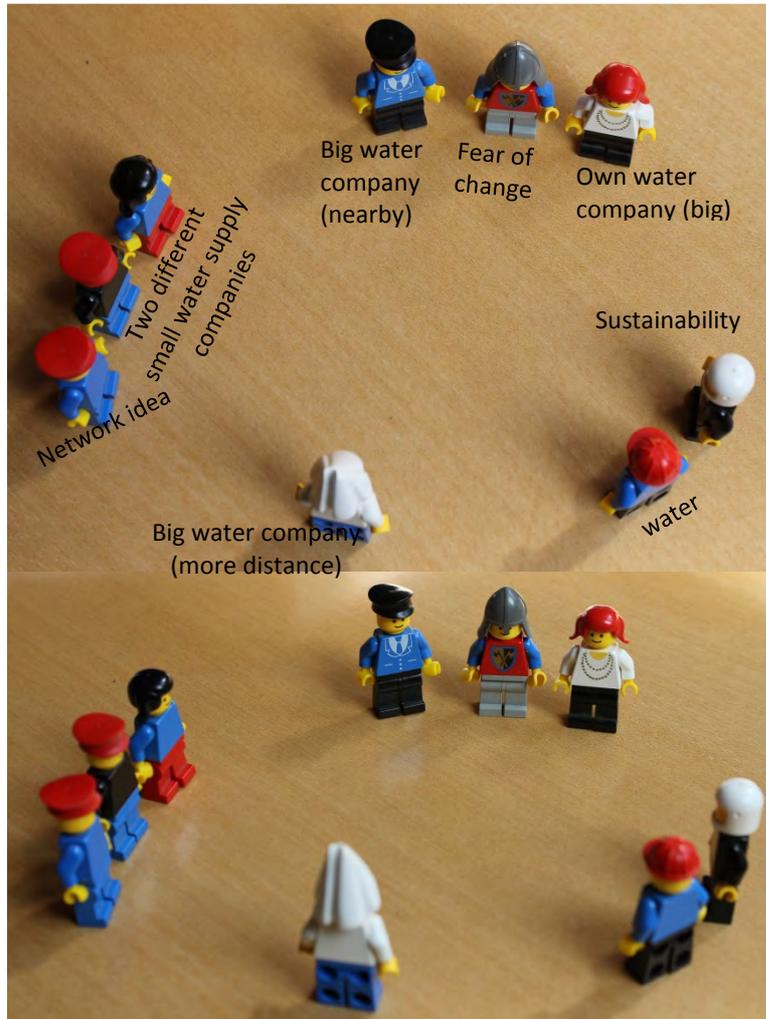
Figure 1: Final image

In addition, we were testing three different orientations of the idea: (1) pure water, (2) technical progress, and (3) social development. The first impulse of the idea was to go closely to the option 1 (pure water). Further working on systems level using a matrix of transformation and disorganisation as one centre and growth and embedding as the second centre showed that the water industry is well established and focussed on growth and transformation. Yet, the deep structure of the industry is not really transparent or conscious.

All in all, in complex contexts, such as sustainability and resilience, learning progress can be achieved on the knowledge level as well as the level of action. So, transdisciplinary research processes can be rapid problem identification and problem structuring to allow direct problem solving in cooperation between science and practice and enable the direct transdisciplinary integration [21].

4   DISCUSSION

Today's business studies have to teach and educate more and more multi-causal and inter- and trans-disciplinary contexts that require new and innovative methods. The integration of systemic structural constellations in research and teaching allows teaching and learning complex relationships, multi-level challenges and sustainability transdisciplinary and making the importance of sustainability for businesses tangible and visible. Thus, it provides essential knowledge for business contexts. In systemic structural constellations, systems can be simulated by spatial arrangements of persons or symbols. The success of the method is to assign the action research [1], and can be described by the systematic spatial locations and perception of decision-makers [2, 3]. System constellations permit both a deep look into the informal structures and relationships of institutions and social structures as well as the testing of interventions or different solution options with regard to their effects [4].

The method appears as a very powerful tool in explaining and educating multi causalities in systems and offers itself as a complement to traditional methods for teaching transdisciplinary system expertise in business administration. In teaching and raising awareness of complex issues, such as sustainability and resilience, learning progress can be achieved on both the knowledge level and the level of action. Transdisciplinary systemic thinking can be developed quickly into a system by the representation of an element. Findings, insights, implementation options, conclusions, etc., resulting from work with systemic constellations are often not attainable by a pure study of documents, interviews or an empirical survey, at least not in a comparable speed (a constellation takes 0.5-2 hours). Additionally, the own experience of a system image and the corresponding effects and relationships can make a difference in perception, evaluation and future action. Transdisciplinary research processes enable, thus, rapid problem identification and problem structuring, allow direct problem solving in cooperation between science and practice and permit the direct transdisciplinary integration in research contexts [21].

However, system constellations do not necessarily cause systemic and transdisciplinary action. Beside the revelation of hidden or non-visible pattern, the mesh of relations and interaction structures the subsequent discussion with company representatives and students is of particular importance for the transdisciplinary teaching and research process. The visualization of depth structures and hidden pattern allows a discussion of science and practice at eye level, as well as a mutual stimulation of theory, practice and reality.

Asking students for their feedback regarding the integration of systemic constellations in teaching, the following answers are quite representative. 'It is great that we have the chance to try alternative methods.', 'The method is a great supplement to the traditional methods of economics.', 'My other focus is controlling, so I was very sceptical; yet, there is a lot of fun and it is incredibly informative.', 'I cannot understand why the method is not spread more widely.' One student even has got a job offer in marketing / market research, precisely because he used the method of system installation in his education. Company representatives are all positively surprised by the possibilities and the substance of insight gained by the method. They experience the joint reflection enriching.

However, the enthusiasm of the students and practice partners for the method of systemic constellations cannot hide the responsible use of the method. Its use in transdisciplinary research and teaching needs a sound training in systemic structural constellations and a respectful interaction with people and their concerns. Just because the method has the potential to build a bridge between innovative teaching, research and practice for identifying and initiating new transdisciplinary options and ways for action and implementation, an ethical and respectful treatment of concerns, people and processes is mandatory. By using the method in transdisciplinary contexts the responsibility can go far beyond the university system. This might also be a reason for the big scepticism towards and awe of systemic constellations. Anyway, past experiences show that the unity of research and teaching in transdisciplinary contexts should pursue.

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CONSUMING BEYOND SURVIVAL: AN EVOLUTIONARY APPROACH TO SUSTAINABLE CONSUMPTION

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ABSTRACT

This paper aims to further extend sustainable consumption research beyond value-based models for identifying behavioural intentions as these have met with mixed results. Considering the range of internal and external factors affecting choice, it looks to examine the role of an individual's status in consumption decisions as what we consume has been identified as an important element in how we manage our social position. Within evolutionary psychology, the individual is identified as a decision maker, motivated to manage their status by navigating social hierarchies in a strategic way and where the tactics that are available and most attractive are shaped through social norms and structures. What remains unclear is a full understanding of the relationship between strategies for navigating these hierarchies, the associated tactics and how and when they are used. The following work briefly explores current practice in promoting sustainable consumption and presents a conceptual framework for examining sustainable consumption as a means of increasing status. This paper concludes that status strategies embody a pivotal role on consumption, thus a better understanding of them is essential to promoting sustainable consumption. Examining the widespread culture of consumption from this perspective enhances the understanding of the increasing desire to consume as a means to signal status among peers and identifies possible behavioural interventions.

1   INTRODUCTION

Mounting evidence strongly links human consumption to increasing global temperatures and extreme variability in precipitation [1]. Efforts to reduce environmental damage from human consumption have explored new economic paradigms, such as a transition away from a linear model of production and consumption, as well as technological advances in production. Current scholarship largely accepts that existing technology and policies will not produce the significant and timely emissions reductions necessary to reach the IPCC suggested stabilisation level of greenhouse gases, a major contributor to current climate variability [2, 3]. Despite these efforts, reducing consumption has become an integral component in climate change mitigation and adaptation policy [4, 5, 6]. Policy makers, non-profit organisations, and marketing professionals alike, wish to communicate the importance of making lifestyle changes to overcome climate change issues, but knowledge of what effectively engages the public in making long-term lifestyle changes remains unclear [6, 7]. Thus, the field of marketing faces the challenge of re-focusing its strategies on sustainable production and consumption, while ensuring continued consumer value within the marketplace [6, 7].

2   OBJECTIVES

While existing research in sustainable marketing research has explored broad research streams, ranging from communications, organisational strategies, policies and institutional reframing, many approaches to changing consumption have centred on value-based models [7, 8, 9, 10, 11, 12]. These models place a strong focus on attitudes and beliefs as means of predicting and encouraging pro-environmental behaviour, however increasing discourse on these models reveal mixed levels of confidence on their effectiveness in promoting sustainable consumption [13, 14]. This paper aims to extend sustainable consumption research beyond value-based models, such as the *Theory of Planned Behaviour* [15], value-beliefs-norms theory [9], or the values and frames model [11] for identifying behavioural intentions as these have met with mixed results; as illustrated by the continued rise in global greenhouse gas emissions and limited change in public policy [12]. Hargreaves [12] further indicates in a review of current value-based models, that despite the growing complexity of these models, their use has resulted in very little change in behaviours. For instance, a survey in the US, discussed by Griskevicius et al [25] indicates that while a majority of respondents have a strong willingness to engage in environmentally friendly behaviours, less than 10% actually do so. Considering the range of internal and external factors affecting choice, for instance attitudes, values and social norms, this conceptual piece aims to further explore the role of an individual's status in consumption decisions. This paper will first examine value-based models within sustainable marketing. Next it will present evolutionary psychology as a unified conceptual framework for exploring consumption as a status-driven behaviour. Within this framework, rooted in critical realism, the paper will then explain the relationship between status and sustainable consumption, where Dominance and Prestige status enhancing strategies may be used to influence consumption.

3   SUSTAINABLE MARKETING

When applying sustainable marketing to general consumption, governments and non-governmental organisations alike face a more difficult challenge. Within marketing the consumption of goods is theorised to go beyond fulfilling basic needs of survival, it is viewed as a symbolic representation of the self, culture and ultimately status [17, 18, 19]. Thus, pursuing a reduction in consumption, ignoring the issue of economic growth and stability, can present a much more difficult challenge to the individual. Promoting a decrease in consumption no longer becomes solely an issue of comfort and quality of life, but of a perceived loss in identity, cultural meaning and status [18, 20, 21]. Putting theory into practice, sustainable marketing turned its focus on understanding intrinsic motivations for engaging in socially responsible behaviours such as pro-environmental behaviour [10]. Thus emerged within the literature studies on attitudes, beliefs in values and their influence on consumer behaviour. Several models have emerged, such as value-beliefs-norms theory [9] and the values and frames model [11]. Beyond these, one that has been well-favoured within sustainable marketing is the Theory of Planned Behaviour, developed by Ajzen [15]. The next section will now discuss the model as well as its central flaws as a model for encouraging sustainable consumption.

4   THEORY OF PLANNED BEHAVIOUR

The Theory of Planned behaviour (TPB) [15] was developed in an effort to explain behavioural intentions and draws upon attitudes and normative influences. The Theory of Planned Behaviour is widely applied within research focused on ethical or sustainable consumption in an effort to explain, understand and predict consumer decisions [8, 13, 22]. For instance, research applying the TPB has been shown to effectively predict the adoption of water saving technologies and recycling behaviours, as well as behaviours related to

diet and exercise [22].   The model explores the influence of attitudes and subjective norms on behaviour, using a simple linear model which includes consideration of attitudes towards the behaviour, subjective norms and perceived behavioural control as key influences on behavioural intentions. Extant literature on the TPB implies attitudes have a greater influence on the degree to which the behaviour is carried out, compared to subjective norms [23]. Despite the impact of attitudes on behaviour, Carrington et al [8] show that stated intentions rarely translate into behaviour. Discrepancies among the results of empirical studies using TPB have prompted misconceptions of the predictive power of the model, and full understanding of behaviour, thus legitimising further exploration of individual differences in behavioural research. Among some of the items suggested to for further investigation include perceived resources, opportunities to engage in behaviour and ability to overcome obstacles will lead to an increase in an individual's perceived behavioural control (PBC) and possibly the predictive power of the TPB model [13].

Armitage and Connor [13] critique previous analyses on TBP studies and suggest the evidence of its effectiveness is inaccurate based largely on errors in sampling and scope. For instance, Ajzen's [cited in 13] meta-analysis exhibited average multiple correlations between attitude, subjective norms and PBC with intentions to be R = 0.71 for 19 correlations. However as Armitage and Connor [13] point out, the analyses used limited data sets, including unpublished studies and only considered the direct antecedents behaviour and intentions. Beyond the issue of limited sample size, studies involving TPB often rely on self-reported responses on attitudes and subjective norms, which are known to be unreliable as individuals provide answers which they perceive to make them appear more pro-social [8, 13]. Beck and Ajzen [cited in 13] attempted to correct for self-presentation biases by including a social-desirability scale in their studies, however Armitage and Connor [13] found this to have very little effect on observed behaviour.

Further analysis from Armitage and Connor [13] demonstrate that self-efficacy is a greater predictor of behaviour compared to Perceived Behavioural Control (PBC). Ajzen [15] argues they are the same, however others, including Bandura [24] and Armitage and Connor [13], argue that self-efficacy is concerned more with cognitive perceptions of control based on internal factors, as opposed to changing attitudes and norms. Meanwhile, PBC is thought to be more concerned with external factors. Self-efficacy has been shown to play an important role in the decision to undertake behaviours [24], especially when individuals perceive themselves to be capable of dealing with the risks associated with a new behaviour. In the instance of adopting pro-environmental behaviours, self-efficacy would be an important factor to consider, one that many models such, as TPB does not fully address.

In response to the limitations of the TPB, Hards [14] argues for a transition away from value-based models, such as the TPB, value-beliefs-norms and values and from, which do not account for how these factors change over time, thus making it difficult to encourage long-term behaviour change. Hards [14] further criticises existing models that place the individual as either a decision maker or privy solely to social structures, yet that is not the position taken by these authors. In the instance of applying evolutionary psychology theory to behaviour change, as presented in this conceptual piece, the individual is a decision maker, where he or she makes decisions and develops strategies to fulfil certain adaptive functions, which are perceived to be non-conscious. Incorporating the notion from social practice theory that personal values and beliefs are often shaped through social structures, supports the argument that within the conceptual framework used here, the individual is a decision maker, motivated to navigate social hierarchies in a strategic way, where the tactics available and most attractive are shaped through social norms and structures.

Despite being designed as an open model, the TPB, and derivations of it, is criticised for not considering other factors that influence decision-making such as self-efficacy, perceived resources, and perceived

socioeconomic status. Users of the TPB have noted a gap between stated intentions and observed behaviours, termed the intention-behaviour gap and has proven to be a significant barrier to marketing sustainable consumption. The intention-behaviour gap refers to the discrepancy of stated intentions, especially in regards to ethical or sustainable behaviour, and actual behaviour [8]. Given that stated intentions do not correspond to actual behaviour, especially purchasing behaviour suggests that consumers are not truly as ethical as researchers perceive them to be. Carrington et al [8] suggest misconceptions regarding the the intention-behaviour gap are due to overstated intentions and inadequacy of existing models in capturing consumer decisions. Existing models fail to fully epitomise all the factors (internal as well as external) that influence behavioural decisions. Theory development in this area is still growing and largely relies on cognitive approaches, however as with previous models, these fail to include both internal and external factors that influence decision making. Thus, in addressing sustainable consumption concepts should not only move away from traditional marketing techniques and value-based models, but also consider internal and external factors that impact behavioural decisions.

One perspective that enables the development of a more holistic model of behaviour change is Evolutionary Psychology. Using evolutionary psychology as a conceptual framework has the potential for a greater designation of the internal and external factors involved in the decision making process. The key principles of Evolutionary Psychology are described in the following section, which considers both the internal and external factors of behaviour. From the evolutionary psychology perspective cognitive influences in behaviour are described as adaptive mechanisms for relative status designed to aid in navigating social hierarchies, which evolved as a vital element of survival [8, 25]. It is proposed here that adhering to a conceptual framework, such as evolutionary psychology, allows for greater predictability in intentions and, eventually, behaviour.

5   EVOLUTIONARY PSYCHOLOGY: A UNIVERSAL FRAMEWORK FOR UNDERSTANDING BEHAVIOUR

Consumer behaviour research has managed to explore and gain understanding of consumer decisions at the proximal or discrete level, whereby a broad understanding of all behaviour is considered reductionistic [26, 27]. The proximal level describes how consumption fulfils a greater need than simply survival, along with identifying what behaviours have emerged from the marketplace yet there still exists an inability to identify and describe the why these behaviours have manifested in the way that they have at the ultimate level [19, 28, 29]. This is particularly critical when considering that consumer behaviour is often impulsive and irrational [30]. The dilemma of understanding consumer behaviour at the ultimate level has led to the rise in acceptance of evolutionary psychology for examining behaviour, where behavioural pathology is underpinned by both the physical and biological understanding of the world [26].

Evolutionary psychology has entered into the field of consumer research with the aim of establishing a unifying and rigorous framework for understanding the ultimate drivers of behaviour, however this has not gone without criticism. Much of the criticism is based on what many evolutionary psychologists describe as misconceptions and misunderstandings of the core epistemology [27, 31]. From the evolutionary psychology perspective individual inherent behaviour is determined to be neither wholly nature, nor wholly nurture [27, 32, 33]. Tooby and Cosmides [32] state that it is nature that allows for nurture. This view between the nature and nurture debate allows for Derksen [33] to argue that evolutionary psychology theories mediate between relativism and realism, thus allowing for acknowledgement of culture and socialisation as an influencing factor in behaviour, while evolution accounts for universal observations of behaviour [27]. Critical realists lean towards a realist ontology, yet adopt a more subjectivist view on epistemology, in that knowledge and

the production of knowledge occurs as a result of social practice [34, 35]. It is this mediation between nature and nurture that leads one to conclude that adopting a critical realist perspective to underpin the principles of evolutionary psychology reconciles many of the criticisms evolutionary psychology research faces.

6   THE EVOLUTIONARY PERSPECTIVE ON CONSUMPTION

Despite the criticisms of Evolutionary Psychology, its key principles overcome the barriers experienced by using value-based models, such as the Theory of Planned Behaviour. From this perspective individual behavioural decisions are motivated by status, where the benefits associated with status increase survival [36]. The benefits associated with rank relate to the perception that a person of high rank has the ability to provide and care for mates and kin, has the ability to ward off potential enemies and has the ability to acquire resources necessary for survival when all others experience scarcity [21, 36]. In the instance of consumption and status, it is the possession of high resource goods, which serve as a signal of one's ability to incur costs, such as time, effort or money, which are difficult for other's to replicate. Signalling the ability to incur costs is described by Cost Signalling Theory and evolved as a response to the recurring social problem of status [19, 21, 37]. Demonstrating this ability to incur costs, especially through consumption compared to others grants greater access to mates, alliances and protection [19, 21, 25]. Hence, increasing levels of consumption, despite the environmental costs, provide short-term benefits to the individual.

The theory of cost signalling and a universal desire for status indicates an underlying adaptive function for status [21, 25]. Further, work within evolutionary psychology has explored the notion of utilising pro-environmental behaviour as a form of status signalling [21]. Given the costs associated with pro-environmental behaviour, the use of environmentally friendly products or the rejection of high resource products indicates the actor has the time, money or effort available to engage in this form of pro-social behaviour, where the reward for such a sacrifice results in higher social status [21, 38, 39].

7   STATUS STRATEGIES, COMPETITIVE CONSTRUCTS AND COPYING

The literature identifies two strategies for status, Dominance and Prestige. These two strategies are described to have similar influence and effect, yet consist of distinctive and differing characteristics, thus they can be viewed as two distinct types of status [38, 40]. An individual exhibiting a Dominant status typically demonstrates assertive, competitive, coercive and aggressive behaviours [38, 40, 41]. A Prestige driven individual most often demonstrates behaviours that exhibit competence, knowledge, hard work and altruism [38, 40, 41]. An individual exhibiting a Prestige status is typically more well-liked, respected and copied, increasing their chances to form coalitions, attract and retain mates [25, 38, 40]. Conversely, Dominant individuals are often described as individuals that are feared and avoided by others within a peer group [40, 41]. Henrich and Gil-White [41] further differentiate the process of achieving status and the resulting status, in that an individual may use a Dominance strategy for achieving higher status but the end result could be perceived as Prestige.

The process of achieving status among a peer group underpins the issue of status acquisition. Cheng et al [42] suggests that individuals have the ability to compete for higher status under Prestige. However, when one starts to consider the process by which an individual acquires status, such as via competition or cooperation, it is difficult to reconcile the notion that an individual can compete via a Prestige strategy for status given that competition is linked to Dominance. The literature exhibits a clear gap in understanding this relationship between the process of status acquisition and either strategy for status. It is suggested humans have an inherent motive to compete for status, given that high status is rewarded with high resources

and resources are limited [36, 43, 44]. As resources are distributed among individuals of differing rank, competition for higher status drives behavioural decisions [25, 36, 45]. Russell and Fiske [43] suggest that competitive individuals are perceived to be inherently untrustworthy and cold, whereas individuals that cooperate are perceived as the opposite. Additionally, Buunk and Massar [46] state that competitors are often perceived as rivals, as they compete for resources. Individuals that resort to coercion, aggression or fighting via competition risk a loss in reputation or even death, whereas individuals that rely on more submissive tactics, live to fight another day [31]. This evidence contradicts the literature on Dominance and Prestige status in that individuals that compete seem to engender Dominance, not Prestige.

Unpacking these two strategies into more specific characteristics reveals four main underlying constructs in which an individual may utilise these strategies. From the literature these four constructs are identified here as follows: agonistic competition, which aligns itself with the more traditional definition of dominance; cooperative competition, a form of competition that utilises altruistically motivated tactics and adheres to the definition of social dominance [36, 41, 47]; coercive competition where an actor will utilise tactics that appear to be altruistic or cooperative, but are dishonest [38]; and lastly, copying, in which people copy the behaviour of a high status model [41]. Among these constructs there are a variety of tactics available to use and each may be used under either strategy for status. Tactics may include humour [48], conspicuous consumption [19, 21] or pro-environmental behaviours [21, 49].

What remains unclear within the literature is a full understanding of the relationship between status strategies, the constructs and the tactics. Evidence does indicate that both individual differences and environmental factors influence strategy decisions, while group norms may influence the specific tactic used [33, 45, 47, 50]. Additionally, the literature is unclear on where the distinction is between strategies or processes for acquiring for status and actual Dominance or Prestige once status is acquired. One needs to make a distinction between Dominance strategy for status and social dominance orientation. The social dominance theory rests on two main principles. The first is that 'domain-specific strategies for reasoning about social norms involving dominance hierarchies' have evolved within the human mind [31, p. 366]. The second principle is that these strategies are distinct from other types of reasoning strategies, such as mating strategies [31]. This theory intimates that humans have developed the ability to observe certain social cues and develop a strategy for navigating the social dominance hierarchy found among social groups [36]. Thus, humans have the ability to discern between two strategies for achieving higher social status and further decide on an appropriate tactic for achieving the goal of status, where any tactic may be utilised under either strategy for status. This ability or mechanism of the mind that allows an individual to navigate social situations developed to solve the problem of dominance hierarchies, therefore allowing a differentiation between the process of acquiring status and the benefits associated with it [31, 36].

8   DISCUSSION

Incorporating the discussion on consumption and building upon the conceptual framework within Evolutionary psychology the concepts described here endeavour to understand *why* behaviour manifests itself as it does in today's world. From this perspective behaviour is the ultimate result of a mind that is a product of natural selection [28, 31]. It is the view of evolutionary psychologists that human consumption and behaviour is the culmination of the desirable traits of successful survivors [28, 31]. In the instance of promoting sustainable consumption, where increasing levels of consumption has been strongly linked to status, the evolutionary theory of cost signalling helps to explain why high resource displays of skills, time and effort have signalled status among many cultures over many centuries. Veblen stated that consumer's insatiable appetite stems from the inherent desire for status and emulation of others [cited in 51]. Individuals

of lower status often aim to emulate, or copy, those of higher status and will participate in higher levels of consumption [39, 51, 52]. Veblen thought, "human behaviour - and consequently consumer behaviour - is produced via the interaction of instinctual aspects of individual and institutional forces, the interplay between nature and nurture, mind and environment" [53, pg. 735]. The ability to signal status through consumption ultimately augments behaviour [51] and it is this social behaviour that has led to overconsumption and the present climate issues, where consumer value is a direct result of status signalling [25].

Examining consumer behaviour from an evolutionary perspective demonstrates that the motivation to consume, especially at unsustainable levels is driven by the desire for relative status, where the goods we consume signal our status [20, 25]. Thus, we have a desire to not only 'keep up with the Joneses'; we want to appear to be of slightly higher status than the 'Joneses' [25, 52]. This drive to appear of higher status has led to increasing levels of consumption of natural resources, contributing to the current climate issues. However, evidence demonstrates that conspicuous consumption is not the only strategy for signalling increasing status. It has been suggested that pro-social behaviour, such as conspicuous displays of pro-environmental behaviour, could be an effective strategy for increasing one's status [21, 38].

This conceptual model presented in this paper identifies behavioural interventions in the decision making process that transition away from value-based models used within sustainable consumption research. The paper concludes that in order to promote sustainable consumption, status strategies must be understood as these represent a fundamental influence on consumption and that sustainability research must continue to transition away from value-based models to adopt a more holistic approach in identifying behavioural interventions. Examining the widespread culture of consumption from this perspective enhances the understanding of the increasing desire to consume as a means to signal status among peers and identifies possible behavioural interventions.

9   ACKNOWLEDGEMENTS

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ECONOMIC ACTIVITY: BETWEEN APOCALYPSE AND REDEMPTION

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ABSTRACT

There is a tension between the short-term focus of the market economy and the requirements of sustainable development, particularly with respect to vulnerabilities associated with scalability and the diffusion of environmentally damaging technologies.

Technological developments and globalisation have accelerated economic and social change in a way that is historically without precedent. This is potentially destabilising and may compromise the continuity that is inherent in the concept of sustainability.

Discussion of economic issues tends to focus on aggregates, such as output and consumption. However, from the perspective of sustainability it is important to analyse the qualitative composition of these aggregates, with respect to questions such as changes in the product/service mix, what are the limits to consumption (both for products and for individuals), and the uncertainties and vulnerabilities of the economic system.

Conventional national accounting has well-known shortcomings with respect to measurement of welfare. The extent to which consumption expenditure, and its growth, benefits the consumer depends on a number of factors: some consumption is actually a cost rather than a benefit, while other forms of consumption change qualitatively as they increase quantitatively, a manifestation of the law of diminishing returns. The consequence is that impressive economic performance, as conventionally measured, may not actually improve the quality of life

1 INTRODUCTION

A market system that emphasises short-term growth in economic variables does not sit easily with sustainability. Scalability in production and consumption is perceived as advantageous, but it can increase the vulnerability of the systems upon which economic activity depends. In particular the diffusion of technology without regard to its wider impacts can give rise to severe environmental damage.

Consumption is often equated with welfare, but this at best misleading, and subject to serious qualifications. Not all consumption is directly beneficial, and welfare does not necessarily increase in proportion with consumption. The composition of consumption is subject to incessant change, and to some extent diminishing returns, over time. Whether there are limits to consumption, and if so what defines the limits are complex questions to which the answers are inevitably speculative. Meanwhile

there needs to be a stronger focus on the implications of growth in incomes and consumption, to ensure long-term stability and to avoid apocalyptic outcomes.

2 ROBUSTNESS OF THE ECONOMIC SYSTEM

The compatibility of the market economy with sustainable development remains problematical. As J.M. Keynes put it "there is no clear evidence from experience that the investment policy which is socially advantageous coincides with that which is the most profitable" [1, p.157], going on to warn of the adverse consequences "when the capital development of a country becomes a by-product of a casino" [1, p.159].

Furthermore, technological development is prone to sub-optimal outcomes. One reason is that we live with the legacies of earlier technical change, and what was once optimal can become sub-optimal, in the sense that, in the absence of any legacy it would have been designed differently today. One interesting example is the QWERTY keyboard, which offered advantages for manual typewriters that would jam if the typist exceeded a certain speed, but which now persists merely because it has achieved a critical mass and the costs of transition to a better keyboard layout would be prohibitive. Other instances are the result of non-standardisation, such as the proliferation of electrical systems, differences in rail gauges and incompatibility of computer systems – all of which can be barriers to trade.

Perhaps paradoxically, these two factors – sub optimality and non-standardisation - can afford some protection and work in favour of sustainability: universality can increase vulnerability. Modern civilisation, particularly in urban environments, is dependent on the smooth functioning of the technology on which it has come to depend, although "to appreciate it, we must witness its occasional failure" [2, p.109]. One striking instance of such a failure was the 1996 breakdown of the electricity supply across the western United States: this was exacerbated by the high degree of interconnectivity of the system network. Musing on the vulnerability of human constructs, Barabási suggests that "natural systems have a unique ability to survive in a wide range of conditions ... they often sustain their basic functions under very high error rates. ... This is in stark contrast to most products of human design". So while "it seems that nature strives to achieve robustness through interconnectivity", the character of natural interconnectivity is evidently differs from that of many human systems [2, p.111].

A vital factor affecting system vulnerability is scalability. A scalable system is distinguished from a random system in that it has a high degree of concentration – for example if a network is dependent on a few highly connected hubs, to which (and through which) the other elements are linked. Another distinguishing characteristic is replicability. Consumption that Hirsch [3] categorises as "non-exclusional" can be scaled upwards without limit, unlike other forms of consumption that, as they increase, change in nature (perhaps becoming unrecognisable in the process) and become devalued.

The development of information technology highlights instances of scalability. Taleb suggests that specialisation in scalable activities in a globalised economy has given the US a competitive advantage: thus "there is more money in designing a shoe than in actually making it ... the American economy has leveraged heavily on the idea generation" [4, p.31]. On the other hand, scalability confers a highly uneven "winner takes all" distribution of rewards, as the vast majority of enterprises engaged in scalable activities fall by the wayside; while the potential rewards may be much higher than for non-scalable activities, there is a lower probability of achieving them.

This specialisation in intellectual property has undoubtedly generated gains, not just to those directly involved but to the global economy as a whole. On the other hand the - in principle - infinite

replicability of the scalable component of output (and hence of consumption) is not without risks. The spread of computer viruses and malware through the widely used Windows operating system illustrates the point.

Risks of environmental damage can be intensified by the spread of scalable technological know-how. One instance is the adoption of intensive agricultural practices, involving increased usage of pesticides and artificial fertilisers and loss of wildlife habitats. Industrial scale monoculture can also increase vulnerability to threats such as extreme weather events (particularly drought) and animal and plant diseases.

An environmental protection strategy should seek to anticipate and, as far as possible, avoid catastrophically damaging changes, or at least mitigate their consequences. Proper account needs to be taken of the non-linearities mentioned above, such that environmental damage associated with a particular activity or technology increases disproportionately with the scale of activity. As Taleb puts it "the harm from polluting with ten difference sources is smaller than the equivalent pollution from a single source"; and this insight is the basis of "a simple ecological policy ... [with] a risk management rule for pollution. Simply ... split your sources of pollution" [5, p. 287]. The wisdom of this mixed-strategy approach contrasts with the perception of advantage from scalable specialisation; perhaps they can be reconciled by the understanding that the type of risks that are acceptable for individuals are not desirable for society as a whole, particularly if the outcome is externalised, with adverse consequences borne by individuals who were not parties to the original decisions to incur risks.

3 INTERACTIONS WITHIN THE SYSTEM

Civilisation is now subject to unprecedented pressures. The process of change that began with the industrial revolution has intensified with the onset of globalisation, driven by the development of information technology, sometimes characterised as a second industrial revolution.

From another perspective, these transformations can be seen as exceptional; and if so, the maintenance of economic growth requires a continuing series of exceptional changes, which is inherently implausible.

The economic steady state is one of diminishing returns. Increases in investment (or consumption) generate less than proportionate increases in output (or consumer satisfaction), other things remaining the same. To counter diminishing returns, other things must not remain the same. The classic instance was the role of technological development in averting the Malthusian spectre of famine. Increases in population can cause output and consumption to grow in aggregate, while, due to diminishing returns they decline in per capita terms. However the industrial revolution, with massive increases in labour productivity, came to the rescue, permitting populations to grow and prosper.

This was so successful that it seemed that society might face abundance, the antithesis of famine. For instance J.M. Keynes foresaw continuing technical progress that would greatly reduce the amount of labour required to satisfy material needs [6, p.16]. So innovation counters diminishing returns - for a time. Keynes was writing at a time when the low hanging fruit of the industrial revolution in OECD countries had been picked. Technological development, particularly information technology, and globalisation, which permits the diffusion of state of the art technology, will give a continuing impetus. It is a matter of speculation as to how long and how far the process can continue.

This is the crux of the tension between the market system and sustainable development. Sustainability by definition implies long-term stability, tempered by the realisation that nothing lasts forever. Ancient societies had many features that from a modern perspective may be unacceptable or unattractive such as slavery, autocracy, superstition and economic inequality, and for most people life

was, to borrow the wording of Thomas Hobbes, "nasty, brutish and short". Nevertheless many ancient civilisations displayed durability, some over thousands of years, and their legacies persist to this day.

With respect to sustainability, earlier civilisations had an advantage inasmuch as the absence of rapid and disruptive change implies a continuity that is absent in the modern world: dramatic technological advances, and aspirational consumption, were largely unknown. From a Gandhian perspective the distinction is very clear: "for [Gandhi] 'The distinguishing characteristic of modern civilisation is an indefinite multiplicity of wants', whereas ancient civilisations were marked by 'an imperative restriction upon and a strict regulation of these wants'" [7, p.299]. There was no problem of growing instability induced by increasing wealth: as Taleb puts it "we are prone to make more severe errors just because we are wealthier ... simply by being richer, the world is troubled with additional unpredictability and fragility [5, p.288].

On the other hand present day civilisation has the advantage of knowledge, and awareness, of the type of threats that damaged, and in some instances destroyed, ancient civilisations, such as disease, natural disasters and the breakdown of political and social institutions. In principle this should imply a capacity to anticipate and prevent these adverse developments.

However, such long-term thinking tends to be the antithesis of the market system. Keynes declared that in investment decisions implicitly assume "that the existing market valuation ... is uniquely correct in relation to our existing knowledge" and that "the existing state of affairs will continue indefinitely, except insofar as we have specific reasons to expect a change". Moreover, such an assumption, as long as we can rely on its persistence, "will be compatible with a considerable measure of continuity and stability". Investments are safe "over short periods, and hence over a succession of short periods" as long as there are no expectations of change. Keynes went on to point out the divergence between what should be the social objective of investment "to defeat the dark forces of time and ignorance which envelop our future", and the private objective of investors, which is "to outwit the crowd" [1, p.152-53].

4   DIMINISHING RETURNS

The law of diminishing returns is a pervasive feature of economics and, it could be said, an unfortunate fact of life. In terms of the production process it means that if an input is increased, with the level of all other inputs remaining the same, a point will eventually be reached at which additions of the input yield progressively smaller, or diminishing, increases in output. The same effect is manifested in consumption: if the input to the consumption process is the use of, or at least access to, a good or service, the utility derived from that consumption (the output) increases at a progressively declining rate.

The effects of diminishing returns are countered by advances in technology over time. While technological change can bring about improvements to a given product and render it more widely available at a lower price to consumers, that product can also be superseded by newly-developed, and more attractive, alternatives.

Specific products may have a high income elasticity of demand when first introduced, such that their consumption tends to be the prerogative of those on high incomes. Later, as their price is reduced through mass-production and technological advances the income elasticity would be expected to decline, and may eventually tend to zero before the product is superseded altogether.

Elasticities normally measure the response of consumption to a change in another variable (so for instance price elasticity of demand is defined in terms of proportionate changes in quantity demanded

induced by a change in price). However it is also possible to define elasticities in terms of changes induced by a change in the amount consumed: such would be an elasticity of environmental impact in response to a change in consumption of a product that induces that impact. For a product with a specific and unique type of environmental impact, it might be anticipated that the elasticity would be low, or zero, at levels of consumption that are sufficiently low that the impact is within the absorptive capacity of the environment, but as consumption increases the elasticity more than proportionately as the maximum absorptive capacity is approached. In other words there is a non-linear relationship between consumption and the wider costs of that consumption.

The benefits of consumption are also subject to diminishing returns over time, but not uniformly. The availability of some products can be extended though simple linear extrapolation. McAfee [8] quotes "Varian's law", as follows: "A simple way to forecast the future is to look at what rich people have today", adding that "applying this method a few years ago would have led one to foresee the rise of Uber and the spread of smartphones around the world, to take just two examples". However this is true only for certain categories of product; other types of consumption are subject to diminishing returns, such that the benefit derived from their consumption declines as consumption increases. The phenomenon was noted by Hirsch, who identified a significant, and growing, element of consumption as positional goods, which are "either (1) scarce in some absolute or socially imposed sense or (2) subject to congestion or crowding through more extensive use". Goods in the first category remain in fixed supply as the economy grows, and so increased incomes tend to raise their prices (and hence their exclusiveness) rather than increase their availability; Hirsch identifies personal services as an area where this effect is manifested, where increasing costs (as labour becomes more expensive) combined with static productivity place a continuing constraint on affordability. They are in a sense the consumption counterpart to land, which is the factor of production that is immobile and, in aggregate, in fixed supply, and ownership of which generates rent that accrues to the owners from the efforts of the users. Goods in the second category undergo radical transformation as their consumption increases: so, for example, an uncongested road becomes qualitatively different when it becomes heavily congested. Hirsch cites as examples education, travel and vacation homes [3, p.27]. These goods have high income elasticity of demand, but the quantitative change within the elasticity calculation is of course deceptive. An intensification over time of these effects would render apparent increases in consumption to some extent illusory and self-defeating [3, p.64].

5   LIMITS TO CONSUMPTION

The concept of welfare as the objective of human activity has long been debated by philosophers, economists and other categories of intellectual. Political debates tend to focus on economic variables, notably gross domestic product (GDP) and consumption, as measures of welfare, and – more importantly – implicitly equate increases in their magnitude as beneficial to individuals and society. So discourses on economic policy tend, rather unquestioningly, to assume "economic growth as an end without end" [6, p.181]. From this perspective, increased consumption means increased welfare, which is - supposedly - the ultimate objective of economic activity.

Other areas of political debate have a very different tenor, drawing attention to the unsatisfactory aspects, and possibly damaging effects, of economic expansion. As Hirsch put it "national accounts focus predominantly on gross output gross ... it represents the economic contribution to welfare, whatever that may be ... nicely begging the question of what [economic] activity is for" [3, p.58]. Indeed the shortcomings of national accounting magnitudes as welfare measures are well known. For instance, where economic activity is environmentally damaging, expenditure on remedial measures actually enhances GDP, although the need for such expenditure detracts from welfare. Hence the

extent to which output of the economy and its growth are welfare-enhancing depends upon the qualitative composition of that output and any changes in its composition.

The ultimate source of economic information is prices, either determined directly in the market by exchanges between willing buyers and sellers, or inferred, either from observed behaviour as individuals make trade-offs or from individuals' stated preferences. Consumption has to be paid for out of the flow of income or the stock of wealth. Insofar as the income is generated by labour, it is subject to a trade-off between leisure and the work necessary to earn the income. Leisure has an economic value, and this is recognised (for instance) in the valuations of leisure time that are routinely included in assessment of transport projects. Nevertheless, in the narrowly-focused political debates on economic policy only consumption, principally of traded goods and services, is thought of as welfare enhancing.

As the economy, defined in terms of GDP, grows, consumption also increases. In the short-term, other things remaining unchanged, this may be a reasonable proxy for a proportionate increase in welfare. In other words, if there is a fixed relationship between the beneficial and the detrimental aspects of consumption both will increase in the same proportion. Among the things that have to remain unchanged are, in particular, the work/leisure trade-off and the composition of consumption.

In the long term other things are liable to change. Consumer preferences change, external effects of consumption may become more apparent, consumer satisfaction may be subject to diminishing returns, and non-renewable resources come under increasing pressures. This in turn prompts the question are there limits to consumption?

Two recent books have addressed variants of this question, from differing perspectives. British authors Skidelsky and Skidelsky [6] ask "how much is enough?", while Guha [7], writing in an Indian context, poses the question as "how much should a person consume?" While there are varied and significant differences between them, one notable common feature is that neither gives a definitive answer to the questions they pose; they are, rather, concerned with the criteria and considerations that are relevant in addressing their variants of the question.

In the Skidelskys' account the preoccupation with economic growth and increased consumption is historically exceptional. They write of a perception in the nineteen-sixties that the capitalist countries were approaching a "consumption plateau" [6, p.181], and trace this notion back to the nineteen twenties' prophecy, ascribed to J.M. Keynes, that eventually "humanity would be able to satisfy all its material needs at a fraction of existing work effort – at most three hours a day ..." [6, p.16].

Consumption is of course not confined to the fulfilment of specific needs, and over time the concept of what is needed is liable to change. To circumvent the problem of defining a specific consumption pattern, the Skidelskys refer to an abstract categorisation of "basic goods": health, security, respect, personality (autonomy and individuality), harmony with nature, relationships, and leisure. These are not goods in the conventional sense, but rather preconditions, such that "a life that realises all of [the basic goods] is a good life" [6, p.167].

Need is also a theme of Guha's analysis of consumption, which refers to the Gandhian aphorism that "the world has enough for everybody's need, but not enough for everybody's greed". Guha suggests that "for the individual willing to heed his advice Gandhi's code of voluntary simplicity offered a sustainable alternative to modern lifestyles". However, the number of such individuals was evidently insufficient to build a consensus in favour of sustainable levels of consumption, as India's post-independence rulers pursued industrial development designed to "make India like England and America" at the expense of "environmental degradation [and] inequalities of consumption" [7, pp.299-300]. The consequence has been to sharpen the divisions within society between groups defined by their resource catchment: "omnivores", who can draw upon geographically dispersed

natural resources, and "ecosystem people", mainly dependent upon the resources of their immediate vicinity [7, p.301]. The dilemma implicit in this distinction is that while not everyone (or even most people) can be an omnivore, ecosystem people are by no means content to remain with a status that in many respects they perceive as under-privileged. Consequently there will be intensified conflicts over consumption, and consequently over access to natural resources, such that "the replicability of North Atlantic styles of living will be more directly and persistently challenged" [7, p.324].

6   THE COMPOSITION OF CONSUMPTION

From the perspective of sustainability it is important to analyse the qualitative composition of economic variables: within economic aggregates are components that can be very different in terms of their wider impacts.

The "consumption" variables in macroeconomic models are generally aggregates of numerous items, and inflation measures are averages of prices weighted by quantities of goods and services. So in this sense consumption is (implicitly) treated as homogenous – although it self-evidently is not.

A price index ideally measures changes in the prices of an unchanged basket of goods and services, with constant weighting. In practice this is unrealistic over any time period other than the very short term, because the composition of consumption changes over time. In the elementary standard economic model market prices, and quantities consumed, are determined by interaction between supply and demand, which are in turn influenced by numerous exogenous factors. These include changes in factor prices and technology (on the supply side) and tastes, incomes and income distribution (on the demand side). The model assumes that all of these remain constant, which is of course unrealistic: a change in consumers' preferences, for instance, will modify the demand function and this will normally give rise to changes in both price and quantity consumed.

Consequently there can be no typical consumption pattern that remains unchanged over time, and the components of price indexes are subject to frequent revision. Over the long-term, changes in consumption patterns, driven principally by technological developments, are so radical as to render comparisons, and indexes, meaningless. The phenomenon is illustrated by the example of Nathan Rothschild, ranked by Forbes magazine as, adjusted for inflation, the second richest man who ever lived. As Kay [9] points out, Rothschild lived too early to enjoy the benefits of consuming products and services available now even to those of modest means, and "was dead at the age of 58 from an illness that could today be cured by an antibiotic costing a few pence".

The upshot is that our wants may, frustratingly, include things that are beyond our reach. Furthermore wants, and hence tastes, can change over time, and this complicates judgements as to whether changes in consumption are welfare enhancing. Thus "if the environment deteriorates then a shift in resources to counter ...'bads' does not represent a change in consumer tastes but a response, on the basis of existing tastes, to a reduction in net welfare which the conventional national accounts hide" [3, p.62].

What then is consumption? At one level, the basic economic concept is simply the aggregate of price multiplied by quantity consumed for all goods and services. At a more abstract level it can be defined in terms of the utility that is derived, for instance in the Skidelskys' notion of basic goods. Hirsch distinguishes between "intermediate" and "final" consumption: goods and services in the former category are a means to satisfaction of wants for those in the latter category. If total consumption is unchanged but the ratio of intermediate to final consumption increases, there is actually a reduction in welfare which is not detected by the conventional economic measure [3, p.56].

7 STRATEGIES FOR CHANGE

A strategy for sustainability requires a consciousness of the historical context: what can we learn from the durability of ancient civilisations, and if we cannot, or do not wish to, emulate them how can we adapt to the different circumstances and constraints of modern civilisation. There needs to be a focus on robustness, treating scalable activities (particularly technologies) with caution. Recent experience with the banking crisis has been salutary. Far worse are the potential consequences of environmental catastrophes. Ancient civilisations were vulnerable to catastrophe, but they lacked the technology that might have exacerbated vulnerabilities. Technological developments have to be matched by an awareness of threats lurking within them.

The spread (some would say the triumph) of the market economy has been a phenomenon of modern history; the manifestation of market forces, both in legitimate transactions and manifested in corrupt dealings has been even more pervasive. Markets predominantly focus on the short-term; they are not well equipped to deal with the inherent uncertainties of the longer term. Hence heavy discounts tend to apply to future costs and benefits

The short-term focus does not lend itself to awareness of the wider context, and specifically vulnerabilities and the effects of diminishing returns. Macroeconomic variables, particularly income and consumption, are taken as key indicators, changes in which are taken as measuring the success of economic policies. The true benefits, and the limits, of increasing consumption are seldom questioned, although there is good reason to believe the gains are not self-evident and may be, at least to some extent, illusory. A more sophisticated system of accounting for consumption would be helpful, to measure qualitative changes (taking account of Hirsch's concept of exclusional goods) and distinguishing between intermediate and final consumption.

The market economy operates within a legal framework that establishes the monetary system and enforces contractual obligations and regulatory standards and requirements. This framework has widespread acceptance because without it the economic system could not function properly, if at all.

A strategy for sustainability should build upon the legal system, as a mechanism to ensure not just that the market economy functions, but that it continues to function – in effect, to save it from itself. As it is accepted that it is wrong to do things that are unlawful, it should also be unacceptable to engage in practices that compromise sustainable development; and economic decisions would be made within this wider framework.

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Assessing the Trends and Policy Correlates of Agricultural Production and Sustainability Outcomes in Ghana and Nigeria

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Introduction

Agricultural production promotes broad-based economy development especially for agriculture-based developing economies. However, variability of agricultural production and its attendant unsustainability outcomes could pose significant threats to sustainable development of emerging economies like Ghana and Nigeria. This paper provides empirical analysis of the trends and policy correlates agricultural production and sustainability outcomes. It underscores the influence of political systems and international development agenda setting as correlates agricultural production and sustainability outcomes. This is to the extent of providing evidence for policy on agriculture and sustainability outcomes in Ghana and Nigeria.

African economic trajectories have always underscored the need for agriculture-led development to solving the challenges of industrial growth, rural-urban migration, conflicts and overall economic development. Agricultural growth and accompanying positive growth linkages have wide-ranging impacts on overall growth and incomes of the poor (Dorosh and Mellor, 2013; World Bank, 2008; Hazell and Ramaswamy, 1991). Others (Manyong et al., 2005) have argued that the peasant nature of agricultural production system, with its low productivity, poor response to technology adoption strategies, and poor return of investment impede sustainable agricultural growth and development. Thus, suggesting that agriculture development as strategies for promoting equitable resource redistribution, sustainable growth and development thereby ensuring overall welfare improvement of the citizenry. Further, incomes from agriculture derive from the fundamental interest in the distribution of human welfare and poverty reduction. According to Dorosh and Mellor (2013), a high rate of agricultural growth has far-reaching positive implications for the economic development of low-income countries in terms of increasing employment and accelerating poverty reduction. Therefore, this paper assessed the trends and correlates of agricultural production and sustainability

outcomes in Ghana and Nigeria with a view to informing policy prescriptions for post-2015 sustainable development agenda.

Materials and Methods

Comparable time series dataset on agricultural production and sustainability outcomes, including political systems (military or democratic rule) and international development agenda (pre-millennium development goals era or millennium development goals era) spanning 1961- 2012 were analysed. Descriptive statistics (including means, standard deviations and coefficients of variation) and inferential statistical models (analysis of variance) were employed.. The indices of agricultural production were gross production index and net production index, while the indices of agricultural production sustainability outcomes were gross per capita production index and net per capita production index. The data were source from the website of the Food and Agricultural Organisation of the United Nations (FAO) via http://faostat3.fao.org/download/Q/QI/E.

Results and Discussion

The results (Tables 1 and 2) show that geographical differences, time trends, political system and the context of the millennium development goals (MDGs) influenced the indices of agricultural production (gross production and net production) as well as agricultural production sustainability outcomes (gross per capita production and net per capita production). The indices of agricultural production and agricultural production sustainability outcomes were correlated with time trends for Ghana while political system (military rule) was the single most important correlate for Nigeria.

Table 1. Trends in the Indices of Agricultural Production and Sustainability Outcomes

Period	Indicators	Ghana	Nigeria	Better performing country
1961-1970	Gross per capita production index	85.19 (3.49)	72.17 (4.59)	Ghana
	Net Production Index	31.08 (2.58)	26.58 (3.11)	Ghana
	Net per capita Production Index	85.63 (3.61)	72.71 (4.09)	Ghana
	Gross Production Index	30.93 (2.63)	26.39 (3.32)	Ghana
1971-1980	Gross per capita production index	75.07 (12.23)	60.52 (6.72)	Ghana
	Net Production Index	34.35 (3.86)	28.43 (1.26)	Ghana
	Net per capita Production Index	75.14 (12.27)	61.53 (6.13)	Ghana
	Gross Production Index	34.32 (3.84)	27.93 (1.40)	Ghana
1981-1990	Gross per capita production index	60.44 (5.25)	58.12 (6.85)	Ghana
	Net Production Index	36.32 (5.46)	36.58 (6.77)	Nigeria
	Net per capita Production Index	60.11 (5.19)	59.48 (6.34)	Ghana
	Gross Production Index	36.52 (5.51)	35.77 (7.02)	Ghana
1991-2000	Gross per capita production index	84.59 (6.31)	86.72 (4.40)	Nigeria
	Net Production Index	67.16 (9.77)	68.74 (8.67)	Nigeria
	Net per capita Production Index	84.41 (6.47)	86.92 (4.56)	Nigeria
	Gross Production Index	67.29 (9.66)	68.56 (8.50)	Nigeria
2001-2012	Gross per capita production index	102.65 (7.12)	92.42 (5.81)	Ghana
	Net Production Index	107.57 (17.18)	96.98 (8.84)	Ghana
	Net per capita Production Index	102.72 (7.39)	92.89 (5.56)	Ghana
	Gross Production Index	107.47 (16.85)	96.45 (8.70)	Ghana
1961-2012	Gross per capita production index	82.40 (15.98)	74.70 (15.08)	Ghana
	Net Production Index	57.31 (32.06)	53.21 (29.19)	Ghana
	Net per capita Production Index	82.42 (16.14)	75.41 (14.63)	Ghana
	Gross Production Index	57.31 (31.99)	52.77 (29.19)	Ghana

A test of significance using analysis of variance (ANOVA) indicated that, generally, differences in the indices of agricultural production (gross production and net production) and agricultural production sustainability outcomes (gross per capita production and net per capita production) were due to time trends, political system and policy scenarios, and not country-specific or location variable.

A. Political System

Table 2. Political System and Millennium Development Goals (MDGs) Period

A. Political System

Period	Indicators	Ghana	Nigeria	Better performing country
Military	Gross per capita production index	70.36 (11.81)	70.65 (11.95)	Nigeria
	Net Production Index	36.40 (7.33)	41.87 (16.77)	Nigeria
	Net per capita Production Index	70.26 (11.98)	71.22 (11.40)	Nigeria
	Gross Production Index	36.47 (7.40)	41.55 (16.89)	Nigeria
Democracy	Gross per capita production index	93.55 (10.18)	79.42 (17.13)	Ghana
	Net Production Index	76.67 (34.00)	66.44 (34.93)	Ghana
	Net per capita Production Index	93.66 (10.26)	80.30 (16.59)	Ghana
	Gross Production Index	76.62 (33.94)	65.85 (34.97)	Ghana
B. Millennium Development Goals (MDGs) Period				
Pre-MDGs	Gross per capita production index	75.96 (12.42)	68.83 (12.41)	Ghana
	Net Production Index	41.27 (14.79)	39.04 (17.02)	Ghana
	Net per capita Production Index	75.96 (12.61)	69.61 (11.83)	Ghana
	Gross Production Index	41.31 (14.85)	38.63 (17.15)	Ghana
MDGs	Gross per capita production index	101.72 (7.60)	92.31 (5.57)	Ghana
	Net Production Index	105.43 (18.17)	95.73 (9.59)	Ghana
	Net per capita Production Index	101.79 (7.84)	92.81 (5.33)	Ghana
	Gross Production Index	105.33 (17.88)	95.19 (9.49)	Ghana

Conclusion and Recommendations

Overall, time trends, political system and MDGs era significantly influenced agricultural production and sustainability outcomes. However, there were evidences of differential significant correlates of the indices of agricultural production and agricultural production sustainability outcomes by country. These results underscore the implications of each country's policy in promoting sustainable agricultural development outcomes. The paper concludes that agricultural production and its sustainability outcomes in Ghana and Nigeria are vulnerable to whims and caprices of political systems and international development agenda setting. Hence, agricultural development should be prioritized at both local and international levels, including the post-2015 sustainable development agenda.

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STAKEHOLDERS-DRIVEN SUSTAINABILITY PERFORMANCE ASSESSMENT OF PUBLIC ORGANIZATIONS

ABSTRACT

Sustainability assessments tools are usually developed and applied by technical staff exposing a clear opportunity to stakeholders effectively contribute to the process. In this perspective, stakeholders-driven sustainability performance assessment can be a key tool for organizational management, complementing formal performance assessments. At the same time it can effectively empower stakeholders at organizational level. This research aims to develop a tool of informal/complementary stakeholders-driven sustainability performance assessment to be integrated in the formal sustainability performance assessment models. This tool reflects a checklist composed by questions covering the main sustainability domains that aims to evaluate three dimensions: i) stakeholders' perceptions on the organizational sustainability performance; ii) self-evaluation of stakeholders' individual sustainability practices in their workplace; and iii) collection of sustainability qualitative data by direct observation. The checklist development was based on literature review, expert knowledge and a participatory workshop to collect contributions of a public sector organization's employees as a case study. Nineteen participants evaluated the understanding, usefulness and reliability of the preliminary checklist. The quantitative and qualitative employees' judgements and the experts' contributions were taking into account to validate the tool. A final stakeholders' checklist is then proposed reducing, simplifying and clarifying items pointed out by the participants. This research reinforces the importance given to the existence of a stakeholders-driven sustainability performance assessment tool, although there is a lack of confidence relative to the practical impact on the organizational management. Despite the limitations, stakeholders' involvement was an essential component of the proposed framework otherwise it could not be possible to bring out qualitative aspects crucial for the checklist reformulation. The potential use of this tool will be able to contribute and complement the formal sustainability performance assessment in the public sector, and also encourage companies to rethink theirs actual management and assessment models.

Keywords: performance assessment, sustainability, public organizations, stakeholders' empowerment.

1. INTRODUCTION

The research and development of sustainability assessment tools gained special importance in the 90's [1], but the evaluation of sustainability performance has been focused mainly on private companies and their corporate reporting schemes [2]–[4]. However, there has been a growing need and interest to integrate sustainability informed strategies into the public sector [4], [5]. Public sector represents an important part of international economic activities [2], [6]. They are major employers, providers of services and consumers of resources associated to significant aspects and impacts in the sustainability of the organization. They are an important component of economic activities, so the integration of sustainable development principles and practices into government processes is crucial towards national and global sustainable development [2], [7].

Corporate managers believe that people care about the way organizations affect the environment, recognizing their environmental performance [8]. Organizations want to perform well and be good examples by peer organizations, clients, voters, overseers and other environmental actors [9]. The system has to be flexible enough to adjust to different requirements for information [10]. According to [11], stakeholders need to be involved into the organization such as the mutual interests can be accomplished because they have the capacity to influence the organization and other stakeholders. Decisions may affect a variety of stakeholders and they influence the achievement of organizational plans [12].

Decision-making should be flexible to changing circumstances and include a variety of knowledge, beliefs, behaviors, motivations and values, which is only possible through stakeholders' participation and which

could be very difficult to come up in other way [4, 5]. Promote participatory processes as a management and planning tool leads to long term organization's success and allow to i) decrease stakeholders' exclusion of important organization procedures; ii) increase stakeholders' trust on decisions that are taken; iii) increase knowledge trough perceptions gathered by stakeholders and iv) improve decisions' quality based on more complete information [13].

Participative approaches and inclusion of data collected by stakeholders in performance assessments becomes an organizational challenge to improve its sustainability performance management. Voluntary monitoring is one of the public participation ways used in environmental problems' assessment [15]. This approach, initially associated to water systems conservation programs, gathers citizens groups who voluntarily collect data in order to evaluate water quality parameters. Since most volunteers are non-specialists, the parameters commonly analyzed are easily recognizable depending on citizen perceptions about the body of water like color, turbidity, odor, algae blooms and sources of pollution [16]. Voluntary monitoring allows governments and agencies responsible for ecosystems monitoring programs to overcome spatial and temporal failures of monitoring systems as well as promote a better environmental awareness between volunteers [17].

Stakeholders' engagement in sustainability assessment and reporting initiatives can be used as an indirect way of evaluating its straights and weaknesses as well as its overall utility and societal value, since the greater the stakeholders' involvement the better is the operationalization of the initiatives [8, 9]. [20] formulated a conceptual framework for common local sustainability indicators within a regional context supported by a participatory approach. [21] developed an adaptive-participative sustainability indicators for the assessment, management and reporting of marine protected areas to include local stakeholders at every level of the process. In the public sector, participative approaches like community-based performance assessments are also applied. They allow citizens' involvement in: public sector performance assessments of local government programs, strategies applied to community development, expected goals, performance indicators selection, performance criteria and results monitoring [22]. Citizens' participation in local policies development, data collection and results' presentation enables public organizations to provide services of interest to the community [23]. Specifically at an public organizational context, using frameworks like the Common Assessment Framework (CAF) as a self-evaluation tool allows European public sector organizations at every level to get better results on their performances. Analyzing several evaluation criteria like leadership, people, planning, strategies and results, and including stakeholders' inputs in the evaluation by answering questionnaires leads to a more complete and robust assessment. The questionnaires ascertain the stakeholders' perceptions and satisfaction levels with the public organization [24].

Employees' contribution in the performance assessment process is highly dependent on their sustainability perception. Perception can be defined as the process that involves stimuli recognition and individual interpretation of the environment that surrounds them [25]. Sustainability issues related to organizational performance are relevant and should be recognized as real concerns to stakeholders [16, 17]. An organization perceived as having low performances may compromise its image and its social responsibility. Therefore, understanding internal stakeholders' perceptions can be beneficial for long term growth [28]. Confronting performance information with stakeholders' judgement may contribute to get better results. Organizations perceived with good performances but that do not make efforts for improvement, may put their reputation in risk [29]. On the other hand, organizations that make efforts to accomplish good performances but are not perceived by society may show a lack of communication with their stakeholders. Also the individual awareness to sustainability issues can influence the perceptual analysis of organizational sustainability performance.

Encourage stakeholders' participation in sustainability performance assessments can produce data in a voluntary and informal way that can be compared with formal assessment tools and in the same time complement and enhance it [30]. The complementarity between a formal performance assessment system

with a voluntary and informal one based on stakeholders' inputs, may contribute to rethinking the approaches to manage organizational sustainability performance, and to empower stakeholders through voluntary collaborative contributions.

Despite the above mentioned works on stakeholders' voluntary initiatives, there is a lack of research on approaches that enable a stakeholders-driven performance assessment. Formal organizational sustainability performance assessment tends to be only managed and prepared by technical staff. Organizational sustainability assumes that stakeholders' needs and expectations are satisfied. In this perspective, including them in organizational management procedures is fundamental [31]. This research aims to develop a conceptual tool to support stakeholders-driven sustainability performance assessment of public organizations that will complement the formal performance assessment system. A participatory process on a case study was used to test and validate the proposed tool.

2.   METHODS

2.1. Development of the stakeholders-driven sustainability performance assessment checklist

Firstly the tool was developed using a checklist based on questions for sustainability performance assessment. Those are meant to be addressed to internal stakeholders, namely public organizations' employees. The checklist intended to include perceptions, individual practices and qualitative monitoring indicators (Figure 1).
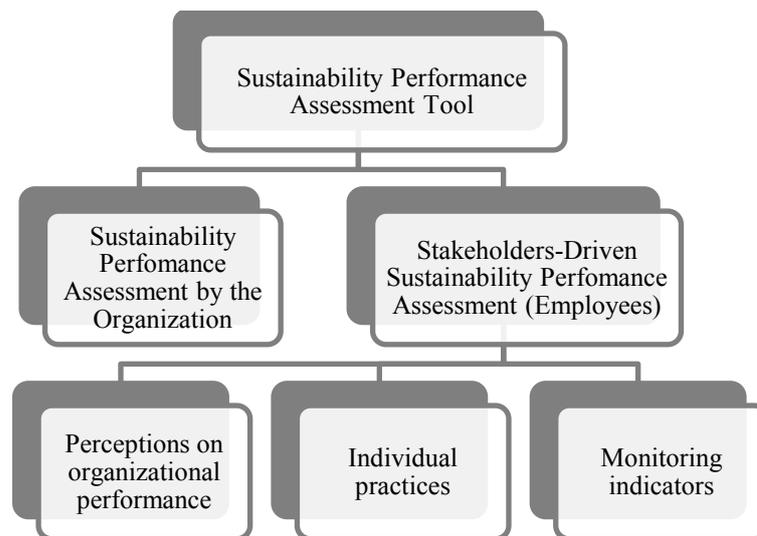
Figure 1 - Conceptual framework for stakeholders-driven sustainability performance assessment for public organizations.

The employees' perceptions on sustainability performance allow the recognition and interpretation of these agents about the organization's efforts in adopting strategies, principles and sustainability practices. Also, the employees' predisposition to adopt sustainability practices in their workplace can influence the organization capability in obtain good performances. In this model, the monitoring indicators concept is explored with employees' voluntary collection of data by direct observation of the organization's facilities.

The checklist is based in close-ended questions using a Likert-scale ranging for the majority of the questions. It has three categories of questions – "Perceptions", "Individual practices" and "Monitoring indicators"– covering the main sustainability domains – Economic, Environmental and Social. A fourth category was included –General questions. It pretended to analyze the perception level of the employee about general aspects of the organizational management. The initial assumption was to establish a direct or indirect association between the core indicators and practices defined in the Sustainability Performance Assessment

model conducted by the organization. Scientific articles, guidelines and sustainability practices checklists were used for the checklist theoretical foundation.

2.2. Checklist evaluation by a case study organization

A participatory workshop was lead in a Portuguese public organization - General Direction of Arms and Defense Infrastructure (DGAIED) belonging to Portuguese Ministry of Defense (MDN). The DGAIED was used as a case study to test and validate the proposed model. Three initial framing questions were made in order to determine the usefulness and impact of this tool in the organizational management and the employees' availability to participate in the tool's implementation. Then, each question from the checklist was evaluated taking into account three criteria: the understanding, usefulness and reliability of the developed tool. The participatory workshop meant to enhance the robustness and quality of the tool [13]. In a first stage the participatory workshop intended an individual checklist evaluation using an ordinal scale scoring system. Each question was scored for each criteria from 1-Very low to 5-Very high (1-Very low, 2-Low, 3-Medium, 4-High, 5-Very High). In a second stage a focus groups session took place. It promoted the participants' discussion and interactivity about the preliminary checklist as well as its weaknesses and strengths identification. The participatory workshop in DGAEID had nineteen participants.

2.3. Data Analysis

Exploratory analyses were conducted using descriptive statistics. The sample was characterized by 'Age', 'Gender' and 'Professional Category'. The results were characterized using the scores' average, standard-deviation and coefficient of variation, taking into account the three criteria used in the participatory process. Scores were then assigned by: i) employee's age (equal and less than 40 years old and more than 40 years old), ii) checklist evaluation criteria (understanding, usefulness and reliability), and iii) question's category and sustainability domain.

The final checklist was weighted using three criteria: i) cut off of questions with average value scores equal or less than 4.0 by the participants in the workshop; ii) participants' qualitative inputs about the preliminary checklist; and iii) experts' assessment (team members of this research project).

3. RESULTS

The preliminary checklist evaluated in the DGAIED workshop was composed by 85 questions. The majority of checklist's elements belong to the "Perceptions" category (75%), followed by "Individual practices" (15%) and finally the "Monitoring indicators" (10%) (Figure 2).

	Perceptions	Individual practices	Monitoring indicators	Total
Total	61	12	8	81
■ Economic	7	0	0	7
■ Environmental	35	11	7	53
■ Social	19	1	1	21
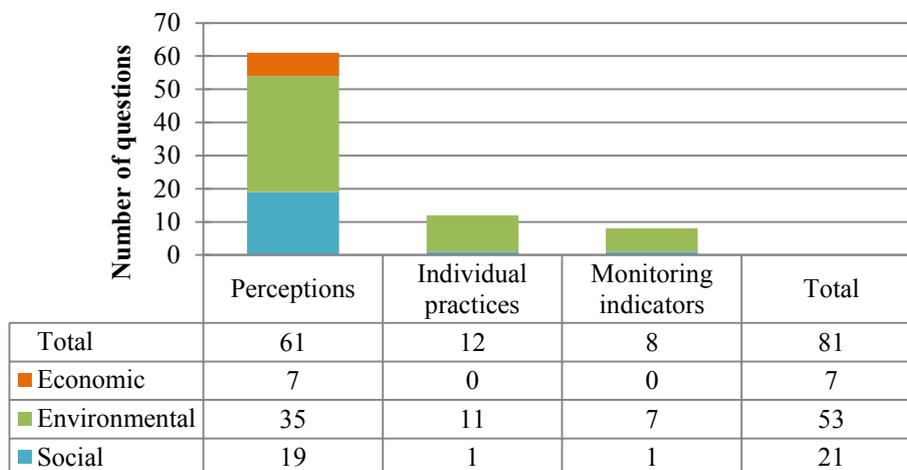
Figure 2 – Stakeholders-driven sustainability performance assessment tool: preliminary checklist.

The participants' average age was 44 years old. The minimum and maximum ages were 29 and 61 years old, respectively. Eleven male employees and eight females participated in the workshop. There were twelve technical superior, two sergeants and five military officials.

The results showed that ten participants agree and seven totally agree with the existence of a stakeholders-driven sustainability assessment tool. The remaining ones were skeptical about the tool. All the seventeen participants showed total availability to collaborate in an assessment process using the proposed tool.

The majority of the participants considered the tool's impact in the organizational management from moderate to high. Two answers revealed a low impact, zero a very low impact and only one a very high impact (Figure 3).
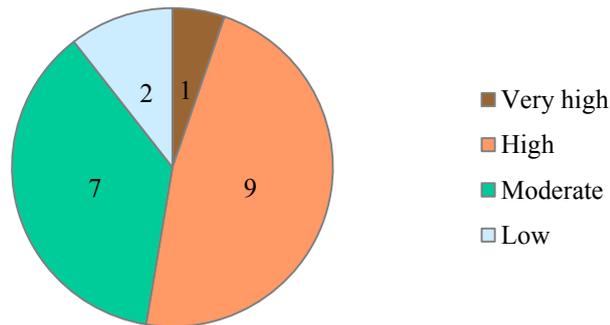
Figure 3 – Employees' opinion on the potential impact of the proposed tool in the organizational management.

The participants considered the stakeholders-driven sustainability assessment tool as an understandable and useful tool, assigning 'high' scores (4.0) for the majority of the questions. However the reliability criterion was scored as moderate (3.0) for the majority of the questions. Similarly to the participants' comments, the reliability was identified as one of the major weaknesses of the checklist tool. Neither the analyses by sustainability domain nor the analyses by questions' category revealed discrepancies in the scores assigned. In general, all the scores assigned were consensual between participants, reflected in low coefficients of variation.

The results of the checklist assessment showed some differences between participants' age groups. Although the score average was generally identical, there were differences between each sustainability domain. In the environmental domain's questions, the participant's aged equal and less than 40 years old revealed score averages slightly higher than the ones aged with more than 40 years old. Issues like waste management, energy, materials and water consumption were better scored. On the other hand, for the social domain's questions, the participants aged with more than 40 years old showed score averages slightly higher than the other domains. Work conditions were one of the major concerns of older employees, reflected in higher scores.

After the cut off criterion application (score average above 4.0) the checklist was reduced from 85 to 42 questions. But this only quantitative assessment promotes inconsistency between the checklist's elements, since it not ensure the sustainability domains or the questions categories coherence and representativeness. In addition, the workshop participants scoring is bias, since the majority of the responses are on the highest scores (averages are between 3,4 to 3,9 with and standard-deviation between 0,4 and 1,2).To improve this result a qualitative analysis was conducted based on the participant's qualitative inputs (focus groups session's results) as well as experts' opinions. The major strengths identified were i) the tool's relevance for organizational management; ii) the empowerment of stakeholders' role in the sustainability assessment process and iii) the relevance of the sustainability domains presented in the preliminary checklist. As weaknesses it was highlighted i) the low reliability of employees' answers due to individual behavior; ii) the

uncertainty about the stakeholders real role's within the sustainability performance assessment tool; iii) the low employees' knowledge about basic sustainability concepts and technical language that may difficult the checklist fulfillment; iv) the excessive number of questions in the checklist and v) some questions' redundancy. All these qualitative inputs contributed to the checklist reformulation taking into account four major aspects: i) irrelevancy, ii) redundancy, iii) extension and iv) complexity of some questions, which for that reasons were eliminated/reformulated. This all process conducted to a final checklist with 61 questions, less than 30% of the preliminary list. The "Perceptions" category remains the largest one (68%), followed by "Individual practices" (20%) and "monitoring indicators" (12%) (Figure 5, and some examples in Table 1).

Table 1. Examples of the stakeholders-driven sustainability performance assessment final checklist.

	Perceptions	Individual practices	Monitoring indicators
Economic	Evaluate the degree of transparency of the organization on the management of public funds, such as expenditures and revenues (no opinion; very low; low; medium; high; very high)	n.a.	n.a.
Environmental	Evaluate the organization's performance on the efficient use of energy (very low; low; medium; high; very high).	Evaluate how often you reuse paper on your daily activities (not applicable; never; rarely; sometimes; often; always).	Evaluate how often you find water leakage or infiltrations in the building facilities. Identify where they happen (never; rarely; sometimes; often; always).
Social	Evaluate the organization's performance in the involvement of employees in management and decision-making processes (very low; low; medium; high; very high).	Evaluate your level of involvement in voluntary actions promoted by the organization or employees' committee to support the local community (very low; low; medium; high; very high).	Evaluate the quality of access facilities of the organization suitable for people with disabilities. Identify possible improvements (very low; low; medium; high; very high).

n.a.: not applicable

|	Perceptions	Individual practices	Monitoring indicators	Total
Total	40	12	7	59
Economic	5	0	0	5
Environmental	20	11	6	37
Social	15	1	1	17
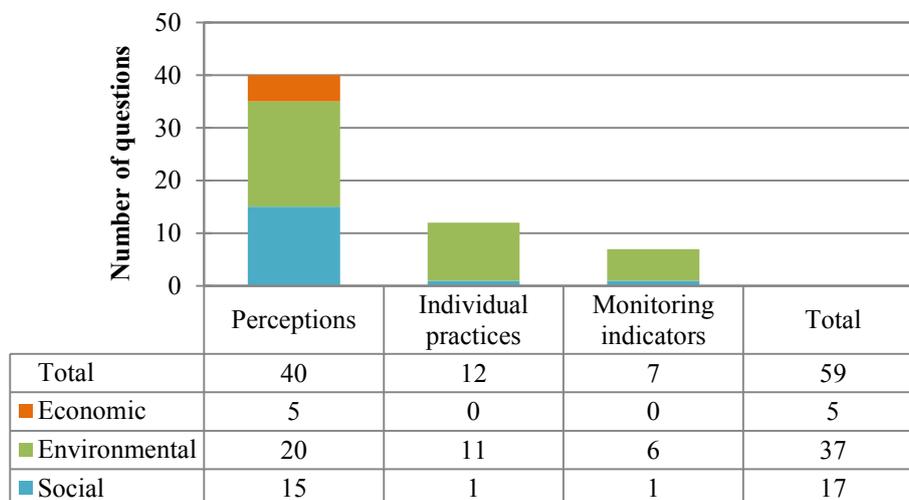
Figure 3 – Stakeholders-driven sustainability performance assessment tool: final checklist.

4. DISCUSSION AND FINAL REMARKS

Stakeholders' evaluation about sustainability frameworks is an important contribution to their active engagement in the overall assessment process and to help managers to take actions in order to achieve the expected objectives [21]. A sustainability performance self-assessment by stakeholders could be particularly useful to cross informal and technical outputs and outcomes as it was seen in the presented research.

The research revealed that age can be a distinctive factor in the way that sustainability is perceived by participants. The results had shown that younger participants are more aware of environmental issues contrary to older ones that are more worried with social issues. Although some authors noted that younger people report less concern with the environment, e.g. [33], other authors showed different findings consistent with the ones accomplished in this research, e.g. [34]. In addition some researchers [26] brought together a range of issues from different studies that put as major employees' concerns organizational aspects essentially related to work conditions and career progression. The fact that older employees are the ones most concerned with social aspects at the workplace may be influenced by age, work maturity and a better knowledge about organizational dynamics.

The majority of the participants have showed that stakeholders-driven performance assessment tools are needed within an organization, revealing its importance. In fact, stakeholders like to feel integrated in performance measurements since when they are engaged in the design, implementation and usage of performance assessment tools, the decision making is more credible reflecting stakeholders' concerns, expectations and opinions [22]. Although the importance employees gave to the tool, few revealed confidence when questioned about the practical impact of the tool in the organizational management. Employees have doubts about the tools' weight in the global sustainability performance assessment and its influence in the organizational management, which justify the results. Nonetheless practical initiatives carried out by employees in their workplace can significantly improve organizational sustainability performances [34]. Giving importance and showing interest in sustainability issues is a first positive step towards implementation of an effective cooperation between stakeholders and organizations [20].

The reliability criterion of the checklist has shown lower scores for the majority of the questions compared to the other two criteria (understanding and usefulness), because, according to participants, an employee who answers the checklist in a real assessment may provide skewed answers, since individuals tend to convey an image of exemplary or compliant employee. Although there is a growing interest about sustainability domain issues, only few initiatives show practical results [20]. Justifying the skepticism observed about the tool's reliability, as it was stressed before, there is a common gap between sustainability perception and organizational sustainability practices [29] which justifies the passivity to turn actions into real practice. For example, in the environmental domain, that can be reflected in several practices like eco efficiency and recycling initiatives, positive environmental attitudes may not necessarily translate into proactive behavior [33], and this does not prevent employees from responding unfairly.

Although participants assigned with high scores the understanding criterion, during the participatory workshop many doubts arose between them about concepts and technical meanings. Also indicators' quantitative scoring self-evaluation by employees conducted to an unsatisfactory result, since the reduced checklist with 42 questions was devoid of coherence between the composing elements. Still qualitative inputs were collected in the focus group session, which enriched the final checklist and at the same time contributed to a feeling of ownership in the process by participants. In fact people involved in the selection and development of indicators – in this case checklists' questions – are more willing to participate effectively and affect administration decisions and operational actions [18]. As demonstrated in the results the great majority of the employees are willing to collaborate in the tool implementation by answering the checklist in a real sustainability assessment scenario.

After the analysis of qualitative inputs by employees and experts' assessment, the final checklist was reduced in about 30%, with a final number of questions of 61. The economic domain is composed by questions that are consisting with Global Reporting Initiative [17] findings of relevant topics identified by public organizations' stakeholders like transparency on public funds and assets management. Relatively to the environmental domain, which has the largest number of questions, the existence of association between questions categories justified the need to include inseparable sets of questions. For example: the association between the 'Perceptions' and 'Individual practices' categories, since it could result in interesting data about the image that employees have of themselves in adapting sustainable practices in their workplace. Comparing the final checklist with [26] findings and the European Common Performance Assessment framework of public organizations [10] (that applied questionnaires to employees), there is a great focus on social issues important to workers related with global satisfaction with the organization, its management and work conditions. These are some of the issues that the final checklist had to keep to guarantee that key employees' concerns are asked and assessed

The main limitations of this research were related to the reliability of this tool. Reliability was the major constraint identified since participants may provide unreliable answers, compromising the confidence level of the stakeholders-driven sustainability assessment tool. Another limitation has to do with the participatory workshop outputs and its organization. The replacement of ordinal scales by qualitative weightings could result in a better assessment, giving preference to more interactive and less formal methods, where each checklist element is analyzed with more time and accuracy, identifying its strengths and weaknesses.

Despite the limitations, stakeholders' involvement is an essential component of this kind of frameworks [4].Also the developed checklist will allow the comparison of the results produced by stakeholders' self-assessment of sustainability with formal sustainability performance assessment and be used to complement the evaluation of sustainability aspects, as proposed in other researches [30]. Also it will encourage the organizations to rethink theirs actual management and assessment models.

5. ACKNOWLEDGMENTS

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TITLE

Is fragmentation affecting regime shifts occurrence in Mediterranean oak woodlands? A case study in southern Portugal

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ABSTRACT

In southern regions of Iberia, in Portugal and Spain, the evergreen cork oak woodlands are human-made scattered-tree ecosystems. These woodlands mimick natural savannas and are truly cultural landscapes, where trees form socio-economic and ecological keystone structures, adapted to limited water availability. Recent disturbances such as abnormal tree mortality and lack of tree recruitment under a changing Mediterranean climate (in particular related to drought) resulted in the gradual disappearance of trees. In some regions, it seems that these woodland ecosystems are undergoing complex ecological regime shifts, leading to a disrupted forest-cycle. At the same time, cork oak woodland ecosystems are increasingly fragmented, with new boundaries with scrublands and other land uses.

A key management challenge is to maintain the trees and their functional traits to the ecosystem's services conservation. In this study, through dendrochronological dating archives in cork samples from trees at contrasting fragmented woodlands in two distinct regions, undergoing a fragmentation process, we derive resilience of trees to cork harvesting. We then assessed the amplified influence of the forest fragmentation on the occurrence of a regime shift (disruption of forest cycle) of these scattered-tree ecosystems. Similarly, the ecosystem recovery, when occurring was also assessed, enabling to identify oak woodlands ecological thresholds for regime shift occurrence. Thus we addressed three main questions for this ecosystem's conservation: 1) Can we detect ecological regime shifts in Mediterranean evergreen oak woodlands?; 2) Are there imminent regime shifts indicators? And; 3) Are there spatial fragmentation thresholds bellow which woodlands become vulnerable to regime shifts?

Basic knowledge on the ecological resilience of Mediterranean oak woodlands will increase our ability to anticipate irreversible changes in the ecosystem may contribute to the design of sustainable land management strategies, to be considered by policy-makers, forest owners and forest managers.

1   INTRODUCTION

In southern regions of Iberia, in Portugal and Spain, the evergreen cork oak woodlands are human-made scattered-tree ecosystems [1]. These woodlands mimick natural savannas and are truly cultural landscapes [2], where trees form socio-economic and ecological keystone structures, adapted to limited water availability [3,4]. Cork oak woodlands generates sustainable productive land uses mainly through tree harvesting for its extremely thick bark, the cork [5,6,7]. Cork is currently the sixth most valuable global non-timber forest product [8], with so far no viable synthetic substitute [9].

Recent disturbances such as abnormal tree mortality and lack of tree recruitment under a changing Mediterranean climate (in particular related to drought) resulted in the gradual disappearance of trees [10]. In some regions, it seems that these woodland ecosystems are undergoing complex ecological regime shifts, leading to a disrupted forest-cycle [11,12]. At the same time, cork oak woodland ecosystems are increasingly fragmented, with new boundaries with scrublands and other land uses [13].

In the cork oak, the cork-rings show a clear patterned growth, resulting from the cork oak phellogen (cork cambium) seasonal activity [14,15,16], opposite to tree (wood)-rings, which are faint and in some cases indistinct [17]. Recently, the cork-ring width chronologies have been used in dendroclimatological studies [18,19,20,21,22]. In this study, we assume the cork-ring widths as an indicator for tree vigor and propose to use the inter-annual variability of cork-ring widths as a tool in detecting the loss of ecological resilience of the tree and eventually forest decline. However, there is a need for a better understanding in the cork-growth in order to be able to assess their reliability, mainly because the cork-rings preserve an archive that (excluding the age-size related trend), it is encoded not only by climatic conditions but also by disturbances (cork harvesting pressure) and by disturbances originated outside the cork oak woodlands as site-specific species growth pattern conditions.

Despite the remarkable resilience of the trees, the former novel disturbances of climate and environmental conditions, sometimes acting recurrently, may surpass their ability to control important ecosystem processes, which eventually result in regime shift and tree decline. Given the characteristic longevity in *Quercus spp.* species, the marked influence of (a)biotic factors, such as climate or environmental conditions disturbances, on tree physiology and the forest system is likely to foster large

tree-to-tree variability in the tree resilience loss breakpoint in time and there is a real need for extended time-resolved chronologies, which have never been done before in cork.

Sustainable management of cork oak woodlands in southern regions of Iberia depends on avoiding trees resilience breakpoint throughout diverging economic pathways, but mostly to a completely different intensification of forest management practices namely bark harvesting.

2   OBJECTIVES/METHODOLOGY/SCOPE

The present study therefore exploratory in nature and aims to build extended cork-ring width chronologies in more or less disturbed cork oak woodlands by cork oak mortality. We look for the degree to which these cork oaks react to disturbances such as cork harvest by characterizing the curve of virgin cork growth and reproduction cork growth and then identifying the breakpoint of the tree loss of resilience, indicative of intrinsic loss of ecological resilience and regime shift occurrence.

This study was carried out in two regions Benavente (less disturbed ecosystem-less fragmented) and Grândola (more disturbed ecosystem-more fragmented) (Table 1). We follow a dendrochronological approach to analyze and test for the significance and magnitude of cork(tree)-growth reductions and derive the tree loss of resilience. The cork oak woodlands fragmentation should amplify the aridity of the region, and eventually disable the tree's resilience to water stress and timely lead to the occurrence of a regime shift (disruption of forest cycle) of the scattered-tree ecosystems. However, the ecosystem recovery, when occurring, was also assessed, enabling to identify oak woodlands ecological thresholds for regime shift occurrence.

A key management challenge is to maintain the trees and their functional traits to the ecosystem's services conservation based on this dendrochronological approach, we addressed the main questions for this ecosystem's conservation: 1) Can we detect ecological regime shifts in Mediterranean evergreen oak woodlands, based on cork-growth –as an indicator for the tree growth?; 2) Could the breakpoint in time for the cork growth be a regime shift indicator, as allow us to detect the loss of ecological resilience of the trees to cork harvesting? and; 3) Are there spatial fragmentation thresholds bellow which woodlands become vulnerable to regime shifts?, i.e., in cork oak woodlands, undergoing a severe fragmentation

process due to oak mortality, is the regime shift occurrence more likely to occur, due to the untimely tree loss of resilience?.

Table 1. Biophysical characteristics of the study regions, Benavente (less disturbed cork oak woodland) and Grândola (more disturbed cork oak woodland).

Study areas	Benavente	Grândola
Location	38°49'N - 08°49'W	38°11'N - 08°37'W
Mean annual temperature	15.3 °C	15.6 °C
Annual rainfall	500 - 600 mm	700 - 800 mm
Lithology	Sedimentary formations	Carbonic schist formations
Slope	Flat and steeply undulating	Steeply undulating (heterogeneous)
Average patch-size decrease (% of initial area)	50	20
Number of patches	170	172
Patch-size frequency distribution scaling exponent (λ)	-1.06	-1.37

3　　RESULTS

3.1　　Dendrochronological approach in cork

The cork-ring chronologies were established and master chronologies were determined for virgin cork growth index based on exponential cork growth curve in the two studied regions (Figs. 1 and 2). In both study areas, the average series virgin cork-ring widths presented a typical declining trend with age, despite the existence of inter-annual variations, in agreement with the found data for a general master chronology (Fig. 3). The virgin cork-rings at younger stages of the tree were larger (almost the double), when compared to the ones at older stages in both regions.

The reproduction cork growth showed a clear increase in cork-ring width promoted by cork harvesting. The same cork harvesting disturbance is followed by abrupt reductions of the virgin cork growth, which in the case of Grândola enabled the visual identification of the subsequent cork harvest as a possible disturbance event (Fig.. 2). Also, at Grândola, a more disturbed cork oak woodland, the reproduction cork growth is irregular and cork-rings (for reproduction cork) are relatively narrow (Fig. 3) when compared to the ones of Benavente..
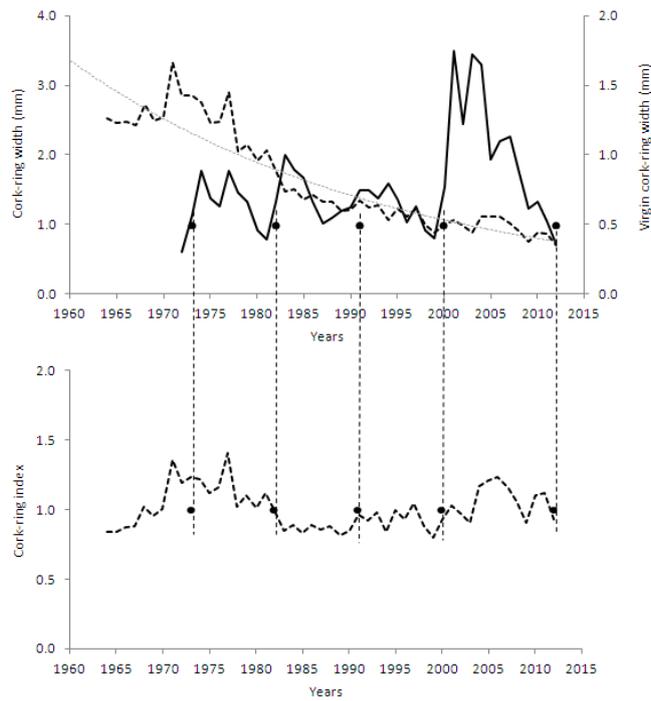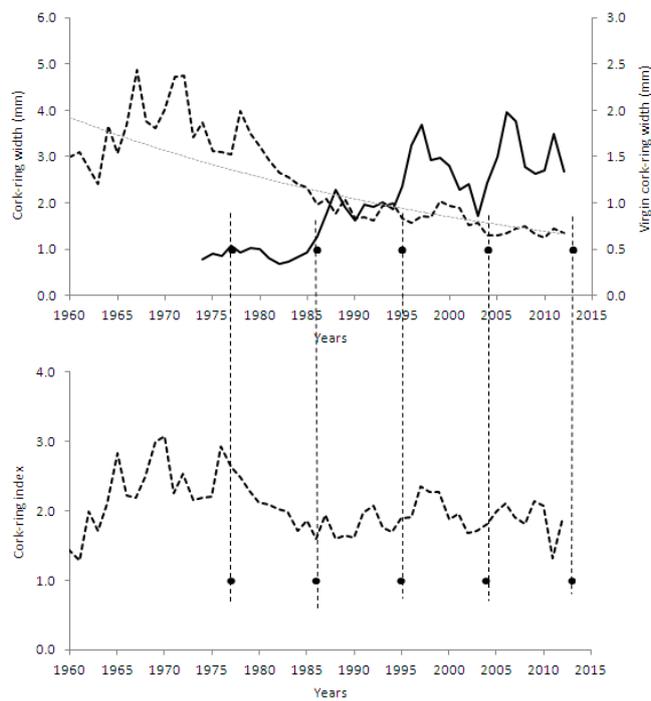
Fig. 1- Cork-ring width trends – virgin cork-rings and reproduction cork-rings – at Benavente. Virgin cork-ring widths with adjusted negative exponential model and cork-ring index: A) within a less fragmented woodland in Benavente and; B) within a more fragmented woodland in Benavente. Black circles with dotted straight vertical lines are indicating the known cork harvesting years.

The variability of the cork-ring width between cork samples at Benavente was high, despite the higher adjustment to the negative exponential growth curve (Fig. 1, A and B). At a less fragmented woodland, the virgin cork-ring widths around 1mm were found at cork ages of 30-40 years (Fig. 1A) while at more fragmented woodlands, virgin cork-ring width of 1 mm were found relatively early, at minimum cork ages of 25 years (Figure 1B).

At Grândola, the virgin cork-ring widths were more difficult to detect in the cork samples and only at two cork samples was possible to adjust the exponential growth curve, and only for few years (Fig. 2). The decreasing trend of the virgin cork-ring width is accentuated and occurs relatively early, at cork ages of 15 years.
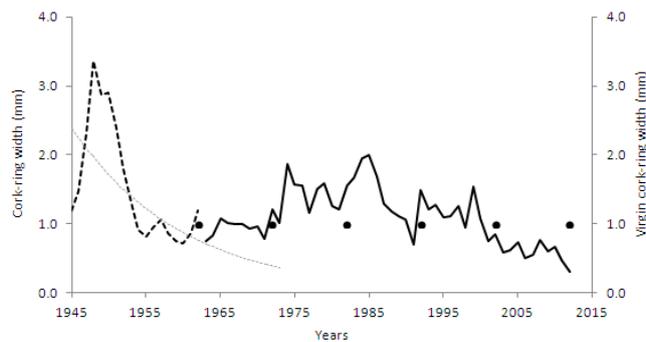
Fig.. 2 - Cork ring widths trends – virgin cork-rings and amadia cork-rings- at Grândola. Virgin cork-ring widths with adjusted negative exponential model within a fragmented woodlan. Black circles are indicating the known cork harvest years.

The virgin cork growth index time series underscored the fluctuations of reproduction cork growth due to the effect of cork harvesting (Figs. 1 and 2). Tests on the observed structural changes showed that none cork harvest abruptly and permanently changed the tree cork growth patterns. According to an established master chronology (Fig. 3) only after the 6-7th consecutive cork harvest the tree loses their ecological resilience.
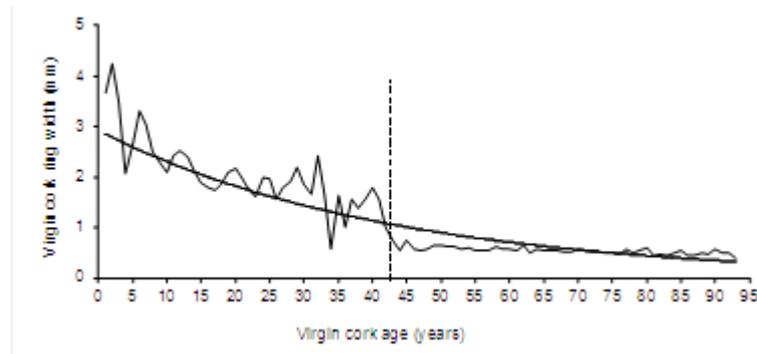
Fig.3- Chronology for virgin cork-ring widths. Straight vertical line indicates the break point in time for the loss of the tree ecological resilience (adapted from [14])

4   DISCUSSION

Based on cork-ring width data sets we addressed one of the main questions of the ecological sustainability of cork oak woodlands and found out that cork ring widths can be used to detect the tree ecological resilience loss and should therefore constitute an indicator for imminent ecological regime shift in Mediterranean evergreen oak woodlands.

To date the existence of a breakpoint in time of the trees resilience to cork harvesting was unknown. This breakpoint could be decisive for the interpretation of the ecological sustainability of cork oaks. After this breakpoint, trees may became more vulnerable and threatened by other (a)biotic stresses [23,24] and untimely lead to a regime shift with profound changes in the response of cork oak woodlands to environmental conditions [25].

Distinct cork growth patterns and responses to cork harvesting were obtained in the study regions: in a more fragmented landscape and in more disturbed cork oak woodlands (due to cork oak mortality) such as Grândola, the virgin cork growth decrease was accentuated and reproduction cork growth was undifferentiated, since their early stages, trees were more sensitive to cork harvesting when compared to trees at Benavente. In fact, at Benavente, trees showed a virgin cork growth decrease pattern similar to the master chronology established for cork growth [14]. Trees in more disturbed cork oak woodlands are in a pathway to decline and recurrent disturbances as cork harvesting may anticipate regime shifts by the loss of trees resilience. The overall goal for sustainable management of cork oak woodlands in southern regions of Iberia should be attainable only if the past and current management practices (including bark

harvesting) have not degraded these ecosystems, and trees have not reached their ecological resilience breakpoint.

Our exploratory study revealed an accentuated collapse of the tree resilience to cork harvesting in more disturbed cork oak woodland, where fragmentation is noticed due to cork oak mortality. Further work on similar cork samples is required for a more precise approach to and sounder knowledge of the resilience of the cork oak to cork harvesting. This work will allow identifying potential suitable sites, at regional level, for undertaking cork oak woodland restoration, through planting or seedling and protection of natural oak regeneration, protection from herbivores, minimizing soil water stress and extensification of forest management practices.

5   ACKNOWLEDGEMENTS

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EXISTING WATER SYSTEMS – A holistic perspective

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ABSTRACT

Obsolescence generally means the process of becoming obsolete or obsolescent; falling into disuse or becoming out of date. Obsolescence can also occur due to unusual factors such as Climate Change, demographics, etc. Based on a literature review and anecdotal conversations with researchers, practitioners and consultants in various sectors of the water industry, it is observed that the term „obsolescence" is rarely used and not as much appreciated with its diverse implications. In the context of climate change impacts, this term is even more uncommon. On the contrary, obsolescence has been, and now, is increasingly „seeping" into existing water systems – in all the three categories: clean-water, grey-water, and waste-water – thereby, compromising sustainability. This is due to wide ranging factors both climate change and *non*-climate change related including water safety, scarcity, security, cleanliness, protection, pollution, wastage/leakage, environmental legislation, water-associated energy implications – water-energy nexus, carbon footprint, carbon cut pressures, „urban creep", population growth and demographics. All such issues are directly and/or indirectly causing obsolescence in existing water networks.

Currently, there is no *building-specific* holistic framework that can address the range of diverse issues and drivers of obsolescence in the water network. Such a holistic framework needs to consider each issue individually but also how they relate to each other in the „bigger picture". This paper outlines a conceptual model of such a holistic framework which integrates all such issues relative to each other – all-in-one-place.

The conceptual framework model also categorises the issues/drivers into climate change induced and *non*-climate change associated groups that cause obsolescence in existing water infrastructures. Additionally, the paper covers climate change impacts in both contexts, climate change mitigation (pro-active approach) and climate change adaptation (reactive approach). In doing so the model addresses both „tipping points" in climate change i.e. positive one (where sustainable attitudes and behaviour become the norm rather than the exception); and the negative catastrophic one, which is likely to eventually occur if the positive one is not effectively employed.

***Keywords**: sustainable development; sustainability; water-energy nexus; existing water systems; water networks; obsolescence; climate change; built environment; urban environment; and climate change.*

1.0 INTRODUCTION

1.1 Background

The word obsolescence comes from the Latin word „obsolesce" which means to grow old. Obsolescence means the process of becoming obsolete or obsolescent; falling into disuse or becoming out of date. Obsolescence can also be referred to as the state of being which occurs when a person, object, or service is no longer wanted even though it may still be in good working order or condition. It is depreciation in value, impairment of desirability and/or usefulness caused by, for instance, new inventions, current changes in design, improved processes of production, or external factors that make a system less desirable and valuable for a continued use [1].

There is a wide range of factors which are causing obsolescence in existing water infrastructures and systems, thereby reducing their sustainability. This is because obsolescence and sustainability are inversely proportional as they act opposite to each other and yet along each of the three principal dimensions of the sustainability philosophy – Social / Ethical, Environment and Economic [2]. Some of these obsolescence factors are of direct, obvious, and conventional nature, such as, ageing water infrastructure, human population growth, urban expansion, and intensification or densification of the existing built environment – also known as „Urban Creep" [3, 4]. Whereas others, which are indirect, hidden and unconventional / contemporary causes of obsolescence, include [1, 5, 6]:

- carbon cap and carbon tax
- GHG (greenhouse gas) emissions (endeavours to decarbonizing water / rendering water carbon free)
- energy issues
- pressures of climate change mitigation and adaptation
- climate change impacts (e.g. more intense and more frequent rainfall)
- water security
- flood hazards and risks
- new, inclusive and integrated environmental legislation (e.g. Water Framework Directive; Climate Change Act 2008; Water Act 2014)
- arrival of innovative technologies and techniques (e.g. SUDS – Sustainable Urban Drainage Systems and Rain Water Harvesting) and
- sustainability agendas and strategies.

The paper is structured in three main parts which are: 1) water and 2) energy in their own individual right; and 3) the two together, i.e., water-energy nexus. The innovative insights presented in this paper are expected to stimulate a healthy debate among practitioners and consultants in both the water and energy industries, and illuminate new frontiers for further research. Also, these innovative concepts are elaborated with a limited number of case studies that are modestly described due to the need for brevity.

It has also been noticed from the review of literature, anecdotes, and computer models/software that the focus is generally either on the energy itself (e.g. reducing GHG emissions, saving energy, green energy generation); or on the water in its own right (e.g. water security, scarcity, drought, flood, SUDS, etc.). However, little attention has been given specifically to the energy and water together and yet holistically considering the afore-listed issues. For instance, no substantial research outcomes have been found specifically for commercial and industrial buildings that consider the whole span (Figure 1) together in one place, where the whole span comprises three main parts as follows:

- energy used in all various operations regarding water within a given building (e.g. pumps);
- energy consumed in operations before the clean-water is supplied to the building (water abstraction, clean water treatment, etc.); and
- also the energy utilized in operations after the waste-water leaves the building (e.g. waste water treatment works).

This fact brought up the idea of researching into water and energy together in the form of water-energy nexus with a whole-system approach, and yet in the built environment context, thereby encapsulating the

afore-listed issues (in the 2nd paragraph above) – all in one place. The scale of the nexus is set neither at a house level nor at a city or town level, but a large building block or a group of buildings on a given site of interest. For instance, a number of buildings on a university‛s campus; a huge and high building / buildings containing flats; a set of buildings in a retail park; etc. To date no literature has been found to report specifically on the whole-system approach at this scale. Details are contained in Figure 1 and Section 4.0 of the paper.

1.2 Aim and objectives

From the built environment perspective and in the water environment context, this paper aims to map both the conventional and unconventional obsolescence causing factors (listed above in the 2nd paragraph) into a holistic framework of the ‚built environment water-energy cycle‛, which is shown in Figure 1 and described in Section 4.0 in the paper. From this point onwards in the paper, this innovative Built Environment Water-Energy Cycle is abbreviated as BE-WE Cycle or referred to as "the Cycle".

The aforesaid aim is set to be achieved via these objectives:

1. to construct and present a conceptual model of a holistic framework for a certain building or set of buildings of interest on a site;
2. then to draw relationships of the afore-listed obsolescence causing factors within the holistic framework – as in a ‚bigger picture‛; and
3. also introduce innovative insights concurrently with objectives 1 and 2.

2.0 WATER – CASE OF URBAN DRAINAGE INFRASTRUCTURE

Specifically in the context of water and using flooding as a case, this section of the paper briefly explains that our built environment is facing obsolescence risks, thereby compromising its sustainability. Flooding is becoming a paramount issue not only in Europe but around the globe for all countries irrespective of whether they are developed or developing [7, 8]. Urban growth and increases in heavy rainfall, individually and cumulatively, are exacerbating flood events and flood risks [9]. In all, around 357,000 properties in Wales, or about one in six buildings, are at risk of flooding. More than 357,000 people live in 220,000 properties that are at risk of flooding from rivers or the sea; 97,000 of which are also at risk of surface water flooding. A further 137,000 properties are susceptible to surface water flooding alone [10]. As for the UK overall, pluvial flood risk accounts for approximately one-third of flood risk in the UK. Approximately 2 million people in UK urban areas are exposed to annual pluvial flood risk of 0.5% or greater (‚1-in-200 year‛ event). An additional, 1.2 million people can be at risk by 2050 due to a combination of climate change and population growth [11]. These cases indicate risks of obsolescence (e.g. in urban drainage water infrastructure) are escalating within the UK built environment due to increasing surface-water flood events. The reasons for the increase in number and magnitude of such flood events can be categorized into two groups, that is, climate change driven and non climate change driven, as follows:

(i) escalating urbanization (due to population increase/demographics and economic growth – which are non-climate change factors)

(ii) increased rainfall (both in frequency and intensity) due to climate change.

This way existing sewer systems (which are predominantly combined in the UK) are becoming inadequate in terms of their capacity and performance. Thus, obsolescence is ‚seeping‛ into the existing sewer networks due to both climate change and non climate change associated aspects. In order to overcome this increasing obsolescence risk, mitigation measures need to be taken. For instance, London is an old city which has had a combined sewer system for centuries. The proposed Thames Tideway Tunnel in London which is a storage and transfer tunnel – the width of three London buses – will be constructed under the River Thames to capture many millions of tonnes of sewage that regularly flows into the capital‛s river [12].

3.0 ENERGY – CASE OF EXISTING BUILDINGS STOCK

Specifically in the context of energy and using existing housing stock (at national level) as a case, this section of the paper briefly explains that our built environment is being hit by obsolescence risks at the expense of its sustainability. The Climate Change Act 2008 enshrines the target of reducing UK"s GHG emissions by at least 34% by 2020 and 80% by 2050. At the same time, it has been calculated that, at today"s level of demolition, two thirds of the houses existing today will still be standing in 2050. With 27% of the UK carbon footprint coming from domestic sector, it is obvious that a crucial element of achieving the target will be the mass retrofitting (i.e. refurbishing to very high levels of energy efficiency) of the existing housing stock throughout the country. As there are around 25 million houses, this means that over 500,000 homes a year need to be retrofitted for the next 40 years. [13]. Thus, a substantial degree of obsolescence is creeping in the UK housing stock due to climate change pressures. In this case, the obsolescence is not only „indirectly" climate change related for it is being driven via the environmental legislation in the form of Climate Change Act; but also expected to be permanent (if not retrofitted). In addition this obsolescence is functional or technical for if new energy efficient technologies not employed; and financial or economic in terms of rental values (if any) and operational costs escalating e.g. due to gas and electricity bills. Creeping up of prices of utility services has been widely and clearly noticed in the last few years, not only in the UK but worldwide.

In summary, the need for adaptation (in other words, requirement of tackling obsolescence) of the existing housing stock is on the increase on various fronts including domestic hot water provision, heating, cooling, ventilation, lighting and other appliances [14, 15]. Obsolescence has to be tackled in existing building stocks be it residential or buildings in the commercial, industrial, government, public and other sectors. This also signifies the fact that climate change adaptation and mitigation interventions need to be planned and implemented to support the quality of life and well-being of UK citizens. Failure to act now will only mean that costs of tackling climate change will be much higher in the future [16]. The UK will also miss out on the commercial opportunities that will emerge on the pathway to a low carbon economy [16].

4.0 WATER-ENERGY NEXUS – A CONCEPTUAL HOLISTIC FRAMEWORK AND INNOVATIVE INSIGHTS

4.1 Background

This section of the paper considers water and energy together and yet in a holistic format as shown in Figure 1. This is a conceptual model of a holistic framework of water-energy nexus, in which a new term „built environment water-energy cycle (i.e. BE-WE Cycle)" is introduced stretching from S1 through S2 and S3 to S4. The framework introduces a whole-system approach in which the „physical" span of the framework starts from the point where the water is drawn (consuming energy) from the natural environment, forced through built environment systems, and finally ends at the point where the water is delivered back to the natural environment (after treatment, in which energy is again utilised). In the „non-physical" context the items listed (as examples) in the fist paragraph of the Introduction section are also to be integrated in the framework. However, due to brevity and scope of study undertaken, both physical and non-physical facets of the framework are only identified and briefly stated as innovative insights, and not discussed to great detail in the paper.

4.2 Literature and computer models/software

The review of literature and standards [e.g. 17, 18, 19], Energy Star [20] and investigation of computer models/software (e.g. Carbon calculator [21], Green Desk [22]) reveal that the „apparent" energy used in buildings has been the main focus. Not much consideration is given specifically to the energy consumed in association with water-use in a given building (i.e. in-situ) and beyond (i.e. ex-situ), and yet without a whole-system approach. See Figure 1 which briefly captures how power is consumed along the whole length of the BE-WE Cycle and the resulting total carbon footprint. The main emphasis in the reported literature to date appears to have been on energy consumed in buildings, and not the energy consumed ex-situ of buildings to

sustain the water environment of a given building. That is, before inlet as clean-water (from the mains) and after the outlet as waste-water – beyond both the „hydro‟ ends of a building.

Both the literature and computer models lack to present unified methods on establishing for a specific set of buildings that how much energy is utilised along the whole length of the BE-WE Cycle and the resulting total carbon footprint (Figure 1). Similarly, there is limited information available on how in-situ sources of water (e.g. rainwater harvesting, obtaining water from a local water course, water abstraction from the in-situ ground, etc.) can be linked in cost-effective terms with the bigger picture (Figure 1) across the whole length from the start to the end – specifically in the context of water-energy nexus. Some more specific examples of aspects which current methods / approaches appear not to have considered either individually or collectively are as follows:

- To decarbonise water, how energy-use (that is associated with the water) can be reduced for a certain set of buildings in a given industrial or commercial setting. Where this decarbonisation of water may not necessarily be only by reducing fossil fuel driven energy-use, but also by generating and using green energy on site.
- How much is the total true carbon footprint of the water for all the buildings of a large retail park (where the term „true‟ implies including both in-situ and ex-situ carbon footprints)?
- For all buildings of a hospital can it be more cost-effective and more-green to abstract water from the in-situ ground rather than take from the mains?
- How much decarbonisation of the water can be for a given set of buildings on a site via a rain water harvesting design and implementation?
- How cost-effective would water recycling be e.g. pay back time; meeting legal carbon cut targets thereby saving on carbon tax; etc.

There is a lack of unified systems on consideration of the position of a given set of buildings in terms of their altitude (particularly in connection to main water supply) to more accurately work out the case-specific energy consumed in the total BE-WE Cycle. No standardised systems have been developed that could specifically help to apportion the energy consumed (to sustain the water environment of a given set of buildings) to the total energy used, e.g. to abstract, store, treat and pump water through the clean water infrastructure. Similarly, there are no established regular methods to work out the proportions of the energy consumed (to sustain the water environment of a given set of buildings) to the total energy used in the waste water infrastructure, e.g. collection, pumping, treatment in waste water treatment plant, etc.

4.3 The Climate Change Act 2008

One of the fundamental ideas the paper presents is that in order to over come obsolescence risks and enhance on sustainability, just focusing on energy alone or water separately can not be enough. The two need to be considered hand in hand. For instance, in the UK, the Climate Change Act introduces legal carbon cut targets of 34% and 80% by 2020 and 2050, respectively, to the 1990 base level [23, 24]. In order to meet these legal carbon cut targets, merely focusing on energy (be it enhancement of efficient energy use, reduction in energy use, green energy generation and deployment, etc.) can not be sufficient. The energy which goes into sustaining our water environment (in a holistic approach – Figure 1) will have to be considered to help establish a true total carbon footprint of the water-energy nexus for a building (or a set of buildings) and then seek appropriate approaches to reduce the true total carbon footprint. This way, legal carbon cut targets can be more effectively met. Furthermore, this will be an additional endeavour on the top of already existing measures and initiatives that focus predominantly on energy and water in separate spheres.

4.4 The conceptual model of the holistic framework

Another fundamentally innovative concept the paper introduces is a need for the development of a holistic framework that can help in two main parts:

(a). Assist water and energy assessors in ascertaining how energy intensive water-related operations are in a single or a set of buildings of interest on a site. This means the water-related energy not only within a given building but also the energy which is consumed (in proportion) in various operations to bring the water from

the natural environment to the building (i.e., S1 to S2 in Figure1) For instance, water abstraction, reservoir management, clean water treatment, etc. Similarly, energy consumed (in proportion) in various operations (e.g. waste water treatment works) while taking the water from the outlet of the building back to the natural environment (i.e., S3 to S4 in Figure 1). Once total true energy (E_T) is worked out, the equivalent total true carbon footprint (C_T) of the building can easily be calculated.

(b). The second main part is how to decarbonize the water of the building. In other words, how to render the water consumption carbon free (as far as appropriately and cost effectively possible) by employing various methods (both technologies and techniques). This necessitates producing an extensive „technology library" – one-stop-shop – containing all technologies and techniques around the world that regards:

    i.   water-saving
    ii.   energy-saving in connection to water, and
   iii.   carbon emissions and cuts

Such a „library" is to systematically store information in the form of a spreadsheet on these features of technologies: costs (capital and running), payback time, implications, constraints or limitations, advantages, and disadvantages, etc.

4.5 Technologies and techniques

Two well established examples of existing techniques are SUDS (Sustainable Urban Drainage Systems) and Rain Water Harvesting. There is a number of technologies and methods available in these two techniques alone. However, there has not been found an evidence of how these can be linked with the total BE-WE Cycle of a single or set of building (Figure 1) in order to

- establish benefits of a given technology around how close water can be decarbonized to zero;
- how far Climate Change Act's targets can be met; and
- yet how cost effectively with payback time.

Thus, the aforesaid holistic framework (of BE-WE Cycle) can help not only to put such existing techniques into wider whole-system context of water-energy nexus but also establish their effectiveness more appropriately in a „bigger picture". Thereby, combating obsolescence risks not only with a narrow focus but wider holistic focus.

There are a number of technologies also available in the form of software available that can help to estimate carbon footprint of buildings e.g. Green Desk; Carbon Calculator. However, they do not cover the whole length from S1 to S4 of the BE-WE Cycle shown in Figure 1. Their primary focus is within a given building setting not beyond. However, such tools can still play a „contributory" role in the aforesaid holistic framework of the BE-WE Cycle to estimate the total true carbon footprint of a given building in the context of water-energy nexus. After establishing the true total carbon footprint of the building, technologies and techniques (like in-situ groundwater abstraction; rain water harvesting; water recycling / reuse; SUDS; etc.) can be employed to decarbonize the water use of the building. This also explains that the holistic framework can be constituted via a number of existing tools. Whereas there are knowledge gaps (e.g. lack of established and unified methods to work out proportion of water-related energy between S1 to S2 or S3 to S4 for a given building), new knowledge and tools can be generated to bridge the gaps. In summary, the framework being holistic can more effectively help the use of the already existing tools (such as carbon calculator, Green Desk, etc.) in a more integrated manner in the bigger picture.

4.6 Standards and environmental systems

The holistic water decarbonizing approach will be helpful to inform existing systems and standards e.g. BREEAM, Energy Star, ISO14000, etc. These standards or systems appear to have touched upon energy that goes into sustaining water environment of buildings. However, they do not provide a full holistic approach (as shown in Figure 1). Thus the holistic framework can be useful in better informing such standard systems.

4.7 Climate change mitigation and adaptation, and water security

Climate change impacts are to be dealt with on two fronts, that is, mitigation and adaptation. As stated earlier, since the conceptual holistic framework (Figure 1) can help rendering the water carbon free – decarbonisation of water use in a more whole-system manner. Therefore, this can support dealing with the climate change on the both aforesaid fronts. For instance, the framework can help reduce carbon emissions which is a climate change mitigation measure. Whereas harnessing rainfall which is increasing in frequency and intensity due to climate change) means reducing flood risks in-situ and ex-site and this is a climate change adaptation measure. In addition, this adaptation will reduce reliance on mains water supply, thereby enhancing water security and minimizing water scarcity and drought issues.

4.8 Water Framework Directive – Water quality, quantity, and flood risks

The whole-system approach can assist not only in reducing flood risks (as indicated in Section 4.7 above) but also in decreasing wastewater amounts to sewers, which means contributing to meet requirements of Water Framework Directive (WFD) in terms of both water quantity and water quality. For instance, reducing in-situ and off-site pluvial flood risk means less flash flooding in downstream rivers and less stress on CSO (Combined Sewer Overflow) which is to do with rivers and coastal water quality issues. For instance, in London as little as 2mm of rainfall causes millions of tonnes of untreated sewage to overflow in the river Thames [12]. Such events are detriments to meet the WFD requirements.

4.9 Sustainability agenda

The holistic framework can also help to drive the sustainability agenda forward in terms of Sustainable Development headline indicators around water, energy, air quality (due to less emissions) and climate change. Furthermore, sustainability and obsolescence are two opposite notions. If sustainability of a system is enhanced, it automatically reduces obsolescence risks. This principle holds in all the three individual pillars of the sustainability philosophy i.e. social / ethical, economic and environmental dimensions. [2].

5.0 CONCLUDING REMARKS

In the context of a certain building or set of buildings of interest on a site, this paper outlines a conceptual model of a holistic framework that interweaves different innovative insights, and existing concepts, standards, technologies, techniques and methods, which currently are predominantly around either energy or water but not energy-water nexus as such and as much. Therefore, based on the innovative ideas presented in this paper, it can safely be concluded that there is immense room for further research and development in the sphere of water-energy nexus (specifically in the built environment context) as this can more productively (both effectively and efficiently) influence on both the areas i.e. 1) saving water, and 2) rendering water carbon free means saving energy. On the top of what has been reported in this paper, therefore, future research, further development, and application of the holistic framework can bring even more unique addition to the new science of water-energy nexus specifically in the context of water-energy nexus for a given single building or a set of buildings of interest on a site.

The paper presents a novel concept by generating and integrating innovative insights while appreciating how the existing knowledge can be tapped into these insights in a more holistic fashion. It is anticipated that the conceptual framework model outlined in this study will attract interest for further investigation from both practitioners in industry and researchers in academia from various built environment disciplines. At present, the study reported in this paper paves a path for further research and development.

If such innovative insights could be integrated into more holistic approaches towards and applied on management of the water-energy nexus, then not only that these can enhance sustainability of our water systems (be it clean, grey and / or waste waters) and thereby reduce obsolescence risks. But also, help reduce (both explicit and implicit) carbon-footprint of the water-energy nexus in the Built Environment. If such endeavours can become the norm of the global society rather than the exception, this will, surely, assist in reaching the „positive tipping point" in climate change earlier than the „negative tipping point". This way, the

fundamental principle of the sustainability philosophy will also be satisfied that we will leave a world for our future generations to be able to meeting their needs without us comprising their ability to do so.

Figure 1: Ins and Outs of the Built Environment Water-Energy (BE-WE) Cycle
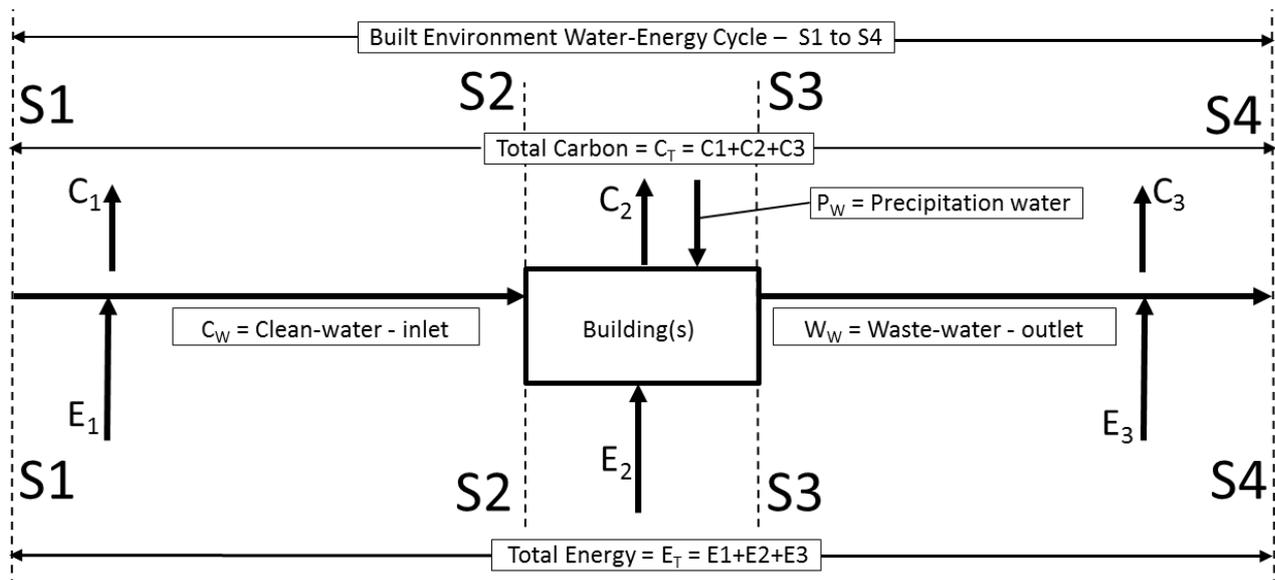
Note: Only operational energy to sustain the water environment, not embodied energy, e.g. energy to operate (not construct) a reservoir, etc.

ACKNOWLEDGEMENTS

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Climate change and the emergence of networked governance in Sweden and Australia

Abstract

With regard to responding to global climate change, urban policy and practice is central in relating global standards and knowledge, national and regional climate change scenarios into context-specific and effective action towards sustainable development at the local scale. In this paper we will look at how local government in Sweden and Australia transcends traditional boundaries of state, market and civil society by forming new partnerships and hybrid organisations that evolve to enable local government to respond to climate change more effectively. Through two case studies we examine some of the theoretical benefits, challenges and potentials of new forms of municipal collaborations introduced above. The two case studies highlight how new types of collaborations among municipalities and between municipalities and the private sector open up opportunities for feasible and (at least potentially) more effective climate change responses at the local scale.

1   Introduction

With regard to responding to global climate change, urban policy and practice is central in relating global standards and knowledge, national and regional climate change scenarios into context-specific and effective action towards sustainable development at the local scale (Bulkeley and Betsill, 2003; Elander et al, 2003; Lundqvist and Biel, 2007; Storbjörk, 2007; 2010; Broto and Bulkeley, 2012; van den Berg and Coenen, 2012; Romero-Lankao, 2012; Bulkeley et al., 2014). Whether out of virtue or out of necessity, for example due to a lack of action at higher levels of government, municipalities can be (and perhaps have to be) forerunners in developing and implementing climate change policy and practice. Yet how cities, through municipal government, mitigate climate change and adapt to its impacts is by no means a straightforward matter (Bulkeley et al., 2014, p. 5-6). Municipalities' broad suite of responsibilities includes infrastructure and property services, planning and development, health and sanitation, community, building, facilities, recreation facilities, and water and sewerage, and these intersect significantly with climate change impacts, such as more frequent and more intense extreme weather events and sea-level rise. Municipalities around the world are developing new mechanisms and avenues for making progress with responding to and planning for climate change in their local setting, increasingly using innovative approaches that transcend traditional administrative and sector-based boundaries and establish new types of collaboration and networked forms of governance that blur traditional demarcations of the state, market and civil society.

By exploring these emerging collaborations, we can increase our understanding of policy and institutional drivers, constraints and changing practices that are guiding adaption and mitigation to climate change at the local scale

In this paper we will look at how local government in Sweden and Australia transcends traditional boundaries of state, market and civil society by forming new partnerships and hybrid organisations that evolve to enable local government to respond to climate change more effectively.

In our paper the concept of tipping points is closely related to path dependency. Path dependency entails a clear risk that tipping points will be harder to avoid due to "institutional blindness". Political investment in collaborative, networked governance and other forms of hybrid political organisation can facilitate change but can also entail the risk that these new forms of governance are less, rather than more, appropriate as policy tools in areas in need of political and democratic steering and control (Granberg, 2008). Accordingly, seemingly innovative governance arrangements designed to better deal with the climate crisis can continue to perpetuate the status quo rather than generating the required changes running the risk of moving the development of society closer to the tipping points of climate change (cf. Lenton, 2011). Recent local government action to develop networked governance,

e.g. through partnerships and hybridisation between local government, civil society and markets, needs to be studied comparatively in different national contexts in order to study if, and how, these organisations are shaping society´s ability to better respond to and address climate change.

A central issue explored in the paper is how different types of networked governance are forming to transcend or overcome a range of constraints including governing capacities, political and public-private boundaries. We examine two types of collaborations, both attempting to shape local climate change policy and practice in their respective contexts: inter-municipal local government partnerships in Melbourne, Australia and municipal companies as a type of hybrid organisation in Örebro, Sweden. What lessons can we learn about the role of these partnerships and hybrid organisations in local climate change governance and in designing and implementing climate change actions?

This analysis is part of ongoing research in both Australia and Sweden and at this stage we have not conducted a fully comparative study. Accordingly, this study includes preliminary reflections on interviews undertaken with each organisation as well as document analysis in each context in a research endeavour that is ongoing and will be pursued further.

2 Transcending state-market-civil boundaries: municipal collaboration and partnerships

Before discussing these new forms of governance illustrated through two examples from Australia and Sweden, it is important to further theorise why and how new forms of municipal collaboration have become necessary for local governments to effectively plan for and respond to climate change.

Municipalities have for decades forged different forms of partnerships with other public and private actors, to achieve particular goals in areas where they lack expertise or where it is more cost-effective to work through partnership approaches. In recent decades, these partnerships most commonly take the form of outsourcing, which involves a legally binding contract with a service provider. However, outside narrow practices of contracting and sub-contracting, other forms of partnerships have shown to be very productive in the local government sector, including the funding of not-for-profit organisations operating at the local scale, international partnerships such as sister-city relationships (Cremer, de Bruin and Dupuis 2001) and transnational municipal networks (Betsill and Bulkeley 2004; Fünfgeld 2015), and a variety of partnerships with private sector organisations, commonly referred to as public-private partnerships (Pattberg 2010; Schroeder, Burch and Rayner 2013).

A key benefit and driver for the development of new partnerships for climate change action – as well as for municipal partnerships in general – is that they potentially allow their members to pool capacities and resources towards achieving shared goals (Glasbergen 2011). Climate change mitigation and adaptation have provided both a challenge for municipalities to respond effectively as well as an opportunity for developing content-specific collaboration, using new forms of partnerships, such as inter-municipal cooperation and hybrid organisations designed specifically to make progress on municipal climate change responses. Below, we will discuss two specific forms of emergent collaboration that can be subsumed under a broad notion of partnerships: inter-municipal partnerships and hybrid organisations designed to assist in municipality climate change responses.

Inter-municipal partnerships

Inter-municipal partnerships at various scales have the potential to become important mechanisms for overcoming institutional, financial and regulatory constraints to generate broad scale or systemic change. In Australia, such inter-municipal voluntary partnerships, often referred to as 'alliances', have become increasingly important in the context of politically weak local government in a federal system and limited national and state policy responses to climate change issues. While not formally constituting hybrid state-market entities (as defined below), some local government alliances, are adopting entrepreneurial approaches in the implementation of their climate change goals. Municipal alliances have been characterised as 'intermediaries' operating across municipal boundaries and

between national, state and local levels as well as between state-market-civil society (Moloney and Horne 2015). Hodson and Marvin highlight the importance of analyzing the mediating roles of 'intermediary organisations and contexts' in understanding urban transitions and the need to examine the politics of whose priorities are dominant and what the implications are for urban transitions (2012:422), highlighting that: "The creation of intermediaries is necessary to constitute a space outside of the obduracy of both existing urban governance regimes and existing socio-technical regimes" (Hodson 2008: 482). By examining emerging institutional arrangements and new forms of collaboration, we are concerned with the extent to which, in different contexts, the various actors and coalitions involved are actually working towards a 'genuine, radical transition' or just continuing to reproduce the status quo (Hodson and Marvin, 2012:437).

Hybrid organisations

Hybrid organisations can be characterised as organisations that mix value systems and logics of various sectors such as, in our case, state, markets and civil society (Koppell, 2006) where municipalities endeavour into other social spheres through close cooperation with non-public actors. It has been observed that hybrid organisations are less susceptible to political/democratic control largely due to the fact that they behave as external entities rather than as extensions of public politics and administration (cf. Koppell, 2006; 2010; Hodson 2008: 482; McGuirk et al., 2014: 146). Accordingly, there is a risk that hybrid organisations are less appropriate as policy tools in areas which required strong political and democratic steering and control and this type of collaboration needs to be studied comparatively in different national contexts (Koppell, 2006; Anguelovski & Carmin, 2011; Bulkeley & Castán Broto, 2013).

Benefits and challenges of new forms of municipal collaboration

Central issues when understanding the policy process is how issues compete to become identified and formulated as central collective challenges/problems and be elevated on the policy/political agenda (Bachrach & Baratz, 1963; Baumgartner, 2013; Zahariadis, 2014). Accordingly, agenda setting is central and we need to know more about how conflicting/reinforcing policy objectives interact in the policy process, i.e. how do climate change issues interact with other prioritised issues on the policy agenda, in order to grasp local government's climate change policy. Here policy representation or framing becomes an important part of this understanding (Lindseth, 2004, Fünfgeld and McEvoy 2014). It is clear that within the contemporary neo-liberal political context it is attractive to frame policy issues, including climate change, in market oriented and growth promoting contexts (cf. Granberg & Glover, 2014) and using approaches aligned with corporate principles and processes, such as climate risk management (Fünfgeld and McEvoy 2014).

Potentially an increased use of informal arrangements and market oriented steering and organisational models (municipal companies) increases the fragmentation of municipal organisations (cf. Peters, 1996). This can lead to a fragmented municipal policy agenda weakening the ability to address climate change issues in a co-ordinated way. On the other hand it has been stated that a dynamic, complex and varied challenge as climate change demands dynamic, complex and varied governance (cf. Kooiman, 1993; Leach et al 2010; Lynn, 2012), and this could be an argument for the need of a broader and more varied 'municipal toolbox' to handle the complex challenges of climate change.

Accordingly, incumbent institutional practices and new institutional designs can be both facilitating and hindering climate action (Bulkeley et al., 2014). An issue that needs to be further investigated is if and how these newly designed institutional practices conflict, supplement or reinforce incumbent institutional practices and if they facilitate a break in path dependency in ways that facilitate efficient climate change action?

3   CASE STUDIES

In the following we use two case studies to examine some of the theoretical benefits, challenges and potentials of new forms of municipal collaborations introduced above. For each case study we examine their role in addressing and potentially shaping climate change policy responses in their local context. We analyse how the work of these municipal collaborations intersects with institutional processes, policy-making and to what extent they are attempting to challenge path-dependencies.

Inter-Municipal Climate Change Partnerships, Victoria, Australia

While local level mitigation efforts in Australia emerged during the 1990s and 2000s, it was not until the late 2000s that a national response to climate change was enacted through a Carbon Pollution Reduction Scheme (CPRS), which has since been repealed under the current national Conservative government. During the late 2000s, as a result of Federal level mitigation initiatives, there was a shift in focus at lower levels of government towards adaptation planning, reducing vulnerabilities and building resilience to climate change. The recent bushfires in Victoria and floods in Queensland have highlighted the importance of planned adaptation. Despite the distinct policy focus on adaptation at the Victorian state level, and in an increasingly hostile national climate policy landscape, local governments, place-based organisations and coalitions continue to trial new and innovative approaches to carbon mitigation and adaptation in very tight funding environments.

Following a review of over 100 behaviour change initiatives in 2008-09 in Australia (Moloney et al., 2010) and a more recent desktop review undertaken in 2013 of low carbon policies, strategies and initiatives in Australia and in particular Victoria (Moloney and Horne, 2015), we have identified inter-municipal climate change partnerships (referred to here as CC alliances) as important 'intermediaries' in climate governance (Hodson and Marvin, 2012). We briefly describe here the 'intermediary contexts' within which CC alliances work in Victoria, who they are and how they operate within Australia's multilevel and highly contested climate policy landscape. We then comment on the capacity and effectiveness of climate change alliances to drive purposive change and transitioning.

Victoria is unique amongst other Australian states in having introduced another tier of regional governance, albeit an informal or voluntary one, to address climate change. Victoria has ten inter-municipal climate change alliances, involving 72 of a total 79 local governments, each unique in arrangement and function, but significant in driving regional level co-ordination and innovation across the state. The CC alliances, comprising between four and eight local governments and other organisations, were initiated by the Regional Partnerships Program as part of the Victorian Greenhouse Strategy released by the state Labor government in 2002. These alliances vary in their arrangements and ambitions; however, they are largely comprised of a local government membership, with aims to work in partnership within their regions, to improve energy efficiency and the take up of renewable energy, and with their communities, to become more resilient to climate change (SECCCA, 2012). After a review in 2006, the partnerships program was considered a success at significantly contributing to raised awareness, improved knowledge and coordinated action at a regional level and was recommended that the program continue to be funded and expanded to encompass the entire state. While this recommendation was not accepted, the alliances have continued to grow and involve most local governments which has lead some to suggest that Australia may now have "three and half levels of government" (Hunt, 2012).

Under the original funding agreement in 2002, the CC alliances had a mitigation focus addressing four key areas: developing greenhouse abatement measures to address their specific needs; building the capacity of local governments, the community and the private sector to engage with greenhouse abatement; partnering with government in the delivery of state and commonwealth greenhouse programs and; improving the integration and targeting of government services and programs (SECCCA, 2012). As informal or voluntary partnerships, they have emerged as important

intermediaries in Victoria particularly in driving regional mitigation and adaptation strategy processes, co- coordinating and delivering on programs and initiatives across local government boundaries and have been successful at developing and receiving state and local government grants to fund these initiatives.

They are playing an important role in capacity building and awareness raising across their partner organisations as well as lobbying state and federal governments to effect systemic or regime change in infrastructure provision and planning. For example, they are acting as lobbyists and advocates for improved access to energy data to assist in future planning and assessments and have a role in building knowledge and technical capacities across their member local governments and partner organisations in driving socio-technical change. They have worked with education and research institutions to undertake research around climate change projections and impacts and identify risks and vulnerabilities to better inform policy and strategy responses. All alliances have been involved in energy reduction initiatives including behaviour change projects working with households, schools, farming communities, and training programs for trades people. Many have made progress in installation of energy efficient street lighting by partnering with state government, electricity distribution businesses and lighting manufacturers and communities. Alliances covering the metropolitan area have been most active in developing key strategies and assessments for their members including Zero Net Emissions Strategies, vulnerability and risk assessments and adaptation strategies and several alliances are working on carbon sequestration initiatives and trialling solar installation projects for low-income households. Despite their important governance role, regional climate change alliances do not have any formal place within the governing hierarchy and are dependent on local member fees and state and federal grants for their continuing work.

As an emerging tier of governance, these inter-municipal partnerships are evolving in terms of their scope and intent advanced through broadening networks, capacity building and exerting more agenda setting influence at the state level. For example, the alliances have played a key role in driving legislative change around the use of Environmental Upgrade Agreements for local governments. As intermediaries they have proven to be significant in the Victorian context, in driving action and innovation, building local coalitions, developing skills and capacities of member organisations and securing funding to drive their projects and innovations. The informal and experimental nature of climate change alliances work in climate governance has certainly driven innovation at the local scale in Victoria and we argue are creating the potential for more transformative change. However the uncertainty around their voluntary membership which requires continual renewal from members and their reliance on government grant schemes and policy parameters contributes to marginalising to some extent their capacity to significantly challenge existing path-dependencies.

Using market tools to combat climate change, Örebro, Sweden

Örebro is Sweden´s seventh largest municipality with 140 000 inhabitants (1 380,1 km²) (expected to increase with 10 000 by 2020) (Statistics Sweden; orebro.se). The city has an industrial history but is today basically an administrative city with a university, local, regional and national offices of public administration. It also strives to be a logistical centre (road and rail) and have a few larger industries established within its administrative borders.

Örebro has ambitious reduction targets aiming at a 50 percent reduction per inhabitant of climate impacts from municipal organisation activities and 40 percent per inhabitant from all activities by 2020 (baseline 2000 6,9 tonnes per inhabitant) (Örebro kommun 2014a). Today the climate impact measured in tonnes was in 2012 5,8 tonnes per inhabitant. This was a 16 percent reduction between period 2000-2012 and a 10 percent reduction between 2008-2012. The latest evaluation leads to an estimated reduction of 35 percent by 2020. Accordingly, further action is needed to reach the target of 40 percent. The primarily methods used are, at least initially, focusing on profitable solutions. The municipality interacts with other societal actors in efforts to create local/regional markets within two

socio-technical systems of central importance to climate abrasive emissions, energy and transport. In the following we highlight some of the more prominent actions engaging two social-technical systems by the municipality.

Local government action: Energy

Örebro´s local government are establishing windmill parks together with the local government in neighbouring Kumla (Örebro kommun, 2014a). They do this through the establishment of a municipal company, KumBro Vind AB, with the objective that the municipality will become self-sufficient on energy. During 2014 the municipal company will build 10 wind turbines mills and the objective is that by 2020 KumBro Vind AB will own 15-20 wind turbines producing 100-150 GWh a year meeting the energy demand of about 20 000 households (http://kumbro.se/kumbro-vind-2/). This would entail reduced CO_2 emissions with 40 000 tonnes a year. The expected investment is approximately 500 million Swedish crowns (approx. US$ 70m). Private actors can buy shares in the municipal company and take part in the future development of the company and the local/regional energy market.

The local government has introduced a solar map and are planning changes to the planning system (easing demands or abolishing fees in building permits) to facilitate the use of solar energy for private housing and businesses. In addition the municipal housing and real estate companies ÖBO, Örebroporten and Futurum is commissioned to put up solar energy facilities on their buildings and on municipal buildings KumBro Utveckling AB are commissioned to build solar power parks on municipal land (Örebro kommun, 2014a). Again, private actors can buy shares in the municipal company and take part in the future development of the company and the local/regional energy market.

Local government action: Transport

Since October 2009 the local government runs all public transport on biogas sourced from local feedstock (Örebro kommun, undated). The actual biogas production is handled by a private company but the investment by this company is clearly connected to the aim of, and supported by investments of, the local government to runs its public transport on biogas. In addition the local government is procuring vehicles (for garbage collection, service and cars) that runs on biogas. The aim is to facilitate the production of biogas fuel locally (harvesting and production) to handle the demand from a growing regional biogas market. The effort has been supported by the national climate investment program (KLIMP).[1] The local government has also initiated an information and marketing campaign for a wider societal use of biogas as fuel for vehicles with the aim to drive a transition for households and business to biogas by creating and supporting a growing local/regional biogas market.

CONCLUSION

The two case studies highlight how new types of collaborations among municipalities and between municipalities and the private sector open up opportunities for feasible and (at least potentially) more effective climate change responses contributing to a sustainable development at the local scale.

As the Swedish case study highlighted the municipality is very active using municipal companies both for their perceived effectiveness and flexibility of hybrid market actors as a tool to expand municipal

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[1] The climate investment-program (KLIMP), emphasising reduction of GHG-emissions, was introduced by the national government in 2003 (Granberg and Elander, 2007). To qualify for grants local government had to put in place measures and strategies for follow-up and evaluation. In addition local government had to finance 15-30 percent of the efforts themselves.

capacity to reach the objectives of its climate change mitigation efforts. Also interesting, and perhaps more important, is the aim of creating, expanding and reinforcing local and regional alternative energy markets. This is a clear example of public (state) intervention into markets but also into the everyday life of the citizens (as it´s aiming at changed behaviours in terms of fulfilling the energy demands of citizens and business) outside the traditional toolboxes of public actors. This can potentially increase the ability of the municipality to handle challenges related to climate change mitigation. On the other hand, an increased use of market action, models and market organisation (hybrid organisations) can lead to a fragmented local government policy agenda weakening the ability to address climate change issues in a co-ordinated and coherent way. Fragmentation can occur when actors with different types of objectives (i.e. welfare and economic profit) and organisational logics (i.e. public and business) interact on the policy agenda. Such fragmentation can have profound institutional ramifications, and it can also have severe consequences with regard to climate justice and equity (e.g. with regard to spatially disconnected and varied support offered for climate change adaptation).

The Australian case of municipal climate change alliances, on the other hand, showed that voluntary inter-municipal partnerships can take on a life and momentum of their own and become catalysts for climate change action. In considering the extent to which climate change alliances and their many initiatives may represent a shift or transition in path-dependent institutional or infrastructural systems we can make some observations. Regional climate change alliances are significant intermediaries in building regional scale capacity and strategies and are seeking to challenge existing energy provision regimes and generate purposive change through multi-pronged collaborative strategies. In our current research we are examining the extent to which this work within the changing climate policy landscape at state, federal and local levels, is "reproducing existing governance orderings" or whether it contains openings that "might produce more transformative political orderings" (McGuirk et al., 2014:146). Our current and ongoing research and our engagement with these alliances through a range of projects doessuggest that they do represent innovative local scale responses that explicitly aim to challenge regime obduracy through institutional capacity building, shifts in systems of energy provision, and through regulatory change. Up until a recent state election there has been an absence of political leadership supporting climate change mitigation at the state level. Despite this the alliances have continued to progress their work and in particular driving adaptation responses and planning across their member local governments. They have played an important role as advocates for local governments, driving knowledge building and awareness raising across local government and trialling innovative mitigation and adaptation initiatives. This has been evident in their work around embedding adaptation and lobbying for legislative change to implement Environment Upgrade Agreements across the local government sector. While we may not yet be seeing transformative change at the local scale, climate change alliances are ensuring that capacity building, institutional reforms and long term planning for climate change is progressing across local governments in Victoria.

Finally, both case studies can be understood as examples of emergent *dynamic, complex* and *varied* forms of governance, required in response to the challenges presented by climate change. Each case is reflective of local governments need to broaden and strengthen their capacity to deal with systemic change by traversing the state-market and traditional governing boundaries. While these approaches offer greater potential for innovative and potentially transformative change at the local scale in each context, the long-term implications or efficacy of these efforts remain unclear. Further research is required to fully appreciate the extent to which local governance climate change actions, such as those discussed here, offer valuable lessons for municipalities and other local actors in handling the complex challenges of climate change.

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PLANNING SUSTAINABLE TRANSPORT AROUND PEOPLE'S NEEDS

ABSTRACT

This paper reviews sustainability-driven spatial planning policy from the perspective of ordinary citizens as they seek to travel, live and work, and carry out their daily lives within the sustainable city. The original definition of sustainability contained social, economic and environmental components. This paper argues that there has been an over-emphasis upon the environmental aspects, at the expense of social considerations, especially gender, creating a dissonance between the sustainability and social equality agendas to the detriment of achieving inclusive urban design. Policy examples from transportation and land-use planning indicate that sustainability-driven planning policy is working against the creation of inclusive, equitable and accessible cities with particular reference to the needs of women. Sustainability policy is set at too high a level to engage with the realities of everyday life. It is concluded that there is a need for a more user-related, social perspective to be integrated into sustainable planning policy. Public transport needs to go where the people want to go, between the different land uses and facilities. In order to enable women and men of all ages to travel comfortably and easily it is important to make transport systems accessible and usable, with adequate ancillary facilities.

Key words: sustainability, accessibility, gender, disability, transport planning, equality

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Introduction

Sustainability has been a key driving force of planning policy for nearly 30 years (Bruntland,1987). But, many citizens have found so-called sustainable policies (especially policies concerned with reducing transport's carbon footprint) have made their daily lives more difficult, whilst not necessarily enabling them to adopt a greener lifestyle. This article discusses the potential conflict between promoting environmental sustainability and creating accessible, inclusive and equitable cities. Having introduced the subject matter, the theoretical perspective will be briefly outlined, along with the methodological approach. Definitions of sustainability and of inclusive urban design will be given highlighting potential bias and lacunae in the UK planning systems' application of sustainability principles. 'The problem' will be outlined in two stages, first regarding the inherited 'pre-sustainability' nature of British cities, and second, the challenges the 'sustainable city' creates for its citizens. In the concluding section, recommendations for creating cities that are both sustainable and inclusively designed will be outlined.

Conceptual and Methodological Perspective

This paper is concerned with investigating in another piece of the urban question, namely, 'who gets what where why and how? (Harvey, 1975) drawing on examples from the UK. A key determinant in shaping cities is the nature of planning policy and thus the perspective and 'world view' of the policy makers themselves (Greed,1994a:10). This paper is based around the investigation of the 'dissonance' between what the planners imagine is required and the realities experienced by the urban population as they seek to access and use 'the city of everyday life'. If there is no recognition of the needs of women and other minorities in the policy agenda, and there is limited representation of minority groups, especially women, among planners and other urban policy makers (CIC,2009), then the spatial needs of minority groups will not register in the professional psyche as being of any importance. Conceptually, the research is concerned with the reproduction over space of social relations, including imprint of gender relations on the built environment (Massey, 1984: 16). The study does not aim to prove a hypothesis or confirm statistically that there is a problem, as it is already widely documented that there is one (Stimpson et al, 1981; Matrix,1984; Little et al, 1988;

Whatmore and Little, 1988; Roberts,1991; Greed,1994a; Booth et al, 1996; Buckingham-Hatfield,2000; Anthony,2001; Hayden,2002; Reeves,2005; Uteng and Cresswell,2008; Jarvis et al, 2009; inter alia). The paper draws, in part, upon personal experiences of trying to get around the city of man, and thus includes a polemic component arising from years of being stuck in traffic jams, standing at bus-stops, and talking to others about shared experiences whilst waiting. This paper also draws significantly upon the author's research on 'women and planning' for over 20 years (Greed,1994,a; Greed, 2011, 2012; Greed and Johnson,2014). The author headed a national study for the RTPI (Royal Town Planning Institute) on the extent to which gender considerations were being mainstreamed into spatial policy in local planning authorities (RTPI,2003; Greed, 2005). The RTPI research yielded a picture of 'what' the quantitative situation was nationally, whilst a series of 15 detailed case studies was undertaken (basically of good, bad and indifferent local planning authorities) in which the 'small details' and concerns of respondents (of both the planners and the planned) were noted, in order to build up a series of key themes that might help explain quite 'why' (qualitatively) some local authorities were supportive and others manifested resistance, or little understanding of the issues. A qualitative, ethnographic approach (Greed, 1994b) in order to make sense of the policy stances and lack of reference to social inclusion considerations (albeit with initial quantitative contextualisation, usually at a national level. But, there has been limited subsequent application of gender considerations to strategic land-use zoning, transportation and environmental sustainability policy. Likewise there appeared to be little understanding of the implications of applying a gender perspective to detailed local planning and urban design matters, including street layouts, detailed accessibility and equality issues, and childcare matters.

Definitions: Sustainability and Inclusive Design

The need to create sustainable cities is a key driving factor in spatial policy-making. But this paper argues that, in the UK, a partial and incomplete approach to sustainability is used which over-emphasizes the environmental dimension at the expense of social considerations. The original definition of sustainability in the Rio Declaration (Buckingham-Hatfield, 2000), included three components: economic viability, social equity, and environmental sustainability (prosperity, people, place). In other European countries, especially within Scandinavian countries, the social component is given greater importance (Madariaga and Roberts, 2013). But, in Britain, a somewhat 'peopleless' concern with the 'green' environmental issues appears to have eclipsed the social component, detracting from diversity considerations, thus reducing the chances of achieving fully sustainable cities. Friends of the Earth has declared that 'transport is one of the worst perpetrators of sexual discrimination' but the social dimension seems to have been jostled out of the way in the modern day environmental UK sustainability agenda (Oliver,1988). 'Inclusive urban design' and 'sustainability' have become disconnected especially with respect to women's issues. Inclusive urban design may be defined as an approach to the planning, design and layout of our towns and cities that recognises and accommodates the needs of those with disabilities and benefits all those other societal groups, especially women, that are currently dis-enabled by the nature of the built environment. Inclusive urban design would create enabling environments, in which, for example, street layouts would be accessible, functional and direct, as well as being safe, attractive, legible and easy to negotiate (Manley,1998; Imrie and Hall,2001). Such an approach would extend the principles to universal and inclusive design (Goldsmith, 2000) to the planning of entire cities in terms of strategic policy-making affect the nature of transport systems, zoning policy, and policy priorities in terms of the location, distribution and design of the different spatial components, land-uses, transport systems, and other spatial components and amenities that make up the urban area (Anthony, 2001).

The 'Old' Problem: The Un-Sustainable City Of Man

Historical planning policy has resulted in cities being based upon the zoning and separation of land-uses creating unnecessary distances between home and work and thus unsustainable commuting patterns. Post-war UK planning prioritised housing clearance and the dispersal of industry, residential areas and public facilities, thus endorsing low

density, suburban development around our cities thus creating extending work commuting distances and enclosed housing estates for women (Roberts,1991: 70-77) Subsequent governments favoured car use, and the 'Americanisation of British cities' although North American women planners had already warned against the problems of urban decentralisation, over-zealous zoning, and car-dominant cities (Stimpson et al, 1981). Entire districts of cities were bulldozed to make way for urban motorways and car parks for the predominantly car-borne male commuter from the 1960s onwards. Thus a car-based urban infrastructure, with dispersed land-use patterns, was developed, whilst public transport was left to decline. By the end of the twentieth century a range of developments, including out of town shopping malls, hypermarkets, business parks and leisure facilities have located alongside the motorway system, whilst schools, hospitals and local authority offices have all been decentralised in the name of efficiency, thus undermining the viability of existing city centres and traditional towns in the process. All these policies have increased traffic congestion and journey times as people try to travel between different land-uses to carry out their daily tasks. So much so that it is now a virtual necessity to possess a motor car, particularly in cities where public transport has been severely cutback and land uses are highly dispersed and essential facilities, shops and amenities are no longer within walking distance. Women have been particularly adversely affected by these changes because women and men still have different roles and responsibilities, and therefore different travel patterns within the city of man (Anthony,2001). Women constitute the majority of the population and thus 'the planned' (51.1%) (ONS,2012). But women have been poorly served by planning policies that do little to recognise or plan for their 'different' needs and travel patterns in the development of land-use policy (Coleman,2008; Reeves,2005). Women are still predominantly the ones responsible for childcare, shopping and home-making, although the majority of women also work outside the home. This means that women's 'journey to work' is likely to be more complex and multi-purpose compared with the simple uninterrupted, mono-journey to work and back again, of the traditional male commuter, and far more difficult to achieve in cities that are still structured around past zoning priorities and decentralisation. Therefore trip-chaining, and multi-tasking are key features of women's travel, and an inevitable result of trying to combine their home and work. For example, a woman may set off from home, stop off at the childminder, then school, get to work, and return via the school gates, shops and childminder, resulting in complex trip chaining. This daily travel itinerary is difficult to achieve when employment and residential areas have been separated out by traditional land-use zoning, based upon male perceptions of spatial functionality (Uteng and Cresswell, (eds) 2008), whereas for women a range of more personal factors come into play such as personal safety, crime, street lighting, pavement condition, accessibility and practicality (Booth et al, 1996) . Women's journeys are already poorly met by public transport systems that have been designed on a radial basis funnelling workers into the centre during the rush hours, and provide limited off-peak services for women part-time workers, and a lack of transverse, inter-district bus routes. More women than men work part-time or their hours are outside the hours kept by office workers. For example, before the rush hour starts early-morning cleaners have already worked several hours in offices, and factory workers have already left early and commuted out to factories on the city edge.

The 'New' Problem: The Sustainable City

A Negative, Individualised, Condemnatory Spirit (sub-headings)

Far from solving the 'old' problems described above, the new sustainability-orientated planning agenda is compounding these problems and creating 'new' problems of its own, not least because of a lack of a gender perspective on planning, and overall a lack of awareness of social user needs, and the realities of everyday life. Solutions appear to be focused upon restriction, control and penalisation, or upon condemnation of personal lifestyle choices, without offering alternatives based upon investment in structural spatial change and better transport systems and services. In spite of the social class being part of the diversity agenda, one senses a certain contempt for 'the people' within the sustainability agenda. But individuals still have to get to work, they are not free agents, and will have no choice but to use their cars if no other alternative is available. In particular many women are time-poor and the

only way to carry out the elaborate trip-chaining journeys described above is by car. After many years of promoting the motorcar, planners have made a *volte face*, to condemn car use, rather than to promote it, in the name of sustainability : but they still retain the same power to shape cities. Policy proposals to restrict the motorcar and encourage public transport use might at first have been welcomed by the public as a way of easing congestion and making cities more efficient. The restrictions were not accompanied by commensurate measures to increase public transport provision. There appears to be little appreciation within the Government of the necessary investment and infrastructural development, and of all the ancillary preparations and facilities that must be put in place to enable the majority of the population to travel 'en masse' by public transport. A new generation of young green transport planners has arisen who are fired up with environmental fundamentalism. They justify their actions in the name of sustainability and are apparently above reproach because of their zeal for the environment and respect for the Planet. If one dares to say, 'what about women?' one is likely to be told (as I have been many times), 'oh we have done women, you should be concerned with the environment'. There seems to be little understanding of the complex and essential nature of people's journeys, especially women's, and the fact that public transport does not provide the routes, destinations, and timetable provision that women and men require. As a result women travel around cities - with difficulty - using their survival skills and precise knowledge of local bus timetables, with limited time budgets to get everything done. Public transport is inadequate, expensive, unreliable, and infrequent.

The New Emphasis on Public Transport

It is impractical to suggest that everyone should get back onto public transport as the services have already deteriorated (Hamilton et al,2005) and are barely meeting people's existing needs, when only a minority travel by public transport. Some groups never had cars in the first place and find their needs displaced in favour of attracting car driving commuters on to public transport. Existing local bus routes that went around residential areas are being cancelled or diverted to provide buses to serve the more direct routes from Park and Ride car parks to the city centre (as in Brislington, Bristol). Likewise the urban Tramway in Croydon, South London, has improved speed of travel within the town centre but has resulted in existing bus routes coming in from the suburbs being diverted and travel times increased (Greed and Johnson,2014: 240). Much of the hype for people to adopt more sustainable lifestyles gives the impression that public transport is readily available and accessible to all. There are large areas of the country, particularly outside London, where public transport barely exists, with, at the most, infrequent and unreliable bus services. The majority of the population live in suburban areas, comprising both decentralised council housing estates and private residential developments, and many of these areas, particularly in the provinces, lack adequate and reliable public transport systems, and have never had access to the rail system. Many small towns and villages had their railway stations closed down as a result of the Beeching railway cuts (Beeching 1963) and promises of alternative public transport never materialised (Greed and Johnson,2014, ch.12). To save time trains may not stop at intermediate stations because of emphasis on inter-city commuter routes. Therefore, of necessity, many people resort to using their car for the journey to work, because there is no alternative. Penalising the motorist does not give individual citizens the power to re-open railway stations, to create new bus routes, or to change ingrained land-use patterns.

The School Run and Related Journeys

Particular hatred seems to be reserved for 'the school run', an activity predominantly undertaken by women taking their children to school by car and parking outside the school. This activity only contributes towards 15% of rush-hour traffic, but it is widely condemned, for 'cluttering up the roads' (Hamilton et al, 2005). In contrast, no-one criticises the 'office run' or the congestion caused by husbands being dropped off at the railway station by their wives. The school run is portrayed in the media as being undertaken by rich lazy housewives in their '4 by 4' Range Rovers, although many families only own a cheap car and have to make major economies to keep it running. (Seldom does one hear that some male parents do in fact undertake the school run too). One feels a sense of *deja vu*, recalling previous

generations of transport planners who condemned 'women car drivers' and their essential journeys (for work, school, shopping, and childcare) as leisure journeys that got in the way of the journeys of the male bread winner. Greener alternatives are promoted such as the 'walking train' where school children parade along in a crocodile to school with mothers being encouraged to supervise this perambulation. Such schemes assume that mothers will be available early in the morning. In reality, many women are 'time poor' and very anxious at this time of day as they are frantic to get to work. One of the most efficient ways of ensuring that their children get to school on time is to drop them off on the way to work, as part of the morning trip chain, with mothers often sharing this role. 'Walking-trains to school' schemes might be viable in higher density urban areas, but are hardly practical in spread-out suburban locations. However, teachers or official wardens, not mothers, should be provided to staff the activity and should be remunerated for doing so. The journey to school is underestimated, in terms of the numbers involved, and the time and commitment provided by parents to ensuring children get to school on time. Local authorities seem surprised when they find large numbers of children, and for that matter cars, converging on the school gates in the morning and their reaction is mainly negative, to fine people for parking and to condemn the activity. But women are by default providing 'public transport' in their private cars, compensating for lack of government provision. Many the supportive journey activities undertaken by parents are unrecognised, unpaid and condemned, such as undertaking 'escort' journeys to ferry children and teenagers around in the evenings because public transport is so limited and parents are wary of letting their children out on their own.

Many main roads into cities provide a priority lane for those with 2 or more passengers, with cameras checking the numbers of passengers. Although the mothers may have ferried several other people and children in their car in the course of their morning trip chain, by the time they head for the final stretch to work they may be on their own again and find they are not entitled to use the 2+ lane and, although arriving later than others, are also not entitled to use the 2+ parking spaces. Both such contrivances favour the rush-hour commuter on his uncomplicated and unburdened 'journey to work'. Parents, who by their unselfish and complicated car journeys are constantly compensating for the inadequacies of urban form, planning policy and public transport provision are likely to be penalised by these measures. Road charging, for example with the 'Congestion Zone 'in central London, is a crude way of promoting sustainability, based upon the ability to pay, not upon the usefulness of the journeys undertaken. It can cut into women's trip-chaining if they have to pass in and out of the zone several times in the day as they undertake their sequence of trips to and from the childminder for example. But public transport also offers insurmountable difficulties. If mothers, taking children to school, try to use the bus, train or Tube in the rush hour, they are likely to get 'condemnatory looks' for 'cluttering up the public transport system' with their offspring. It is illegal to leave small children unattended at home, so pre-school children and most likely their push chairs will have to come along too for the journey. Some escalators still have signs up banning pushchairs, whereas women may be shouted at for using the disabled lift (Lenclos,2002). Public transport, is far from 'public', and, as the Consumer Association commented years ago, mainly aimed at able-bodied men 'carrying nothing more than a rolled up newspaper'.

Provision of Ancillary Facilities and Local Centres

The promotion of cycling and walking is of value for short local journeys, but expecting everyone to stop using their cars ignores the long distances that many people have to commute to get to work, which in turn are the result of past land-use zoning and decentralisation policies. The closure of local shops and decentralisation of retail stores also makes it increasingly difficult to food-shop without using a car. Twice as many men as women cycle in Britain (WDS, 2005). Deterrents include abuse from male drivers, personal safety fears on cycle paths, road safety concerns and lack of ancillary amenities. Buses, trains, railway and bus stations, pavements, streets, toilets, and public spaces need to be accessible to everyone if the government is serious about creating sustainable cities. It is hypocritical to condemn people for using their cars if they are unable to access the public transport system because of steps, steep gradients, poor lighting, narrow footpaths obstructed by posts, poles and bins, poor lighting and unsafe layouts. These issues

affect millions – not 'just' the disabled – but everyone who is disenabled by the design the built environment, but anyone who feels vulnerable or who finds the city difficult to negotiate. Much sustainability policy appears to be framed with little reference to the differences in travel patterns undertaken by women and men. Likewise, emphasis in existing inclusive design policy is generally upon facilitating accessibility at the 'micro' street layout level, by remedial measures such as installing ramps, rather than promoting systemic change in land-use and transportation patterns at the city-wide strategic planning level, that would increase access and mobility for all. The Government has made much of creating 'sustainable communities' (ODPM, 2003), and one would imagine this would be the 'magic link' between 'sustainability' and 'social inclusion'. There appears to be limited acknowledgement or understanding of the range of groups that comprise 'the community'. After the obligatory, introductory reference to the importance of gender, sex, race, age inter alia, 'disability', proves to be the main subject of much inclusive design guidance, thus obscuring other diversity issues that require attention (CABE,2008: TCPA,2009). Indeed women are seldom mentioned in key policy documents on accessible and sustainable transport resulting in the need for 'special' policy documents on 'women and transport' being produced, for example, by the Equal Opportunities Commission (Hamilton et al, 2005), and progressive local authorities (GLA, 2007). A community is not sustainable if it ignores the needs of its elderly constituents (Age UK,2009:44) and has limited understanding of women's 'different' use of the city and its transport systems (Uteng and Creswell (eds) (2008) and only holds old-fashioned stereotypical views of men's activity patterns (Reeves,2005:74). People over 50 years of age now constitute 21 million people (a third of the population) (Gilroy, 2008) of whom over 65% are female so clearly this is another 'women and planning' issue. Age UK puts an emphasis upon a city-wide, strategic spatial approach to reshaping the city to meet the needs of the ageing population., stressing the key components of safe streets, transport, pavements, toilets, shops, places to meet, seating etc. The link is made between sustainability and inclusive design by showing that an increased localisation of food production, shops, housing and social facilities reduce climate change and the chances of local flooding, as well as diminishing the need to travel. Recommendations are not limited to ramps and disabled toilets but address city-wide strategic planning policies on transport lan-use, and the location of local centres and facilities.

Sensitivity to ethnic minority needs does not figure strongly in the sustainability agenda either; indeed they can be condemned for using too much public transport! A large, Nigerian-led church sought planning permission to rebuild on a site in Dagenham, East London on land designated for industrial use by the Thames Gateway planners, which had remained vacant and unwanted for several years. They were refused permission to develop. They were shocked by this decision because the church had been forced to relocate in the first place as the land they were on was designated for compulsory purchase to make way for the Olympic Games; and they had been reassured by that planners that every effort would be made to find them an alternative site. One of the key reasons given for refusal was that 'church goers would strain local public transport' (Planning, 11.09.09:5), as most such worshippers would arrive by bus or foot and few had cars (CAG, 2008; Onuoha and Greed, 2003). In contrast, any other development which did not generate car journeys or require car parking spaces, such as new green office development, would be welcomed as ideally 'sustainable' ... (Greed, 2005). Clearly sustainability and social inclusion are not linked in the minds of the planners. The application was also turned down because it was not seen as being of economic value. In reality such churches provide a host of supportive social amenities and services, such as childcare, careers guidance and housing advice that enable the functioning of economic activities. But land uses that contribute to the 'social capital' of the area are not included within the remit of 'sustainability' within the local planning policy framework (Planning Inspectorate, 2009).

Conclusion and Recommendations

The current approach to sustainability puts a disproportionate emphasis upon environmental factors, with particular concern about transportation issues. It makes it more difficult for people to live their lives without providing viable alternatives, not least because women's journeys and land-use needs are not given adequate attention in sustainability policy. Rather than introducing negative car-controlling policies, and tinkering around with traffic light sequences and

parking space allocations, apparently to slow the traffic down and to discourage people from using their cars, there needs to be positive measures, such as realistically investing in public transport to give people viable journey alternatives. In the longer term, fundamental structural changes are required to urban form and structure through forward planning policy. If the full agenda of 'sustainability' were taken into account, the social impracticalities would soon come to light. Likewise if the full agenda of 'inclusive design' were taken into account, rather than restricting it to a few' special' disability measures, the needs of the majority of the population would be met, especially women and the elderly. Adding together women of all ages, who make up 51.1% of the population, plus men over the age of 55 (to capture all the elderly from 55 upwards), over two thirds of the population (ONS, 2012).

Whilst much of the blame for a lack of inclusive urban design rests with the town planners and urban designers, 'planning' is not all powerful. The statutory powers governing the scope and nature of the planning system militates against the implementation of true sustainability policy because so many practical, everyday issues (such as toilets) and 'social' issues (such as childcare), are not 'officially' of concern of the planning system. Such matters are deemed *ultra vires* 'not a land-use matter' within the UK planning system. In contrast environmental sustainability , easily fits into the planning system, because it is relates to the physical environment and traditional protectionist concerns of town and country planning. The government did not hesitate to integrate EU directive requirements for EIA, that is Environmental Impact Assessment, into the planning system. There is no parallel requirement that SIA (Social Impact Assessment) should be carried out. So social considerations (unlike environmental requirements) do not feature in the main body of development plan documents. However, some progressive local authorities have included equality policies in the Supplementary Planning Guidance documents (GLA,2007) and produced guidance reports on spatially-relevant topics, such as public toilets, which fall outside of the scope of statutory planning (GLA,2006; Greed,2003).

To achieve truly sustainable transport policy there is a need to relate land-use patterns more directly to women's trip-chaining travel patterns and time-budgeting, and examples of this can already be found in some more progressive municipalities in Western Europe and North America (Madariaga and Roberts, 2013; Fincher and Iveson,2008). For example, Groningen City Plan in the northern Netherlands requires that childcare provision is planned alongside school buildings to ensure that the trip-chain is simplified for busy parents, dropping off children on the way from home to work, thus making bicycle travel both possible and preferred. This policy is enabled by applying Dutch central government guidance on approaches to urban planning that combine work and family care needs within housing areas. Likewise at the detailed street layout level there has been a concern to link gender issues to traffic management matters, such as traffic calming for many years in Germany (Hass-Klau, 1990). Overall, there is little evidence of gender being taken seriously into account in British town planning (Greed,2005; Jarvis et al, 2009). Yet, the Gender Equality Duty (DCLG, 2007) , requires all local authority departments including architecture and planning, not to discriminate in terms of policy making, allocation of resources , provision of public services, and recruitment and promotion of planning staff. The RTPI has published a Toolkit for practitioners (RTPI, 2003 and subsequent guidance), whilst the Government itself has promoted diversity in planning (ODPM,2005).

Whilst we await such changes, there is a need to re-evaluate existing priorities and investment. If social and environmental issues were cross-referenced, then sustainable transport policy would prioritise different types of journeys as 'essential'. Rather than building new Park and Rides to meet the existing needs of predominantly male commuters, greater emphasis would be given to local, and off-peak bus services to meet working women's unrecognised travel needs, and, as a result, the routes and timetables would be reconfigured to meet the substantial, unmet, 'off peak' needs of the travelling public. As for car use, new car parks would be built, and not condemned outright, but aimed at meet different priorities, with more flexible combinations of private and public transport modes. If sustainability policy were more 'joined up', collector car parks would be built around all suburban railway stations, especially in Greater London, and around bus termini in the main provincial towns. This would enable people to get to the railway station by car and park, and then use the train. En route to the new car parks they could still carry out the

other parts of their trip chain, such as getting their children to school or childcare, and on the way back carry out essential food shopping and other necessary home-making duties. At present many people use the car for their entire journey as there is no connecting bus route from their residential area to the nearest railway station (which may be 10 miles from home) and once in the car it is quicker to go all the way. A wider picture of travel patterns and their social value would be built up. Supporting services such as toilets, bus-shelters, crèches, cycle lanes, steps, storage and carriage of luggage, and shopping home delivery services would all be integral components of the transportation infrastructure. Nevertheless some enlightened local authorities have sought to demonstrate the linkages between sustainability and social inclusion. For example Plymouth first used a matrix model to link sustainability and gender issues in planning policy making (Plymouth,2001). The Greater London Authority and several of the London boroughs have strongly promoted the mainstreaming of gender into planning policy too but with variable results (GLA,2007). But much more needs to be achieved nationally. As an alternative to spread out, zoned, low density cities, many women planners would like to see the 'city of everyday life' which they define as the city of short distances, mixed land uses and multiple centres as the ideal objective that would fully take into account gender considerations. Such a city structure would benefit all social groups, reduce the need to travel, create more sustainable cities, that would be more accessible, whilst creating higher quality of urban environment for all. It would provide more jobs and facilities locally and help revitalise declining areas overall.

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How Does Population Declining and Aging Affect Residential Energy Demand in Japanese Cities?

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ABSTRACT

In this study, the impact of the low birthrate and aging population on the consumption of household energy (electric power, city gas, propane gas, and kerosene) is examined based on the data from eight cities in Japan's Kyushu region from 2002 to 2012. The study found that the economies of scale work between the number of people in a household and the household energy consumption per member of a household considered as a good indicator showing how the household uses energy efficiently. However, it also found that the economies of scale are gradually being lost in the cities. This happens because the number of households, particularly single-person households and senior single-person/married households is increasing along with a low birthrate and aging population, resulting in a decrease in the number of people in a household. If the low birthrate and aging pattern continues, the economies of scale in household energy consumption could possibly diminish further. For urban sustainable development, the idea of sharing household energy consumption should be taken into account in city planning.

KEYWORDS: aging population; economies of scale; Japanese cities; low birthrate; residential energy Consumption; urban sustainable development

1. INTRODUCTION

Japan became a "hyper-aged society" (a society in which the ratio of people aged 65 or older exceeds 21%) in 2007, and a decrease in birthrate and increase in aging population in the country continues. The impacts of the low national birthrate and aging on work force, economy, pension, healthcare, nursing care, local economy, and so on, are a matter of discussion in the country. In contrast, a conversation around the impact of the low birthrate and aging on the environment is far less common. However, knowledge of the impact of low birthrate and aging on the environment is essential in realizing urban sustainable development, more specifically in building low-carbon as well as senior friendly cities. This study examines the impact of the low birthrate and aging on the consumption of household energy (electric power, city gas, propane gas, and kerosene) based on the data from eight cities in Kyushu region (hereinafter Kyushu) indicating one of Japan's four main islands located in the south[1]. This study focuses its analysis on the number of people in a household that affects the household energy consumption. The existence of economies of scale that work between the number of people in a household and the household energy consumption per member of a household (meaning the higher the number of people in a household, the lower the household energy consumption per member of a household) are identified in the studies on residential energy demand (for example, [1] [2] [3] [4]). In addition, a limited number of studies attempt to investigate the impact of population aging on energy demand or residential energy demand (for example,

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[1] Eight cities are Kitakyushu and seven cities in which prefectural government offices are located (Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki and Kagoshima).

[5] [6]). Using the data from eight cities in Kyushu from 2002 to 2012 this study aims to examine the impact of a low birthrate and aging on the number of people in a household, and the resulting impact on the household energy consumption

The structure of this paper is as follows. Section 2 outlines the changes in household energy consumption in Japan. Section 3 outlines the changes in population, households, the number of people in a household, and the household energy consumption per member of a household in Japan. In Section 4, the data from eight cities in Kyushu are analyzed to investigate the impact of the low birthrate and aging on household energy consumption. Finally, Section 5 discusses the implications of study results for city planning.

2. CHANGE IN HOUSEHOLD ENERGY CONSUMPTION IN JAPAN
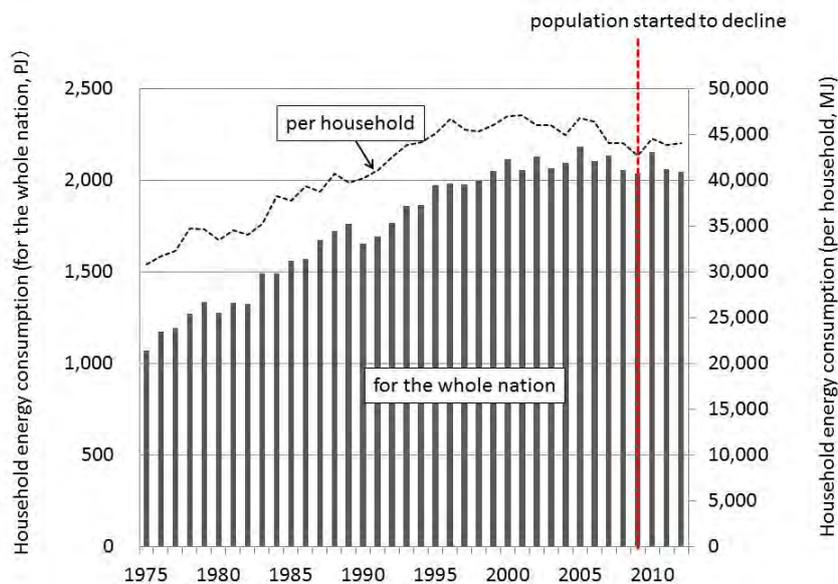
Figure 1. Change in household energy consumption in Japan (1975–2012)

Data source: Jyukankyo Research Institute Inc. (2013), p.31, pp.204-5.

Figure 1 illustrates changes in household energy consumption in Japan (for the whole nation and per household). The value of the household energy consumption for the whole nation is available from Jyukankyo Research Institute Inc. [7]. It was 1,071 PJ in 1975 (10.2% of the total national energy consumption of 10,510 PJ, which consists of industry, households, business, and transportation sectors); 1,562 PJ in 1985 (13.8% of the total national energy consumption of 11,325 PJ); 1,973 PJ in 1995 (12.9% of 15,318 PJ); 2,182 PJ in 2005 (13.6% of 15,996 PJ); and 2,030 PJ in 2012 (14.2% of 14,347 PJ) [2]. Though Japanese population started to decline in 2009 (as discussed in Section 3), its household energy consumption for the whole nation has been relatively stable during 2009-2012 with an increase in 2010. The value of the household energy consumption per household (national mean), a commonly used unit to

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[2] PJ is 10^{15} joules (J: unit of energy). MJ is 10^6 J.

indicate the degree of energy consumption in the household sector, is also available from Jyukankyo Research Institute Inc. It is based on the annual reports of family income and expenditure survey from the Ministry of Internal Affairs and Communications-Statistics Bureau [8] [3]. The family income and expenditure survey is a sample survey that targets approximately 9,000 households (households with a single person or more than 2 persons) from 168 municipalities, excluding single-person households of students and households in facilities or institutions [9]. Therefore, the value of the household energy consumption per household is for households with a single person or more than two persons, excluding single-person households of students and households in facilities or institutions. The household energy consumption per household has a similar trend as the national household energy consumption.

3. DEMOGRAPHIC CHANGE AND HOUSEHOLD ENERGY CONSUMPTION PER MEMBER OF A HOUSEHOLD

The household energy consumption per household in the previous section is commonly used to indicate the level of energy consumption in the household sector. However, to indicate how the household uses energy efficiently, the household energy consumption per member of a household is more appropriate. This section examines how the household energy consumption per member of a household has changed along with low birth rate and aging population in Japan.

Figure 2 demonstrates the change in the total population of Japan consisting of people under 65 years of age and those 65 years of age or older, and also the change in the number of households. The total population of Japan continued to increase from 1975 to 2008, excluding 2006, and reached its peak in 2008 (127,076,000). Following this, it decreased gradually (126,394,000 in 2012). In 1970 Japan attained the title of an "aging society," which is defined by the World Health Organization (WHO) and United Nations (UN) as a society in which the ratio of the people 65 years of age or older exceeds 7% (7.1%); in 1994 an "aged society" where the ratio of the people 65 years of age or older exceeds 14% (14.1%); and in 2007 a "hyper-aged society" where the ratio of the people 65 years of age or older exceeds 21% (21.6%). In 2012 the ratio of people 65 years of age or older was 24.4%. Population of 65 years of age or older increased from 8,865,000 in 1975 to 30,793,000 in 2012 (nearly 3.5 times). On the other hand, the number of households was 33,911,000 in 1975; 44,831,000 in 1995; 51,102,000 in 2005; and 54,166,000 in 2012 (nearly 1.6 times).

According to the national census, the definition of a household is a "group of people who share the livelihood and residence, or a single person who maintains a residence independently," and the households are generally categorized as a "general household" and "facilities and institutions." The "general household" category includes residents of detached houses and collective housing, and individuals living in bachelor quarters and dormitories of companies, organizations, shops, and public offices. On the other hand, "facilities and institutions" category includes students living in dormitories, hospitalized patients in hospitals and sanatoriums, and residents of welfare facilities such as seniors' homes and child protection

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[3] The value of household energy consumption per household is calculated from the household expenditure on energy and the price of energy in the survey.

facilities. Household unit is per building for this category. This study focuses on only "general households" firstly because the data for "household energy consumption per household" used in this study is based on the family income and expenditure survey that excludes "facilities and institutions" as mentioned in Section 2 and secondly because the share of "facilities and institutions" is very small in terms of the number of people living in households (only 1.96% of total number of people living in "general households" and "facilities and institutions" as of 2010).
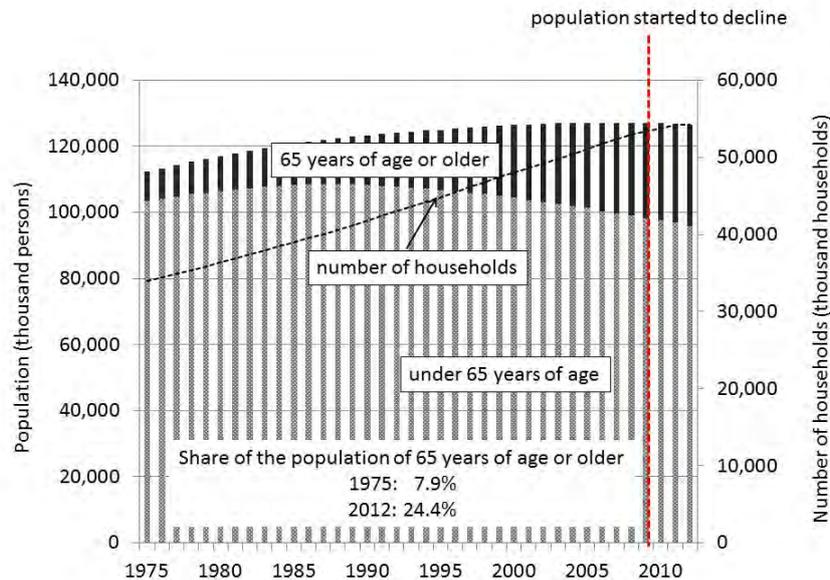
Figure 2. Change in the population and the number of households in Japan (1975–2012)

Data source: Ministry of Internal Affairs and Communications-Statistics Bureau e-Stat/Regional Statistics Database.

Energy used in a household (in the forms of electric power, city gas, propane gas, and kerosene) has a large portion shared by the members of the household (e.g., lighting in a living room and gas for cooking). Therefore, as the number of people in a household increases, the household energy consumption per member of household decreases. This is what is called the economies of scale in relation to the household energy consumption. However, as illustrated in Figure 3, a phenomenon opposite to the economies of scale is occurring. That is, over each five-year period during 1980–2010, the "household energy consumption per member of household" (national mean) increases while the "number of people in a household" (national mean) decreases[4]. In other words, the economies of scale in terms of household energy consumption are gradually being lost.

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[4] A decrease in the number of people in a household happens as a result of an increasing rate of households exceeding an increasing rate of population.
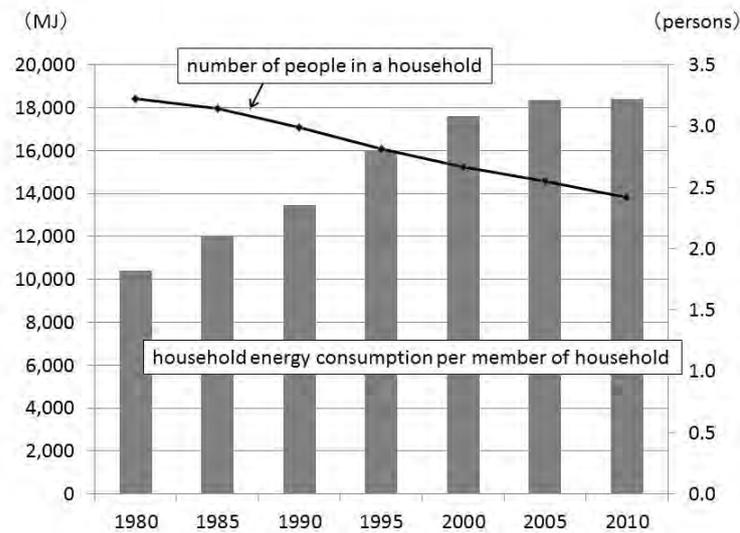
Figure 3. Changes in the number of people in a household and the household energy consumption per member of a household in Japan (1980–2010)

Data source: Ministry of Internal Affairs and Communications-Statistics Bureau e-Stat/Regional Statistics Database.

4. IMPACTS OF LOW BIRTHRATE AND AGING ON HOUSEHOLD ENERGY CONSUMPTION: AN ANALYSIS OF EIGHT CITIES IN KYUSHU

As mentioned in Section 3, in Japan, as the number of people in a household decreases, the economies of scale in relation to the household energy consumption are being lost. This section uses the data from eight cities in Kyushu to examine the presence of the economies of scale in household energy consumption, while analyzing the impact of low birthrate and aging on the number of the people in a household.

4.1. Deciding factors for household energy consumption per member of household

This study considers the energy consumption per member of household as a good indicator showing how the household uses energy efficiently rather than the energy consumption per household. It would be determined by several factors. The first factor is, as already discussed in Section 3, **household composition** such as the number of people in a household and the type of a household (e.g. a nuclear family, a two-generation household, or a senior household). The second factor is **climate**. In Japan, which has a north-south orientation and four seasons, climate has a significant impact on energy consumption. The third factor is **economic factor**, which includes household income and energy price. The fourth factor is **housing factor**: housing type (detached house or collective housing) and total floor area. The fifth factor is **lifestyle of household members.** Energy consumption varies by lifestyle, which is attributed to the type of a household (e.g. a household with seniors who stay at home more hours in a day is likely to consume more energy). It is ideal to analyze the impact of low birthrate and aging on these factors (household composition, climate, economic factor, housing factor, and lifestyle) and then the impacts of changes in these factors on the household energy consumption, particularly the household energy consumption per

member of household. However, the study excludes the factors of energy price and climate from the analysis firstly because low birthrate and aging is unlikely to affect these two factors and secondly because the impacts of changes in energy prices and climate can be assumed almost the same across eight cities in Kyushu. On the other hand, aging population is very likely to affect the factors of housing and lifestyle because senior households tend to live in detached houses with large floor area and to stay at home more hours in a day. As a result, this section focuses its analysis on the household composition.

4.2. Changes in population and households in eight cities in Kyushu

Table 1 and Table 2 show the changes in population and households in eight cities in Kyushu for national census years 2000, 2005, and 2010. Table 1 outlines the population along with the ratio of people 65 years of age and older, the number of general households, and the number of people in a household (city mean) obtained by dividing the number of people in general households with the number of general households. During 2000-2010, population decreased in Kitakyushu, Saga, and Nagasaki while it increased in the other five cities. However, the share of people aged 65 and older and the number of general households increased in all eight cities. On the other hand, the number of people in a household decreased gradually in all eight cities. This decrease resulted from the fact that the increase in the number of households exceeded the population increase. For example, during 2000-2010, the number of households increased by 3.3% in Kitakyushu while its population decreased by 3.4%.

Table 1. Changes in population and the household composition in eight cities in Kyushu
(general household) ① (2000, 2005, and 2010)

	Year	Population（persons）	Share of people 65 years of age and older（%）	Number of households（households）	Number of people in a household（persons）
Kitakyushu	2000	1,011,471	19.2	406,414	2.4
	2005	993,525	22.2	412,247	2.4
	2010	976,846	25.1	419,984	2.3
Fukuoka	2000	1,341,470	13.3	594,861	2.2
	2005	1,401,279	15.2	632,653	2.1
	2010	1,463,743	17.4	706,428	2.0
Saga	2000	243,076	18.6	84,727	2.8
	2005	241,361	20.8	87,445	2.7
	2010	237,506	23.0	90,154	2.6
Nagasaki	2000	470,135	19.5	182,831	2.5
	2005	455,206	22.6	183,164	2.4
	2010	443,766	24.9	187,267	2.3
Kumamoto	2000	720,816	16.7	277,181	2.5
	2005	727,978	19.0	286,998	2.5
	2010	734,474	20.8	301,718	2.4
Oita	2000	454,424	15.1	174,036	2.6
	2005	462,317	17.6	182,159	2.5
	2010	474,094	20.2	195,228	2.4
Miyazaki	2000	392,178	16.1	154,929	2.5
	2005	395,593	18.7	161,890	2.4
	2010	400,583	21.2	169,758	2.3
Kagoshima	2000	601,693	16.6	246,494	2.4
	2005	604,367	18.8	254,694	2.3
	2010	605,846	21.0	264,093	2.2

Data source: Ministry of Internal Affairs and Communications-Statistics Bureau e-Stat/Regional Statistics Database.

Table 2 indicates that the share of single-person households, including senior single-person households, increased in all eight cities during 2000-2010, and that the share of senior households that includes both senior single-person households and senior married households increased in all eight cities during 2000-2010. The increase in the number of households is clearly attributable to the increase in the number of single-person households and senior households. During 2000-2010, the share of the number of single-person households, including senior single-person households, increased by approximately 3-4% in all eight cities in Kyushu, and the share of senior households composed of senior single-person households and senior married households also increased by approximately 3-4% in all eight cities.

Table 1 implies that, if the increase in the number of households continues to exceed the increase in population (actually, Japan's population is predicted to decline further), the number of people in a household is likely to decrease further. Table 2 implies that, with population aging, the share of senior single-person and married households is likely to increase further.

Table 2. Changes in population and household composition in eight cities in Kyushu
(general household) ② (2000, 2005, and 2010)

	Year	Share of single-person households (%)	Share of senior households		
			Total (%)	Share of senior single-person households (%)	Share of senior married households (%)
Kitakyushu	2000	30.3	19.1	9.6	9.5
	2005	32.1	21.7	11.0	10.7
	2010	34.6	23.9	12.5	11.4
Fukuoka	2000	43.1	11.6	6.2	5.4
	2005	43.9	13.3	7.2	6.1
	2010	47.7	15.0	8.5	6.5
Saga	2000	27.0	14.6	6.6	8.0
	2005	28.8	16.6	7.7	8.9
	2010	30.9	18.2	8.8	9.4
Nagasaki	2000	29.2	18.4	9.0	9.4
	2005	30.7	20.8	10.2	10.6
	2010	33.7	22.4	11.4	11.0
Kumamoto	2000	32.0	14.5	6.9	7.6
	2005	32.8	16.5	8.1	8.4
	2010	34.9	17.8	8.8	8.9
Oita	2000	28.9	13.2	5.6	7.6
	2005	30.0	15.7	6.8	8.9
	2010	32.4	17.9	7.7	10.1
Miyazaki	2000	30.6	15.6	7.0	8.6
	2005	31.9	18.1	8.4	9.8
	2010	33.6	20.1	9.5	10.6
Kagoshima	2000	33.5	17.5	8.6	8.9
	2005	34.6	19.1	9.5	9.6
	2010	36.6	20.7	10.5	10.2

Data source: Ministry of Internal Affairs and Communications-Statistics Bureau e-Stat/Regional Statistics Database.

4.3. The number of people in a household vs. the household energy consumption per member of household in eight cities in Kyushu

Here, using the data of eight cities in Kyushu from 2002 to 2012 (panel data) available from the annual reports of the family income and expenditure survey by the Ministry of Internal Affairs and

Communications-Statistics Bureau, the presence of economies of scale in household energy consumption is verified. In the family income and expenditure survey that targeted approximately 9,000 households in 168 municipalities, the total number of households in eight cities in Kyushu was approximately 100 for each city. Figure 4 is a scatter plot of "the number of people in a household" (city mean) and "the electric power consumption per member of a household" of eight cities in Kyushu (sample number: 8 cities x 11 years = 88). As the average "number of people in a household" increases, "the electric power consumption per member of a household" decreases. Hence, the economies of scale in electric power consumption are functioning. The minimum value of the number of people in a household is 1.80 with the annual electric power consumption of 2,159.9 kWh. The maximum value of the number of people in a household is 2.77 with the annual electric power consumption of 1,778.9 kWh. The difference in the annual electric power consumption is 381.0 kWh, which is comparable to the monthly usage for an average family. The 2002–2012 data for "the number of people in a household" and "the gas consumption per member of a household" in eight cities in Kyushu was also used to create a scatter plot, shown in Figure 5. In gas consumption, though less prominent than in electric power, a similar relationship was identified, and it was confirmed that the economies of scale are functioning.

As shown in Figure 4 and 5, it was confirmed that the economies of scale exist regarding household energy consumption in eight cities in Kyushu. However, the economies of scale are being lost in the cities since the number of people in a household is decreasing as shown in *4.2*. If the low birthrate and aging pattern continues, the economies of scale in household energy consumption could possibly diminish further.
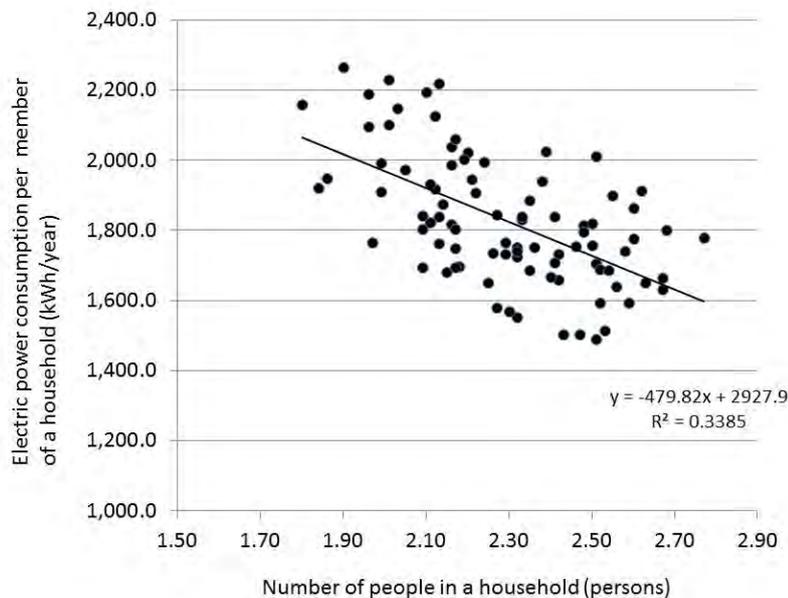
Figure 4. The number of people in a household and the electric power consumption per member of a household in eight cities in Kyushu
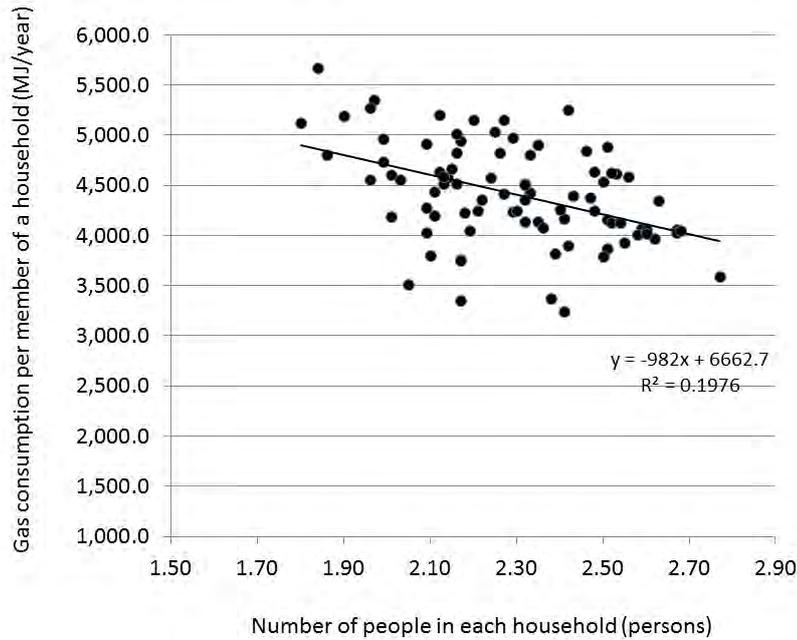
Figure 5. The number of people in a household and the gas consumption per member of a household in eight cities in Kyushu

5. COCLUSION

This study found that the progression of the low birthrate and aging would result in further diminished economies of scale in relation to household energy consumption. Diminished economies of scale is likely to happen not only because of a further decrease in the number of people in a household but also because of an increase in senior households which tend to live in detached houses with larger floor space and spend longer hours in their houses. The study findings provide two insights into efficient household energy use. First, living in a residence with the floor space that matches the number of people in a household makes household energy use efficient. Second, sharing the use of household energy as much as possible increases the overall efficiency of the household energy use. Sharing household energy should be promoted within a household, between households, or even in a community.

For urban sustainable development, the idea of sharing household energy consumption should be taken into account in city planning. If a community is designed compactly, the potential for sharing household energy must increase. In this sense, compact city must be a good solution for building a low-carbon society as well as senior-friendly society.

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TITLE

Fostering Humanitarian Architecture for vulnerable communities. Contributions to the inter-cooperation within the Portuguese Speaking Countries' Community (CPLP).

ABSTRACT / SUMMARY

Aiming at explore the links between architecture, natural hazards, vulnerability, disaster risk reduction, long-term recovery, slum upgrading, social innovation, community-oriented design and self-help building., this paper focuses on the role played by architects working alongside humanitarians and developers. It seeks new methodological approaches and a reestablishment of architectural practice and education. In practical terms, this research will look for lessons to be learned from worldwide experiences that can be applied to the CPLP, in order to make a contribution to strengthening the inter-cooperation.

To fill the gap between humanitarians and designers working alongside vulnerable communities translation tools between those professionals will be explored. In this sense, an attempt it will be made to bring into 'humanitarian architecture' social innovation's features.

Applying a trans-disciplinary approach, the research proposes a discussion on the concepts of social innovation, community-design and incremental housing. The fieldwork of the NGO Building 4 Humanity provides a living laboratory for this approach and for testing the findings on the role played by architects in severely affected communities' environments.

From initial results, it has emerged that the most sustainable and resilient accomplishments occur when architects work as 'cultivators' and 'facilitators', assuming a creative but also supporting role, instead of working merely as designers and processes controllers. The reestablishment of architectural theory, practice and education, in order to better plan, build and use the adaptive capacity of architecture, stands as a point of transformation towards a more sustainable and equitable world.

Key words: *trans-disciplinary, humanitarian architecture, social innovation, urban disaster, CPLP*

INTRODUCTION

Musseques, favelas, cortiços, caniços, bairros de lata: different names for equally unplanned, highly dense and overcrowded squatters' settlements. These areas typically have a lack of infrastructures, are exposed to floods and landslides, and are socially stigmatised. They are also recognised by their precarious security, social and public health problems as well as for their fragile and hardly expandable houses. Unsurprisingly, in these non-city areas leave marginalised communities exhibiting both immediate and developmental needs. Thus, in 'the planet of slums' social exclusion prevails making it difficult for people to escape the cycle of poverty [2]. Moreover, in these areas the relationship between disasters and development is of much greater magnitude due to the high vulnerability of people and houses. Countries such as S.Tomé e Principe, Cabo Verde, Guiné-Bissau, Angola and Mozambique, Brazil and Timor-East present different urban realities, face particular problems and singular challenges. Yet, their local governments and city dwellers have to deal with similar shortages and risky circumstances when it comes to informal settlements, which are characteristically present in the peripheral and sometimes even central areas of their major and rapidly growing cities.

Portugal incorporated Hyogo Framework for Action 2005-2015 into governmental policy in 2004. Since then, Disaster Risk Reduction (DDR) has been increasingly included in humanitarian aid policies, however, little attention has been paid to the issues related to rebuilding after disaster or development programs for informal settlement within bilateral cooperation with African Portuguese speaking countries [1]. Corresponding to the impact of disasters, conflicts and extremely poverty issues, NGO's present in the field are mostly specialised in emergency response, and just a few of them have been dedicated to (re) building employing a long-term developmental perspective. As a result of that, there is a significant lack of planning, design and enduring action, notably in vulnerable areas, such as the informal settlements. Thus, besides the need for urgent humanitarian aid, acting in favour of sustainable urbanism and architecture for informal settlement is necessary. By reducing disaster risks, promoting better building, retrofit, and rebuilding, it is possible to achieve a more substantial social impact. Within the scope of analysis, synthesis and learning from local traditional and innovative attempted solutions, the current research will be looking selected experiences on low-income housing and recovery. Ultimately, the aim is to apply lessons to the Portuguese speaking countries community (CPLP), especially in Africa and in general in the Global South, where Portuguese is the most spoken language. Particular attention will be given to the concept of incremental housing, which has proven to be effective throughout decades of slum upgrading operations based on self-help or aid-self help building.

OBJECTIVES/ SCOPE

The research goals are as following:

- (1) Questioning the place occupied by architectural design practice and the role played by architects on rebuilding recovery processes addressed to very severely affected communities in the context of humanitarian aid (post-disaster rebuilding) and low-income housing (development contexts).

- (2) Building up translation tools between humanitarians and architects, exploring common conceptual vocabulary, web-based digital mapping, computer aid design and interactive systems for re-generating building types.

- (3) Incorporating the subject of 'humanitarian architecture' into the architectural graduation curricula and outlining a post-graduate proposal with a focus on the CPLP geography.

- (4) Yet focused on how to better plan, design and rebuild in disaster-prone and informal settlement areas, investigation must also address education at different levels, ranging from children (formal and informal education for disaster risk reduction) to adults (long life learning), to students of university (particularly those enrolled in architectural, urban design or urban planning graduations).

- (5) Bringing into the discussion of theory and practice of architecture, features and tools used in social innovation, towards a sustainable and trans-disciplinary architectural approach to be applied in the context of disaster and development.

 - (6) Making a contribution to the strengthening of cooperation amongst Portuguese speaking countries in the areas of post-disaster rebuilding, disaster risk reduction, post-recovery assessment, informal settlement upgrading.

Furthermore, research should contribute to a better understanding of a few crucial points when comes to deal with much needed or several affected communities:

- (1) Which is the role-played by architects and architecture in the post-disaster, namely in the aftermath, in the developmental phase and also in between the two phases?

-    (2) How many people are interested in the subject, what are the short and long terms architectural impacts, to what extent it matters, and, ultimately, does it make a difference?

-    (3) What examples may confirm architectural impacts and the actual role played by designers working near humanitarians and low-income housing developers such as local communities, NGO's, and municipalities?

- (4) How to involve the communities in design and building meaningful processes and how useful are classical tools, such as 'incremental housing', and social & ecological innovative tools, such as community building, experiential learning, gender issues and 'decoupling' and creative thinking?

- (5) How to educate, enable, empower and technically support people for disaster risk reduction and launch, in a community driven & oriented basis, design and building recovery, and developmental processes?

Synthesising into just one question:

- How to assist people build to meet their long-term physical, social, cultural, psychological and spiritual needs?

A first working hypothesis was that the more sustainable and resilient accomplishments occur when architects undertake a creative but also supporting role. A second hypothesis was that the dissemination of incremental housing design among householders, builders ad self-builders may respond to both emergency and long-term needs, allowing for effective urban form and building type controlled massive reconstruction and upgrading.

METHODOLOGY

The approach adopted is trans-disciplinary whereas the type of investigation is action-based. Accordingly, the investigation undertakes the challenge of facing the theatre of humanitarian and developmental operations. Moreover, it brings together in humanitarian projects and surveys experts coming from different areas and with a diverse background, while working and alongside and within communities. Learning on the field, drawing near the residents and researching by project and by doing, designing and building in a local-resources-basis, requires a close relation with stakeholders. In a small scale and low profile NGO this relation with local communities may progress through remote communication; in the beginning, indirectly, via humanitarians on the field; afterwards, directly, thanks to internet technologies and social networks. Precisely, these interfaces of communication will be addressed in next stage through a web community-driven mapping collaborative tool for architectural models simulations. This technology is supposed to anticipate both physical ad financial scenarios for rebuilding and incremental housing and risk reduction measures and support the monitoring and assessment of long-term impacts of on-field actions. [3]

Keeping the focus on the geography of the Portuguese-speaking developing countries, the research deals with an encompassing framework concerning (1) theory and practice, (2) planning and building, (3) the social and the environmental, (4) the ethical and the educational, (5) innovation and traditional knowledge.

In terms of research methods, the in-situ observation, interviewing and surveying embraces a genuine exchange and intercultural dialogue with residents; digital mapping and computer aid design tools assist and try to advance this interaction while pursuing communities' empowerment on recovery, urban upgrading and housing issues.

In the field, these methods were realized in the form of an action & research laboratory. This laboratory was constructed in Guinea-Bissau, by crossing information with on-going projects and research for African countries by Portuguese based NGO Building 4Humanity Design and Reconstructing Communities Association and also follow steps of the joint international project leaded by a Portuguese University, focusing on local building types and energy efficiency, the SURE Africa [4].

DISCUSSION

In the past three decades, we have been witnessing a great augment of research related to disasters. Firstly, at the beginning of the Eighties, the focus was clearly on sheltering which result in several reports and guides for emergency action, reconstruction and relocation issues [2]. These documents were produced at request or directly by the United Nations and the World Bank, two entities that since then become leaders in the promotion of actions and broad and statistical studies on the impact of natural hazards and of the situation of developing countries [5]. In the nineties, the attention gradually shifted to more sophisticated disaster recovery guides, with the incorporation of disaster mitigation strategies, livelihoods and community engagement [6]. New educational programs for international development and disaster marked this period. From this programs arose a wide range of researchers coming from social sciences. In the 21st century, new developments in technology, notably in GIS, the consolidation of the environmental university programs and reshaping of geography and mathematic sciences enabled the incorporation of scholars from these areas, concomitantly contributing to widen the scope of post-disaster research. Thus, the new studies addressed risk and economic issues [7], social and cultural impacts, livelihoods, gender issues, minorities, social and cultural impacts, as well as in-depth investigations on participation models [8]. Additionally, in a gradually way, acquired importance the subject of the informal settlement, the place where came to live the majority of the most vulnerable

people. Although covering an increasingly wide range of areas, it is noteworthy in recent studies, the lesser attention paid to architectural issues within the humanitarian context. As such, there is little evidence of Architecture exposure to other fields of research, just a few signs of trans-disciplinary investigations [9]. It is necessary to go back many decades to find an integration of architecture to services, infrastructures, economics and social dimensions, like the one proposed by the 'site and services projects' (SSP). [10]. In this matter, it is noteworthy the current interest in the trans-disciplinary concept of incremental housing (IH), successfully implemented by Alejandro Aravena and Elemental group, in Chile [11]. This concept, both in research and practice, can be seen, at a certain extent, as a revision of the SSP. [12]. Recently, this concept has been approached by cutting-edge research focused on computer aid design-based automation software, with the goal of optimising mass housing design and (re) construction [13].

In the Portuguese-speaking countries arena, the inter- cooperation on urban research gave rise to studies that addressed peripheral non-infrastructured areas issues, highlighting social concerns and the right to the city, in Lefebvre terms. [14]. Singular cases in African countries, addressing thermic comfort and building performance of local houses through specific software simulation, showed the potential of cultural landscape and building type concepts in design thinking and within the field work of NGO's near communities [15]. In addition, this examples, by emphasizing local cultural idiosyncrasies thorough rituals and architecture revealed that 'build meet people needs', in Paul Oliver meaning, involves, at the same level, to meet physical, cultural and spiritual needs [16], comprising World Health Organization notions of Well-Being and Quality of Life, therefore, exploring the full extent of architecture possibilities and expanding our understanding of what inhabiting is about [17].

This shift in the current architectural practice into a definitive humanitarian architecture [18] means to move from the dominant design-centred approach to drawing near social innovation issues regarding local housing recovery and development trough: (1) community oriented design of a local resources-based architecture or just enabling, perhaps capacitating stakeholders, community-driven design, (2) urban cost-efficient and socially equal infrastructure lay-out, (3) land design subdivision towards open and green public & community spaces and private secure tenure, (4) local empowerment on building techniques, (5) assistance, facilitation, cultivation in self-help and aid self-help building. (6) Attention to correlative themes such as community involvement, land rights, local governance articulation, social business, minorities and gender [19].

Pursuing the chief objective of enhancing lifestyles and livelihoods research tries to bridge architecture with other disciplines presents on the field of disaster recovery and development [20]. It argues that an architecture embedded in a trans-disciplinary approach is more likely to foster

communities' participatory action, sustainability issues, and, ultimately, is more suitable to pursue a much-needed dynamic of social change. [21]

RESULTS

Both literature analysis and under progress operations of NGO Building 4Humanity, namely the project of converting an old colonial chapel into a children's library and small community centre in an almost inaccessible island in Guinea, point to the best methods of informing local leaders and households to rebuild and incrementally expand their houses, without mischaracterising traditional settlements and vernacular architectural knowledge and caring about previous lifestyles and livelihoods.

Besides, from the interaction with stakeholders, it has emerged that the most resilient achievements occur when architects work as 'cultivators' and 'facilitators' instead of working as merely designers and processes controllers. In this sense, these on-going experiences corroborated literature, specifically, case studies that advocate that in the humanitarian field, to filling the gaps between theory and practice a new conceptual and instrumental lexical in needed, in order to pervade architectural discourse towards a revitalised humanitarian architecture.

Initial results suggest, therefore, that a new commitment, a real shift in architectural practice within the humanitarian context is necessary to allow on-going innovative practice and thinking permeate architecture. Instead of undermining its credibility or diminishing its field of intervention, this cross-disciplinary interaction, tend to consolidate architecture as a broader body of knowledge to where high kinds of knowledge converge to and amalgamate. But what will be the profile of this new humanitarian architecture?

The practice, when analysed in the light of literature, mainly case studies reflecting on direct action-planning and building field experiences, whether in disaster or development context, also provided valuable clues to devise a set of principles for a 'humanitarian' and sustainable practice: (1) Prioritising local cultures, knowledge and resources; (2) paying attention to minorities, (3) investigating urban & architectural design and building strategies and also participation models that strengthen the social and cultural component of sustainability and community resilience, (4) incorporating into 'humanitarian' architecture intercultural and interdisciplinary dialogue, (5) integrate to practice digital and analogical tools for social innovation, (6) bring in findings of ground-breaking research and mainstream disruptive practices that attempts, not necessarily prioritized in this order, assertive concepts such as (i) system building type, (ii) incremental housing (iii) community resilience (iv) disaster risk reduction (v) women participation and

leadership, (vi) cultural landscape preservation and valorisation (vii) cultural and social assets, (viii) well-being and quality of life.

Additionally, innovative tools such as web collaborative digital community mapping tools and open source mobile applications for engaging community members in the process of DRR, recovery, resettlement and slum upgrading, might also be of great interest whenever is assumed by local groups as part of their social agenda. This widened conceptual and instrumental lexicon was supposed to pervade architectural discourse and practice, thus contributing to filling the gaps between theory and practice, between humanitarians' immediate focus and designers' developmental visions. Ultimately, this upgrade of humanitarian architecture fits the purpose of building translation tools for the necessary inter-sectorial dialogue among professionals.

The dialogue between researchers and professionals from the field may find it rewarding to start from acknowledging of a common ground of interest. To this end, the research champions that social innovation might be this common ground from where to built up, possibly in a more consensual and fertile way, this dialogue between humanitarians and designers.

At this point, it is important to bear in mind that a trans-disciplinary approach must not overlap to the nature of the discipline of Architecture. In a rapidly and increasingly urbanised world, the role to be played by architects should never be underestimated if a consistent 'humanitarian architecture' is to be accomplished. To go beyond disciplinary boundaries and let related disciplines permeate architecture, to accomplish a trans-disciplinary approach is required. Rather than mitigating architectural identity and running the risk of turning it into a syncretistic field of knowledge, which it is not the case, this approach point to the full spectrum of architecture's possibilities.

The incorporation of digital mapping into the communities' participation process as a strategy of inclusive citizenship and the delivery of GIS mapping and 3D simulation tools to be spread and patent registered will constitute one of the innovative elements and final outcomes of the research. This effort, still in progress, has been supported from its initial stage by ESRI-Portugal, the national supplier of ESRI-International solutions the world leader producers of GIS Technology with relevant experience on the area of disaster management, technical support, training, and product design. This partnership is supposed to generate, in the next three years, two different products, one non-profit, other commercial. The first is an online open source mapping application to be easily accessible to stakeholders through mobile technology. The second, a more sophisticated solution combining GIS mapping and 3D simulation tool, provide assistance to technician and developers from the private sector. Both solutions are supposed to expand the possibilities of transferring knowledge and data collection among Portuguese-speaking countries. These tools matter since they can contribute to improving practice and hence, influence housing policy.

CONCLUSIONS

After certificate the importance of design, does it matter? and scrutinize the role played by

architects, how their skills can better utilized, near themselves, near humanitarians, other agents

and stakeholders, a new shared vision of so-called humanitarian architecture, detached from

fashioned objects to be commercialized trough superfluous colored books that rapidly become

popular among architecture students, and well-intentioned agency reports that impress politicians

and the public opinion, is supposed to emerge. This refreshed vision should be grounded on a

commitment that allows architecture to play in the arenas of emergence and development at its

best making a real contribution. But this must be a game of giving and receive. Build back better

should mean accept different roles and modalities of participation, ranging from full design (of

public emblematic and more complex buildings such as schools, health centres, sports pavilions

and workships places), to produce pro-active building codes based on local building types,(to

guarantee safe construction and conserve city identity) to enable community design or simply not

participating at all and let assistance go. Hence, it is argued that a re-conceptualization of

theory, crossing artificial and inhibitor boundaries and a re-foundation of the practice of

architecture in the humanitarian context is required if a sense of place, city identity, beauty and

the sustainability of the built and natural environment is to be pursued. This entails

fostering a trans-disciplinary approach and investigate in which ways and at what extend the

discipline of architecture may assimilate information from other fields and transform them to

knowledge, and import apparently useless working tools and give them a new use, whether or

across emergence or development stages.

A *social innovation architecture* encompasses a extensively use of the following pairs of

complementary concepts: (1) Cultural Landscape and intangible heritage (2) Building system

types, vernacular and informal architecture (3) Action planning and community oriented design (4)

Self-help building, site and services and incremental housing, (5) Creative thinking and

Incremental design, (6) eco-sufficiency, and finally, should take in serious account gender roles,

women participation, equality, social justice and the relationship between architecture, culture and spirituality.

However, this process of re-awakening of architecture is unlikely to trigger by itself. It depends on a great measure of a broader framework of fostering social change. And social changes, at least long-lasting changes takes a certain time to occur and usually must be preceded of raising awareness on social inequities and the dynamics of both social and cultural change. These dynamics, in turn, emphasizes the role of education. Thereby, to gave birth to social change it is critical that education is addressed. For this reason the working plan comprises the production of diverse pedagogical material to children and aim at penetrating the architecture most conservative curricula, bringing in courses dedicated to urban disasters issues and to informal settlement upgrading in the geographical context of the CPLP countries. The promotion of digital mapping adds operationally to different objectives of the research whilst and in the case of education make it more attractive to students while giving them a tool that makes it easier to embrace the set of cities of the Portuguese-speaking community as a community with a common heritage and similar challenges

The next stage of participation process' research comprehends the incorporation of digital mapping into the communities', as a strategy of inclusive citizenship, and the delivery of GIS mapping and 3D simulation tools. This effort, still in progress, is been supported by ESRI-Portugal, the national supplier of ESRI-International solutions the world leader producers of GIS Technology with relevant experience on the area of disaster management, technical support, training, and product design. This partnership aims to generate an online open source mapping application to address stakeholder's needs through mobile technology and a GIS-3D solution to assist technicians and developers. Both solutions are supposed to expand the possibilities of transferring knowledge and data collection among Portuguese-speaking countries. These tools matter since they can contribute to improving practice, facilitate the exchange of good practices and hence, influence housing and urban upgrading policies about disaster recovery and development.

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FROM THREAT TO OPPORTUNITY: SPATIAL STRATEGIES INTEGRATING URBAN AND WATER DYNAMICS TOWARDS A SUSTAINABLE REDEVELOPMENT MODEL FOR INFORMAL SETTLEMENTS IN MEXICO CITY'S PERIPHERY

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ABSTRACT

Current problems related to urban growth and climate change are increasingly challenging cities all over the world but to a greater extent fast growing developing cities. New approaches, guiding models and planning policies to make water and green structures the basis for sustainable urban development have derived over the past years; therefore new experiences in other contexts may further contribute to this learning process.

This paper explores the feasibility of implementing sustainable strategies combining water management with urban design into a new and more complex context 'the informal'. The challenges related to water and informality are also common to most developing cities, hence the importance of spatial alternatives that tackle both issues. Researchers, urban planners and policy makers may find this paper useful to collaborate in projects in developing and fast growing cities dealing with these themes.

This paper presents relevant approaches developed in cities around the world focusing on concepts such as sustainability, liveability, resilience, integration and transdisciplinarity that supports the development of future water systems in the light of the present challenges. Those approaches are discussed in the context of informal settlements; considering the interactions and mutual dependencies between water systems and social systems to minimize vulnerability to water related risks while providing new economic opportunities.

Sustainable water management is presented as the tipping point in the process of transforming vulnerable communities into sustainable societies and as the key in avoiding a flip into an undesired state. Strategies are presented for a particular case study in Mexico City to illustrate that providing space for water within these vulnerable areas would not only diminish risk but also improve the liveability of these communities. Governments, private sector, society and NGO's need to work together to adopt water innovative technologies, new management practices and new governance arrangements for new urban water systems to become a feasible urban regeneration model.

Keywords:

Sustainable urban water management, informal settlements, urban redevelopment, liveability.

1   INTRODUCTION

Mexico City Metropolitan Area (MCMA) is one of the world's most populated cities, located in a large valley in south central Mexico. As the country's capital it works as the economic, industrial, political and cultural centre. With a population exceeding twenty one million people nowadays, the metropolitan area is facing a critical situation in terms of spatial, social and environmental aspects. This paper focuses on the two major issues that have arisen throughout the development of Mexico City Metropolitan Area. On the one hand, the lack of integration of environmental factors in the planning and decision-making processes throughout the growth of the city has led to a serious *hydrological imbalance at metropolitan scale*. On the other hand, the failure of planning to manage urban growth has caused *spatial fragmentation and social segregation of peripheral areas*. As a consequence, informal settlements located on peripheral areas of the city are the most vulnerable to water related risks. Valle de Chalco Municipality, the case study for this paper, is one of those marginalized informal settlements where all the problems related to water become visible *(flooding risk from surface water, risk from open air sewage canals and water scarcity)*.

In the following, this paper provides background to the historical urban development of Mexico City and it presents deeper the two major issues relevant for this paper. Afterwards, it provides an analysis of the spatial

and social characteristics of Valle de Chalco Municipality and its water problematic. Later, this paper presents the approaches that underpin the vision for a desired future and it makes a case for sustainable urban water management as a feasible strategy for urban regeneration of informal settlements. It then presents urban water strategies developed for the specific case study, and further discusses a possible redevelopment model transferable to other informal settlements to contribute towards the hydrological metropolitan regeneration. It concludes by recognizing the role of each stakeholder involved in urban water regeneration projects and the importance of creating partnerships between government, private sector, citizens and NGO´s to actively initiate transition processes towards delivering this type of projects following innovative approaches and strategies.

1.1. *Mexico City's Historical Urban Development*

Water has had a symbolic importance for Mexico City since the exact location of its historical centre corresponds to the ancient capital empire of the Aztec civilization Tenochtitlan, founded in 1325 on an island in Lake Texcoco, one of a system of five interconnected lakes occupying a large area in the valley of Mexico. Starting from the times of the Spanish conquest, the five lakes had gradually been drained as the valley of Mexico became urbanized. While the ancient civilizations took advantage of living with water, with a complex system of canals, dikes, and levees to keep floods outside, the Spaniards turn the capital into a city on dry land. The result over five centuries has been considered as one of the most radical transformations in the history of urbanization [1]. Since the beginning of the modern urbanization process, the normal practice has been to enclose rivers and canals to prevent floods. Rivers and natural water bodies have not been used as spatial guiding elements to design the urban space; instead its water structure had become invisible over time, losing an invaluable natural and cultural heritage from the past. Some of the rivers are currently used as open-air sewage canals, posing serious risks to inhabitants. Those practices need to change, as it has been realized that enclosing water takes away great opportunities for urban areas to cope with environmental challenges and improve urban quality [2].

During the second half of the twentieth century Mexico City experienced very intense demographic dynamics. Like other large cities in Latin America the period known as Import Substitution Industrialization (ISI) promoted concentrated urban, industrial and political activities in the main metropolis. From 1950 to 1980s a dynamic process of occupation of the peripheries started. In the late 1960s the city grew exponentially, expanding along the periphery where cheap communal land was transformed into informal low density housing for the working class [3].This is the period of the first informal settlements 'slums' forced to occupy peripheral land because of the lack of legal available one, according to their economic capacity. The periphery experienced from this moment on, an endless dynamic of occupation and posterior consolidation, occupying risk areas, thus being exposed to natural hazards such as floods and landslides. The turn to Neoliberal politics and free market ideologies started in the early 1980s and culminated in the North American Free Trade Agreement NAFTA of 1994, opening up Mexican markets to foreign investment. With the modification of a Constitutional law in the early nineties, allowing the legal trade of communal land for dwelling, land speculation became the best business in Mexico City. Real State Development since then is the 'institutional way to make city'. Massive land incorporation for housing development carried out by private and group's economic interests to stop the production of informal settlements was conceived as the strategy for 'urban development' [4]. This led to the development of middle class gated communities in the peripheries, being 'pockets of formal urbanization within a sea of informality' [5]. This urban phenomenon had severe social, economic and ecological effects on the whole territory.

In 2003, it was estimated that informal settlements constitute roughly half of the urbanized area and house more than 60 per cent of the population [6]. Nowadays, most settlements have been improved to varying degrees as property is regularized, infrastructure and services put in and houses solidly built. However, in 2010 it was estimated that almost 60% of the city's population were below poverty line and still more than 20% of the population were living in informal settlements with deficits in urban services, often in high-risk areas and with dubious property titles [7].

1.2.   Hydrological Metropolitan Imbalance

Historically, the water sector has only had a limited influence on decisions that affect the shape of cities and even more cities in Latin America. In Mexico, the delivery of infrastructure and services came late in the planning process and the services were added incrementally as the city expanded and socio-political drivers emerged. The water infrastructure projects began in 1951, when the Lerma Water Supply System was opened to bring water from other hydrologic basins 60 km away. Almost three decades later, another structure was constructed to bring more water to the city: the Cutzamala System 150 km away. In parallel, the works for a complex network of sewage started. The sewage system has 1353 km of underground tunnels that reach a depth of up to 240 meters [8]. Nowadays, 77% of the water used in the Basin of Mexico comes from underground sources, and two out of every three cubic meters extracted come from overexploitation. Land subsidence, cracks and cavities are signs of the need to reduce the volumes extracted [9]. The other percentage of used water comes from long distances causing enormous costs and loses. It is estimated that the lost water due to leakages in the network would be enough to provide the service to 4 million people more, as 40% of water is lost for this reason [8].

Determining aspects of the current water management model in the Basin of Mexico City include the massive export of wastewater to the few treatment plants to the north of the city, aquifers overexploitation, importing water from other basins and increasing urbanization of recharge sites. The current model is based on the extraction, use and disposal of water, a linear system that is reaching its limits [9]. Furthermore, there are important social and energetic costs of the current water resources management. One of the key contradictions is the transportation of rainwater surplus from the south to the north keeping it from the local inhabitants that are the most needed; there are crop loses in these areas from the lack of water. The transportation of water also mean going through the metropolitan area over 23 km by pumping wastewater combined with rainwater on counter slope through open-air sewage canals with high and growing risks and enormous energetic costs [9]. Moreover, there is an enormous imbalance between water availability and its use among the different regions within the city. The uneven distribution and use of water between rich and poor areas makes more obvious the economic and social inequities between regions. Population wastes enormous amounts of water, people living in wealthy areas use up to 600 litres per capita per day, while the corresponding rate in poor areas is about 20 litres [8].

Today, new hydraulic works and huge investments are in progress, meanwhile the drilling of wells and overexploitation of aquifers continues. Land subsidence in the central area and in the south-east area of the city is dangerously increasing. For this reason from the mid 1980's a New Chalco Lake emerged where the former Xochimilco Lake disappeared in the beginning of the 20th century, threatening Valle de Chalco Municipality's population.

1.3.   Spatial fragmentation & social segregation of peripheral informal settlements

In Mexico City, urban policies following a Neo-liberal framework are the cause for its spatial, environmental, political-administrative and social fragmented state [10]. Spatial fragmentation and social segregation are considered effects of urban sprawl [11]. Four aspects of fragmentation are emphasized in literature: *(i)* spatial: spatial atomization and general lack of integration of the city, plus increasing separation of functions like housing, business, recreation and shopping, *(ii)* environmental: disintegration and depletion of rural lands with their natural assets due to the urban development process, *(iii)* political-administrative: division of metropolitan regions into numerous administrative units and failing of local administrative units to introduce an integral approach to deliver collaborative policies and strategies, *(iv)* social: defined with an approach based on poverty and deprivation and therefore closely related to social segregation [11].

The dissolution of social housing, characteristics of the housing market, the prevalence of low density and peri urban sprawl, and income inequality have had spatial consequences upon the urban, creating uneven geographical development. The population with fewer resources has been pushed to the outskirts of the city. It is there where the urban poor have found cheaper housing within illegal subdivisions on communal land property. Although illegal, this method of urban development has become institutionalized to the point that for the poor, illegality is the most 'rational' appropriation of urban space.

It is also important to mention that to this day Mexico City retains a strong mono centric form but its uncontrolled growth over the decades has led to new centralities and polycentric forms at its peripheries. Kozak (2008) concludes, that 'there cannot be an equitable integration of polycentric centralities in a megacity without an efficient mass transport system' [10]; if the transport system is not accessible to a large proportion of the population it may increase inequalities and fragmentation, this is the case of Mexico City where its polycentric form largely represents a process of fragmentation from a greatly ineffective integration of a transport scheme.

The case study for this research, Valle de Chalco, is a municipality spatially and socially segregated from the rest of the city. During the last three decades the provision of basic services like drainage and water supply for households in most of the peripheral sub-centres had a general improvement. However, Valle de Chalco was one of the exceptions where the situation in 1990 was much worse than in 1970, the speed of population growth was way ahead the provision of services. In 2000, housing indicators where: 78% of the dwellings had no inside tap; 40% had corrugated cardboard roofing and 20% had only one room [12]. Today, Valle de Chalco still has some of the worst housing conditions in Mexico City.

1.4. Case Study: Valle de Chalco Municipality

Valle de Chalco Municipality lies on the old bed of Lake Chalco inside the Chalco-Amecameca sub- basin, which was substantially drained in the nineteenth century. Continual flooding in Valle de Chalco is the result of the complex interaction between urbanization in an ex-lacustrine area. Paradoxically the location hosts different urban problems related to water: *(1)* On one hand inhabitants, mainly low-income families, live in constant risk as the area has been inundated with waste water two times in recent years (2000 and 2010). Floods were caused by the rupture and discharge of La Compañía Canal, an open-air sewage canal that collects domestic wastewater from two municipalities in the state of Mexico: Valle de Chalco and Chalco [13]. The people in this area were severely affected and unable to cope with the disaster. *(2)* On the other hand part of the population living in this area does not have access to basic services such as water supply and drainage, since the provision of services has lagged behind the speed of population growth. *(3)* Furthermore, part of the urban area from this municipality is in high risk of flooding from the new lake emerging from the accumulation of rainwater on the lowest part of the sub-basin.
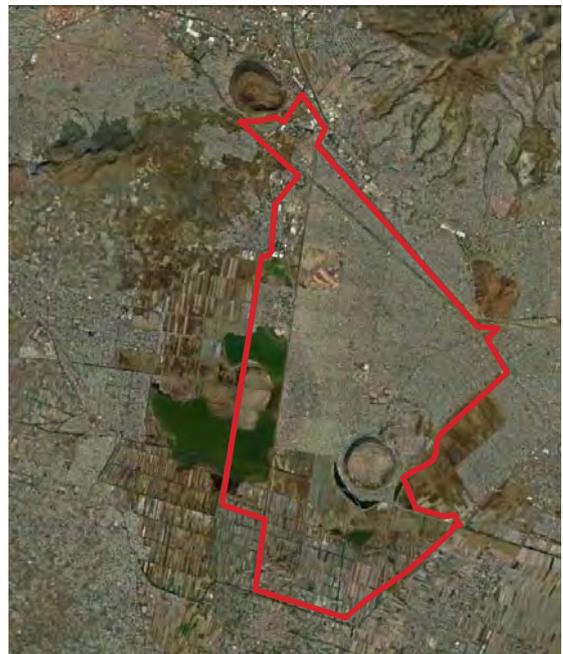
Valle de Chalco Municipality
Surface= 4,636 ha
Average density = 150 inhab/ha
In 2010, there was an approximate of 87, 612 dwellings with an average of 4.64 inhabitants per dwelling.
The forecasted population for 2010 was 406,521 inhabitants, for 2020 it is expected almost to double to 745,622 inhabitants.
Source: [12], Image from Google Earth, 2010

It is important to add some information to the third of the above mentioned problems. In the early eighties fourteen deep wells, called Mixquic-Santa Catarina System were drilled in the plains of the ancient Chalco lake at depths of 400 m, to meet the growing demand of fresh water of the Mexico City Metropolitan Area [14]. As a result of the over exploitation along the years differential subsidence occurred in the territory that led to the formation of a topographic depression located approximately in the centre of the plateau, which started forming a new lake from the accumulation of rainwater that did not flow by gravity through the channel system in the area. Based on the controls and magnitude of the regional land subsidence, the lake surface was expected to grow to 1500 ha by the year 2015, increasing the risk of flooding to the urban areas of Valle de Chalco Municipality. Urban areas within a radius of 2.5 to 3 km with centre in the well P9 of the MSCS Mixquic-Santa Catarina System are considered high risk areas [14]. The New Chalco Lake has worked in certain extent as a limit for urban expansion and environmental control. It was declared a water sanctuary and ecological reserve in 2004. The contradiction is that even this beautiful place lives just next to

the municipality, the inhabitants are not able to appreciate it, the Acapol open sewage canal is crossing N-S direction in between the municipality and the lake; on top of a protective dike.

2   NEW APPROACHES FOR FUTURE URBAN WATER SYSTEMS

2.1.   *The City as an Urban Ecosystem - Understanding Sustainability and Liveability*

After the global adoption of sustainability as the common goal for cities around the world, an environmental planning discourse has evolved in the context of the trinity of sustainability principles: environmental sensitivity, economic opportunity and social equity [15]. It has then been realized that economic, social development and quality of life and the environment are intertwined as an interacting trinity. The city as an urban ecosystem with ecological processes driven by human activities is the theory behind new initiatives on sustainability and resilience in the planning and design disciplines. The UN ecosystems approach is an integrated strategy for managing land, water and living resources that recognizes the strong linkage between ecosystem services and human well-being. It ensures that these essential services, and the systems that support them, are correctly valued, protected and managed. An ecosystem is a dynamic complex of plants, animals, microorganisms and their nonliving environment, of which people are an integral part [16]. The benefits that we derive from nature and rely on, from timber and food to water and climate regulation, are all ecosystem services.

The ecosystem services concept in the context of sustainability is a key concept for water planning in developing cities. The concept states that the protection of landscapes that provide ecosystem services can be justified on economic terms and conversely their absence or degradation can have negative economic and ecological effects. As natural resources are the basis of subsistence in many poor communities and the livelihoods of developing country populations are directly dependent on healthy ecosystems, this concept is especially relevant for this research. There is a recognized link between poverty alleviation and the benefits that people derive from ecosystem services. Protection and sustainable management of ecosystems is therefore a critical element of poverty reduction strategies, as it helps maintain or enhance the delivery of the water, food and other ecosystem services poor people rely on [16]. This approach understands the ecosystem services in relation to water as: provisioning (e.g. drinking water), regulatory (e.g. flood protection) and cultural services (e.g. recreational and aesthetic benefits) [17].

It is also relevant to this study the concept of liveability as it has been recognized as 'the appropriate relationship between people and their environment' [18]. From an ecosystem point of view, it can be taken as the goal of an urban regeneration project in informal settlements. The similarity between sustainability and liveability is clear and one could argue liveability could contribute to the whole concept of sustainability, but in an ecological perspective, liveability is an ecological interpretation of the 'people' aspect in the sustainability trinity [18]. While sustainability is about the capacity of the city to provide clean water, food, and its ability to assimilate pollution and waste generated. Liveability is about the comfort capacity of our cities, the *quality of life* provided to the people. The concept of resilience that has been more recently added to the language in relation to how we need to plan our cities is discussed later, as for this research it is closely related to other terms such as risk and vulnerability.

2.2.   *Sustainable Urban Water Management*

Innovative and sustainable alternative approaches for water resources management have been introduced in several countries around the world. This paper focuses on the principles of Water Sensitive Urban Design approach to develop integrative strategies for ecological, economic, social, and cultural sustainability. This approach considers all parts of the urban water cycle (drinking water, storm water run-off, waterway health, sewerage treatment and re-cycling) combining the functionality of water management with principles of urban design [19]. In order to integrate sustainable water management, particularly decentralized storm water management, into urban design, it is important that the solutions follow 5 basic principles: *1) **Water sensitivity***: solutions should use decentralized methods to bring urban water management closer to the natural water cycle, *2) **Aesthetics***: solutions should be used to provide an aesthetic benefit where possible and adapted to the design of the surrounding area, *3) **Functionality***: solutions should be used in an

appropriate way, adapted to the local basic conditions and the intended use, consider the corresponding maintenance requirements and consider possibilities for adaptation to uncertain and changing basic conditions, *4) **Usability***: solutions should be used to create places that are usable for recreation and/or nature conservation purposes and *5) **Public perception** and acceptance:* Public involvement: solutions should consider the demands of all stakeholders and involve them in the planning process, costs should be comparable to the costs of conventional solutions [19].

In terms of wastewater management it has been acknowledged that poor sanitation leads to degradation of living conditions, health and economic opportunities; this is the reason why sanitation is included as one of the United Nations Millennium Development Goals [20]. In response to the deficiencies of centralized approaches to service delivery, in recent years there has been increasing emphasis on the potential benefits of adopting decentralised approaches to sanitation and wastewater management, which are considered to be particularly appropriate for peri-urban areas. Reclaiming wastewater for agricultural reuse is increasingly recognised as an essential strategy in areas of the world where water is in short supply. Wastewater reuse has two major objectives: it improves the environment because it reduces the amount of waste (treated or untreated) discharged into water courses, and it conserves water resources by lowering the demand for freshwater abstraction. In the process, reuse has the potential to reduce the cost of both wastewater disposal and the provision of irrigation water. A well-developed awareness of the context and priorities of the community and other stakeholders and the social-cultural elements are key elements for sanitation planning. The choice for a specific sanitation system has to be context specific and should be made based on the local environment (temperature, rainfall, etc.), culture and resources (human and material) [20].

2.3.   Risk, Vulnerability and Resilience

As population grows and climate changes with regard to managing water modern notions as risk and resilience and related terms as hazard, vulnerability, adaptation and mitigation can be particularly useful to better understand and address future challenges. Risk is the key concept with regard to managing water hazards however it is a subjective and complex issue in itself. According to White (2010) the risk of flooding can be viewed as 'a function of both the existence of a hazard (the potentially damaging event) and vulnerability (the susceptibility to its impacts)' [21]. Vulnerability in this instance does not only focus on land use or physical environment but also incorporates social, economic and cultural factors such as wealth, access to resources, social networks and ethnicity [21]. Accordingly, Abbot states the starting point for the development of the planning framework for an upgrading process of informal settlements is the recognition that there are two underlying developmental needs that are linked to their vulnerability [22]. The first of them is to deal with the issues of social exclusion and sustainability and the second is to integrate all the elements of vulnerability into the upgrading process.

Additionally, Moser (1995) suggests that there are two dimensions of vulnerability, 'its sensitivity (the magnitude of a system's response to an external event), and its resilience (the ease and rapidity of a system's recovery from stress)' [23]. Therefore, analyzing vulnerability involves identifying not only the threat, but also the 'resilience' in exploiting opportunities, and in resisting, or recovering from, the negative effects of a changing environment. Resilience is a more strategic way of thinking about sustainability that must be based on environmental, ecological, social, and economic drivers and dynamics of the specific context and integrated across scales. It has been viewed as a key idea to tackle risk; the concept has been recently advocated to describe the way in which cities can attempt to recover from disasters and to the effective implementation of features into planning, governance and response systems towards cities less exposed to flooding and water stress [24]. Based on the idea that resilience is not an unconnected aim but is rather embedded in the concept of risk, it can be seen as a mechanism to manage the consequences of risk on people and places via spatial planning.

2.4.   Assets as means of Resistance 'Resilience Strategy': Water as an asset for marginalised communities

Moser (1995) suggests that 'the means of resistance of vulnerable populations are the assets and entitlements that individuals, households, or communities can mobilize and manage in the face of hardship' [22]. Since vulnerability is closely linked to asset ownership, it can be said that the more assets people have, the less

vulnerable they are. Consequently, the objective of an upgrading process for informal settlements should be to reduce the vulnerability of those living in the community through strategies that look for the activation of economic opportunities and ways in which their assets may be augmented. Moser developed an asset vulnerability framework to facilitate interventions that would promote opportunities and remove obstacles to ensure that poor residents use their assets productively [23]. Based on that framework, obstacles, opportunities and potential solutions were identified for Valle de Chalco Municipality.

ASSET	OBSTACLE	OPPORTUNITY	POTENTIAL SOLUTION
LABOUR	[-] Long commuting to work places because of limited public transport [-] Very low level of income [-] Large part of the population is part of informal economy	[*] Manufacturing local industries [*] Existing railway line	[+] Provide adequate skills training for urban agriculture [+] Stimulate local entrepreneurship by microcredit schemes by NGO's [+] Reorganize local and regional transport systems and implement new light rail system towards closest metro station
HUMAN CAPITAL	[-] Low education levels [-] Respiratory diseases related to open sewage canals and dust storms [-] Inability to provide safe, clean water, less consolidated areas without provision of sewage and water	[*] Improve quality of existing under populated schools and improve access to higher education	[+] Provide new educational infrastructure for new skills training program [urban agriculture, wastewater treatment] [+] Provide adequate, accessible low-costs healthcare. [+] Provide credit for education expenditures [+] Rainwater harvesting and decentralised stormwater and wastewater management [community based]
PRODUCTIVE ASSETS	[-] Low quality self-constructed housing	[*] 90% of households hold tenure of their properties [*] Existing home-based enterprises	[+] Finish process of legalization [+] New housing typologies to promote organized and quality self-expansion [rental opportunity, home-based enterprises, small businesses] [+] Income generation from expropriation of properties from people at risk or demolished areas
HOUSEHOLD RELATIONS	[-] Need to support weaker members [-] Overcrowding and lack of privacy because of intergenerational densification	[*] Cohesion of family members	[+] Provide community-based, community supported care for children and the elderly
SOCIAL CAPITAL	[-] Lack of quality public space for social interaction [-] Escalation in levels of crime and violence attributed to increasing unemployment curtails community activities [-] Vandalism in existing public spaces [-] Social segregation between areas with different level of consolidation		[+] Promote community based organizations for urban agriculture and water self-management [+] Externally managed NGO and government agency projects with income or welfare components [+] Provide community facilities, especially for youth [+] Locate night schools close to residential neighborhoods

Table 1: Asset Vulnerability Framework for VDC Municipality [based on Caroline Moser, 1998].

3   RESULTS

Based on the insights from research, the self-management (independence from unsustainable centralised metropolitan structures) of water resources at municipal, community and household level is thought as an asset for the inhabitants of Valle de Chalco. Through this their basic needs: fresh water supply and safety from environmental hazards (flooding) will be fulfilled. Furthermore, a decentralised management of water as part of their human capital will enable inhabitants to increase their other assets; for instance through rainwater harvesting their household relations may be improved and through urban agriculture in community gardens their social capital assets will be augmented. Consequently, the protection and sustainable management of ecosystems (water) is an appropriate approach for informal settlement upgrading; to reduce their vulnerability and turn present risks into opportunities.

The decentralisation of the water systems from the metropolitan structures will be the driver for the redevelopment of the area regarding ecological, economic and social criteria. The proposed strategies and specific actions proposed at city level and at local level would need to be implemented within a timeframe of fifteen years. A phasing scheme is proposed based on different conditions such as: risk, community economic opportunities, government support, etc. Each phase would involve specific stakeholders and financial models to realise the physical interventions and social programs. Specific stakeholders gathered in

four different groups: public organisations, private groups, community and NGO's would play a key role in the redevelopment process.

1   **Ecological Point of View**
CITY SCALE

1.1 Decentralized management of water resources - VDC independency from Metropolitan Infrastructures.
    Actions:
    1.1.1. Cease groundwater overexploitation at Chalco-Amecameca sub basin.
    1.1.2. Removing the Acapol open sewage canal.
    1.1.3. Wastewater treatment of polluted water coming from Amecameca open sewage canal.
    1.1.4. Lakeside Waterpark – New 'Chinampas' area for traditional floating agriculture system.

LOCAL SCALE

1.2 VDC Sustainable Water Resources Management
    1.2.1. Rainwater harvesting and reuse at household level.
    1.2.2. Decentralised stormwater management.
    Actions:
    1.2.2.a. Separation of stormwater from sewage.
    1.2.2.b. WSUD features implemented on each type of street for surface landscape drainage. Requalification of street network: [i] Structural Axes: Bioswale - Wet Swale, [ii] Main Roads [Green commercial corridors]: Shallow Pit, [iii] Secondary streets [green-blue corridors] : Rain Gardens + Canal for stormwater water retention + Permeable pavement on taxi-bike circuit, [iv] Internal Streets [Cluster alleys]: Ditch + Raingarden, [v] Collective Semi-public Spaces for Recreation and Production: community gardens for urban agriculture.
        1.2.2.c. New Water Reservoir for high peak storage retention.
        1.2.2.d. Local water retention basins.
        1.2.2.e. Reuse of groundwater from hand-dug wells.
    1.2.3. Wastewater reclamation and reuse for urban agriculture.
1.3. The new streets' profiles will promote sustainable ways of transport: walking, bicycle and taxi-bike.

2   **Economic Point of View**
CITY SCALE

2.1 Improve spatial integration of Valle de Chalco Municipality with the rest of the city.
    Actions:
    2.1.1. Implement a Light Rail Transit system using the existing railway crossing the municipality.
    2.1.2. Create new centralities at regional transportation interchanges.

LOCAL LEVEL

2.2 Develop local nodes as multi-functional areas with specific economic activities.
    Actions:
    2.2.1. Create manufacturing industry hub for new employment opportunities and sustainable agriculture hub as a touristic attraction (whole-sale market: fruits, vegetables and flowers).
2.3 Urban agriculture for own food production and as a new business opportunity.

3   **Social Point of View**
CITY SCALE
3.1 New culture of water Actions: 3.1.1. Government and NGO's campaigns for 'water literacy' of the community.
LOCAL LEVEL

3.2 Diminish vulnerability and improve liveability of the municipality.
    Actions:
    3.2.1. Relocation of people living in risk areas.
    3.2.2. Demolishment of houses in risk areas and along main roads (houses in the worst conditions).
    3.2.3. Densification along main roads using new building typologies (396 inhab/ha).
    3.2.4. Community gardens inside each neighbourhood and network of public spaces to improve social cohesion.

Table 2: Strategies and Actions for Valle de Chalco Municipality Redevelopment.

The synergies between strategies (e.g. water strategies brought opportunities to restructure the street network and creating new transport hubs would create spaces for stormwater retention) and needed interactions between stakeholders made clear that integrated water management as part of an upgrading process within the context of informal settlements requires a new holistic approach. Instead of the current sector-based approach, a transdiciplinary approach that involves not only the professional and academic specialists, but also engages the stakeholders and decision makers meaningfully, throughout a continuous, interactive and iterative process of urban planning and design is crucial for dealing with community needs and demands [21]. Transdisciplinarity provides a new level of involvement in policy development, including public, private and not-for profit interests in developing and implementing strategies to attain the aspirational state 'the fifth paradigm' of water management for cities of the future [25]. According to Novotny, et.al. (2010), in order to get to that state, social, economic and environmental drivers would need to be at the same level for decision making.

4   DISCUSSION

Strategic urban planning is suggested as the way in which the planning process for redevelopment projects can be organized built under the principles of participatory governance. It offers various potentials, as it is need oriented it promotes an institutional awareness of local problems and empowers the citizens to participate in the core actions of the state. Based on its principles, it can be a way in which the problems of socio-spatial segregation and fragmentation can be countered since the community is involved in the process of urban planning. Instead of a supply oriented approach strategic urban planning is a need oriented approach implying a phased process. The steps within the planning process act as a logical structure for developing dialogue, creating participation and guiding actions. Firstly, a diagnosis of the current situation made by the community and others is needed to identify the problems. Secondly, objectives and possible alternative solutions must be developed aiming to solve the problems. The selection process of the most suitable alternatives is made and finally the selected alternative is divided into operational parts to be further developed.

Furthermore, participatory observation is recognized as essential for an upgrading process of informal settlements. The participatory process needs to be part of each specific upgrading project as it improves the design and effectiveness through organized expression of demand, which allows a project to access local knowledge taking all relevant factors into account in the solutions proposed. It enhances the impact and sustainability of projects through demand expectations and responsiveness, which is crucial in enhancing local ownership of a project. Participation contributes to reach goals such as good governance, democratization, and poverty reduction by building local capacity to interact with authorities and other stakeholders to further common goals. It establishes clear channels for community participation in decision-making, giving people the opportunity to influence the actions that shape their lives.

Finally, in order to evaluate the feasibility to transfer the proposed strategies for VDC Municipality into other informal settlements, parameters were defined and analysed further into another informal settlement Ciudad Nezahualcóyotl, a municipality of Mexico State adjacent to the northeast corner of Mexico's Federal District. Those parameters are: a) *Morphology and density:* to assess the possibility for water retention, *b) Local and regional connectivity:* to assess potentials to reconfigure urban structure (connections between local and metropolitan mobility network and centralities) *c) Socioeconomic profile of different groups:* to assess constraints or potentials of the population. Since the social, economic and environmental vulnerability of this and other informal settlements in Mexico City are very similar, it was possible to successfully assess each of the parameters, demonstrating that the methodology followed by this research project may be transferable. It was recognized that there is potential to build an urban regeneration model from proposed strategies for VDC Municipality. However, the challenge would be on finding and exploiting unique territorial and social characteristics in other informal settlements that could generate different design proposals.

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MINERAL-WATER-ENERGY NEXUS: IMPLICATIONS OF LOCALIZED PRODUCTION AND CONSUMPTION FOR INDUSTRIAL ECOLOGY

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ABSTRACT

Urban and remote areas are increasingly using decentralised systems for renewable energy production and storage, as well as for water harvesting and recycling and to a lesser extent for product manufacture via 3D printing. This paper asks two questions – how will these developments affect (i) the end-uses of minerals, including critical minerals and (ii) the implications for industrial ecology and the development of a sound materials cycle society. We find a trade-off between using higher-performance critical minerals in low concentrations which are complex to recycle, and unalloyed, standardised materials for increased effectiveness across multiple reuse cycles. Design and operational challenges for managing decentralised infrastructure are also discussed as their uptake approaches a tipping point.

1   INTRODUCTION

Decentralised energy systems – specifically renewable energy-based systems – are becoming more prevalent in rural areas (where they may have a competitive advantage over fuel-based systems that require storage and import of fuels) and in urban areas where policy and incentives have been making such systems more affordable to households. From the perspective of the environmental impacts of energy systems, this is generally an important and useful investment by society. However, when considered from the perspective of a sound materials cycle – in which a very high percentage of materials is captured and recycled at end-of-life – there are a number of competing priorities that may drive the overall environmental impact in different directions under decentralised energy futures. This paper examines some of these issues.

Materials in Decentralised Generation (DG)

The development of new advanced electronics and energy devices has become highly dependent on a variety of functional materials that were largely unused, unheard-of or unavailable until the last 40 – 50 years. Examples include: rare earth metals (permanent magnets for electric motors and generators; and in fuel cells), platinum group metals (catalysts for fuel reforming and electrodes for fuel cells), by-product metals (thin film solar cells) [1]. In addition to these, a range of seemingly common materials are also listed as "critical" in different countries according to their economic, geographic and geological availability, importance to society and risk of supply-chain disruption [2]. While many of these materials are not currently scarce, increasing global demand and competition for materials in

emerging economies and the lack of current investment in expansion of capacity may at some point in the future put pressure on supply. Recycling of such materials is a valuable activity from the perspective of maintaining resource security, the inherent value in the material and the reduction of a potential waste stream, however, in many cases the existing infrastructure is insufficient to domestically recycle at high rates of recovery or with economically feasible costs – particularly in developed countries. Moreover, the recycling of materials is often not much less energy-intensive than the extraction of primary metals.

Due to the high price and relatively low production rates of functional materials such as Indium, Gallium, Germanium, Selenium and Tellurium, the design of electronics and energy technologies that rely on them (e.g. photovoltaics) has focused on reducing the amount of material used in a given product to produce the requisite service. For example, thin-film solar cells use material layers of a few microns at most, bonded to each other and sandwiched among other bulk materials. This makes separation of the materials particularly difficult, and the technologies are most certainly not "designed for disassembly" at this level. Thus a trend that makes the product cheaper and more environmentally benign in the earlier stages of the lifecycle is conversely making end-of-life processing more difficult.

Distributed energy systems benefit from the electricity generation and usage being in close proximity (and thereby minimising loss in transmission). However, the nature of such systems being "distributed" creates a dispersion of the contained material that is not the case in centralised systems. The level of impact of such dispersion will vary according to the geographical situation – particularly the proximity to urban centres and recycling facilities. It is considered that such dispersion of materials may impact on the collection rate and the cost and energy required to collect the materials and transport them to the recycling centre.

2   OBJECTIVES/METHODOLOGY/SCOPE

In the case of identifying the critical minerals utilised in renewable or clean energy technologies for distributed or centralised generation, the methodology undertaken was as follows:

1. Literature (particularly LCA studies) and technical documentation was reviewed to identify the critical minerals utilised and a first-order estimate of the quantities of these materials for distributed energy systems

2. Existing equipment and installations were reviewed to obtain key parameters – such as the spatial density of the plant and contained metals.

3. Estimations of residential-scale spatial density or distribution of distributed energy were undertaken using sample population densities from Brisbane, Australia and a simplified model of a city as concentric circles of increasing population density.

4. Value of the specific materials utilised was obtained and was applied to understand the spatial value density in different configurations.

5. Interactions with decentralised water and production systems were then discussed together with implications for pursuing a sound material cycle society.

3   RESULTS

Critical Materials in Decentralised Energy

The review of LCA literature [3] and other technical documentation provided initial estimates of the range of materials and the quantities required per kilowatt of installed capacity. This review also identified the typical scale of individual units and power plant scale installations, building on other recent estimates [4]. Table 1 shows the key critical materials, their function within technologies, the range of reported densities of materials per unit generating capacity and typical scale. While details on wind turbine technologies are readily widely available, the specific quantities and ratios of photo-active materials (PVA) in photovoltaics is often unclear. The estimates here are based on a USGS [5] study as well as the reported total PVA in various LCA studies.

Table 1: Density of some critical functional materials in distributed energy technologies

Technology	Critical materials	Function	Density (kg / kW)	Typical scale (kW)
Wind turbines	Dysprosium, Neodymium,	Permanent magnets	0.15-0.2 (Dy and Nd combined)	1500 – 5000 (turbines)
	Copper	Generator windings and wiring	1.2 (turbine only – onshore) 2-5 (windfarm averages onshore) 6-12 (windfarm averages offshore)	15,000 – >1,000,000 (wind farm)
Photovoltaics	Indium, Gallium, Selenium, Tellurium	Photo-active materials (total PVA reported)	0.4 – 1.4 (various LCA studies) 2-3 (USGS)	1 – 5 (residential) 10,000 – 550,000 (solar farm)
	Copper	Electrical connections and power electronics	0.25 (various LCA studies)	
Fuel cells	Platinum	Electrodes / catalysts (PEM FC)	0.0001 – 0.001 (various)	5 - >350,000
	Yttrium, Lanthanum	Electrolyte and electrode materials (SOFC)	0.02-0.2 (Yttrium) (various)	

**note battery storage technology has not been considered in this analysis*

Utilising the figures in Table 1 and incorporating historical prices from the United States Geological Survey for 2012 [6, 7], Table 2 gives an estimated range of the valuable materials contained in typical distributed energy technologies with renewable or clean energy focus. It should be noted that these are at a relatively high price point, and that there is still a considerable uncertainty in the quantity and specific material quality requirements for some of these technologies.

Table 2: Estimated range of potential value in contained metals at 2012 prices

Technology	Critical materials	Average value per unit capacity ($ / kW)	Total value of contained metals	
			Unit scale ($US)	Power plant scale (Million $US)
Wind turbines	Dysprosium, Neodymium,	44.6	$ 57,000 – 255,000	$ 0.57 – 51
	Copper	10.9 (unit) 28.4 (onshore) 72.9 (offshore)	$ 15,000 – 61,000	(onshore) $ 0.24 – 40.5
				(offshore) $ 0.73 – 97
Photovoltaics	Indium, Gallium, Selenium, Tellurium	555.3	$ 130 – 4,900	$ 1.3 – 539
	Copper	2.0	$ 2 - 10.1	$ 0.02 – 1.1
Fuel cells	Platinum	27.5	$ 25 - 250	$ 1.75 – 17.5
	Yttrium	24.3	$ 22.1 - 221	$ 1.5 – 15.5

With regards to recovery of valuable materials, there are a number of factors that should be considered, including:

- Total value and concentration of contained material

- Spatial density of material in operating conditions (t / km^2) – including effective spatial density with consideration of probability of individual unit failures and replacement rate

- Number of units requiring to be disassembled for cost-offset

- Effectiveness and cost of recovery of materials from products

- Physical and chemical composition of materials in products, for example, relatively pure or relatively complex material streams (impacting on cost and effectiveness)

From Table 2 it can be observed that the valuable materials on the unit of capacity is highest in PV, however the size of such units ranges widely – typical residential scale units are smaller, therefore the total contained content in such units is small, whereas wind turbines are more prevalent at megawatt scales, therefore total content is higher while value per kilowatt may be lower.

Considering the spatial density in the case of a power plant scale operation, of the technologies compared, fuel cells present the most compact unit, and therefore the most spatially dense. Wind turbines have typical spacings of 300m – 1.5km, while photovoltaics are typically closely spaced for individual units, but have significant overall land area coverage, therefore a designed with sufficient space for maintenance vehicles to pass between. Estimates based on site maps and data indicate that Sakai solar power station in Japan has approximately 49 MW / km^2 rated capacity without considering any buffer zone. On the other hand, residential solar in a city is likely to have a much lower energy density (we estimate at high levels of uptake ~1 MW / km^2 in a modelled Australian city). The Wattle Point wind farm in South Australia has an overall spatial energy density of around 5 MW / km^2, while the theoretical energy density for wind turbines with the pseudo-industry-standard spacing of 7 times the diameter of the turbine [8] is around 33 MW / km^2. Some of the largest fuel cell installations in the world have approximately 2800 MW / km^2 spatial energy density, although these could theoretically be increased by multi-level vertical installation (unlike PV). Residential scale fuel cells, although currently small scale, are likely to present a similar spatial density to residential solar. Likewise, although the feasibility in urban areas is unclear, for the sake of comparison we will apply the residential spatial density of PV to wind power. Given these estimated spatial densities, and including the previously presented data, Table 3 presents some indicative material and value spatial densities.

Table 3: Estimated range of potential material and value density

Technology	Critical materials	Mass density of contained metals (t / km^2)		Value density of contained metals ($US million / km^2$)	
		Residential scale	Power plant scale	Residential scale	Power plant scale
Wind turbines	Dy, Nd	0.24	6	0.06	1.5
	Cu	1.8	117 (onshore)	0.01	0.9 (onshore)
			300 (offshore)		2.4 (offshore)
Photovoltaics	In, Ga, Se, Te	2.3	83	0.76	27.1
	Cu	0.34	12	0.003	0.1
Fuel cells	Pt	0.001	2	0.04	77.4
	Ytt	0.15	309	0.03	68.4

Table 3 indicates that fuel cells and photovoltaics have the best power plant scale spatial value density. Due to the high spatial power density of fuel cells, they have a very high spatial value density – whereas photovoltaic installations have a high per kilowatt value of materials but a low spatial power density. On the unit scale, wind turbines have a very high value density, but as they are widely distributed across the landscape, the spatial value density is diminished.

With regards to the extraction of the valuable material, in the case of rare earth magnets in wind turbines, this is a relatively straightforward activity – assuming that the material is to be reused for the same or similar purpose. If a separation of the materials is required, this can require significant thermal energy and is technically challenging. However, this is still likely to be comparatively effective and less process-intensive than the recycling of valuable components in fuel cells or especially in PV panels. In both of these technologies thin-films of materials are used to reduce the cost and to optimise properties such as mass transfer (fuel cells). The recovery of such diffuse and intermixed materials of micron-scale films is complex.

Considering the failure rates of individual units, the high value density in a single wind turbine mean that the extraction of value from a single failed unit would be relatively more attractive than the failure of a smaller PV of fuel cell unit. This may offset the lower spatial value density of wind turbines in a windfarm.

4   DISCUSSION

The density, potential range and material value density of materials contained in DG equipment also needs to be considered in the wider socio-political context in which the materials exist. This includes; the types and locations of firms and organisations that participate in the primary production of DG products, and associated service activities; organisations involved in the collection and reprocessing of materials and; the supply chain customers for any recycled materials. Each of these organisations will have an impact on the realisable value (and hence viability) at the economy level of recycling, rather than the potential value at the physical material level. The political and policy context that the firms and organisations operate in can also provide a push or pull tension for all of these activities.

The firms involved in the production of renewable energy equipment are large national and multinational firms that compete on per unit cost, and therefore have competitive advantage in the scaled up production of DG equipment. These firms by and large are innovative and research intensive but are largely focused on incremental performance improvements to existing products and process innovations to enhance competitive advantage in production.

There are a number of drivers influencing the firms that manufacture DG to be involved in the collection and recycling of end-of-life product. Product Stewardship programs such as PV Cycle in Europe is one such example of DG equipment manufacturers closed loop management of materials. The PV Cycle association includes product manufacturers of 80% of the European solar market and is a voluntary agreement to take-back and recycle post 1990 end-of-life PV systems (see http://www.pvcycle.org/). The Association has a target of collecting 65% of PV systems installed after 1990 and the recycling 85% on the contained materials.

The Association was established in 2007 [9] with the motivation for members to join the association are related to corporate governance commitments to sustainability rather than to obtain new inputs from recycled products. Given the 20-25 year lifespan of PV systems, joining PV Cycle also represented an ambition rather than reality for most of the Association members. As of 2010 only two of the 40 members [10] had actual take-back schemes and recycling facilities in place (German based Deutsche Solar AG and US based First Solar). This year (2015) marks 25 years since the base year of 1990, but as the exponential growth of PV installed generation occurred after 2000, there is still time

for the industry to establish and trial take-back schemes before volumes increase. The availability of time is positive in the sense that schemes can be in place by the time volumes increase, but is a negative in that recycling activities will lack critical mass, and therefore lack the incentives for innovation that will be required to cost-effectively take back, recycle and re-use materials.

For some Solar PV firms, end-of-life take back and recycling of products is part of firm strategy. For example First Solar operates product stewardship of all their products globally (not just in Europe with PV Cycle) and have done since 2002. First Solar has a specific commitment to the environmental sustainability of their products including end-of-life. This allows the company to claim they have the lowest carbon footprint of available PV technologies [9]. With the sale of each model First Solar sets aside funds for the estimated future costs of collection and recycling of the unit. The funding is kept in a separate trust account and independently audited annually [9]. Again here the motivation for recycling is not capturing the value of the materials in products but rather avoiding the costs (both financial and reputational) of end-of-life product contributing to waste streams.

Whilst not quantified in the same level of detail, the remainder of this discussion section considers the interaction of decentralised energy with other distributed infrastructure, including water provision and recycling and also product manufacture as shown in Table 4.

Table 4: Nexus between energy, water and minerals

Technology	Energy	Water	Minerals
Decentralised energy	Decentralised energy systems should have higher efficiencies as there are limited transmission losses	Demand for water is reduced as decentralised energy systems do not require water cooling systems of large power stations, however solar farms require water for cleaning	Need for a wider range of speciality and expensive metals and minerals for decentralised energy systems (e.g. battery storage)
Decentralised water - **raintanks** - **onsite recycling**	Decentralised water systems typically need decentralised energy system (e.g. local pumps) for transporting water	Decentralised water systems may require higher levels of maintenance for delivering water security	Decentralised water systems typically do not require speciality or expensive minerals or metals
Decentralised production, e.g via additive manufacturing	Decentralised production can be energy intensive, innovative designs are required to overcome	Although not essential, decentralised production can benefit from decentralised water systems	Decentralised production requires smaller units which can require speciality or expensive minerals or metals, in theory less materials can be used through clever design

Considerations for sound material cycle society: a checklist

There are several key factors that should occur for sound and resilient material circular society at the intersection of the material-energy-water nexus. These include:

- Need for reliable (often smaller scale) technologies that are economic to purchase and operate
- Holistic thinking across 'value chain' encouraging stronger product stewardship measures

- Smarter and more innovative design approaches that value 'design for remanufacturing, recycling and re-use'
- Policy and regulatory frameworks that fosters efforts towards dematerialisation
- Reliable data and information across all parts of circular 'value chain' to allow new and emerging business to conduct the relevant business cases with confidence
- Supporting infrastructure to help encourage the appropriate producer/consumer behaviour to enable the circular 'value chain'
- Setting of suitable targets for remote and urban areas to track performance over time, not only for one indicator (energy or waste), but of the material-energy-water nexus

The above characteristics are relevant for the nexus between energy, water and minerals. Such an example is the use of higher-performance critical minerals in low concentrations which are complex to recycle but are essential for decentralised energy and water systems, compared with unalloyed, standardised materials which can be used widely and can be effectively recycled or re-use across multiple cycles, such as materials used in centralised energy and water systems.

5   ACKNOWLEDGEMENTS

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Balancing public and private regulation

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Abstract:

Voluntary Sustainability Standards (VSS) might develop into a viable alternative to public regulation. However, it turns on the (regulatory) circumstances whether that holds true in practice. If public regulation on CSR topics lacks, governments are unable to agree on certain topics on a global level or diverging public regulation exists, VSS can be helpful to set global standards. Obviously, private standards will especially be helpful if they are commensurate with local public legislation (and e.g. treaties) and/or are accepted by local governments. If one neglects this, numerous domestic structures might exist that frustrate VSS. Furthermore, governments have to remain vigilant whether these private regimes do not result in market disruption, consumer detriment or hamper of trade. VSS might also compete with public arrangements which might limit the uptake of VSS. However, if public regulation exists VSS might be a viable alternative if compliance with not too compelling public norms by market participants is rather poor and the public policymaker is aiming to incentivize the better performing part of the market to embark in higher standards and thus only desires to regulate the less performing part of the market. Furthermore, the effectiveness of VSS themselves should be assessed using an integrated multi-disciplinairy (comparative) approach entailing legal, impact-assessment, legitimacy, governance and behavioral aspects. Only effective VSS in the aforementioned sense are a true alternative to public regulation.

Beyond that, the legal perspective in connection with (the effectiveness of) VSS is discussed, featuring FSC and UTZ Certified as an example. It is important from this perspective that VSS have a clear and sufficiently selective objective and sufficiently specific norms, are regularly evaluated, entail 'conflict of law rules' and an effective grievance mechanism, provide sufficient means for monitoring and enforcement and contribute to a more balanced risk attribution between producers and (ultimate) buyers.

1. Introduction, scope and methodology

Balancing private and public regulation is a broad and challenging topic, which has been discussed in literature in diverging disciplines for some time. I do not aspire to provide a holistic solution or view on the topic within the limits of this contribution. Rather, I focus on this topic in connection with Voluntary Sustainability Standards (VSS) in supply chains and derive examples from two initiatives: UTZ Certified (coffee, cocoa and tea) and FSC (sustainable forestry). Furthermore, this contribution focusses on legal issues in connection with regulatory governance, although some side steps to other disciplines are made.[1] Its objective is to identify the regulatory conditions necessary to enable VSS to be a viable alternative to public regulation as well as legal indicators in connection with the effectiveness of VSS.

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This paper is based on a literature review in connection with VSS focusing on legal issues. Furthermore, several reports on the functioning and effectiveness of (amongst others) UTZ Certified and FSC have been consulted to provide useful data in connection with these two initiatives.

2.   VSS in supply chains

VSS are usually implemented in supply chains through a contractual mechanism which entails certification by third parties.[2] Certification generally entails (i) establishment of standards, (ii) certification assessment for compliance with the standards, (iii) a certification seal or label, (iv) accreditation of the certifier by an accreditation body, and (v) compliance monitoring.[3] These contractual mechanisms may be used to show (human rights) due diligence in a supply chain.[4] An overview of these contractual relationships is shown through the figure below. The blue arrows mark the contractual relationships. Relationships of a different nature shape this mechanism. The 'real' supply chain is governed by the contractual relationships between the producer, the trader and the retailer.[5] The supply chain contracts usually entail a perpetual clause. This clause obliges a contractual party to implement the relevant contractual requirements it has to meet vis-a-vis its buyer in the contracts it concludes with its suppliers.[6] Certification is implemented in connection with the production of for example coffee, cocoa, tea and wood and in the supply chains to prevent unauthorised diffusion of certified and non-certified commodities.[7] The certification body has contractual relationships with the producers and traders it certifies. These entities remunerate the certification body for its services. Furthermore, the certification body has a contractual relationship with the standard owner which allows it to provide certification services. This contractual relationship also implements the rules which govern the certification process. For example, it provides rules for the failure to meet the requirements for certification by the producer or trader.[8] Finally, the certification body has the permission of an accreditation body to provide certification services.[9] This accreditation body supervises all certification bodies in a specific country. Beyond that, a contractual relationship exists between the retailer and the standard owner if the retailer desires to make use of the (eco)label of the standard owner such as UTZ Certified or FSC. This contractual relationship usually entails a license to use the trademark connected to the (eco)label and requirements for proper usage of the (eco)label.

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┌─────────────────────────┐      ┌─────────────────────────┐
│   Accreditation Board   │      │    Owner VSS (label)    │
└─────────────────────────┘      └─────────────────────────┘
             │                                │
             ▼                                ▼
┌──────────────────────────────────────────────────┐
│              Certification body                   │
└──────────────────────────────────────────────────┘
     │                    │                         │
     ▼                    ▼                         ▼
  Producer  ──────▶   ┌────────┐  ──────▶        Retailer
                      │ Trader │
                      └────────┘
```

Perpetual clause
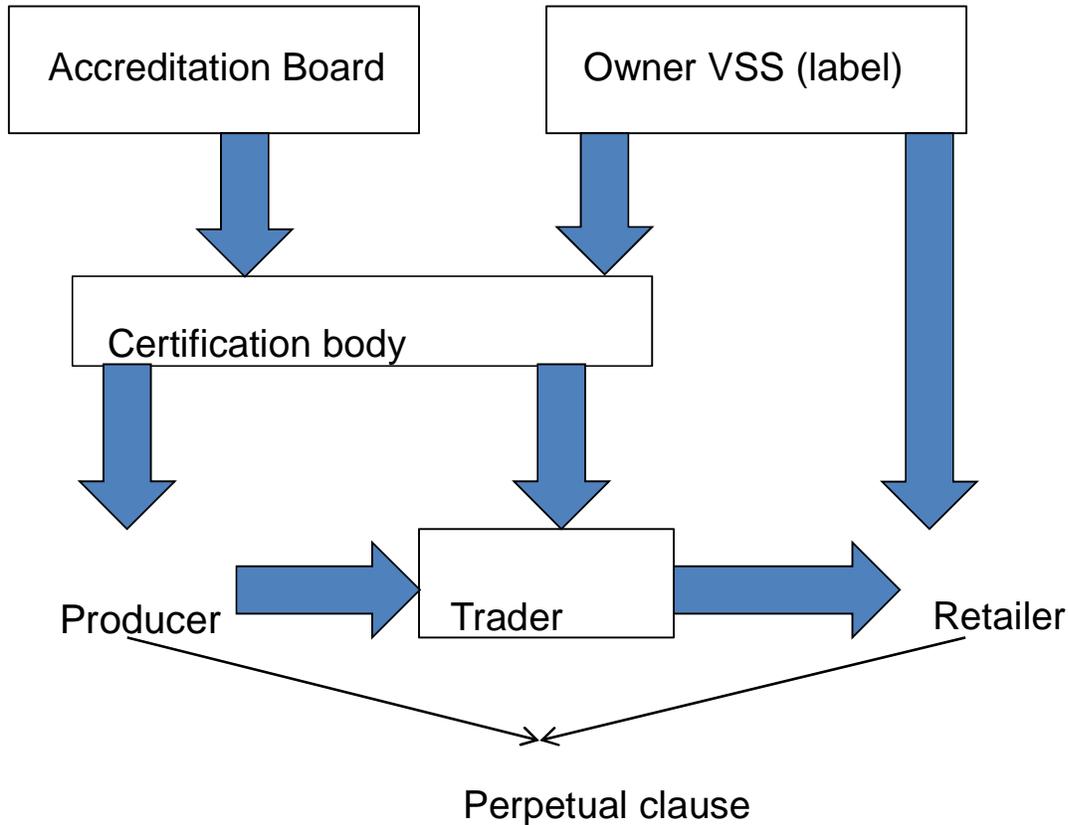
3.   Regulatory governance in connection with VSS

After explaining the functioning of VSS through contractual mechanisms, I will touch upon the concept of regulatory governance, which is related to balancing private and public regulation. Regulatory governance has a broad meaning and covers many aspects of (optimizing) regulatory regimes. It, amongst others, concerns the topic of balancing public and private regulation and may be disaggregated into six components: (i) framing the regulatory agenda and setting objectives; (ii) formulating rules or norms; (iii) implementing rules within targets; (iv) gathering information and monitoring behavior; (v) responding to non-compliance through sanctions and other forms of enforcement and (vi) evaluating policy and providing feedback, including review of rules.[10] In terms of balancing public and private regulation components (ii)-(v) are of overriding importance and components (i) and (vi) play a role.

However, this contribution focusses on regulatory governance in connection with VSS and especially addresses legal issues. Therefore, it will not discuss all the topics mentioned above, but zoom in on issues (ii), (iv), (v) and (vi) in connection with VSS. As has been elaborated hereinabove VSS are deployed in supply chains. Supply chains raise difficult issues of leverage in terms of controlling CSR and sustainability performance of (distant) suppliers which, unfortunately, cannot be all evaluated in this contribution. Hence, the topic of balancing public regulation and VSS is narrowed down to two topics: (i) are VSS a viable alternative to public regulation as a mean to control CSR and sustainability issues in supply chains and if so, (ii) which legal conditions have to be met for VSS to perform.

4.   Should VSS be considered as a viable alternative?

One might favor public regulation because VSS are often associated with a high sense of freedom to opt in or out of a certain sphere.[11] Parties who wish to join the regulatory bodies participating in the regime are free to do so. Thus the uptake of VSS might be rather limited or the requirements of the VSS might not be strict enough.[12] Moreover, it lacks legitimacy (in the traditional sense) because of its detachment from traditional government mechanisms. Other reasons for preferring public regulation might be that VSS enlarge the risk of market disruption (due to a restriction of competition), free-riders benefitting from the existence of VSS without adopting or implementing it, consumer detriment and insufficient protection against human rights violations and environmental damage.

That said, to date public regulation cannot be considered to be the silver bullet in the CSR arena, especially not on the international level. Research has revealed a considerable decrease of the number of treaties and the increase of private regulatory frameworks as VSS since 2000 and thus the insufficiency of traditional international law.[13] Beyond that, adequate public regulation might lack or might be enforced rather poorly. VSS might bridge this gap to a certain extent.[14] Furthermore, public regulation is, by its definition, involuntary in nature and might thus hamper compliance as opposed to standards which a company voluntarily adheres to, for example because of market demand. Beyond that, consensus exits over the inability of states to regulate global markets. Even where international standards exist, they are hardly uniformly implemented in public law. Therefore, for example, private (NGO) led forestry protection regimes and regulation of measures preventing and diminishing the effects of climate change are implemented.[15] Hence, VSS may fulfill national public policy objectives beyond the legal sphere of a national state. The European Commission has also called for self- and co-regulation schemes in the area of CSR, as these are important means by which enterprises seek to meet their social responsibility.[16] Several other advantages and drivers of international private regulation are discerned,[17] which also apply in connection with VSS: (i) the need for harmonization and the reduction of transaction costs[18] and (ii) (timely) implementation of new techniques[19] and flexibility.[20]

From the foregoing one might conclude that VSS might be a viable alternative in supply chains.[21] However, it turns on the circumstances whether that holds true in practice. Therefore, it should be assessed which objectives are strived after by certain VSS and whether the approach chosen (also considering the (interaction between) existing public regulation and private schemes) is likely to achieve these objectives.[22]

If public regulation on CSR topics lacks in certain countries, governments are unable to agree on certain topics on a global level or diverging public regulation exists, VSS can be helpful to set global standards and may be preferable. A high rate of adoption of international private standards through associational channels suggests the comparative organizational advantage of VSS over (domestic) public regulation.[23] Governments might ultimately see these private standards as guidance for adapting public regulation. This has happened in Ivory Coast and Ghana, where the government now enforces quality criteria in connection with crop.[24] Standard systems may thus serve as a learning laboratory to test standards, verification systems, technologies, results, and other aspects at a reasonable scale, before broad mandatory application in public regulation.[25] They might also build consensus to help to identify key areas for improvement and be a driver for stakeholders to convalesce around a limited number of key issues. This enables governments to develop a focus on regulatory actions supported by stakeholders.[26]

Obviously, private standards will especially be helpful if they are commensurate with local public legislation (and international obligations arising from e.g. treaties) and/or are accepted by local

governments as a proxy to compliance with its own laws or an improvement of the local situation.[27] If one neglects this aspect numerous domestic structures might exist that frustrate, amplify, or reconfigure international private initiatives.[28] For example, the lack of a sufficient legal and management framework may hamper VSS.[29] Uncertainties over land tenure, property rights and community rights may undermine such private systems.[30] Corruption and poor enforcement might exacerbate this.[31] Furthermore, governmental regulation should not obstruct private standards. Therefore, VSS solutions for complex problems should also be adapted to local or regional legislation, conditions and concerns and preferably negotiated with local governments in order to circumvent adverse interference of national regulation.[32]

Furthermore, governments have to remain vigilant whether these private regimes do not result in market disruption, consumer detriment and hamper of trade.[33] For example, certification might exclude or complicate access to a certain market, because standards might favor producers in developed countries as they use production methods which are close to or compliant with these standards, whereas these methods are less common in developing countries.[34] The cost of certification might cause a further complication especially for smallholders.[35] However, VSS are considered to raise trade barriers only if they are not deployed in niche markets and mandatory in practice.[36] In order to circumvent this obstacle 'western' governments may negotiate these standards with the (developing) countries in which these are intended to be used. If an agreement with these countries is reached they should be WTO-compatible because they are voluntary and jointly agreed upon.[37]

VSS might also compete with public arrangements as is the case in connection with tropical wood. The EU has entered in Voluntary Partnership Agreements (VPAs) on the prevention of illegal deforestation.[38] The VPAs offer an opportunity for the EU and developing countries to participate in a jointly governed system of legality assurance, while imposing obligations on European timber firms to exercise due diligence in respecting local legal standards.[39] Legality assurance in terms of complying with the due diligence requirement entailed in public regulation can be more or less provided by VSS as well. However, whereas the legality requirements necessary to exercise due diligence are less stringent then the requirements set forth by VSS such as FSC or even PEFC, this disencourages participation in VSS if one just seeks to comply with the legality requirement.

Furthermore, the relationship between VSS and national laws can be problematic. For example, rather strict labor laws exist in the Brazilian coffee sector. However, these laws are considered to be too strict and compliance is rather poor. The Brazilian government tolerates this situation unlike VSS which require compliance with national labor laws. As a result Brazil is more sustainable in theory in terms of social conditions than many other coffee-producing countries, but this is hard to certify due to lack of compliance with labor laws in practice.[40] Furthermore, a commodity exchange has existed in Ethiopia which did not allow certified products to be sold as trading was anonymous and other means of trading where considered to be illegal. This problem is currently addressed with a two track coffee trading system, although full traceability is still not guaranteed.[41] Beyond this, Ghana used to have a state monopoly on cocoa trade.[42] A state entity set the price for cocoa (regardless of prices on the world market). This system has partially been liberalized, but is still in place. As a result productivity is rather low and the results for sustainability are hard to determine.[43]

Thus it depends on the (regulatory) conditions whether VSS are a viable alternative. Important issues are whether public regulation lacks (on the global level), whether VSS are commensurate with local public regulation (if existent) and adapted to local conditions and concerns as well as to international obligations arising from e.g. treaties and whether they are accepted by local governments. If public regulation exists VSS might be a viable alternative too if acceptance of (and thus compliance

with) not too compelling public norms by market participants is rather poor and the public policymaker is aiming to incentivize the better performing part of the market to embark in higher standards and thus only desires to regulate the less performing part of the market. Furthermore, the effectiveness of VSS themselves should be assessed using an integrated multi-disciplinairy (comparative) approach entailing legal, impact-assessment, legitimacy, governance and behavioral aspects.[44] Only effective VSS in the aforementioned sense are a true alternative to public regulation.

As the number of pages of this contribution is restricted I will focus on the legal (effectiveness) perspective only because research on VSS usually does not take that perspective. This contribution thus adds to existing research. I will illustrate this perspective by comparing two examples of VSS: FSC (forestry) and UTZ Certified (cocoa, coffee and tea).

5.   Effectiveness of VSS from a legal perspective

The legal avenue focuses on the objectives of VSS and whether they provide 'conflict of law' rules in connection with other VSS or public regulation, enforcement of private regulation, conflict resolution and attribution of risks in supply chains.[45] Therefore, this avenue does not analyze the substantive private norms. Rather it provides for 'meta-rules' on the formation and enforcement of such regulation and the resolution of conflicts in connection with these norms.

5.2.1   Goal attainment and specificity of VSS

In terms of goal attainment both FSC and UTZ Certified involve objectives they strive after in terms of sustainability and social impact.[46] In order to assess whether these goals have been achieved (actual impact) a clear and sufficiently selective objective is a necessary condition. However, having defined a clear objective does not mean that this objective is attained. For example, unintended side effects might occur. Therefore, next to clear objectives clear indicators/verifiers are needed to assess whether these objectives have been met. FSC does not provide such indicators/verifiers. UTZ Certified deploys a list of 50 indicators to assess whether its goals have been achieved.[47] Furthermore, UTZ Certified has embarked in third party evaluations of the achievement of its objectives.[48] This impact study provides some evidence that at least part of its objectives have been met.

In terms of specificity and prescriptiveness of the norms, which might enhance compliance,[49] UTZ Certified seems to involve more specific and prescriptive norms.[50] For example, it differentiates between different types of crops and provides for different VSS for coffee, cacao and tea. Furthermore, it for example entails more precise and practical commands regarding crop protection and transport. FSC seems to provide more general norms and some forestry expert say that these are not well adapted to different local circumstances and production processes. Nonetheless, both initiatives provide supporting (training) documentation to explain (the proper use of) the VSS.

5.2.2   Regular review

Both initiatives evaluate and review their VSS. Documentation (publicly) available reveals that FSC evaluates and reviews its VSS on a five year basis.[51] However, as FSC refers to all local (public) norms (section 1.5) this part of their VSS cannot easily be reviewed because local governments need to be engaged and consent in this evaluation and review. Especially if the local norms are negotiated with western countries (local forestry standards have been negotiated upon by many countries of origin and the EU)[52] it might be a difficult and lengthy process to review these norms. UTZ Certified states that it evaluates and reviews its VSS every five years.[53] As UTZ Certified refers to specific local public norms

only (e.g. on labor conditions, minimum wages and national cocoa quality standards)[54] the review issue FSC encounters does affect UTZ Certified to a lesser extent.

5.2.3   Conflict of law rules

It is important to involve 'conflict of law' rules which indicate which rule/standard prevails if it is contradictory to other public or private regulation/standards. The need for 'conflict of law' rules becomes salient if, as FSC does, it requires compliance with national laws (of the country of origin, section 1.5)[55] and prescribes (in section 4.7) the protection of indigenous sites. A deforestation permit in Indonesia requires complete deforestation of the grounds the permit pertains to and is revoked if this requirement is not met.[56] Therefore, if indigenous sites are part of the grounds included in the permit national law does not permit the preservation of it. FSC does not entail rules how to address this issue. If the aforementioned 'conflict of law' rules would have been implemented, the choice would have been (as the FSC standards are fundamentally challenged) to negotiate with the Indonesian government or to withdraw.

However, FSC does not entail 'conflict of law rules'. UTZ Certified provides some guidance on 'conflict of laws' but does not entail a holistic framework to address this issue. For example, it stipulates that the minimum working age is 15 or a lower age in case national regulation entails a lower age.[57] That said, it does not elaborate what should be done if the working age entailed in local regulation is rather low (e.g. 10 years) and the objectives of UTZ Certified are fundamentally challenged. Furthermore, UTZ Certified refers to specific provisions in local regulation. Although it does not entail an obligation to comply with all national laws in a certain country, it endorses these norms, especially if the national standard is higher than the UTZ Certified standard.

5.2.4   Grievances

A further aspect to compare FSC and UTZ Certified is the way in which grievances are (effectively) dealt with.[58] FSC entails a requirement of establishing or participating in a company based grievance mechanism (section 4.6). However, having a company based grievance mechanism as such does not indicate effective resolution of grievances, but is of course a necessary ingredient to start with.[59] Moreover, FSC poses no further requirements the grievance mechanism has to comply with, not even the requirement that a written procedure should exist and communicated to relevant stakeholders. Therefore, it might be unclear to stakeholders a mechanism actually exists and the procedure might be shaped at the discretion of the company. It might even change with every complaint. However, research conducted in Africa reveals that only one out of eight FSC certified logging companies which' grievance mechanisms have been evaluated is lacking a written procedure.[60] That said, FSC does not entail an escalation mechanism (for example to itself) if the company based grievance mechanism does not result in resolution of the conflict.[61]

UTZ Certified has built its own grievance mechanism, which amongst others involves recording of the complaints (section 2.C of the code of conduct). This mechanism is elaborated in the UTZ Certified Complaint Handling Procedure.[62] Its mechanism involves an escalation procedure to UTZ Certified and even independent third party involvement if UTZ Certified itself is part of the conflict. This mechanism seems more independent than the company based mechanisms prescribed by FSC and might therefore be more effective. However, its disadvantage might be that it is unclear whether complaints will be handled at the head-office of UTZ Certified or on a local level (the latter seems more effective) as well as whether stakeholders confide in this mechanism, because it, for example, lacks (referral to) a clear procedure and information on possible outcomes.[63]

5.2.5   Enforcement

Both FSC and UTZ certified entail (third party) certification. Certification might be helpful and is a common tool to monitor/support compliance with VSS (as well as public regulation).[64] FSC has certified a total of 184,371,469 ha of forests in 80 countries (involving 1294 forest management certificates and 27 923 FSC chain of custody certificates (connected to supply chain certification)) as per 2014.[65] However, FSC does not certify itself but accredits certification bodies.[66] Conversely, UTZ Certified issues the certificates itself, but engages independent third parties to monitor compliance with its standards.[67] UTZ Certified certifies 715.648 MT of coffee globally (engaging 212.914 smallholders),[68] 534.614 MT of cacao (engaging 256.111 smallholders) and 65.132 MT of tea (engaging 30.757 smallholders).[69]

Enforcement of a violation of private standards is, next to the usual contractual mechanisms, connected to trademark law. Both FSC and UTZ Certified are registered trademarks. The use of the mark is granted to every applicant who meets the VSS of FSC or UTZ Certified and is certified.[70] If a company advertises a product referring to such an eco-label while it is not granted permission to use the certification mark, all usual means to redress the infringement of a trademark might be invoked by FSC or UTZ Certified. The same applies if a company is granted the use of the certification mark but fails to meet its standards or if the certificate has been suspended or revoked, while the permission to use the mark may then be suspended or revoked too. However, decisions from state courts might not always provide effective access to public enforcement. It depends on the legal situation, and especially the implementation of the rule of law, in a specific country.

Reputational risks emerging from liability for violation of environmental or social (workers or human rights) norms might be reduced by participating in FSC or UTZ Certified and complying with their VSS. Although this may not be considered as (public) enforcement, the risk of incurring reputational damage (liability) might incentivize compliance with VSS. The same is true in connection with the risk of loss of more remunerable markets that demand certified products.

5.2.6   Risk attribution in supply chains

A serious issue in supply chains not addressed by VSS (and thus not by FSC or UTZ Certified) is the attribution of risks. By and large most risks and costs are incurred by the producers. For example, the costs of compliance and monitoring are incurred by producers, they are exposed to the risks connected to world market developments (prices) and of transport.[71] Furthermore, the period in which payment can be expected by smallholders from (ultimate) buyers might be rather long.[72] Thus, it might be helpful if the standard owners would play a role in balancing the risks between (especially) producers and (ultimate) buyers. They might make a more balanced risk attribution part of the requirements for participating in the scheme. This approach seems to be more feasible than expecting producers and (ultimate) buyers to agree on a more balanced risk sharing agreement. That said, such requirements might make VSS imposing these less attractive and to date no VSS entail such requirements. Therefore, a more broadly shared vision has to be developed that the attribution of risks is a problem that has to be addressed, like, for example, the issue of reasonable livelihood for producers has been addressed in the past.

6.   References

[1] See for a broader approach including other indicators Martijn Scheltema, Assessing Effectiveness of International Private Regulation in the CSR Arena, Richmond Journal of Global Law and Business 2014, vol. 2, 263, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2442715.

[2] *See* Fabrizio Cafaggi, *The Regulatory Functions of Transnational Commercial Contracts: New Architectures*, 36 FORDHAM INT'L L.J., 1561, 1566, 1580, 1601–11 (2013) and in connection with food safety Paul Verbruggen, *Enforcing Transnational Private Regulation: A Comparative Analysis of Advertising and Food Safety,* Elgar, 2014, 168 and 184 ff. Sometimes certification is also prescribed by investors. Cf. Verbruggen 2014, 168.

[3] *See*, Alejandra Martinez Gandara, *The law and economics of eco-labels*, Ph.D. Thesis Rotterdam 2013, 51–52 (in connection with eco-labels). *See*, *e.g.*, Georgios Dimitropoulos, *Zertifizierung und Akkreditierung im Internationalen Verwaltungsverbund*, Tübingen: Mohr Siebeck, 2012, 224 (on certification in general).

[4] See on (human rights) due diligence in general e.g. SHIFT, Human Rights Due Diligence in High Risk Circumstances: Practical Strategies for Businesses, March 2015, http://www.shiftproject.org/publication/human-rights-due-diligence-high-risk-circumstances-practical-strategies-businesses. Human rights due diligence might be prescribed by law in certain countries in connection with mining. See on this OECD Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas (second edition), www.oecd.org/daf/inv/mne/mining.htm; Olga Martin-Ortega, Human Rights Due Diligence for corporations: from voluntary standards to hard law at last?, Netherlands Quarterly of Human Rights, vol. 32/1 2014, 68-71.

[5] The figure displays a simplified supply chain, in reality these chains entail a higher number of intermediary parties.

[6] Usually this clause is harnessed with a contractual penalty.

[7] However, commodities of which the production as well as the supply chain have been certified are not always sold to the end-users with the (eco)labels of e.g. UTZ Certified, for example because the minimum content of certified commodities required to display the label on the product is not met.

[8] In these cases the certificate of a producer or trader might be suspended or eventually revoked.

[9] This permission might be implemented in a contractual relationship or an administrative decision dependant on the nature of the accreditation body. This body might be a private, semi-public or public entity, which varies per country.

[10] *See* for these six components Burkhard Eberlein, Kenneth W. Abbott, Julia Black, Errol Meidinger and Stepan Wood, *Transnational business governance interactions: Conceptualization and framework for analysis*, **8 REG. & GOVERNANCE**, 6 (2014), available on http://onlinelibrary.wiley.com/doi/10.1111/rego.12030/pdf.

[11] Cf. Edward J. Balleisen and Marc Eisner, *The Promise and Pitfalls of Co-Regulation: How Governments Can Draw on Private Governance for Public Purpose*, in: J. Cisternino (ed.), New Perspectives on Regulation, [2009] The Tobin Project 133 and 134 to be found at www.tobinproject.org, 131; Deirdre Curtin and Linda Senden, *Public Accountability of Transnational Private Regulation: Chimera or Reality?*, in: Colin Scott, Fabrizio Cafaggi and Linda Senden (eds), The Challenge of Transnational Private Regulation: Conceptual and Constitutional Debates, Wiley-Blackwell: Oxford 2011, 168.

[12] IIED-report, xi.

[13] E.g. Joost Pauwelyn, Ramses Wessel en Jan Wouters, *International Informal Lawmaking: An Assessment and Template to Keep it Both Effective and Accountable*, Joost Pauwelyn et al. (eds.), Informal International Lawmaking, Oxford University Press 2012, 500-535.

[14] Cf. Colin Scott, Fabrizio Cafaggi and Linda Senden, *The Conceptual and Constitutional Challenge of Transnational Private Regulation*, in: Colin Scott, Fabrizio Cafaggi and Linda Senden (eds), The Challenge of Transnational Private Regulation: Conceptual and Constitutional Debates, Wiley-Blackwell: Oxford 2011, 4.

[15] Fabrizio Cafaggi, *New Foundations of Transnational Private Regulation*, in: Colin Scott, Fabrizio Cafaggi and Linda Senden (eds), The Challenge of Transnational Private Regulation: Conceptual and Constitutional Debates*, Wiley-Blackwell: Oxford 2011, 26.

[16] Communication from the Commission on a renewed EU strategy 2011-14 for Corporate Social Responsibility of October 25th 2011, COM(2011) 681, p. 5, 9, 10, *available at* http://ec.europa.eu/enterprise/policies/sustainable-business/files/csr/new-csr/act_en.pdf (last visited March 13th 2013). The Commission proposes a multi-stakeholder CSR platform in a number of relevant industrial sectors for enterprises, their workers, and other stakeholders to make public commitments on the CSR issues relevant to each sector and jointly monitor progress. *See id.* at 9.

[17] Cafaggi 2011, 25-30; Fabrizio Cafaggi and Andrea Renda, *Public and Private Regulation, Mapping the Labyrinth*, [2012] CEPS Working Document no. 370 to be found at www.ceps.eu, 6. *See also* Eberlein et al. 2014, 9 and 10.

[18] Cafaggi 2011, 25; **PETER UTTING, REGULATING BUSINESS VIA MULTI-STAKEHOLDER INITIATIVES: A PRELIMINARY ASSESSMENT**, UNRISD Research Project Promoting Corporate Environmental and Social Responsibility in Developing Countries: The Potential and Limits of Voluntary Initiatives, 84 (2001). In connection with eco-labels, *see* Gandara, *supra* note 25, at 262-63.

[19] Cafaggi 2011, 27.

[20] Balleisen & Eisner 2009, 133-34; Cafaggi 2011, 47. *Cf.* Anthony Ogus and Emanuela Carbonara, *Self-regulation*, in Francesco Parisi (ed.), Production of Legal Rules, Edward Elgar: Cheltenham 2011, 234.

[21] See on the means of implementing these standards in supply chains e.g. L. Vytopil, Contractual Control and Labour-related CSR Norms in the Supply Chain: Dutch Best Practices, Utrecht Law Review, vol. 8(1) 2012, 155,

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https://www.utrechtlawreview.org/index.php/ulr/article/view/186. Cf. on private standards in supply chains Cafaggi 2013, 1557.

[22] *See* Scheltema 2014, 288-290.

[23] Christine Overdevest and Jonathan Zeitlin, Assembling an experimentalist regime: Transnational governance interactions in the forest sector, 8 Reg. & Governance 33 (2014).

[24] IIED, Building a roadmap to sustainability in agro-commodity production, 2013, www.aidenvironment.org/media/uploads/documents/201310_IFC2013_Building_a_roadmap_to_sustainability_Phase_I_report.pdf, viii and 58 (hereinafter referred to as the IIED-report).

[25] Resolv, Toward Sustainability, The Roles and Limitations of Certification, www.resolv.org/site-assessment/files/2012/06/Report-Only.pdf, (hereinafter refered to as Resolv-report), 85.

[26] Resolv-report, 85.

[27] Overdevest and Zeitlin 2014, 24.

[28] Tim Bartley, *Transnational governance and the re-centered state: Sustainability or legality?*, 8 Reg. & Governance 95 (2014) in connection with timber regimes. *Cf.* Resolv-report, 89.

[29] *Cf.* Resolv-report, 31.

[30] Resolv-report, 31.

[31] Resolv-report, 31.

[32] *Cf.* Overdevest and Zeitlin 2014, 24.

[33] *See* Scheltema 2014, 346-348.

[34] *See* e.g. Gandara 2013, 159; Gabriela Alvarez & Oliver von Hagen, *When Do Private Standards Work? Literature Review Series on the Impacts of Private Standards; Part IV,* ITC Technical Papers 21 (2012) *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2184314, 13–14.

[35] *Cf.* Kimberly Elliott, 2012. Is My Fair Trade Coffee Really Fair?, CGD Policy Paper 017. Washington DC: Center for Global Development. http://www.cgdev.org/content/publications/detail/1426831, 7; Resolve-report, 82 and 83. For example RSPO has set up a Smallholders Support Fund to cover the cost of certification of smallholders. See IIED-report, 38.

[36] Resolv-report, 31 and 32. As a consequence several labels have addressed anti-trust issues and have explicitly stated topics that can and cannot be discussed.

[37] Overdevest and Zeitlin 2014, 37.

[38] The EU has negotiated these bilateral VPAs with developing countries in order to establish privately monitored licensing systems for the export of legally harvested wood to the European market. *See* Overdevest and Zeitlin 2014, 36.

[39] Overdevest and Zeitlin 2014, 28.

[40] IIED-report, 59.

[41] IIED-report, 61.

[42] IIED-report, 61.

[43] IIED-report, 61.

[44] *See*, Scheltema 2014, 277-283.

[45] Scheltema 2014, 288-293.

[46] Cf. on the (type of) norms they have implemented in connection with the social, environmental and economic dimension, Jason Potts, Matthew Lynch, Ann Wilkings, Gabriel Huppé, Maxine Cunningham, Vivek Voora, The State of Sustainability Initiatives Review 2014, State of Sustainability Initiatives, www.iisd.org/pdf/2014/ssi_2014.pdf (hereinafter refered to as SSI Review), 71, 73 and 76. The human rights coverage of UTZ Certified is observed to be better than that of FSC. See SSI Review, 72. Furthermore, on environmental issues like water and energy indices both seem to entail less stringent norms than multiple commodity initiatives. See SSI Review, 80. Furthermore, the importance of climate change is an area for improvement of all initiatives. See SSI Review, 85.

[47] See for these indicators www.utzcertified.org/images/stories/site/pdf/downloads/impact/4.%20utz%20certified%20_program%20indicators%20version%202.pdf.

[48] UTZ Certified Impact Report, January 2014, combining results from 24 external impact studies and data from UTZ Certified, https://utzcertified.org/en/mediacenter/reports-brochures/26582894.

[49] See e.g. Scheltema 2014, 291.

[50] However, the prescriptiveness of FSC norms increased since 2008.

[51] See https://ic.fsc.org/second-consultation-on-cw-documents.712.htm.

[52] E.g. the VPAs the EU has concluded. *See* Overdevest and Zeitlin 2014, 36.

[53] UTZ Certified contends it conducts five year evaluations/review of its VSS. See https://utzcertified-trainingcenter.com/home/index.php/en//code-revision-general-information.

[54] See for the cocoa standards requirement Code of Conduct Cocoa CO.B.7, www.utzcertified-trainingcenter.com/home/images/stories/library_files/EN_UTZ_Cocoa_Module_2014.pdf.

[55] Thus certification of this standard de facto replaces public supervision (especially if government agencies do not supervise or very infrequent).

[56] See e.g. IIED-report, 43.

[57] Section 79 of the General Code.

[58] See on the importance of effective grievance mechanisms e.g. IIED-report, 36.

[59] See for an elaboration Scheltema 2014, 331-339.

[60] The data of this research have kindly been provided by Paolo Cerutti, researcher in the CIFOR and EU Pro-Formal project, www.cifor.org/pro-formal.

[61] As has been noticed in the just mentioned research the issue is sometimes referred to a government agency in such circumstances.

[62]

https://www.utzcertified.org/images/stories/site/pdf/special/101012_UTZ_CERTIFIED_Complaint_handling_procedure.pdf.

[63] See on requirements for and effectiveness of such (non-judicial) grievance mechanisms e.g. Scheltema 2014, 331-339.

[64] See on the importance of safeguarding the credibility of claims about compliance with VSS IIED-report, xi.

[65] https://ic.fsc.org/facts-figures.19.htm.

[66] See for a list of accredited FSC certification bodies http://www.accreditation-services.com/archives/standards/fsc.

[67] https://www.utzcertified.org/en/aboututzcertified.

[68] The largest quantity of certified coffee is sold as UTZ Certified. However, 4C covers the largest amount of certified coffee produced. See SSI Review, 164, 167 and 176.

[69] In 2012/2013, see Impact-Report 2014, 49-55. Furthermore, a considerable number of brands is making use of UTZ certified. See https://www.utzcertified.org/en/?option=com_brandsdetails&partners-and-brands&task=filter&country=All&product=2. See also SSI Review, 146 and 147.

[70] *See, more generally e.g.*, Gandara 2013, 253.

[71] See on these issues in connection with the production of grapes Peter J. Ras and Walter J. Vermeulen, *Sustainable production and the performance of South African Entrepreneurs in a Global Supply Chain. The Case of South African Table Grape Producers*, Wiley InterScience/ERP Environment 2009, 333.

[72] Ras and Vermeulen 2009, 333.

WEB APPLICATION FOR PERFORMANCE ASSESSMENT AND BENCHMARKING FRAMEWORK TOWARDS A MORE SUSTAINABLE PUBLIC SECTOR: THE SPS PROJECT AS A CASE-STUDY

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ABSTRACT

The public sector (PS) and its organizations, given their size and influence, are expected to lead by example in delivering sustainability goals, embracing sustainability insights in planning, decision-making and operations.

It is crucial to integrate sustainable development (SD) principles into all government processes. Besides the operational performance, public agencies should assess the sustainability performance of their decision-making processes through identification and evaluation of SD principles on several PS initiatives (such as legislation, regulation, policy or plans).

There is a research gap in SD initiatives since they mainly focus on the environmental dimension of SD and on the measurement and evaluation of government operational performance, namely the assessment of government operations and management practices. In this context, integrated environmental, social and economic issues are poorly addressed, and our framework aims to assess sustainability performance, through an integrated approach of SD dimensions, by optimizing performance management

This paper aims to present a Sustainability Performance Evaluation Framework for the PS, to be tested and validated through a case study – the Portuguese PS – through a web-based graphical interface which addresses both strategic and operational PS's broad domains related to: i) Profile of PS agencies; ii) Check-list for PS department's self-assessment: sustainability performance self-assessment criteria; iii) PS sustainability performance indicators and index. This application also aggregates sustainability data for PS activities, contributing to the performance reporting, assessment and to confer the sustainability PS label – Sustainable Public Service (SPS).

As a result, an interactive guidebook that will help self-assessment of PS agencies by providing guidelines for sustainability good practices implementation is being developed. It will facilitate the integration of sustainability of PS operations and strategic activities to provide wider knowledge of sustainability best practices, as well as offer common web links that produce available information related to PS sustainability performance.

With this approach it will be possible to measure and benchmark sustainability performance, facilitate continuous improvement and exchange good practices, regarding daily activities (operational and strategic levels).

KEY WORDS

Indicators; Assessment; Reporting framework; Public participation; web-based interfaces; Public Sector.

1   INTRODUCTION

Public agencies, given their size and influence, are expected to lead by example in delivering sustainability goals by ensuring that sustainability informs planning, decision-making and operations. Thus, the integration of sustainable development (SD) principles into all government processes – including policy formulation and operations – is crucial for the implementation of SD and is, actually, the major challenging task of the public sector (PS) organizations [13].

Sustainability performance measurement has been increasingly recognized by PS organizations as one tool that allows us to evaluate the integration of sustainability considerations on government processes. Several governments are beginning to implement "greening and sustainable government" programs. These initiatives focus on the environmental dimension of SD and on the measurement and evaluation of government operational performance, namely the assessment of government operations and management practices. In this context, integrated environmental, social and economic issues are poorly addressed. Neither of them integrate a two level (strategic/policy and operational) assessment approach. Besides the operational performance, public agencies should assess the sustainability performance of their decision-making processes through identification and evaluation of SD principles on several PS initiatives (such as legislation, regulation, policy, plan or programme).

In this context, this paper aims to present a research that consisted in developing a Sustainability Performance Evaluation Framework for the PS. The resulting framework from the research would enable PS organizations:

- To assess sustainability performance, through an integrated approach of SD dimensions, and optimise performance management;
- To benchmark sustainability performance and facilitate continuous improvement and exchange of good practice;
- To improve sustainability performance through daily activities (operational and strategic levels); and
- To assess how sustainability principles are embraced in decision-making management processes.

More specifically, this paper presents a Sustainability Performance Evaluation Framework for the PS, to be tested and validated through a case study – the Portuguese PS – through a web-based graphical interface which addresses both strategic and operational PS's broad domains related to: i) Profile of PS agencies; ii) Check-list for PS department's self-assessment: sustainability performance self-assessment criteria; iii) PS sustainability performance indicators and index. This application also aggregates sustainability data for PS activities, contributing to the performance reporting, assessment and to confer the sustainability PS label – Sustainable Public Service (SPS).

As a result, an interactive guidebook that will help self-assessment of PS agencies by providing guidelines for sustainability good practices implementation is being developed. It will facilitate the integration of sustainability of PS operations and strategic activities to provide wider knowledge of sustainability best practices, as well as offer common web links that produce available information related to PS sustainability performance.

To develop the PS sustainability profile a questionnaire survey will be conducted involving a representative sample of the Portuguese central government agencies.

The Sustainability Performance Evaluation Framework will include the development of a checklist, which will allow the assessment of PS practices against established sustainability criteria. Those criteria and respective performance indicators include the evaluation of the environmental, social and economic performance of PS policies, plans and programs and operational activities in the context of overall performance. The evaluation of the framework itself will be conducted through a meta-performance process that will allow the continuous improvement of the entire framework, where the effectiveness of the framework will be measured. This will represent a significant part of the model review information. This framework could be used as a self-assessment and communication tool for public organizations. The framework will be tested and validated with the

Portuguese PS case study. A national questionnaire survey will be carried out, involving a representative sample of central PS agencies.

The interactive guide book will assist self-assessment of PS agencies, supporting the framework implementation, and provide guidelines for sustainability good practices implementation, providing web-links to good practices reference documents and sites, e.g. sustainability performance indicators and reporting guidelines.

The Sustainable Public Performance Benchmarking tool will be a web-based graphical interface supported by a relational database, setting into practice the framework developed. The data obtained through the framework test and validation will be used in a first benchmark exercise.

It will be expected that the research outputs could contribute to the promotion of a SD strategy in Government activities and in the overall PS. The proposed research will try to integrate operational and strategic levels for the sustainability performance assessment of the PS, aiming to integrate the environment, economic, social, cultural and institutional issues. This innovative approach tries to improve and mitigate the main drawbacks of sustainability assessment methods developed for the PS, mainly focussing on environment and operational issues.

2   METHODOLOGY

This research proposal is a further development of previous work on environmental performance evaluation of Public Sector (PS) using defence sector as case study. Previous research for the defence sector included an assessment of the environmental profile, through the evaluation of how environmental management practices have been adopted in this sector and an assessment of environmental aspects and impacts, and the development of an indicator framework, supported by the selection and construction of environmental performance indicators. ([11–13]).

Worldwide, the integration of the environmental and sustainability principles into decision making processes and operations management is a major challenging task of Public Sector (PS) organizations. As stated by Hertin ([3]), in already difficult and contested areas of policy there is a risk that environmental and sustainable development is sidelined as a worthy, but intractable objective. When public policy needs to be increasingly flexible, responsive and co-operative, integration needs to be achieved by efficiency.

As significant employers, providers of services, and consumers of resources, public agencies also have a major impact on national and global progress towards SD. Within the PS there are several types of public organization such as: central and local government departments, agencies, trading funds and public corporations. PS organizations pursue political and social goals rather than simple commercial objectives. In the private sector there are sole traders, partnerships, co-operatives and private and public limited companies. Given their size and influence, public agencies have an important leadership role in delivering sustainability goals by ensuring that sustainability informs planning, decision making and operations ([4]), The integration of SD into all government processes – including policy formulation and operations – is crucial for the implementation of SD [13].

Sustainability performance measurement has been increasingly recognized by PS organizations as one tool that allows us to evaluate the integration of sustainability considerations on government processes. As stated by the Organization for Economic Cooperation and Development [8], performance measurement is one tool that is crucially important for sustainable development. Public organizations are beginning to realise they must shift their management towards sustainability and as such PS sustainability performance evaluation is becoming a growing reality.

There are a number of initiatives that aims to evaluate the sustainability performance of the PS. Several governments are beginning to implement "greening and sustainable government" programs [1,7,14–16].

However, these initiatives mainly focus on the environmental dimension of SD and the measurement and evaluation of government organizations operational performance. The operational level is the main component analysed, in which government operations that impact on the environment and the implementation of environmental management practices are assessed, e.g. environmental management systems, environmental audits and environmental performance evaluation, including measurement and communication. It should also be stressed that none of these initiatives integrate a two level (strategic/policy and operational levels) assessment approach.

The majority of these initiatives consist in compiling guidelines on how to assess environmental and sustainability performance on government agencies. Overall public service performance results are available for the general public but do not include any mechanisms for public participation, namely for the evaluation of the indicators presented or for the evaluation of sustainability performance of the public service by consumers or costumers. Performance indicators play a central role as tools of performance measurement. Several of these initiatives measure or provide guidance through performance indicators (e.g. the UK and the South Australian frameworks include a set of environmental performance operational indicators that reports annually on the progress and outcomes of greening initiatives).

Besides the operational performance, public agencies should assess the sustainability performance of their decision-making processes through the identification and evaluation of SD principles on several PS initiatives (such as legislation, regulation, policy, plan or programme). As stated by Pope [10] sustainability assessment should have the important function of encouraging decision-makers to give ample attention to the sustainability characteristics of PS initiatives and also clarify how planners, policy-makers, and decision-makers take into account the goals of sustainable development in the carrying out of their initiatives.

As stated before, this study wants to contribute to the ongoing debate about frameworks for PS public sector-sustainability integration, including to how to evaluate the evaluations, as a critical assessment of the strengths and weaknesses of an evaluation, and conclusions about its overall utility, accuracy, validity, feasibility and propriety.

The methodological approach will be supported by the following main components:

a) The typification of activities (operational and strategic), aspects/pressures and impacts that interact with sustainability could be performed through an input-output-outcome approach. This will allow obtaining a general PS sustainability profile. To develop this task a literature review will be conducted. This literature review will include international web based research case studies and scientific journals

b) Design of the conceptual framework for sustainability assessment taking into account the indicator framework proposed by Ramos [13], aiming to assess the operational environmental performance of the public sector , incorporating a systems analysis approach, which means the design of the main relationships and flows among different components of PS sustainability performance evaluation.

c) Test and validate the Sustainability Performance Evaluation Framework for the Public Sector (PS) through a case study – the Portuguese PS. This case will put in practice the proposed tool and a set of performance evaluation indicators will be proposed to be adopted by this national case study, and the usefulness of this methodology will be demonstrated. As a first step of this of this task a questionnaire survey will be developed to obtain the Portuguese PS sustainability baseline. The survey will be applied to a representative sample of Portuguese public organizations, derived from pre-defined criteria.

d) A web-based graphical interface will be developed through the support of a relational database, setting into practice the framework developed. This web-based interface will address strategic and operational PS's broad domains related to: profile of PS agencies; check-list for PS departments self-assessment: sustainability performance self-assessment criteria; PS sustainability performance index The application of this kind of tool will allow to aggregate sustainability data for PS activities, contributing to the performance reporting and the assessment and to confer the sustainability PS label – Sustainable Public Service (SPS).

On the next section, this last topic will be developed.

3   SUSTAINABLE PERFORMANCE EVALUATION WEB APPLICATION

The Sustainable Public Performance Benchmarking (Sustainable PPB) tool will allow the sustainable performance comparison and exchange of information among public agencies. This tool will also have a sustainability public sector (PS) label – Sustainable Public Service (SPS) – for the agencies with the best performance. Through a ranking of PS sustainability agencies, it is expected that pressure be put onto those that show the worse results in order to obtain a fruitful competitiveness. Additionally, the example given by the PS may warn and raise public awareness, contributing towards behavioural change in individuals and society alike.

This interface will use new knowledge representation and visualization approaches examining a noncompartmentalized and non-hierarchical idea of knowledge. This will be done through the construction of semantic networks that tend to bring closer the association process and the mechanisms of knowledge exploration, to the ways human memory and thought structuring and organization occur [9].

This web-based interface will address strategic and operational PS's broad domains related to:

   i.   Profile of PS agencies (including areas of special concern to characterize the sustainability performance and functioning of the sector, showing issues linked to the development of the sector's mission, activities, operations and services provided, size, environmental sustainability aspects and impacts, among others);

   ii.   Check-list for PS departments self-assessment: sustainability performance selfassessment criteria;

   iii.   PS sustainability performance indicators and index (this index could be applied to measure sustainability performance among different PS departments and supported on the raw data collected from the public services).

The application of this kind of tool will allow to aggregate sustainability data for PS activities, contributing to the performance reporting and the assessment and to confer the sustainability PS label – Sustainable Public Service (SPS).

In addition, this database will also allow public participation in the sustainability performance assessment process of Public Sector entities. General public and all stakeholders could carry out their own public service sustainability assessment and compare this result with the institutional self-assessment. This task's main result will be the Sustainable Public Performance Benchmarking tool – Sustainable PPB, a web-based graphical interface delivered as an information dashboard.

As for the implemented system architecture (figure 1, it's a typical three tier architecture, entirely based on Open-Source technology, and therefore does not involve licensing costs, which is an enormous advantage, since it cuts off the cost for payment of annual licensing. This Open Source solution still allows the development and deployment of a truly interoperable and fully functional web-based GIS application.

SPS system uses a set of powerful Javascript frameworks and libraries that considerably improve modularity, structure, and the overall implementation of modern development architectures, such as Model-View-Controller. The application is based on the MVC pattern, which divides the software into three interconnected parts, separating the flow of information internally and handling how it is presented to the user. Here MVC is used on both client and server sides [6]. This MVC framework is ideal for developers who want full control over the behavior of an application, enabling the design that supports a rich routing infrastructure. It provides better support for test-driven development (TDD). It works well for Web applications that are supported by large teams of developers and for Web designers who need a high degree of control over the application behavior.

Figure 1 – *SPS technological architecture*

SPS database was implemented according to Microsoft SQL Server is fully ACID (atomicity, consistency, isolation and durability) compliant and fully supports the implementation of primary/foreign keys, complex query execution, triggers, views and multiversion concurrency control (MVCC).

On the logic tier, PHP (version 5.3.10) was used as a general-purpose server-side scripting language that was originally designed for the development of dynamic web pages. Its development started in 1995 and it is released as free software. The use of such language will provide the necessary server functionality for complex query execution to the central database allowing the development of specific KPI Dashboards and reports. This scripting language is flexible, powerful, and general-purpose language best suited for web development.

As soon as requests arrive, IIS connects to the PHP file, which then decides whether to start a database process or any other service present on the server. Both alphanumeric and geospatial data related to SPS management unit's properties are stored on a Microsoft SQL Server object-relational database [6].

Finally, at the presentation tier level, there were used several FOSS JavaScript libraries: ExtJS (version 4.21) and jQuery (version 2.0.3).

ExtJS is a dual-licensed (both FOSS and proprietary) cross-browser JavaScript library for building rich Internet applications (RIA). It provides a consistent core user interface and interaction library containing several widgets such as windows, grids, tabs, forms and charts that are allowing the development of desktop-like web applications.

On the client side, every rendered component and interaction is handled by the browser's JavaScript interpreter. The ExtJS framework can be considered the backbone of the application, responsible for most of the user interface, DOM event's listeners and MVC implementation. Additional tools and plugins from the popular JQuery library were also added to enrich the interface [6].

We've chosen ExtJS for its structure and consistency, as it considerably improves scalability and ease of maintenance of the application, backed up by a solid architecture. The best way is to follow certain conventions and define application views, models and controllers before actually implementing them.

Forms, tables, charts, map panels and basically every other interface element are placed on different views. The model can be considered a runtime repository, managing the data structures that are accessed by the views. ExtJS also packs a Store class that encapsulates a client side cache of Model objects. Stores load data via Proxy, and also provide functions for sorting, filtering and querying the model instances contained within it. Ultimately, the controller is the logical decision point that will retrieve, build or modify a Model based on the required action. It is also possible to handle triggered events that comes from the views. Multiple models and views can be connected to one or several controllers. In SPS's case, the latter is used to manage requests between the web application and the server.

This approach allows for the reutilization of a single tool on several situations, anywhere on the application. For instance, every map panel found in SPS comes from the same view, but are then handled by different controllers, according to the needs.

These frameworks/libraries also come with methods for managing browser's requests, which reduces the amount of time dedicated to handling common network errors, giving the developer a certain level of abstraction and allowing him to focus on more complex and specific work. As they're being constantly updated, these open source libraries provide a trusted source to keep up with the latest web standards.

At the end of the design, development, programming and implementation of the system, there was provided a first version to be tested by users before pursuing to the fully fledged system.

4   RESULTS & CONCLUSIONS

Some authors, as Ness [5] and Fraser [2], state that these assessments tools have demonstrated that approaches can be categorized based on numerous facts or dimensions, such as temporal characteristics, focus or coverage areas, product level or proposed change in policy and integration of nature-society systems (such as social and/or economic aspects).

In this context, the web SPS Assessment Tool, contains a questionnaire designed towards the responsible of the PS institution (figure 2), and their employees (figure 3), which will assess this institution according its social, environmental and economic dimensions.

Figure 2 – *SPS Assessment Tool – PS Responsible Questionnaire*

Figure 3 – *SPS Assessment Tool – PS employees Questionnaire*

The SPS label and the web benchmarking tool will be original research outputs that will contribute to reduce the current gaps and limitations identified for sustainability performance assessment of public services approaches. It will impact significantly on the sustainability performance assessment of public sector activities, making the reporting of sustainability performance data more comparable among public organizations and easier for the decision makers and general public to handle. It will also contribute to improve government action, to publish specific guidelines for public sector and to organize training actions for technical staff, lectures in pos-graduation courses and demonstrative experiments for undergraduate courses.

The proposed approach tries to help the public sector decision-makers to understand the sustainability profile. The application of this kind of study could be used by public services in the future to collect and aggregate environmental, social, institutional and economic performance data for public sector activities, contributing to

the reporting and the assessment of the state of the public organizations from a sustainability perspective. These results could complement future developments in specific performance indicators and indexes, applied to the whole sector or to a single organization, which take into account actual sustainability pressures and impacts.

More broadly, this method might be also applied to an evaluation of other sector's sustainability performance evaluation.

5 ACKNOWLEDGEMENTS

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ABSTRACT TITLE

Attempting to break the (Unsustainable) Establishment: How the Scottish Greens Co-opted a Movement for Democratic Change.

Theme
Global Governance
Track
7B
Justification of the paper
Much has been proposed regarding how we might change consumer lifestyles and influence the policies and actions of government and businesses so to avoid dangerous climate change. However, despite this, the main indicators of atmospheric pollution continue to increase (IPCC 2013) with this partly explained by the failure to persuade politicians from the largest polluting countries (i.e. USA, China) to agree to legally binding reduction targets.

An ambitious research area that may help address this is to examine how wider social movements can be co-opted to change the established social order of countries where political and economic decision making is resistant to urgent calls for action.

Purpose
This paper helps understand how key barriers such as establishment individuals, governance structures and institutions, can be challenged and changed. Guidance is provided on how to appropriate democratic power to help us live sustainably.

Theoretical framework
Social movement theory (Della Porta & Diani 2006; Melucci 1989) is the organising framework used with particular reference made to Kozinets & Handleman's work (2004) examining the aims of ideological groups.

Results and conclusions
The findings come from a study of the Scottish Green party's involvement in 2014 Scottish independence referendum. They show how charismatic leadership, public debate and at some time ethically difficult collaborations with other related social movements (civic nationalism and republicanism), lead to the weakening of the prevailing narrative maintained by the UK establishment. By helping replace this with a more socially democratic, environmental conscience narrative, the green movement developed greater willingness to act, gained new activists, and a stronger policy voice within existing political parties. Hence changes to entrenched establishments are possible.

Implications for Tipping Points

It shows how changes to a country's politics can be made so that the voice of prevailing science can be heard and hence feasible engineering and behaviour change solutions may be enacted.

Key words
Social Movements
Sustainable Development
Social narratives

Next Generation Rural Natural Resource Governance: a Careful Diagnosis

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Abstract:

Achieving "sustainable development" requires the exploitation without diminution of financial capital, manufactured capital, intellectual capital, human capital, social and relationship capital, and (particularly) natural capital (Technical Taskforce of the International Integrated Reporting Council 2013). This requires effective natural resource governance, to guide human uses of the earth into sustainable patterns (Armitage et al. 2012, Agrawal and Perrin 2009). Agriculture and rural communities are central to sustainable development because among other reasons: agricultural activities typically require natural environments; agriculture is resource dependent and fundamental to society; and rural people are frequently relatively poor (International Fund for Agricultural Development 2010)[2]. Good rural natural resource governance is thus a prerequisite for sustainable development.

Keywords: Cost sharing, human behaviour, transaction costs, institutions, data, recognition, social justice

Rural natural resource governance shapes the human behaviour that affects the economic, social or ecological sustainability of natural capital, the sharing of resource benefits, the costs of use, and the costs of conservation (including of the governance system). Particular behaviours drive exploitation, contamination, conservation, and restoration, market transactions and other aspects of resource exploitation or protection. Whilst 'governance' conjures up government and the law, resource use and conservation are driven by people and organisations serving diverse roles using many different types of instrument. These include: government as lawmaker and regulator, land manager, creator and defender of private rights, and instigator and implementer of public policy; primary industries such as mining and farming, and the industries that add value to or deal in rural products; and civil society as purchasers and consumers, political activists, volunteers, taxpayers and voters. The many behaviours that create governance outcomes are shaped by the political system, social dynamics, the economy, culture,

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[2] Whilst the statistics indicate steady improvement in rural poverty in the developing world, overall the majority of people in extreme poverty (71%) are rural.

technology, and industrial systems. Governance involves responses to complex and dynamic drivers, and requires multi-faceted interventions across society (Martin 2008a, Scarlett et al. 2013).

Governance success depends upon whether the interventions 'fit' with the context and can be resourced. The hypothesis this chapter develops is that some preferred rural governance approaches fit poorly with the rural context, and that effectiveness is constrained by insufficient implementation capacity. Whilst our focus is Australian natural resource governance, our diagnosis (and prescriptions) apply more broadly to rural natural resource governance.

Economic, social, and environmental governance outcomes reflect a coupling between dynamic human and biophysical systems, through transactions between people or people and nature. Good rural natural resource governance is thus a process of managing complex socio-ecological systems, adjusting transactions to ideally create patterns of resource use and conservation that deliver human services, justly, whilst preserving natural and other capitals. One governance tool is the law, relying on the powers of the state. The law serves many functions in natural resource governance, enabling environmental and social harm, as well as protection, restoration and social benefits. Legal arrangements include property rights, administrative law, contract, trade practices, intellectual property, indigenous rights, taxation, criminal law, and the laws that govern public and private organisational arrangements.

Institutions are shaping forces, and legal arrangements are part of the mix. Beyond the law and governments, markets dictate many outcomes, as do investment arrangements, cultural and sometimes religious or social norms. Powerful forces like taxation, consumer preferences, and competitive positioning of manufacturers or retailers cannot be ignored. The law sits alongside culture (e.g. indigenous or commercial culture), social norms, voluntary collaboration, industry requirements, and other normative mechanisms. These constitute a complex and often inconsistent 'regulatory' mosaic.

These considerations indicate that governance involves strategic management of complex social and economic systems. Effectiveness requires reshaping patterns of transactions that couple human systems to ecological systems (Martin and Gunningham 2011). Fundamental to strategic effectiveness are the "fit" between the strategy and the context, securing sufficient of the right resources for implementation, and the quality of implementation (Martin and Verbeek 2006, Burgman et al. 2009). The alignment of context, strategy (including legal instruments), resources and effective implementation will determine how effective rural natural resource governance will be.

New Rural Natural Resource Governance Problem Archetypes

Overconsumption and contamination of natural resources such as minerals, water, forests, and biodiversity are archetypical environmental challenges to which governance systems respond using regulation, economic incentives or social mechanisms to control accumulating harms. Managing overconsumption and contamination problems requires the exercise of restraint. Instruments promoting restraint such as

regulation, licensing, and economic incentives to conserve are appropriate tactics. Investment in recovery and restoration may also be required, involving different types of instrument. Governing these accumulative harms is less a 'collective action' problem (Adger 2010) than it is an individual action problem. Whilst conventional accumulative challenges will always be with is, contemporary rural natural resource governance involves other archetypes that require institutional strategies that challenge traditional concepts of legal governance.

Established weeds, human or animal disease, soil erosion and salinity, many social problems, and pest animal problems will increase "under their own steam" once the processes of harm are established. They are 'autopoietic': they adapt to circumstances, and increase without external impetus (Seidl 2004). Responding to an established disease, weed, or a pest animal or insect invasion requires investment of funds and labour by those affected (not just restraint by those who have caused the harm). The investment generally has to be coordinated, comprehensive and sustained, a difficult collective action challenge. Intervention can involve complex behaviours, substantial investment and complex coordination. Depending on the issue, coordinated collective action may need to cover large areas. Such coordinated action is more likely when landholders have the same enterprise type. Cattle farmers have different concerns than lifestyle landholders or managers of public conservation estates, whose concerns differ from those of sheep producers, miners, wheat producers or peri-urban communities. Land use and social fragmentation makes autopoietic problems difficult to manage – we detail this further below. The unique character of this type of problem has not been well recognised in rural natural resource governance. Academic understanding of collective action is generally based on relatively simple problems where individuals know each other and have reasonably symmetrical abilities and interests (Golembiewski and Olson 1966, Lubell 2007, Ostrom 2010). We do not have a lot of knowledge or a body of successful experience to govern these archetypes. Traditional legal instruments are ill-suited to forcing positive cooperation and investment across tenures where other forms of persuasion or voluntary cooperation fail.

Rural natural resource governance is affected by the changing nature of risk and risk-management. Traditional problem archetypes involve observable actions of people and observable linear responses of people and ecosystems. Causes, effects and actors are within the same jurisdiction, and issues are easy to define. Emerging social and ecological risks exhibit far more complex nonlinear dynamics and span jurisdictional boundaries, frustrating traditional governance (Dietz et al. 2003, Lim 2014).[3] Many causes interact in un-anticipated ways. Sometimes understanding the issue requires intelligence that is not available to authorities, or challenges science. Often the causes, effects, and actors do not respect jurisdictional boundaries. Those who drive the system that causes the problem may be multinational

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[3] Jurisdictional boundaries are defined by nation or state, and organisational authority and power. Constitutions, the limits to the power of the state over private property or the interests of the citizen, and national sovereignty, limit government action.

corporations or networks of corporations who may be more economically powerful than governments, and operate across many jurisdictions (Vorley 2002).

Increasingly rural natural resource governance is concerned with non-linear cause/effect phenomena (Martin and Gunningham 2011, Mayne and Stern 2013, p. 12) . Biodiversity loss may be caused by interacting factors including over-harvesting, indirect poisoning, habitat loss, and interspecies competition, coupling complex biophysical, economic, social or other factors. A particularly challenging problem arises when cause and effect transcend institutional structures (particularly jurisdictions) and test the knowledge or power of governments. Even within state boundaries, depending on local laws, governments often have few practical legal options to force people to take coordinated action on private land, or to sustain the investment of labour or funds for the public good. Even where legal authority exists, political impediments to "excessive" government action are substantial in rural areas, where notions of private property rights are powerful norms. Because an owner (or a state) has the ability to exclude interventions touching their estate, this limits the ability to require coordinated action. Solutions to these problems typically require institutional arrangements, though voluntary coordination will reduce formality (and transaction costs).

There are also limits to rural citizens' decision-making capacity and their willingness to take action. The first consideration is the "tragedy of the commons" (Hardin 1968). The benefits of protecting the resource are distributed across society but only some of the benefit (and most of the cost) of rural resource conservation accrues to those whose action or restraint is needed. Across large areas, the ability of society (largely through government) to supervise those who impact upon the resource is limited by transaction costs and jurisdictional limits. Experiments by Erling Moxnes (2000) demonstrate how difficult it is for farmers to understand the consequences of their own actions. In addition the economic imperatives for harm-doing even when it is clear that resource use is unsustainable are very strong (Moxnes 2000). When these factors combine with political resistance to forced conservation, the hurdles to effective rural natural resource governance are substantial.

The management of trans-boundary groundwater illustrates this type of problem: the physical state and dynamics of the aquifer cannot be readily observed, so there is ambiguity about the physics of the resource; extraction and contamination activities occur in different jurisdictions, frustrating supervision and control; and authority and responsibility are fragmented and limited by sovereignty. The 'tragedy of the commons' is also evident (Martin and Becker 2011, Tan et al. 2012, Arnold and Gunderson 2013, Waslekar and Futehally 2013).

The causes of harms may be episodic or chronic, and the resulting governance strategies for each type are different. Episodic harms are generally managed as "risks": interventions are contingent upon phenomena such as the leak of a pollutant or a damaging incident like a storm. Risk instruments like insurance or disaster management, and managing risk perception and responses, are likely to be part of environmental risk governance. Examples include bio-security or natural disaster risks. Chronic harms however typically

call for sustained investment of funds or manpower, requiring sustained resourcing and motivational instruments. The requirement for sustained investment is likely to be particularly draining on less wealthy communities. Biodiversity loss is typically a chronic problem, though episodic factors may play a part.

Social and Economic Capacity

We have briefly considered the problem archetypes that challenge conventionally used governance strategies. Identifying more effective rural governance strategies should begin with understanding the challenge, the context, and the resources that may be available. Whilst we focus in detail on Australia, the challenges in this wealthy and ecologically unique country mirror the situation around the world.

We open our exploration of the strategic issues with a comparison of countries that are more and those that are less economically dependent upon agriculture, and Australia. The less agricultural comparators are Switzerland, UK, USA, Canada, and France. The more agriculture dependent jurisdictions are Iceland, Argentina, China, Thailand and Indonesia[4]. The comparisons are indicative rather than definitive, because the total number of countries in the world is relatively small (thus limiting the sample) and given the large number of variables involved.

Fig. 1 International Comparisons
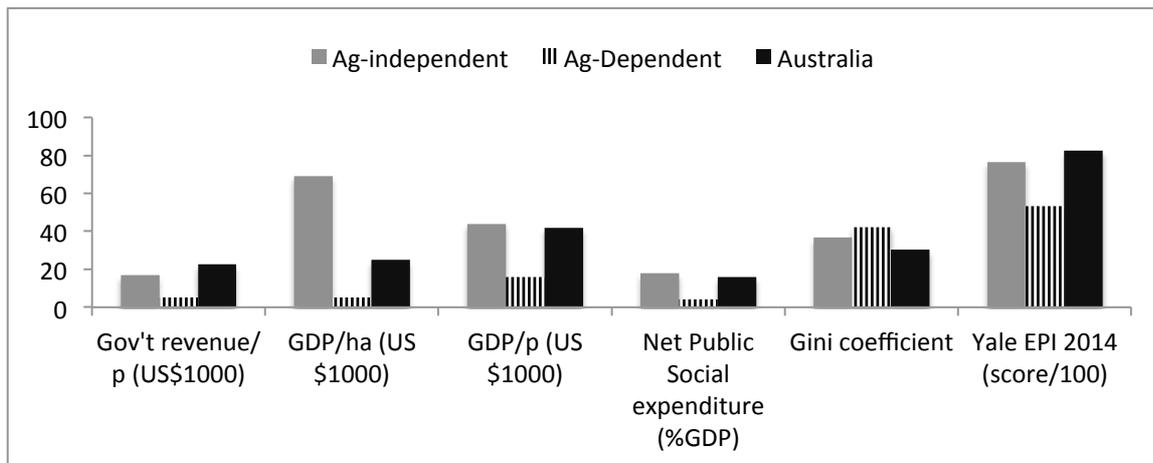
Authors' diagram using data from Yale Environmental Performance Index (2014) and C.I.A (2014)

All data converted to a common 100 point scale for ease of representation.

Countries that are agriculture dependent are likely to be relatively poor, and perform less well on social welfare and on environmental governance measures. Sustainable development (and thus resource governance) outcomes are worse for rural people than for others, and in many jurisdictions environmental capital continues to depreciate.

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[4] Selection of countries was based upon criteria to ensure a diverse sample, including developed and less developed countries, diverse climate and ecological conditions, and degrees of agricultural activity. The findings are considered to be consistent with other intelligence on agriculture and development.

Whilst national poverty and institutional deficiencies, failings of stewardship, and incapacity of farmers are partial explanations for this, the effects of geography, demographics, ecological and social system dynamics, and the dynamics of markets, are very important. This is in addition to political and cultural considerations including corruption and transparency, education and health, and welfare services. In all of these agriculture dependent jurisdictions the statistics indicate that they fare worse. This suggests that the drivers of disadvantage and environmental degradation are deeply embedded. It calls into question rural governance strategies that do not address structural causes of governance underperformance. Traditional legal governance relies largely on laws affecting the land manager, rather than those targeting change to the rural system that shapes the transactions of the land manager.

Australia is an informative case study in part because it is rich (comparable to the industrialised USA or the United Kingdom on a per capita basis) unlike many 'developing', agriculturally dependent countries, and it has strong governance institutions. It has reasonable income equality (Whiteford 2014), transparency, and performance across many variables. It has a high standard of literacy, and around 9% of GDP is spent on a high standard health system. Internationally its public and environmental governance score well. Many of the conventional explanations of poor social or sustainable development outcomes in developing countries are thus absent: it is indeed, "The Lucky Country" (Horne 2008 p. 228)[5]. However even in Australia patterns of rural social disadvantage and environmental harm mirror developing countries. This has significant implications.

Turning firstly to environmental outcomes a recent paper (Ritchie et al. 2013) by prominent ecological scientists decried the failure of (mainly) rural natural resource governance.

> *Australia's highly diverse and predominantly endemic biodiversity is seriously imperilled. In the past two centuries, at least 27 mammals, 23 birds (including island species and subspecies), 4 frogs and over 60 plant species have vanished (Department of Sustainability 2009). In addition, over 1500 mammals, birds, reptiles, amphibians, and plants are currently threatened with extinction, along with over 3000 ecosystem types (Keith et al. 2013). In Victoria, for instance, ~30% of the original native vegetation remains, and some vegetation types, such as grasslands and open woodlands, have been reduced by more than 99% since European settlement (Bradshaw 2012). The situation for marine systems is far more uncertain owing to data limitations even for economically important species (Beeton et al. 2012, FRDC 2012). In addition, Australia has the world's most recent mammal extinction, the Christmas Island pipistrelle bat (Pipistrellus murrayi) in 2009 (Martin et al. 2012). If current trends continue, many other species such as the Leadbeater's possum (Gymnobelideus leadbeateri) will suffer the same fate. Indeed, Lindenmayer and Possingham (2013) suggested that the Victorian government is knowingly condoning activities that will reduce the viability of this IUCN-listed endangered species* (Ritchie et al. 2013, pp. 1133-1134).

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[5] The 'lucky country' descriptor was used satirically in the opening lines of the final chapter.

There has indeed been a significant decline in biodiversity in Australia over the last 200 years, greater than any other continent, with the extinction of 50 animal and 48 plant species. Threats to biodiversity include land clearing and fragmentation of habitats, over consumption of resources, pollution and invasive species (ABS 2013). Ritchie et al. (2013) draw the conclusion that the cause is the failure to legislate and enforce traditional forms of environmental protection. Australian governments are guilty of passing laws that are not adequately implemented, and have been guilty of 'winding back' legal protections. However political, legal and institutional failures are far from complete diagnosis of the underlying causes.

The first consideration is history. Australia was colonised by Europeans in 1788. Prior to that human occupation was by Aboriginal people who were non-industrial. Colonising countries had already diminished their biodiversity, and therefore had (residual) ecologies that were more resilient to these pressures. Biodiversity decline in Australia was inevitable, though the degree of inevitable loss and the quality of the strategies to stem the losses are important matters for debate.

The second consideration is the macroeconomics of conservation. Australia covers 7.688 million square kilometers (ABS 2014a), and contains only 23.5 million people (ABS 2014b). Around 81% of the population lives within 50kms (Department of the Environment 2011a) of the coast and 66% in capital cities (ABS 2014c). The effectiveness of any strategy depends substantially upon the sufficiency and appropriateness of the resources for its implementation. The Australian paradigm for rural natural resource governance relies upon landholder action and investment and government regulation and limited subsidisation. Volunteer labour and philanthropic investment contribute. This resourcing paradigm is not only historically insufficient, it is likely to be increasingly so.

Our estimate (subject to caveats) is that landscape protection and restoration in Australia is likely to require around 2% of GDP (Martin and Werren 2009), much of this investment being required in non-urban areas. Interventions such as regulation, education or extension, or stewardship incentives can do little without manpower or funds. Australia's GDP of US$46.6K per person is comparable with France (US$40.4K), United Kingdom (US$37.7K), Canada ($44.5K), Switzerland (US$55.2K), and the United States (US$54.8K) (C.I.A. 2014)[6]. Our GDP per hectare including all economic activities (US$1995) is similar to Argentina (US$1713) and Canada (US$1976) and less than Brazil (US$2628) but our agricultural and mining GDP combined is only 20% of our national GDP (ABS 2012b, National Farmers Federation 2012) . Australia's population density is roughly equivalent to Mongolia or Iceland (around one hundredth of the density of the UK, one tenth of the USA, or one fiftieth of the density of China) (The World Bank 2015). Adjusted for urban concentration the manpower (and funds) for stewardship are minute compared to the challenge. There is limited manpower and money available 'in the bush' for stewardship of a vast land.

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[6] Australia enjoys a lower level of family income inequity than these countries, measured by the Gini coefficient at 30.3.

The second constraint is the limited capacity of rural people. In developing countries 55% of the population lives in rural areas.. More than 70% were living in extreme poverty in 2011, compared to 55% of the total population. Rural poverty is probably under-represented in these statistics because of migration of the rural poor to cities (International Fund for Agricultural Development 2010). Even in wealthy Australia a pattern of relative socio-economic disadvantage persists.
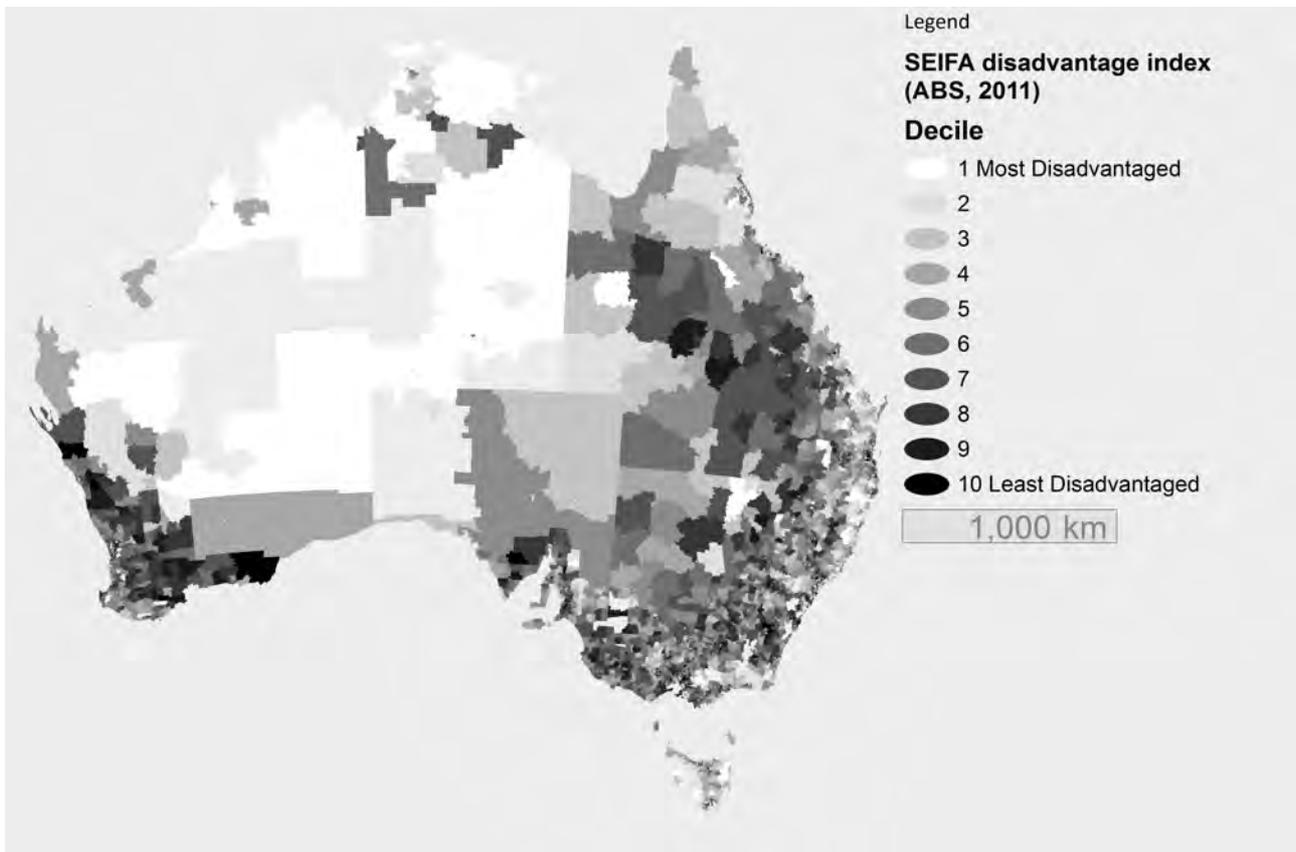
Fig. 2 Distribution of socio-economic disadvantage[7]

The correlation between remoteness from urban centres and disadvantage reflects:

1. relatively low rural incomes;
2. limited availability of professional services
3. a resulting lower average standard of education, health, and other measures of welfare
4. a higher proportion of residents of aboriginal descent (with rural Aboriginal people being the most disadvantaged sub-group of the overall disadvantaged Aboriginal population) (Steering Committee for the Review of Government Service Provision 2014)[8].

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[7] Prepared by R Blackley, Queensland Murray-Darling Committee Inc. Unpublished. Socio-Economic Indexes for Areas (SEIFA) is a product developed by the Australian Bureau of Statistics, 2011

Even within a rich and well-governed country, social justice and environmental outcomes from natural resources are unsatisfactory, reflecting the common characteristics of rural areas in many countries.

Exporting the Limited Rural Wealth

Location, resource dependence and socio-economic characteristics have implications for what is feasible, effective and fair. A worldwide trend is the declining share of the price of agricultural produce accruing to the producer, achieving a redistribution of wealth away from rural areas (Vorley 2002, Murphy 2006). The low return on capital experienced by many primary producers, the low incomes of rural people, and the poor socio-economic status of rural communities all reflect this. Commodity markets, supplier/buyer chain dynamics and government policies create pressure on farm-gate gross margins. Coupled with other issues of farm economics, this undermines farmer welfare and investment capacity. These pressures contribute to over-exploitation of resources, poor welfare outcomes, and a reduced capacity to protect the environment (Vorley 2002).

Australia's agricultural share of GDP fluctuates around 3-4% and its percentage of labour force employed in agriculture fluctuates around the same level. Off-farm processing and marketing increases the average contribution of agriculture to around 12% of GDP, a leverage of at least 3 to 4 (National Farmers Federation 2012). Mining in 2009-10 contributed 8% to national GDP (ABS 2012b). Transformation of minerals to finished product adds most of the value within the end product. Overall most economic value of agricultural production is secured outside rural areas.

The percentage of the wealth which does accrue to the farmer varies with the commodity: for drinking milk the percentage is 25-44 (Australian Competition & Consumer Commission 2008), for poultry it is less than 8%[9] (Australian Competition & Consumer Commission 2008), for beef the 10 year average is 33% (Meat and Livestock Australia 2015a), for lamb the 10 year average is 48% (Meat and Livestock Australia 2015b) and for vegetables 40-50% (Victorian Farmers Federation 2008). One result is that despite working long hours 'the average weekly disposable income of farmers in 2009-10 ($568) was considerably lower than that of people working in other occupations ($921)' (ABS 2012a)[10]. There are many reasons why the economic value of primary production is not retained, but regardless of cause, the consequences include poor rural social and environmental outcomes.

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[8] Whilst most Aboriginal people now live in urban and inner regional areas, Aboriginal people are a higher proportion of the population of rural and remote areas. For most indicators, outcomes for Aboriginal and Torres Strait Islander Australians worsen as remoteness increases.

[9] Based on the price the chicken grower recieves compared to the retail price of a dressed frozen chicken. This value is much less when compared to other commodities as the chicken grower is essentially a contractor. The processor provides the chicken grower with the majority of the inputs required for the growing process.

[10] Low income does not mean a lack of wealth. Farming is capital intensive. The average wealth of farming households in 2009-10 was $1.3 million, compared to other households ($393,000). Income is the more relevant measure of welfare and of capacity to invest in stewardship.

The 'missing markets' problem for environmental values in primary production contributes to unsatisfactory economic and environmental performance. This is beyond the control of rural people. One dimension is the lack of market payment for good stewardship (or market penalty for bad practice). This reduces the incentive for stewardship and the economic capacity to exercise it. Another missing market is for non-production values, which are mainly pursued through regulation or land acquisition rather than market payments. A third missing market is consumer payment for the natural resources embodied in what they consume. This 'caps' the recovery of the full value of natural resources, a key to equitable and efficient conservation.

The degree of embodied environmental values is illustrated by water and greenhouse gas emissions. These indicate the natural resources implicitly exported within primary products.

Table 1 Embodied water for selected agricultural commodities (Hoekstra and Chapman 2007).

Agricultural commodity	Average embodied water content Australia (m^3/t)	Average embodied water content World (m^3/t)
Rice (husked)	1327	2975
Wheat	1588	1334
Maize	744	909
Soybeans	2106	1789
Beef	17112	15497
Eggs	1844	3340
Milk	915	990

Table 2 Embodied greenhouse gas emissions for selected agricultural commodities (Eady et al. 2011).

Agricultural product	Greenhouse gas emissions (kg CO_2equivalent)
1 kg live weight - 40 kg prime lamb	7.9
1 kg live weight – 833 kg cull bull	13.7
1 kg live weight - 158 kg cull sows	2.2
1 kg live weight - 2.5 kg meat chicken	1.7
1 kg sunflower	0.34
1 kg field peas	0.40

Rural producers can do little to create a market for environmental or social values if consumers and distributors, who have market power, are not prepared to pay for this. In a high margin industry it may be feasible for producers to invest to protect unpriced values, but in commodity industries this is less likely.

It is not only through agricultural markets that distributional problems arise between rural communities and the balance of society, relevant to natural resource governance. Society relies on rural landscapes for conservation because urbanisation and industrialisation destroy natural values: continuation of cultural practices (particularly of Indigenous people) is often possible only in rural areas; enjoyment of nature and outdoor recreation often requires rural or wilderness areas. Rural conservation is delivered through public and private protected areas and regulation, access controls and initiatives such as regional natural resource management. Rural people typically receive little economic return from resource conservation and restoration and non-production uses, but bear costs of withdrawal of land and other resources from production, fragmentation (Brown et al. 2005, Bryan et al. 2013) (causing management complexities) and restrictions. Conservation for the public benefit, no matter how laudable, does have distributional impacts (Bergstrom et al. 1985, Merenlender et al. 2004) which are systemic, and which affect wealth and welfare, and the transaction costs of governance.

This analysis suggests that there is a problem with the economic model for rural landscape governance. To achieve desired outcomes will require more funds and human capacity than is likely to be available from rural communities, or even from government. This is particularly if the landscape is sparsely populated, and there is little economic activity. Effective rural natural resource governance will require a powerful fiscal model to share the load more equitably across society, engage those with significant economic resources, and deploy funds and manpower in a systematic and coordinated manner (Martin and Werren 2009).

Fragmentation Transaction Costs are a Governance Issue

Resource competition and land use fragmentation increase management complexity, frustrating coordinated action, generating conflict, and impacting the feasibility of some enterprises, particularly in peri-urban areas (Martin et al. 2010). Delivery of conservation and cultural values from rural lands reduces land and resources for primary production, intensifying competition and adding to fragmentation of land and other resource use (Shepheard and Martin 2009). This creates problems for sustained, coordinated collective action (discussed above). Rural communities incur costs of providing environmental or cultural benefits to society through reduction in access to resources, restrictions upon their use of the resources to which they do have access, and the transaction costs of coordinated action.

Within the broad land use categories shown in Table 5 below there is increasing diversification in land uses (for example the 'production' categories encompass traditional grazing and cropping, new species grazing and cropping, 'lifestyle' farming, private conservation) which create problems for coordinated management. However we do not have data on land use change within the broad categories, for example from cropping to animal production or between types of primary product, or conversion of production to

lifestyle farming (Department of the Environment 2011b). Land use control relies on legal restrictions over things like biodiversity harm, clearing of native vegetation, of water pollution; and project environmental impact controls (such as for mining, quarrying or wind-farm development). There is also fragmentation of legal rights and institutional arrangements: within private tenures, property rights might include tradeable water rights, biodiversity banking interests, mining interests, and contingent rights such as under family law and government rights of access (Martin et al. 2013). The intersection of many laws administered by many agencies, the three levels of Australian government, proliferating market and other rights, results in institutional complexity (Gibbs et al. 2013). Spatial and economic considerations restrict the ability of government to effectively supervise land use in many parts of Australia, notwithstanding legal responsibilities.

The change in land use in the period 2001 to 2006 in Australia indicates longer-term shifts. There was a reduction of 654,686 km^2 in land used for 'production from relatively natural environments' (Table 5). There was an increase of 517,374 km^2 of 'land used for dryland agriculture and plantation production' and an increase of 142,437 km^2 of 'conservation and natural environment'. Some 'productive natural environment' lands may have been converted to conservation or to agriculture and plantations. There was also an increase in 2006 of land used for intensive purposes of 13,968 km^2. Intensive uses include residential, mining, transport and communications land use (Australian Collaborative Land Use and Management Program n.d).

Many effects of fragmentation on coordinated landscape management arise from a shift from homogenous land use (such as widespread grazing or cropping producing similar products, thus sharing land and environmental management issues) to more diverse land use (a more complex mix of grazing, cropping, urbanisation, lifestyle and conservation uses, and more diverse production increasing heterogeneity among stewards).

Table 5 Change in land use from 1996-7 to 2005-6 for residential, mining and production areas (Australian Collaborative Land Use and Management Program n.d).

Land Use	1996-97 (km^2)	2005-06 (km^2)	Change (km^2)
Urban residential	6,102	10,343	4,241
Rural residential	9,442	9,491	49
Mining	1,366	1,482	116
Production from relatively natural environments	4,455,238	3,673,099	-782,139
Production from dryland agriculture and plantations	423,441	1,000,708	577,267
Production from irrigated agriculture and plantations	24,413	26,847	2,434

Table 6 Change in land use from 1996-7 to 2005-6 for traditional indigenous uses, nature conservation and native vegetation. (Australian Collaborative Land Use and Management Program n.d)

Land Use	1996-97 (km^2)	2005-06 (km^2)	Change (km^2)
Traditional Indigenous uses	897,311	876,578	-20,733
Nature conservation	446,915	569,240	122,325
Remnant native vegetation	239,059	223,944	-15,115

Mining occupies 0.2% of Australian land and 2% of the country is subject to mining leases (Minerals Council of Australia n.d). A greater percentage is subject to exploration licenses. There is conflict over the expansion of mining and coal-seam gas extraction, with a concern that prime agricultural land is being lost to mining (Geoffrey et al. 2013). According to Millar and Roots (2012) no data on the amount of agricultural land being converted to mining is available.

Increasing land use heterogeneity has governance impacts. We illustrate this with the autopoetic (self-generating, see Maturana and Varela (1980), and for its relevance to law Teubner (1987)) invasive species problem, using wild pigs as an example. Wild pigs cause damage to crops, lambs and other young animals, native vegetation and small native species like frogs or turtles, and can spread disease (Martin et al. 2014). They are adaptive, can travel great distances. If controls are unsuccessful the animals learn to avoid similar control, and pass this knowledge on to other animals (Whitney and Gabler 2008). The effectiveness of control degrades with landholder nonparticipation in coordinated action (Martin 2008b). Unfortunately personal incentives to participate in control differ with the type of enterprise. Other than for social licence reasons (Williams and Martin 2011, Owen and Kemp 2013) , a mining company may have no economic reason to invest in coordinated control. A grain grower, sugar cane producer or a lamb producer will have different preferences as to when and how control should be implemented. For some landholders the effects of wild pigs upon their enterprise will be significant, but for others it will only be an episodic risk concern. There will be some landholders for whom pig control is not attractive, such as for those who use pigs as a hunting resource, or who are paid for hunting over their lands. For landholders who use dogs for farm management, poisons carry a particular risk. If all landholders have the same type of enterprise many complexities disappear though there will still be differences in attitude and capacity. The increasingly complex mosaic of production, conservation, and indigenous peoples land uses thus increases the costs and reduces the effectiveness of control. It can also result in social conflict (Shepheard and Martin 2009).

For problems with complex causes and effects that span jurisdictions and involve unrelated actors, management requires complex institutional coordination (e.g. collaborative agreements or trans-boundary conventions). Coordination and complexity generate transaction costs: the time (and frustration) cost to the landholder in dealing with agencies; the administration of frontline coordination and coordination

across agencies; monitoring widely-spread and diverse activities with a small number of people; and costs of conflict and distrust (Martin and Gunningham 2011) . Insufficient attention is paid to the impact of landholder and volunteer transaction costs and their effect in disenabling community action, but this is an important concern (Martin and Gunningham 2011) .

Fragmentation, community expectations driving political demands, insufficient funding and weak economic incentives to voluntarily achieve desired standards of conservation, lead to regulation being relied upon in circumstances where other approaches are preferable (Martin and Gunningham 2011) . Intense conflicts have emerged over regulatory issues like the protection of native vegetation, mining and gas extraction, animal welfare, water, biodiversity and land development, and many other issues (Paavola 2007, Martin and Becker 2011). Political opposition, the high transaction costs of monitoring and enforcement, and arguably unachievable expectations, have resulted in implementation difficulties, disputes and political challenges. One result is a political 'see-saw' over regulation, in the political arena and within agencies, over enforcement (Martin and Verbeek 2000, House of Representatives Standing Committee on the Environment 2014, Beetles 2015).

When regulations prove to be ineffective new regulations may be created, compounding the structural problem (but at least temporarily minimising the political one). Australia's history of rural regulation demonstrates that whilst effective regulation may be necessary, the creation of a regulatory instrument is far from sufficient to ensure outcomes. The processes through which rural regulation is created and implemented do not adequately address the many variables that need to be taken into account to ensure effective, efficient, and fair laws (Martin et al. 2007, Tan et al. 2012).

Prognosis

Governance strategy must, like all forms of strategy, be forward looking. Current or historical conditions are relevant only to the extent that they indicate the challenges and opportunities that the strategy must deal with. We have touched issues where history and trends suggest that many of the known challenges will continue into the future, and that many will follow the existing trajectory which suggests that socio-ecological outcomes seem unlikely to improve markedly unless 'game-changing' contingencies arise.

The regulatory, extension and investment capacity of government is increasingly strained. Australian governments of all persuasions have continued to reduce their staffing of rural agencies including those involved in frontline environmental and production support and the management of protected areas such as national parks (though the area of rural protected areas increases). The shrinking contribution of government in rural natural resource governance is the result of two factors: the overall pressure on government resources and declining political attention to rural issues. The most recent Intergenerational Report indicates that Australia's underlying cash deficit under current legislated arrangements will increase from 2014-15 to around 6 per cent of GDP by 2054-55 with net debt increasing to almost 6% of GDP (Anon. 2015). Whilst many debates are possible about the reliability of projections and about how resources are

allocated, the overwhelming sense is that governments will be under further pressure to cut expenditures, and rural natural resource governance investment is more likely to suffer than not.

The second important contingency at the intersection between ecology, economics and institutional arrangements is climate change. The following chart highlights some alternative futures for regions of Australia, under a variety of scenarios that reflect the climate modelling for the 5[th] Assessment Report (AR5) of the Intergovernmental Panel on Climate Change adjusted for Australian conditions. What is significant is the enormous variation in possible outcomes in Australian landscape and social consequences, across a variety of issues.

Fig. 3 Australian sustainability indicators: future scenarios 2011-2100.
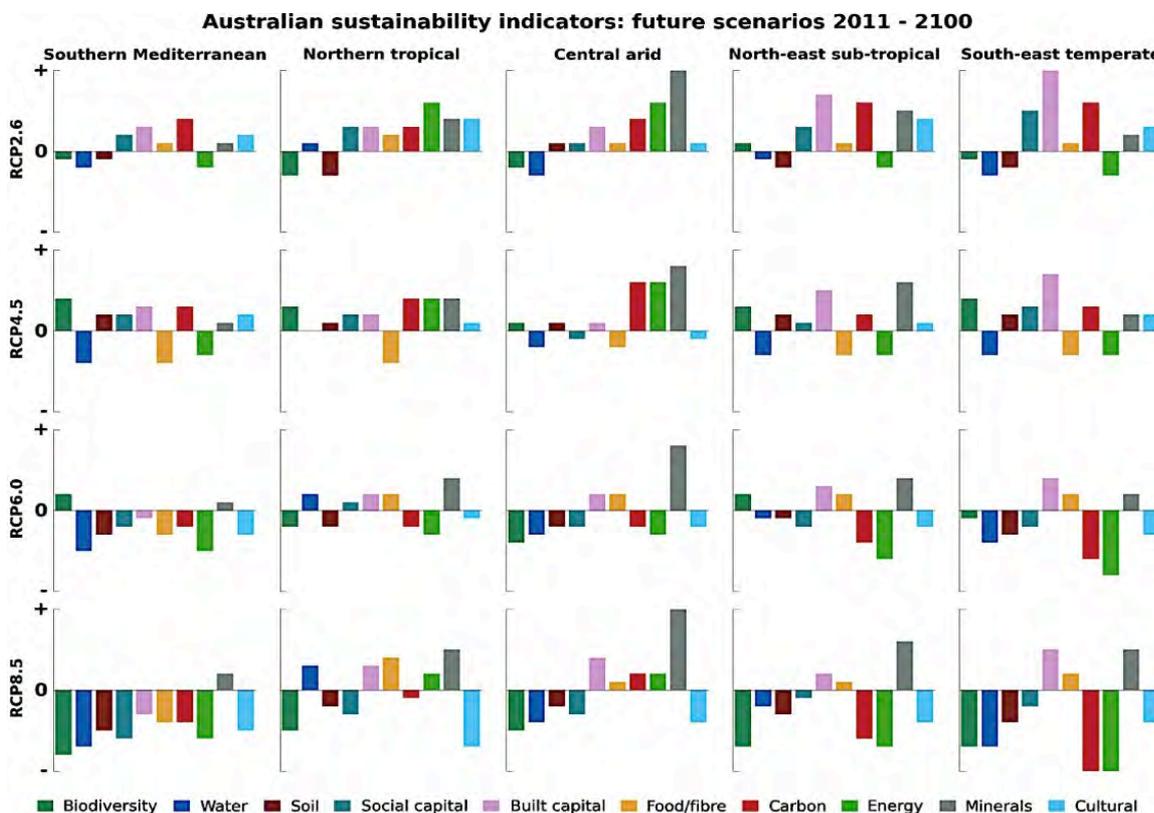
Source: Bryan[11]

The data in Fig. 3 was interpreted and qualitatively downscaled by an expert ACEAS working group in the context of the RCP descriptions. The + is a positive change in the sustainability metric relative to 2011 levels and – is a decline. Background information to aid interpretation can be found in van Vuuren et al. (2011).

The basic assumptions that underpin these scenarios are biophysical climate change, and the human response to climate factors. The future outcomes of resource governance are highly variable, but that governance factors will be a key determinant of what these outcomes are.

Prescription

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[11] Dr Brett Bryan, CSIRO (unpublished).

It seems unlikely that the Australian community could be satisfied with the outcomes that are being achieved from rural natural resource governance, if they were aware of the facts. If past trends continue, particularly with climate change, rural demographics, and declining public investment, sustainable development outcomes will probably be even less gratifying than those currently being achieved. Thankfully, projections are not destiny. Innovation in rural natural resource governance (and in other areas of rural governance) could lead to better outcomes.

In 2013 a diverse group of leading researchers turned their minds to the future of rural Australia and the governance challenges that would have to be met. Their deliberations were inputs into the model cited above. They concluded that

> *Biophysical and economic drivers are converging that may induce a second industrial transformation of Australian landscapes. The combination of increased societal expectations of environmental stewardship and the spectre of climate change require transformational adaptation. We need to adapt to our environment as it changes, and as we change, and we need to do it fast. The six emerging economies for ecosystem services — carbon, water, food, energy, amenity and mining — provide opportunities for the kind of transformation and adaptation that we need and want. These will shape how we use and conserve our unique natural capital but we need to manage the risks of trade-offs and unintended consequences. To achieve positive transformational adaptation of Australian land- scapes and to provide an opportunity to thrive within environmental limits, new partnerships between government, science, the private sector and communities are required. This is up to all Australians. Science needs to inform critical environmental limits and develop new ways of understanding the social processes underpinning transformational adaptation. Governments need to regulate environmental limits, streamline existing laws, institutions and governance, and establish and support innovative local adaptation. The private sector needs to better engage with communities, participate in new markets for ecosystem services, and reduce the reliance on government for funding environmental management. Despite being subject to unprecedented pressure already, individual landholders and communities have the responsibility of innovating and implementing evidence-based, collaborative change. These are the first steps needed on an adaptive path to sustainability in the second industrial transformation of Australian landscapes* (Bryan et al. 2013 p. 6)*.*

In practice true 'sustainable development' in rural Australia will depend upon fundamental innovation. providing solutions that are not currently available to meet major challenges. It will require significant improvement in the profitability of rural land-use, to afford both good incomes and environmental protection. We also have to achieve far greater effectiveness and efficiency in the conservation of natural systems and assets, and find more equitable ways to allocate the benefits and costs of land-use and conservation. Far more funds for environmental stewardship will have to be found, through markets which

better reflect environmental inputs, or conservation funding. Given the constraints on government it would be risky to assume that these resources can come from the public sector. We must overcome the conflicts and transaction costs of fragmentation which prevent sustained, well-coordinated collective action over large areas. "Traditional" public and private governance strategies will have to become more effective, less costly for those being governed and for those who govern, and they will have to distribute the benefits and burdens more fairly. Without radical innovation it is hard to be sanguine about sustainable development outcomes in Australian rural communities. Throughout this chapter we have referenced studies that propose reforms that might individually or in combination significantly improve rural natural resource governance outcomes. There are many others. We finish this chapter by highlighting some other possible catalysts for significant change.

One is greater involvement of industry in natural resource governance. Corporations and industries are changing their stance on natural resource governance driven by four strategic considerations: brand value; resource availability and costs; risk-management and corporate citizenship. This involvement comes in many forms, ranging from voluntary reporting, through environmental philanthropy, reducing the product or service footprint, 'greening' corporate strategy, and whole of industry initiatives. There are many industry codes and standards, reporting schemes, environmental stewardship and 'chain of responsibility' initiatives including as those based on the ISO 1400 international standards, or ISO 14040 life-cycle reporting. This is statistically indicated by the growth of environmental labels, with 458 'ecolabels' reported for 197 countries, spanning 25 industry sectors (Ecolabel Index 2015). Increasingly the private sector is central to setting and enforcing environmental and other standards, through initiatives variously termed "hybrid governance", "co-regulation" or other terms (Sorsa 2009, Armitage et al. 2012). Industry has regulatory power because it can control access to the market, vitally important to primary industries. Harnessing this power to address the missing markets problem and the limits of traditional regulation is an important opportunity. There is a contest underway over "who will govern" for the environment: governments, industry, NGOs, or combinations of these roles. It is possible to contemplate a more integrated and coordinated approach that could help transform rural natural resource governance. These strategies will require different types of law, and legally supported integrity mechanisms if the community is to trust in them.

A second opportunity is to reassert (and support) the role of citizens in leading coordinated action. Over recent decades Australia constructed a regional natural resource management programme that involved (with varying degrees of success) citizens and three levels of government. Whilst this led to many successes, dependency on government institutional arrangements was entrenched, sometimes driving out citizen led initiatives (Williams et al. 2008; Curtis et al. 2014). As governments are forced by economic circumstances to reduce their rural support and leadership roles such as extension and project work, a vacuum is emerging. The opportunity is for new models of community led coordinated action, drawing upon

developments in community engagement theory and practice, and upon the use of behavioural science to improve the effectiveness of engagement and communications (Whelan and Oliver 2004, Williams et al. 2008, Martin et al. 2012). The law has a significant role to play in ensuring that governance arrangements empower and enable, rather than marginalize, community leadership and coordination.

The next generation of rural natural resource governance must respond effectively to new classes of challenge, whilst dealing more effectively with issues we have always had to deal with since colonisation. Greater effectiveness will require high levels of coordinated collective action, and integrated responses on a "whole of system" management basis. This will undoubtedly be very challenging, and if we are unable to succeed any aspirations of rural sustainable development in Australia will not be met. There are, thankfully, many possibilities to deal more effectively with these challenges. As always the limiting factor is political will. It is leadership by citizens that will motivate politicians to take the necessary steps. As always, the quality of social capital will determine the economic and ecological outcomes of rural natural resource governance. The law can be a support or an inhibitor to the transformation of rural natural resource governance.

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Transforming cities towards an ecological worldview: applying sustainability transition theories and resilience thinking to urban planning

Abstract

Cities are complex and dynamic social-ecological systems; both human and ecological systems are in mutual interaction. As a social-ecological system, a city's form and structure can change over time. The transcendence and durability of cities is in fact due to their continuous change. Major transformations are often viewed as technological or socio-technological transitions, such as how transport, communication, and housing are fulfilled, and include changes to user practices, regulations, networks, infrastructure, and symbolic meaning. Theories of sustainability transitions investigate the processes by which innovations in socio-technical systems, arising in niches, displace existing dominant or mainstream technologies. Research to date has focused on applying the theories to sustainability transitions in energy systems, water systems, and zero emission housing. These systems all fit easily within a 'socio-technical' conceptual framework. How can theories of sustainability transitions apply to innovations in social-ecological systems?

The purpose of this paper is to propose viewing transitions and transformations through the perspective of an ecological worldview. An ecological worldview sees humans as active participants in the co-creation of the living systems we inhabit, and understands that living systems are characterized by change, and therefore by uncertainty and unpredictability. A resilience thinking epistemology, one that is marked by complex relationships, along with transitions and transformations, is used to guide the research. Here, resilience thinking helps us to understand that the world is not mechanical and reasonably predictable, helping us to further grasp the concept of an ecological worldview.

This paper develops a new framework for analysing the transition process of policy innovations that links sustainability transitions and an ecological worldview. This framework is applied to San Francisco, Oakland, and Vancouver using live/work policies to explore new ways of theorizing innovations in complex and dynamic social-ecological systems.

Introduction

The uncertainties and challenges of climate change, peak oil, declines in biodiversity, and volatile financial systems, put increasing pressure on cities and urban regions, and necessitate the development of new approaches to urban planning and design [1, 2, 3]. Cities and urban regions generate great demands for resources, such as fresh water, energy, building materials, and clean air, and generate large volumes of waste. At the same time, cities, as hubs of service, knowledge, capital, and innovation, can offer solutions to these challenges [4]. In an increasingly urban age [5], cities, as complex systems, require new sustainability approaches that can provide multi-functional responses. We propose viewing these innovative and evolving systems, processes and dynamics as 'sustainability transitions', and analysing their development and adoption within the conceptual foundation provided by theories of sustainability transitions and the multi-level perspective. We extend the application of these theories, informed by an 'ecological worldview', to apply to social-ecological systems, such as cities. Social-ecological systems locate humans within a broader, integrated ecological system of human and non-human nature, and acknowledge that living systems, including cities, are characterized by change, and therefore by uncertainty and unpredictability [6, 1].

The paper uses the example of a niche innovation within urban planning, 'live/work policy', to develop a new framework for analysing the transition process of policy innovations that links sustainability transitions and an ecological worldview. This framework is applied to live/work policies of San Francisco, Oakland, and Vancouver to explore new ways of theorizing innovations in complex and dynamic social-ecological systems. 'Live/work' refers to combined dwelling and workplace in a single unit or property. Policies for live/work are still far from widespread in urban planning systems globally; they can therefore be viewed as niche innovations within an urban planning regime. Viewing niches or points of transformation, through an ecological worldview provides a way to view things differently, and to create the conditions in which positive change happens. By applying sustainability transitions theory to urban planning, the aim of this research is to support and facilitate resilient urban social-ecological systems.

This paper provides a background to the theories and concepts discussed. Then, the methodology for the research is outlined, including the development of the new framework. This is followed by the results of the application of the new conceptual framework using live/work policies in San Francisco, Oakland, and Vancouver. Finally, the paper ends with a discussion on the theoretical and practical applications of this research.

Background

Cities are complex, dynamic, multi-scale, and adaptive social-ecological systems [7]. Social-ecological systems include both the biophysical aspects (ecological) and mental and cultural activities (social) in mutual interaction, and have many scales across nested phenomena [8, 9]; "there is a growing understanding that architectural and urban practice must be more explicit in recognizing the city as a complex and dynamic system, rather than as a disembodied entity that may be reduced to fragmented zones, function and professional institutions" [10 p.7]. By examining cities as social-ecological systems, the nuances and forces of change can be studied [11]. As a social-ecological system, a city's form and structure changes over time. A social-ecological system that is able to adapt and adjust to uncertainty and disruption is also able to capitalize on positive opportunities that the future may bring [12, 13]. Viewing systems this way sees human agency as an internal part of the system and its dynamics [14].

The challenges facing cities today are often described within a sustainability framework; with sustainability defined as a goal, an endpoint, something that is (or should be) attainable and measurable. Sustainability transitions have been conceptualised as long-term processes of change, and are the result of interacting economic, social, technological, institutional, and/or ecological developments. They are co-evolutionary in nature, and involve a board range of actors [15]. Applying a 'multi-level perspective', theories of sustainability transitions investigate the processes by which innovations in socio-technical systems, arising in niches, displace existing dominant or mainstream technologies. The multi-level perspective defines three levels (Figure 1): landscape (macro-level), regime (meso-level), and niche (the micro-level), forming a nested hierarchy [16]. The nested character of the levels demonstrates that regimes are embedded within landscapes, and niches within regimes [16]. Landscapes influence change both on niches and regimes; in return, niches (may) change the regimes and a new regime changes the landscape in the longer term [17].
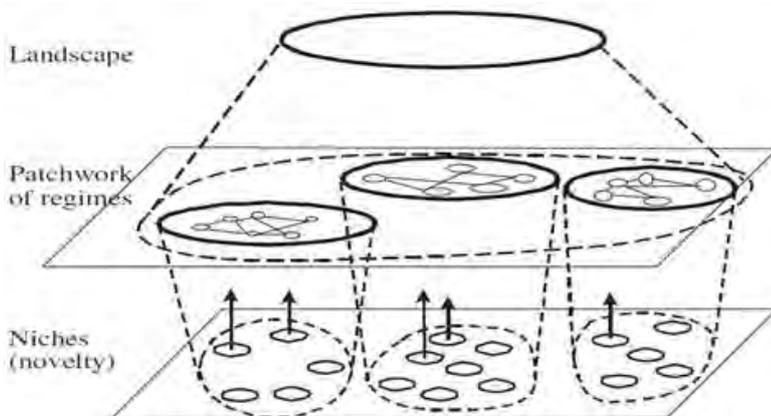
Figure 1 Multi-level Perspective as a Nest Hierarchy [16 p. 1261]

One of the strengths of the multi-level perspective is that transitions are viewed as non-linear processes [3]. Transitions can be explained by the interplay of stabilising (and in some cases resisting) mechanisms at the regime level, combined with destabilising pressure from the landscape and radical innovations at the niches [18]. Interactions between processes at different levels are shown in Figure 2: "(A) niche innovations build up internal momentum, (B) changes at the landscape level create pressure on the regime, (C) destabilisation of the regime creates windows of opportunity for niche innovations" [19 p. 545]. Three strategies for changing regimes have been identified [20]. The first two strategies call for transformation at the landscape, through either altering the structure of incentives and permitting market forces to function; or planning "for the creation and building of a new socio-technical system based on an alternative set of technologies" [20 p. 279]. The third strategy involves niches, and proposes to build ongoing dynamics of change to exert pressure from the niches to influence transformations in desirable directions. Our research is interested in the role of niches (as radical innovations are generated in niches [16]), and their ability to influence change. Niche situations provide 'protected' space for new ideas, artefacts and practices to develop, without experiencing the full range of pressures and selection by the regime [21]. Successful

niches are ones that show good growth potential and are robust [21]. They exercise influence, and provide the seeds for change [21, 16].
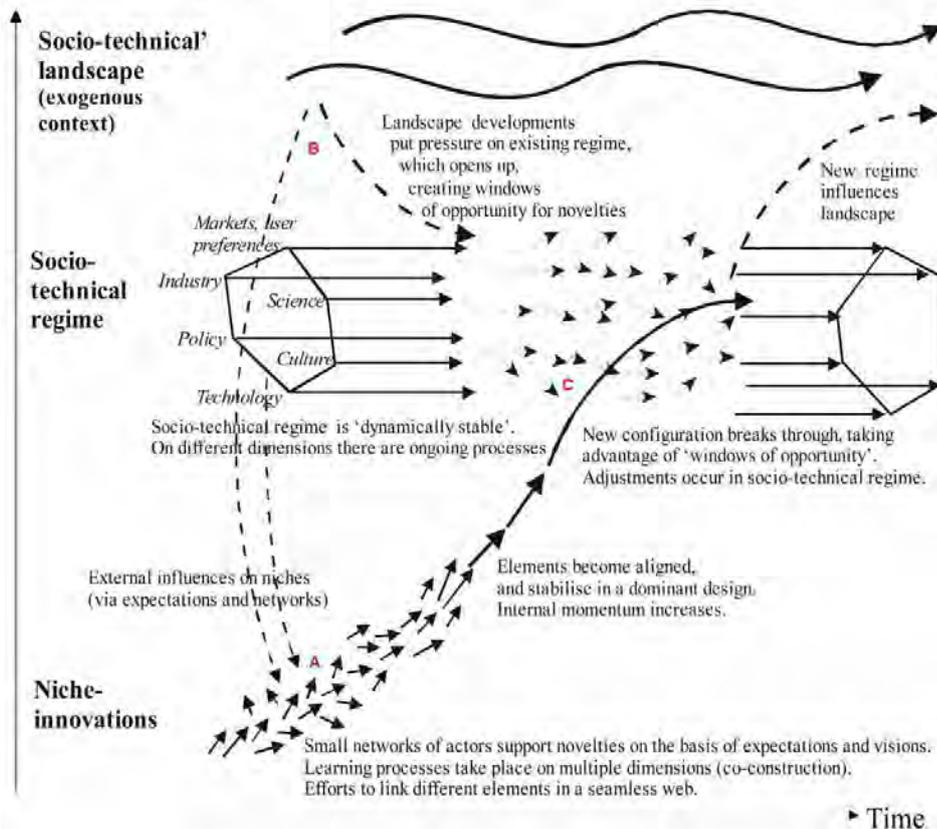
Figure 2 Multi-level perspective on transitions (adapted from [19 p. 546])

Transitions build resilience through small-scale disturbances or interventions that can reorganise and renew the system. The concept of resilience in urban social-ecological systems extends the theoretical framework of sustainability transitions, which was developed for a socio-technical system context, to incorporate notions of adaptability and change. Resilience comes from the Latin root *resilire*, meaning to spring back. Physical scientists were the first to use the term resilience to denote the characteristics of a spring, and describe the stability and resistance of materials to external shocks [1]. Since the 1960s, starting with ecologists and the rise of systems thinking, multiple concepts and meanings have developed. Engineering resilience measures the gravity of the disturbance, and the speed with which the system returns to its previous state. Ecological resilience is the ability of an ecosystem to withstand shocks and rebuild itself when necessary. Evolutionary resilience refers to system transformation, rather than returning to a previous equilibrium. Evolutionary resilience requires continuous adaptation [1]. "Resilience is the capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop. It is about the capacity to use shocks and disturbances like a financial crisis or climate change to spur renewal and innovative thinking" [4 p. 3].

The theories of sustainability transitions have been developed and applied to the context of socio-technical systems, within an overarching mechanistic worldview. There has been debate about the applicability of concepts of transformation and resilience to socio-technical systems and social-ecological systems respectively, and the suggestion that application of the concepts cannot be interchanged between the two systems (for example [22]). We argue that when narrower definitions of social-ecological systems, which externalise technology are used [22], there are indeed limits to the interchangeability of concepts of transformation and resilience. Theories of sustainability transitions can be applied to social-ecological systems when these are conceived within the broader perspective provided through an ecological worldview. These broader perspectives focus on systems as integrated, holistic, and interconnected; social-ecological

systems are defined more broadly as "integrated living systems consisting of agents (human or otherwise), their actions and behavioural patterns, and a physical substrate (chemicals, energy, water)" [23 p. 380].

A resilience thinking epistemology, which utilises a dynamic, systems perspective [9], guides this research. Systems thinking in resilience provides a different (non-linear), and useful, framework for problem-setting and problem-solving [24]. Resilience thinking is also marked by complex relationships [25], along with transitions and transformations [26]. With social-ecological systems at its centre, it has an element of pluralism, in that it helps to bridge different epistemological perspectives [26, 27]. Resilience encourages working within a theoretical framework of multidisciplinarity and multi-functionality [28]. As a framework, resilience is about thinking about cities and urban regions as interconnected systems, and helps us to further engage the concept of an ecological worldview.

Methodology

Research on sustainability transitions to date has focused on applying the theories to sustainability transitions in energy systems (e.g. [29, 30, 31]), water and sewer systems (e.g. [32, 33]), and zero emission housing [34], which fit easily within a 'socio-technical' conceptual framework. However, this research is interested in how theories of sustainability transitions can be applied to social-ecological innovations within an ecological worldview. Live/work was chosen as a niche innovation within urban planning because it fits within the concept of the social-ecological framework, meaning it interacts across different scales and phenomena with both the ecological and social aspects of cities. Live/work has the potential to contribute positively to a city at the neighbourhood scale [11] from multiple perspectives, including social, economic, and cultural, as well as environmental [35].

This research uses an embedded multiple-case study approach with a theoretical replication design; each individual case has the same central theoretical framework and the same units of analysis applied to it. This approach was chosen to explore contrasting results [36] between different bounded systems. The aim of the case studies is to examine policies for live/work in three cities, and identify the process of adoption or 'transition' of these policies from a niche innovation to a 'mainstream' or regime policy. The three cities are San Francisco, Oakland, and Vancouver. The cities were selected because of their history and practice surrounding live/work; they each have a history of both traditional and contemporary live/work, as well as supporting policies and legislation. San Francisco represents one of the first contemporary iterations of live/work in the 1980s following the movement in New York in the 1960/70s, and Oakland and Vancouver represent the next wave [37, 38]. These three cities also provide different political, cultural, and geographical contexts (the landscape level as used in the multi-level perspective) to view and compare the trajectory of the niche innovation.

The theoretical framework for this research is theories of sustainability transitions within an ecological worldview, viewing sustainability transitions within social-ecological, rather than socio-technical systems. The unit of analysis for the research is the process of acceleration of live/work as a niche innovation within the different bounded systems. To do this, the multi-level perspective from theories of sustainability transitions is applied to live/work. The multi-level perspective has been adapted to the city context: the 'landscape' level describes the city as a whole, the 'regime' describes the city's urban planning system and processes, and 'niches' focus on live/work policies or approaches (Table 1). The trajectory of live/work as a niche innovation is investigated within each city to analyse how sustainability transitions accelerate, and which policy-mixes, institutional changes, or governance contexts influence those processes. Data collection included documentation; interviews with planners, architects, developers and builders, and occupiers of live/work; direct unstructured observation; and physical artefacts in the form of live/work units and developments. Policy research also plays a vital role for this research; primary sources were supplemented with secondary sources from formal academic studies of the cases, government and administrative material, media sources, and project information.

Table 1 Applying the multi-level perspective to Live/work

Landscape	Existing urban form, including political contexts and governance models, the economy, and the cultural patterns and dynamics.	**City**
Regime	The structure, current practices, dominate rules, and routines of the city (policies, programs, and legislation).	**Urban planning**
Niche	Live/work policies and projects.	**Live/work**

The city, as the landscape, is relatively static and cannot be easily changed by actors in the short term. The landscape embodies the physical, technical, and material setting that supports the city as a system. The regime level represents a system's rules and regulations. Planning, as the regime, is concerned with the structure, current practices, dominant rules, and routines of the city. It exists in a shorter time frame than the landscape level, and is more malleable. Niches can influence transformation, and represent experimentation and innovation. Niches, as small-scale interventions and radical innovations, build up internal momentum, which may lead to bottom-up change. Moving upward in the nested hierarchy of the multi-level perspective, niches may change the regime, and a new regime changes the landscape over the long term. The absence of structure and coordination at the niche level, compared to the regime and landscape, allows for new, agile interactions to take place that may support innovation.

Case studies

The development, evolution and future prospects for live/work policies and practices, as niche innovations, were investigated within each case study city.

Case 1: San Francisco

San Francisco's Board of Supervisors passed the Live/Work Ordinance in 1988, which allowed the development of live/work projects in industrially zoned neighbourhoods [39]. Originally, the ordinance allowed under-used or vacant industrial land to be transformed into artist live/work units. During this period, permission from the city was relatively easy to receive, as long as the rules were followed. Over time, with more interest in live/work developments, and concern over the loss of industrial buildings, the city extended the ordinance to commercial properties in the South of Main and Mission districts [40]. However, the live/work ordinance in San Francisco became increasingly unpopular; protests took place in opposition to the large-scale live/work and office conversion in traditionally blue collar and artist neighbourhoods [41, 42]. Initially the live/work units were developed by converting existing buildings, but by the mid-1990s, new construction live/work began to outpace conversions [40]. The city did not anticipate or plan for developers flooding the market and the increased vulnerability of the artist community. Anti-displacement efforts such as the *Ellis Act*, and the election of new Board of Supervisor positions, led the mayor to impose a ban on most live/work construction in 2001 [41]. Since then, any live/work development application is reviewed on a case-by-case base with a stricter definition of live/work and a more rigorous permitting process [40].

Case 2 Oakland

Oakland's first formal live/work building was developed in 1985. However, it was not until 1996 that Oakland adopted the Oakland Live/Work Building Code. Initial live/work projects were possible due to flexible home occupation regulations in Oakland [43]. The 1996 legislation opened up and formalized live/work development opportunities, which led to a variety of types, including rental and ownership options, as well as non-artist units in developments. The City of Oakland believes that live/work projects have the ability to support economic development initiatives, as well as goals from the Climate Action Plan [44]. Today, Oakland's regulations provide a useful model for converting existing buildings into live/work, but as a planner with the city admitted, there is a hole in the city's zoning ordinance with regards to new construction live/work. The department wants to pin down where new construction live/work should be allowed, as well as redefine live/work and work/live. While this is high on the department's list of priorities, because it is a relatively small team, it has yet to be finalized [44].

Case 3 Vancouver

Formal live/work developments have existed in Vancouver since 1987 [45]. These were permitted in the form of 'homecraft' and 'dwelling units in conjunction with artist studios' [46]. The original live/work projects were intended for artists, but became very popular with technology-based fields of the new economy, especially new media [45]. As a result of this, in 1995 Council approved changes to policies on Artist Live/Work studios, and directed the planning department to investigate regulations for "general live/work" in mixed-use areas. In 1996 'Live/work and Work/live: Vancouver overview including strategic directions' was adopted by City Council. The purpose of the document was to provide direction for the Council for the implementation of live/work throughout different neighbourhood plans. (Vancouver does not

have one overarching strategic planning document, but a series of neighbourhood plans and major planning projects.) In 2006, Council adopted Live/work Use Guidelines that are still in operation today. These guidelines are to be used along-side building by-laws, district schedules of the zoning and development by-laws, or official development plans. There is not a clear-cut path to building a live/work development in Vancouver, but there are guidelines and strategic directions available to help guide the discussion and decision-making process. Unfortunately, at the end of the 2000s, City Council put a hold on most new live/work developments due to taxation regulations from the provincial government and wanting to better understand how to implement more affordable live/work.

Results

Figure 3 provides a comparison of the trajectory of live/work as a niche innovation within each city. Live/work in San Francisco accelerated and joined the regime, only to be discarded when it could not be fully controlled. The trajectory of live/work in Oakland was slower than in San Francisco, but live/work was finally incorporated into urban planning and continues to grow within the city. Live/work in Vancouver accelerated and joined the regime, but unlike the other two cities, it is neither declining nor increasing within urban planning.
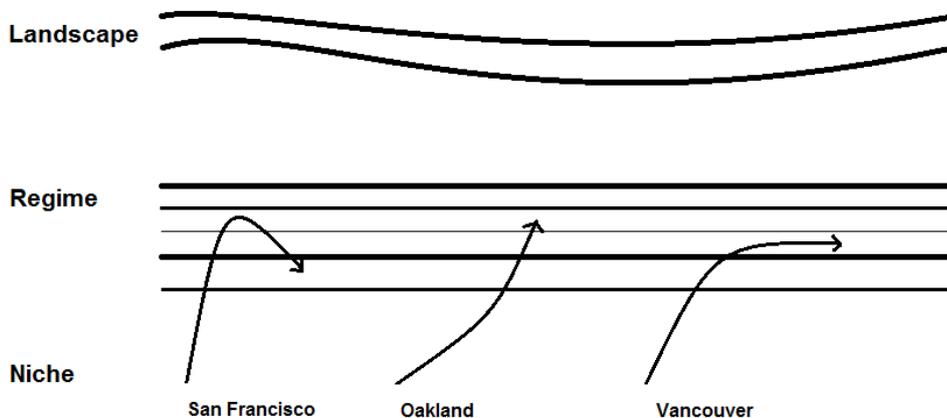
Figure 3 Trajectory of Live/work in each Case Study

Governance, policy mixes and institutional changes

The three trajectories of live/work in the different cities demonstrate how a particular niche accelerates, and which policies or governance contexts influence the process. San Francisco is a charter city and both a city and a county; as such it has more power than other cities. These designations allow the City to makes decisions and create its own laws. San Francisco was one of the first to implement live/work legislation in the US. However, there was not much in the way of reflection and evolution of the policies. When the legislation was no longer functioning in the way it was intended, the City essentially put a stop to any future live/work projects.

Oakland functions within the regular US framework of multiple levels of government, which includes county (Alameda County) and state (California). Oakland's planning department is fairly small, but is receptive and tries to leave some policies open for interpretation to foster innovation and to allow place-based approaches. For example, the flexible home-occupation regulations allowed initial live/work projects to take form. Legislation for live/work was only approved once there were enough examples from which to learn. Now, almost twenty years since Oakland's legislation was approved, the City is reviewing its policies given the current context of live/work within the city.

Vancouver is a charter city, but is part of a regional (Metro Vancouver) and provincial (British Columbia) multi-level Canadian government structure. Its charter city status means that it does not need to prepare an official community plan (strategic planning document), which all other cities in British Columbia are legislated to do. As a result, Vancouver approaches planning from a neighbourhood versus whole city scale. Live/work policies have been written to support and supplement this type of planning. Projects are reviewed within its context and setting, rather than simply following a particular building code or zoning by-

law. Like Oakland, Vancouver has also reviewed and updated its live/work policies to reflect the changes in the city, although the next iteration of live/work policy in Vancouver is yet to be seen.

Discussion

When sustainability transition theories are applied in different contexts, and to different types of systems, key concepts such as 'resilience', 'sustainability' and even 'social-ecological systems' take on different meanings [22]. This is a key challenge when working in multi-disciplinary and transdisciplinary areas, and reinforces the importance of explicitly defining these terms, which are commonly used, but whose meaning is often implicit or implied. Applying a theoretical framework in a different context forces researchers and practitioners to be explicit in their use of terms, and facilitates development and maintenance of shared language (though as a 'new' theoretical framework gains familiarity, it is likely to become part of the implicit and assumed language, and lose some of its novelty value in forcing explicit definitions).

This research has analysed the policy adoption or transition pathways of live/work policies in three cities. The application of the 'multi-level perspective' from sustainability transition theories facilitates comparisons of the transition pathways between the three cities. Live/work practices, as niche innovations, have arisen initially in artist communities and in under-used or neglected buildings or precincts. These locations act as protective spaces and creative innovation 'niches' in which practical approaches and subsequent policies were first tested and developed. The different transition pathways of live/work policies in the three cities, as illustrated in Figure 3, can be understood by examining the regime conditions and rules. The application of sustainability transition theories, particularly the multi-level perspective, to the adoption pathways for live/work policies in three cities provides a framework within which to analyse the different pathways. It contributes to the process of identifying and highlighting key barriers and success factors in the adoption or failure (possibly only temporary) of these policy innovations.

Applying sustainability transition theories to live/work policies encourages reflection and analysis of policy adoption processes, which could support strengthened and rigorous policy-making processes. It may also expand the time frames or horizons for policies to be implemented, rather than reacting to short term changes in the policy innovation's transition pathway. The sustainability transitions theoretical framework can also provide lessons on potential transition pathways and policy innovation processes for live/work in other cities by considering the make-up of the regime and the presence of key success factors and barriers in those cities.

This process of 'learning-by-doing' and experimentation is a key element in the public policy aspects of sustainability transitions research [29, 47]. It is also a process in which many local governments are already actively involved, as demonstrated by their membership of networks, alliances and groupings in which policy and action innovations are shared and developed. Networks of cities range from local or regional in scale, to those spanning international boundaries; examples include ICLEI Local Governments for Sustainability, C40 Cities Climate Leadership Group, the Rockefeller's 100 Resilient Cities and the World Mayors Council on Climate Change.

This research's application of sustainability transition theories to analyse policy innovation in social-ecological systems has demonstrated that the theories are relevant beyond the boundaries of socio-technical systems, and beyond solely singular or bi-functional technical innovation transition processes. Cities are complex social-ecological systems that include humans and their social and cultural institutions, as well as their infrastructures and built form, within the larger biophysical and ecological context when viewed within an ecological worldview. Sustainability transition theories are relevant for analysing processes within these systems as well as in socio-technical systems. However, when changing perspective from a mechanistic worldview and its associated focus on socio-technical systems to an ecological worldview, the transition pathways must be understood differently. Within an ecological worldview, social-ecological systems will not necessarily reach an 'equilibrium' or steady state (at which point in a socio-technical system, the innovation transition would be considered to have successfully established within the regime), and outcomes may be less predictable.

Further research on live/work policy innovations could focus in more depth on the power and political dimensions of the sustainability transition processes, including the multi-level governance systems in which decisions are made, and in which transitions proceed [22]. The three case study cities highlighted in this research are all located within complex governance structures with multiple scales of government authorities, and multiple layers of decision-making, regulations and policies. Further attention to the political processes overseeing the transitions of innovation policies is warranted. In addition, this research identified

the changing demographic in cities (and in some cases gentrification and exclusion of the original artist communities) as one of the factors leading to the withdrawal of City policy support for live/work practices. This reinforces calls for research that considers the competing power relations, values, knowledge and interests of the various actors involved in the multi-level perspective of sustainability transitions [22].

This research operates on two levels, both theoretical and practical. We have demonstrated the theoretical applicability of sustainability transitions to social-ecological systems (not just socio-technical systems), within a broader, overarching 'ecological worldview'. In demonstrating this applicability, we have analysed the innovation transition pathways in practice of live/work policies in three cities in North America. This analysis can contribute to the development and adoption of live/work policies in other cities, by highlighting the experiences of the three case study cities. Further research could extend this undertaking to examining other urban sustainability policy innovations, to build understandings of policy transition processes. Viewing cities from within an ecological worldview can contribute to new ways of thinking, and to building resilient urban systems.

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Theme: B. Gender and Development or / and 1. Sustainable Development Science

Track: 1c. Role of Academia

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DIVERSITY MANAGEMENT AS A PULL FACTOR FOR SUCCESSFULLY PRACTICED HIGH-QUALITY BLENDED-LEARNING PROGRAMMES IN FURTHER EDUCATION

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ABSTRACT

The Bologna process considers a greater internationalization and cultural diversity. In virtual higher education and e-learning programmes quality is particular important but difficult to manage and to reach. This paper shows the relevance of diversity as a pull factor in the field of e-learning offers and demonstrates why standards are practical and indispensable for further academic education programs in this field. In virtual higher education students are often faced with uncertainty. The development of quality standards is not only useful because of the uncertainties but also in facing diversity and cultural differences at a high standard. However, socio-cultural, gender and diversity aspects are not really integrated within a university's strategy nor represented in quality dimensions on a specific level. This paper presents the importance of the standards and linked them with the cultural characteristics of students. Moreover, it highlights diversity aspects in the developed quality framework.

1 INTRODUCTION

E-learning promises a particularly high flexibility to study as it allows a space-and time-independent learning for the participants by various approaches. Temporal, spatial and socio-economic barriers of learning are easier to overcome due to the increasing acceptance of new media and access to the internet [22]. In total, e-learning and the increasing internationalization and, thus, the consideration of cultural diversity provide new dynamics concerning the traditional understanding of quality and life-long learning offers in German universities. These challenges need sustainable solutions and an integration of sustainability criteria in quality as well. Ehlers [7] argues for a holistic understanding of quality in further education that goes far beyond accreditations and standards. The German Government has been taken an active role in strengthening Germany's qualification initiatives like "Advancement through Education: Open Universities" which seeks to increase the educational opportunities of heterogeneous students and to ensure a solid base of professionals for the future. The objectives of the reform efforts are to secure the offer of specialists, to improve the permeability between vocational and academic education, to transfer and integrate knowledge more rapidly into practice, and to safeguard the international competitiveness of the science system to strengthen a sustainable profile in terms of lifelong learning strategies and occupational studies. In addition, the Bologna process considers a greater internationalization and cultural diversity. However, socio-cultural, gender and diversity aspects are not really integrated within a university's strategy nor represented in quality dimensions on a specific level. The target groups of this initiative are the non-traditional students, such as for instance persons with family responsibilities, professionals with job obligations, such as persons, who are in working life and which are Bachelor-graduates, persons with professional skills, who do not have a higher education entrance qualification, job-returnees, drop-out students or unemployed graduates[1].
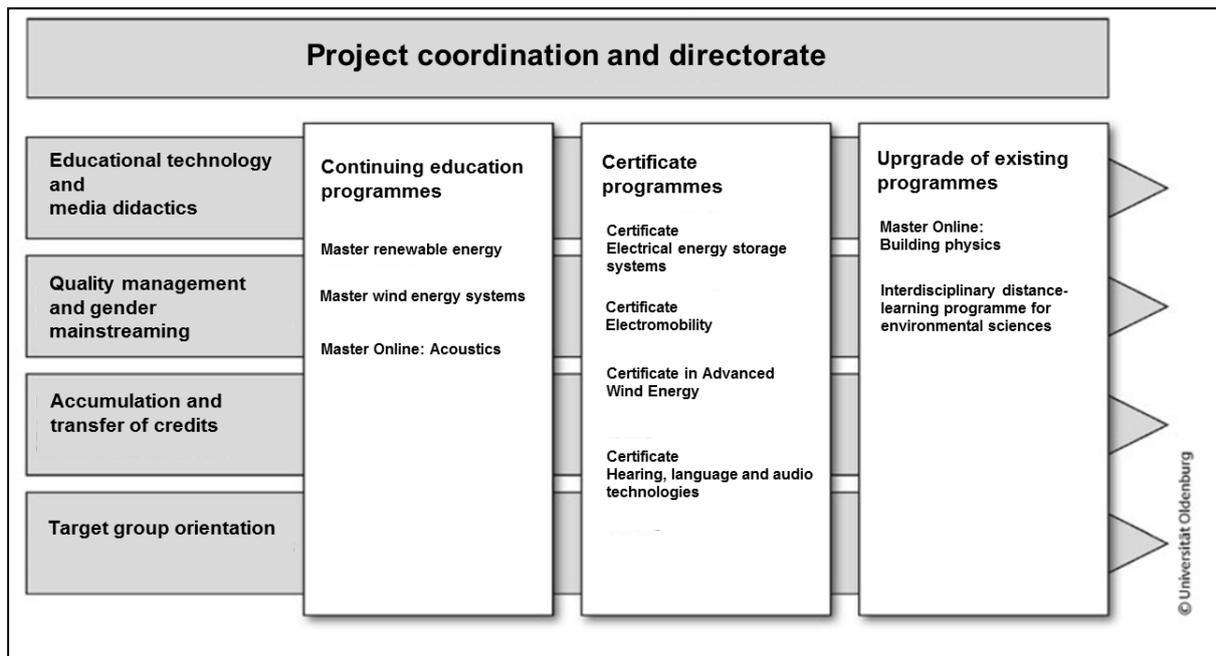
Figure 1: Project structure of mint.online [25]

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1 For further information about the qualification initiative see http://www.wettbewerb-offene-hochschulen-bmbf.de/foerderprojekte [4].

One of the BMBF[2]-funded projects is the collaborative research project mint.online [25] aiming the (re-)development of extra-occupational courses in the STEM-subjects[3]. The project points at part-time courses from master's degree and certificate level for the STEM disciplines. Due to the demographic development, the extension of working time, shortage of skilled experts, academization of the world of labour [5], [26], in particular the orientation of the universities towards lifelong learning and studying is an absolute imperative. Extra-occupational courses therefore can be described as part of the diversification of higher education in the last decade [26]. Based on the fact that these target groups have specific and individual conditions for studying, such as the professional activity, a flexible setting of learning is necessary (e.g. e-learning or mobile learning). They need flexibility concerning location and time [2]. The continuing education programs with technical support have a significant deviation from the normal campus programmes and form of teaching, which is reflected in the quality and understanding of the applicable quality assurance tools. In the mint.online project [25] currently nine courses and certificate programmes will be developed or even established. Four cross-cutting areas are installed in a composition, which provides new scientific insights and support services to the programmes. The project consists of four German universities, research organizations, Fraunhofer Institutes and the Fraunhofer Academy.

The objective of the participating universities (Oldenburg, Kassel, Stuttgart and Hagen) and research institutes of the Fraunhofer-Gesellschaft is to perform advanced master's degree and certificate programmes and upgrades of existing programmes by 2017 and to test these programmes in parts on a pilot basis. The participants of virtual courses become increasingly international, so that academic learning becomes more and more an intercultural learning experience [5]. In German-speaking countries the issue of quality in e-learning contexts has rarely been perceived as a research topic.

The scientific discussion about quality is characterised by a variety of terms and definitions [10]. There are various definitions of quality on the one hand and diverse views how quality in virtual learning contexts or e-learning has to be assured on the other hand [11]. In the international context special learning designs are accompanied by special quality requirements that have to be considered in the design and evaluation of online-based courses [13], [14]. Individuals from different cultural backgrounds have different expectations of higher education and have different learning styles [12]. It is culturally constructed what and why something is to be considered as meaningful learning. The particular challenge for programme development is the alignment of e-learning towards the cultural characteristics of the participants. Culture particularly influences learning processes as it can affect social behaviour, communication, cognitive processes, and the handling with technology [23]. This results in additional demands on the quality of virtual teaching, because different cultural contexts and gender requirements are closely interlinked with different expectations for academic teaching and learning styles [5].

3   OBJECTIVES/METHODOLOGY/SCOPE

The development of quality standards for high-quality virtual extra-occupational study programmes in Germany was based on three quality assurance approaches for e-learning concepts used in the U.S., Australia and the United Kingdom [1], [17], [18]. The concepts were analysed and compared. It becomes clear that the three different countries use similar frameworks and indicators for quality assurance. The identified quality standards provide an appropriate quality framework for virtual higher education. All in all, on the basis of a benchmark study the following congruent quality

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2 BMBF stands for the Federal Ministry of Education and Research. It is a Ministry of the Federal Republic of Germany. It aims to promote applied research and technological development.

3 The STEM-subjects (science, technology, engineering and mathematics) are the equivalent to the German MINT disciplines (mathematics, engineering, natural sciences and technology).

standards were identified and developed for e-learning in the sector of lifelong learning offers in the German higher education system: teaching-learning interaction, teaching material, educational technologies, testing and evaluation, teaching staff, consulting and infrastructure, responsibility and management structures as well as evaluation and information management (see table 1).

Course and programme level	Organizational level
Teaching-learning interaction	**Teaching staff**
Promoting activity: use of wikis, blogs, videos, quizzes, simulations, group discussions and interactive learning cards **Competencies development**: motivation for self-learning processes independent of time and place **Clear articulation**: Definition of learning objectives and competencies before each unit **Diversity**: varied, stimulating and active learning settings	**Requirements**: technical, communicative, methodological and intercultural competences; competence in the use of educational technologies; reflection of the internal and external culture **Support and training**: educational concepts like training, conversion of accessibility **Incentive systems**: monetary, organizational, immaterial **Diversity**: expertise on appropriate theoretical and practical interrelation
Teaching materials	**Consulting and infrastructure**
Timeliness and diversity: absorption by practice and reflection tasks **Feedback loops**: peer-review and evaluations before the use of materials **Verification**: compliance with scientific standards **Cultural background**: Diversity oriented preparation of documents	**Support by administration and technology**: introductory courses and general consulting services **Flexibility**: accessibility on weekends and in the evenings, 24 hour access to resources (digital library services, databases, frequently asked questions or handouts); communication spaces **Credit of inputs**: transparency and contact persons **Focus on participants**: consulting of organizing and realizing the study
Education technologies	**Responsibilities and management structures**
Interface options and flexibility: interaction with service facilities (examining offices, counselling or library) as well as external applications, web 2.0; possibility of representing the contents on a variety of mobile devices **Media diversity and multi-directionality**: text-based , visual and auditory media (in the form of digital texts , podcasts, videocasts, multimedia contents) as well as forums, chats and virtual seminar rooms **Data protection**: transparency and anonymity **Actuality**: innovative learning formats such as animated case studies, simulations, laboratory facilities and hands-on test questions, additional illustration material highlighting problems and solutions	**Anchoring of mission statement**: significance of offers **Embedding in organizational structure and process-oriented organization**: higher education and examination regulations, relevant written statutes; types of authorization regarding offers and organization; testing administration and process; responsibility of program contents; issuing certificates and charging **Organizational development** **Networking and cooperation**
Testing and evaluation	**Evaluation and information management**
Competency-based and diversity: different test formats on different media (e-mail for writing, online chats, phone interviews for discussions, video sequences for experiments, sample solutions for self- checks) **Formative and summative assessments**: feedback on the level of performance by solving task, homework, tests and exams **Regularity**: facilitating informal communication for exchange between the participants **Clear criteria and methods**: Accessible assessment criteria, compatibility between testing forms and set learning objectives	**Regularity**: evaluation of the offers (individual courses, complete courses, units like department or virtual teaching centers) **Satisfaction of students and teachers**: survey of relevant quality characteristics, disclosure and realisation of ongoing optimization potential **Establishment of feedback culture**: feedback to course managers and identification of improvement measures, design based on needs and demand **Variety of methods**

Quality standards highlighted by selected indicators

Table 1: Quality standards highlighted by selected indicators (source: authors' compilation)

Virtual learning arrangements are increasingly being offered across national boundaries. On the base of good practice research and comparative analysis of German speaking HEI's diversity strategies

these quality standards were supplemented regarding diversity and cultural aspects in order to foster long-term development and sustainability orientation. In a next step the cultural dimensions of learning and the diversity requirements are linked with the developed quality standards. It is analysed what cultural and diversity-related particularities have to be considered for an international audience in the developed quality standards. The analysis is based on intercultural teaching and learning research in the specific context of virtual teaching [16]. The researched standards concerned different levels allowed to break down four quality standards for the course and programme level and four for the organizational level and associated structures (see table 1).

On the basis of the developed quality assurance system in the project, services and offers such as guidance or counselling services will arise. These services shall complete the already existing quality assurance tools at the universities (e.g. accreditation). The usefulness of this expansion has particular been shown in the survey of human resource managers of companies. The answers of these respondents confirmed, that there is a need of comprehensive quality requirements resulting for example in the teaching staff, the flexibility of the study organization or the requirements for the teaching staff.

Parrish and Linder-Van Berschot [16] developed a framework for cultural differences. They distinguish social relationships, epistemological beliefs, and temporal perceptions having an influence on learning settings and instructional design, see main issues in the following table.

Social relationships	Epistemological beliefs	Temporal perceptions
Cultural dimension **Equality and authority** How is inequality handled? How is status demonstrated and respect given? What interactions are appropriate for those of unequal status?	**Cultural dimension** **Stability seeking and uncertainty acceptance** How is uncertainty dealt with? Is it avoided or accepted? Is structure assumed more important than flexibility? What is the status of knowledge – established or in a process of development?	**Cultural dimension** **Clock time and event time** Do people conform to an external measure of time, or do they allow the event at hand to unfold on its own time? Which are more important, deadlines or relationships?
Individualism and collectivism Which prevails, the interests of the individual or the interest of the group? To what degree are interpersonal relationships valued?	**Logic argumentation and being reasonable** How are arguments developed? Which is more important, logical consistency or practical outcomes? How is disagreement managed?	**Linear time and cyclical time** Do people see time as a path and see goals as necessary destinations, or do they see time as a pattern of interlocking cycles into which they step in and out over the course of a life?
Nurture and challenge Which is the more important set of goals, cooperation and security or recognition and advancement? Which achieves better learning outcomes, supportive acts or challenging acts?	**Causality and complex systems (Analysis and holism)** How is causality assigned typically? Is it assigned to a single, most likely source, or is it assigned to the broader context?	

Table 2: Framework of cultural differences [16: 7-9]

From culture research it can be deduced that 'learning how to learn' is highly relevant for participants from more individualistic cultures, while participants from more collectivistic cultures prefer more authoritarian perceived lecturers [16]. Another relevant dimension is uncertainty avoidance. Those cultures tend to more tangible knowledge and applicable rules, while participants from more tolerating cultures are tend to tangible skills (e.g. problem-solving and social skills). Cultures avoiding uncertainty even expect 'right answers' by the lecturers and therefore may require even clearer goals than more tolerating cultures. In order to prevent the risk of isolation and an increased drop-out rate in virtual learning formats, it makes sense to give much room for feedback to the participants (possibly anonymously) ensuring the contents are understood. Fun and enjoyment as a

central teaching-learning interaction is part of all cultures and can be seen as a cross-cultural factor [15].

4 RESULTS

The findings of the benchmark study show that for international heterogeneous target groups, the quality standards must be culturally adopted, because of different expectations and obligations, objectives, and modes of communication and learning styles. In terms of social relations between the learners and the lecturers the distance has to be taken into account. In order to get concrete measurements for diversity pull factors several objectives were developed:

1. the objective on the basis level
2. the trend direction
3. the formulated rough direction
4. the exact formulated direction
5. the measures of the specific area.

In the following figure 2 the process is shown for the areas of diversity-consultation for students, which is an area of the quality standard "consulting and infrastructure" of the organizational level. While designing interactive teaching-learning situations it is equally important (and depending on the participants) to establish individualistic or collectivist learning arrangements.
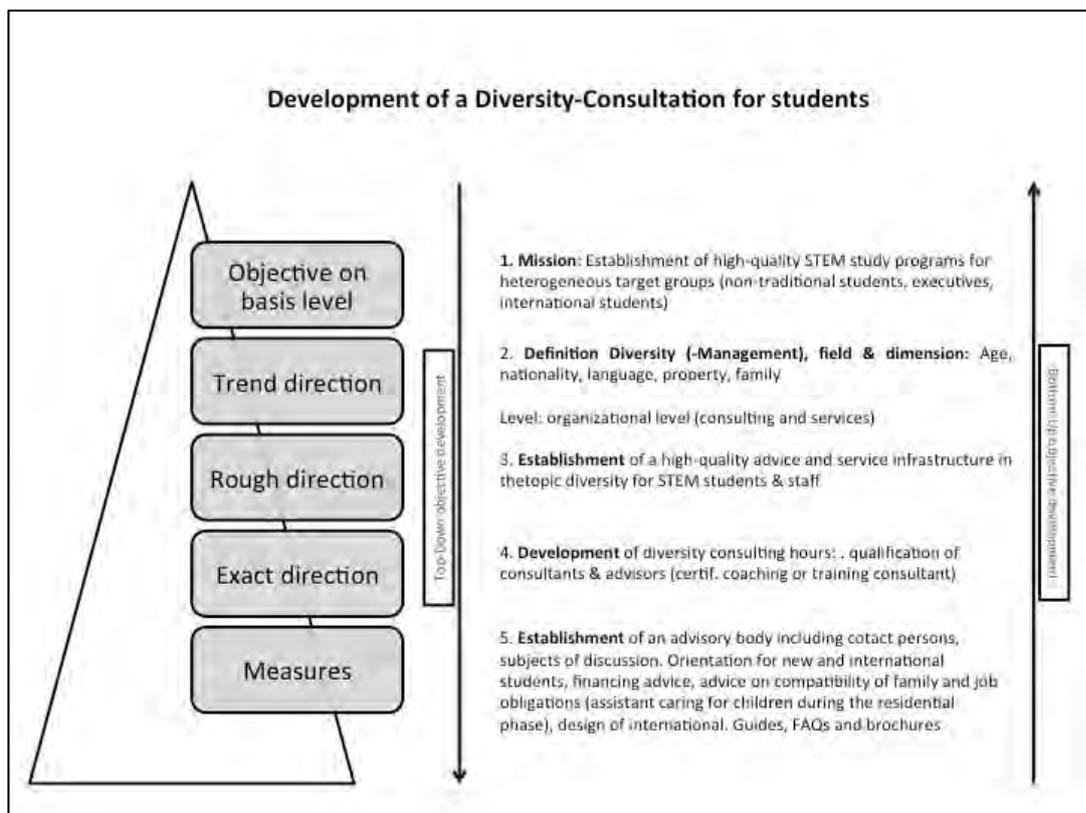
Figure 2: Example of the development process of diversity and quality aspects (source: authors' compilation)

Depending on the temporal perception and the avoidance of uncertainty by the participants the e-learning process should be structured culturally appropriate. Selected aspects are shown in the following table 3.

Quality standards	Diversity management measures	Keywords	References
Teaching-learning-interaction	• Sensitization for the heterogeneity of the student group (e.g. researchers, mentors & lecturer) • Methods: diversity-trainings, qualification measures, diversity-audits & specific coaching • Insemination of intercultural competencies	sensitization, qualification, intercultural competence, audits	[19]
	• Establishment of language courses for an effectively recognition of the needs and expectations of the lecturer's international students	language course	
Educational technologies	• Learning management system supports the individual learning level • Conclusion: Better learning opportunities for students with disabilities	learning level	[9]
	• Part-time-studying supports the compatibility: studying - job - family	part-time	
Teaching material	• Development of guidelines or brochures e.g. for students with disabilities	guideline, brochure	[9]
	• Usage of a gender and diversity fair language • Usage of gender and diversity fair photos	gender- & diversity language	[24]
	• Usage of an international terminology	int. terminology	
Administration & responsibility structures	• Creation of interdisciplinarity as a relevant component of diversity in research	interdisciplinarity	*model of different universities*
	• Internationality as an aspect of diversity in research (e.g. gain international scientists & researchers)	internationality	
	• Implementation of diversity in the leading culture of the university • That should be an assignment of the human resource development	diversity leading culture	
Consulting & infrastructure	• Building up a network for an international exchange (e.g. activities for students with immigrant background)	networking	[20]
	• Communicate the opportunity of a scholarship for disadvantaged groups	scholarship	[3]
	• Support advices for financing expensive extra occupational study/courses	financing	[24]
	• Diversity advices & development of service concepts for disadvantaged student groups	diversity advice and service concepts	[21]
Evaluation and Information management	• Development and implementation of surveys concerning the diversity situation of students at the university	survey	[6]
	• Internal & external communication of diversity at the university • To pursue public relations (university profile, publications, use university's homepage)	communication, public relations	[25]
	• Diversity monitoring • Continuous analysis, report & publishment of statistics	diversity monitoring, analyse situation, reporting	[8]
	• Build up cooperation and networks concerning the diversity mentality (e.g. with diversity project groups, -offices or gender offices at the university. Include international student offices, foundations, etc.)	cooperation, networks	[9]

Table 3: Diversity management measures combined with the mint.online quality dimensions (source: authors' compilation)

Implementing and establishing a quality assurance system, a manual has been developed for the staff working in academic further education. It shall enable a better explanation, realization and application

of the standards. This document intends to complement already existing quality assurance instruments at different universities in order to achieve a superior quality range of degree programmes and certificate courses. It makes it clearer and easier to manage the pull factors in the section of diversity management. Therefore, a uniform description of the eight quality standards, associated challenges and options to influence these challenges is provided. Deduced from this, success criteria are given to secure an improved quality. Simplifying the handling of the quality standards in the staff's everyday work in further education, the developed success criteria are complemented by checklists. They can be used for self-assessments or for any external audits.

In the research project in quality management the main issue is to come to an agreement or to pass minimum standards with all involved joint partners in order to have an accepted, successfully tested and evaluated quality document available in 2015 and successfully operating in 2017.

5   DISCUSSION

The quality requirements of the academic further education could not be completely fulfilled by an existing system, which is geared toward the needs of traditional students in Germany. The consideration of diversity aspects in the area of quality in further academic education is a necessary factor to success and to get participants paying – no matter, whether they pay the course of study on their own or their employers do. There are cultural and diversity aspects to be considered at all quality standards. The identified and developed additional quality standards with the special culture and diversity aspects can help to make programmes better and more successful. Further education is a risky and ambitious challenge for most of the universities in Germany, but a lot of them will have no choice, as to integrate a comprehensive quality system, if they want to survive in a more and more dynamic environment in the academic system. Some important areas of action have been identified and described even in the fields of developing the teaching personnel, the practical orientation of the contents or the respective marketing strategy of the study programmes. In times, in which diverse university strategies becomes more and more important, and all relevant university stakeholders must take a special look at their heterogeneous target groups, the various university bodies have to learn and to accept a certain variety with all their advantages and disadvantages. This means, for example, the warden trained and sensitized in the field of administrative staff for diversity. Or in the field of higher education consulting employees need to give advices with various educational qualifications to be able to different students from different countries.

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PEDAGOGICAL APPROACHES TO DEVELOPING UNDERSTANDING OF SUSTAINABILITY IN STEM GRADUATES

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ABSTRACT

Developing the ability of graduates to think critically and creatively about sustainability issues is a goal now embedded in the 'graduate attributes' of many Universities. However, there is no consensus on the best pedagogical approach to develop this ability/capability. There is little evidence of success in terms of enhanced student learning in STEM disciplines, especially in engineering.

This paper reviews current approaches to developing the graduate attribute of sustainability in STEM graduates. It describes the evaluation methods that have been used and evidence collected on the success of these approaches. It presents results from research undertaken at RMIT University to assess the effectiveness of new approaches to teaching sustainability of engineering projects.

Approaches to teaching sustainability range from traditional lectures to community-oriented and constructive-learning pedagogies. Project based learning is a common approach in engineering education, but outcomes for students are highly variable. Understanding of sustainability was identified as a gap in work readiness of recent graduates. Furthermore, the evaluation of students learning in sustainability needs further development. However, there are few new approaches with evidence of success.

Results are presented on the development of breadth and complexity of student understanding of sustainability, comparing a second and final year course, over a number of years. A substantial increase in breadth and complexity of student knowledge was found after the introduction of a sophisticated and complex framework tool. Focus shifted from "technical" and "environmental" to "social".

A cultural change is needed to move STEM academics away from using traditional approaches to teaching and learning that are ill suited to developing the attribute of sustainability in graduates. The role of STEM graduates in promoting sustainability thinking in their future careers is critical to reaching the tipping point.

Key words:

Pedagogy for sustainability, graduate attribute of sustainability, project based learning.

1 INTRODUCTION

Approaches to teaching sustainability in STEM programs range from traditional lectures to community-oriented and constructive-learning pedagogies [1, 2]. Problem or project based learning is a common approach in engineering education, but outcomes for students are highly variable, dependent on scope, context and learning approach [3,4]. A novel case study approach based on Bloom's taxonomy has been developed recently [5]. Pappas and co-workers describe how their six-course design curriculum uses a developmental approach such that students move successively through six levels of Bloom's Taxonomy.

However, despite numerous innovations in teaching sustainability, there is little evidence that graduates have achieved a skill level in understanding of sustainability necessary for the current world of work, where focus on sustainability is increasing. One study of work readiness of graduates who had undertaken a project based learning curriculum, found a gap in their understanding of sustainability and hence a limited ability to apply it in their employment [6].

Conventional methods of assessing student learning are unsuited to evaluating student learning in sustainability. Examinations are the most common approach, but these rarely test understanding, and are not suited to evaluation of group work. Project based learning (PjBL) is traditionally assessed using reports and presentations, but evaluation of student learning is dependent on the marker's expertise. Other approaches to assessing student learning in sustainability include surveys, contextual references, the Structure of Observed Learning Outcomes (SOLO) taxonomy and 'concept maps' (Cmaps).

Surveys have been widely used in assessing students' understanding of sustainability [7, 8, 9]. Surveys can identify both depth and breadth of learning and directions for curriculum review, where the response rate is sufficiently high. Surveys can be administered with ease using on-line tools, but response rate may be low.

Contextual references is used to evaluate sustainability in the case study approach of [5]. Staff members selected for their expertise in each particular case study context marked students' written responses. Each student wrote four responses per case study, for each sustainability 'context', namely, technical, economic, environmental and social. The expert marker counted the number of issues identified by the student, giving a maximum score of 3 for each context. This evaluation method gives some insight into breadth of student learning but not the depth. It requires the marker to have expertise in the case study. In addition, it does not provide direction for curriculum review.

The SOLO taxonomy is a qualitative tool used to analyse the sophistication of students' writing on sustainability [8,10]. Responses may be characterised on a continuum from "pre-structural" (no understanding) through to "extended abstract" where the students demonstrate critical reflection. This gives useful insight into student learning but requires the marker to have expertise in qualitative assessment. In addition, it does not provide direction for curriculum review.

Cmaps are a quantitative tool that can be used to capture an individual's or group's thinking around any topic [11]. The map makers first identify concepts relevant to a central question and any interlinks between the concepts. Then they construct a Cmap showing the concepts and descriptive links. Cmaps were used in a large European study to evaluate engineering students' learning in sustainability. Students in five Institutions created Cmaps at the start and conclusion of their relevant sustainability course. The Cmaps were analysing by measuring various metrics, including the number of concepts, the number of categories covered, and the interconnectedness of the concepts. Pre- and post-tests showed enhancement of student knowledge depended on pedagogical approach [1]. Cmaps are easy to use and capture the breadth and complexity of sustainability learning. Any gaps indicate where the curriculum should be improved.

In this study, Cmaps were used to evaluate student understanding of sustainability.

Chemical engineers at RMIT undertake a four year 'single degree' program or a five year 'double degree' program with a second major (business or science). They undertake a sequence of six PjBL core subjects during their programs, to develop design skills as well as research, teamwork and leadership skills [12] . Each subject has a different Project, and a team of staff teaching it. All the Chemical Engineering staff teach in one or more of the PjBL subjects. Students work in groups that are supervised (mentored) by one of the teaching team.

Sustainability is taught and assessed in all the PjBl subjects [13]. Students learn to evaluate alternative process plant designs using sustainability criteria. Outcomes from two subjects are compared in this paper, the 3rd and the 5th PjBL subject. Students work in groups of four to six students. In the two subjects in this paper, the staff co-ordinator develops a project brief concerning design of a chemical engineering process plant. The brief includes the product specification and market conditions. A second staff member guides the students in use of a management decision tool (GEMI) that aids selection of best process considering sustainability issues. Other staff members supervise each group.

GEMI The Metrics Navigator™ was chosen to evaluate the sustainability impacts of plant design. It is publicly available and suitable for use with small, simple or large and complex commercial projects. GEMI is a non-profit organization of leading chemical process and manufacturing companies dedicated to collaborative efforts to foster environmental, health and safety excellence and corporate citizenship. The tool helps organizations develop and implement metrics that provide insight into complex issues, support business strategy and contribute to business success. It provides an approach that assesses the materiality of issues. Input from internal and external stakeholders is used to analyse business success factors, business impacts, stakeholder concerns and the organization's perceived degree of control of each issue. Worksheets are used to help analyse business issues in terms of TBL life cycles [14].

In each subject students choose sustainability issues relevant to their plant design from the United Nation Commission for Sustainable Development's Agenda 21 checklist [15]. In the 3rd PjBL subject each group selects one issue and presents their research on the issue to the rest of the class. In the 5th PjBL subject each group also selects one issue but their research is used to develop relevant questions for a Community Forum attended by representatives from the Chemical Industry and from the plant neighbourhood community. Each group then critically evaluates responses of the Forum attendees on each issue to make their best process selection. Each group prepares a Report including literature review and justification of their choice of best process. A Cmap is included to illustrate their thinking on sustainability. In the final year students also sit a mid-semester test where they prepare a Cmap. A technical article on sustainability in the engineering sector is provided in the test: the Cmap should be based on this article. A summary of classes and assessment for each subject is shown in Table 1.

Table 1 Summary of sustainability classes and assessment

Subject	Classes	Assessment
3rd PjBL subject PROC2078 Process Principles	5 @ 1 hr lecture/workshops • How to write a critical literature review • UNCSD's Agenda 21 • GEMI sustainability framework • Risk matrices for business decisions • Group presentations on relevant Agenda 21 sustainability issues • How GEMI worksheets 1a, 1b, 2a, 2b should be filled out.	• Group Interim report with Cmap • Group Final report • Group Final presentation

| 5th PjBL subject | 3 @ 2 hr lecture/workshops | • Group Sustainability report with Cmap |
| PROC2091 Process Systems Integration | • Review of GEMI sustainability framework and critical literature review
• Data collection from Community Forum on sustainability consultation
• How GEMI worksheets 3a, 3b should be filled out | • Individual test with Cmap |

2 OBJECTIVES/METHODOLOGY

The objectives of the study reported in this paper were twofold:

- to compare sustainability learning outcomes in successive PjBL projects
- to compare sustainability learning outcomes for different student cohorts

Cmaps are used to measure sustainability learning outcomes of students working in groups. A sustainability Cmap is evaluated for three metrics: the number of concepts, the number or categories covered by the concepts, and the number of interlinks between concepts in different categories. The categories are based on the following taxonomy [16]: Environmental (Environment, Resource scarcity), Social (Social impact, Values, Future, Unbalances), and Economic (Technology, Economy) and Institutional (Education, Actors and Stakeholders). The complexity indicator (CO) and category relevance (CR) are calculated, normalised for group size. The method and calculations are described in detail in [17].

NC is the number of concepts per student. L_{CA} is the number of connections between concepts in different categories per student per category. CO is the complexity indicator, reflecting both the breadth of ideas and their connectivity, the product of NC and L_{CA}. The average standard deviation for CO was calculated. The results for NC, L_{CA}, CO and CR are compared for students in different year levels, as well as students working as individuals or in groups.

3 RESULTS

The results for the two PjBL subjects are shown in Table 2. The results for complexity indicator (CO) are shown graphically in Figure 1.

Table 2 Comparison of Complexity Indicator (CO) for successive subjects

Level	Year	Class size	NC	L_{CA}	CO	CO s.d.
3rd PjBL subject	2013	84	5.1	0.3	1.9	1.7
	2014	60	6.3	0.3	1.8	1.3
5th PjBL subject	2013	84	8.3	0.5	3.8	1.3
	2014	63	9.1	0.6	6.0	5.4
Experts[18]	2008	19	19.8	1.25	24.8	-

Table 1 shows that the CO increased from the 3rd to 5th subject. The Cmaps contained more concepts (NC) as well as more links between concepts in different categories (L_{CA}). This shows student knowledge expanded in both breadth (number of concepts) and depth/complexity (number of links). The CO for the 5th subject is an average of 4.9, which is significantly higher than the CO for the 3rd subject (average 1.8). Overall this suggests that students are retaining and building on sustainability

knowledge from earlier projects. Their knowledge and understanding is increasing in successive PjBL subjects.

The increases in CO compares with those reported by Segalas *et al.* [1] in the pan-European study of sustainability subjects taught in five Institutions. In that study CO values of Cmaps produced by students at the conclusion of each subject ranged from 1.7 (at Eindhoven University of Technology, NE) to a spectacular 26.8 (for an International short course at the Technical University of Catalonia, ESP). The average CO value was 10.7. No information is given on the standard deviation for the CO values. The CO values reported in this paper for the 5th PjBL subject are in the lower half of results the pan-European study: four of 10 results were less than 4.9, and six of 10 results were greater. This may be attributed to several factors. The portion of sustainability in the RMIT PjBL subjects are much less than the whole subject, compared to sustainability being the entire focus of the pan-European study subjects. The RMIT subjects are core subjects with large cohorts: most of the pan-European subjects were boutique electives. The RMIT students are undergraduate: many of the European students were Masters or PhD level, with a much higher starting level of sustainability knowledge. Unfortunately, Segalas does not include details of the class contact time, curriculum and assessment, although more detail can be found in [18].

Table 1 also shows the CO value for a benchmark group of experts. In the Segalas *et al.* study, as a benchmark, 'several' experts prepared a Cmap on sustainability, for which the average CO value was 24.8 [1].

Table 1 also shows the intra-cohort variation is high. The standard deviation of CO values from different groups in the same student cohort was 70% on average. This indicates the Cmaps varied widely in their complexity from group to group. This reflects different levels of motivation, ability and dynamics in different groups. This suggests care should be taken when drawing conclusions on teaching innovations introduced in a particular year: a longitudinal study should be undertaken to accurately assess the impact of a teaching innovation.

Table 1 also shows inter-cohort variation. The results for 2013 and 2014 for the 3rd PjBL subjects are very similar, suggesting little cohort variation. The curriculum, pedagogical approach and teaching team were similar for the two years. Interestingly for the 5th PjBL subject CO increased significantly, from 3.8 to 6.0, from 2013 to 2014. The standard deviation also increased significantly, from 1.3 to 5.4. This suggests wide cohort variation. The curriculum, pedagogical approach and teaching team were the same for the two years, except that timing of the three GEMI classes was changed from the first part of the semester to the last part. A similar increase in CO was observed for the 2014 cohort when they were undertaking the 3rd PjBL subject in 2012. This suggests this particular student cohort were a more capable cohort than average. This further suggests the utility of longitudinal studies to evaluate teaching innovations.

A longitudinal study is on-going to collect further data to evaluate this approach to teaching sustainability.

The results for complexity indicator are shown graphically in Figure 1. The increase in CO from the 3rd to the 5th subject is clearly seen. The difference in CO between the 5th subject and the experts is large. This indicates that while we are making progress, there is potential to achieve better learning outcomes for our final year students.

Figure 1 Complexity indicator (CO) for successive PjBL subjects
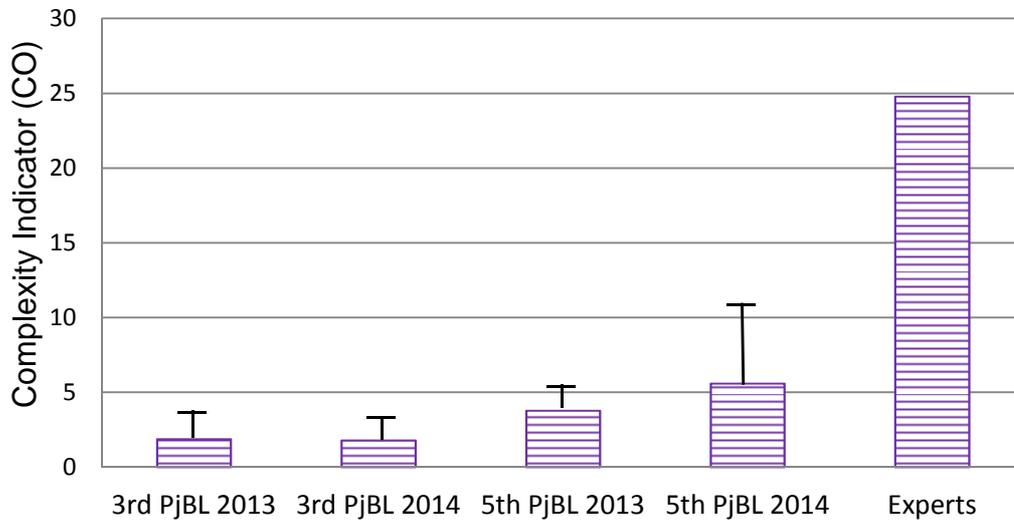
Results for Category Relevance (CR) are shown in Figure 2 and Figure 3 for the two PjBL 1subjects. Ideally there is an even spread of concepts across all categories, that is, each category should have a CR of 10%. However for engineering students there is generally a stronger focus on Technology than other aspects. A technology focus is reinforced by myriad influences in engineering. It reflects the dominance of technology issues in core subjects. These are taught by engineering staff members, who also have a dominant focus on technology. These same staff members supervise the groups, reinforcing the focus on technology at weekly group meetings. Literature on process plant design is also dominated by a technology focus, with scant mention of other aspects, except perhaps environmental. There is very little information on social aspects of plant design.

Figure 2 and Figure 3 show the main focus for students is Technology, as expected. However the focus weakens from the 3rd to the 5th PjBL course, from 37% to 27%, which suggests that the students learning about sustainability is broader and deeper in successive PjBL subjects.

Technology is not the only category with a CR greater than 10%. In the 3rd PjBL subject other prominent categories include Environmental and Economy, reflecting the wider availability of data on these two aspects in the literature. Social scored around 10%, which is good considering the dearth of information available on social aspects of plant design. This suggests that students' learning outcomes in sustainability are broadening in response to the GEMI approach, as social aspects are not addressed elsewhere in the curriculum. There is some variation in categories between 2013 and 2014, again supporting the utility of longitudinal studies.

In the 5th PjBL subject the prominent categories were the same as in the 3rd PjBL subject, but all the Social categories increased (that is Social, Values, Future, Unbalances) as well as Education. Note 'Unbalances' indicates inequity between rich and poor. This further suggests that students' learning outcomes in sustainability are broadening in successive PjBL subjects.

Figure 2 Category relevance (CR), 3rd PjBL subject
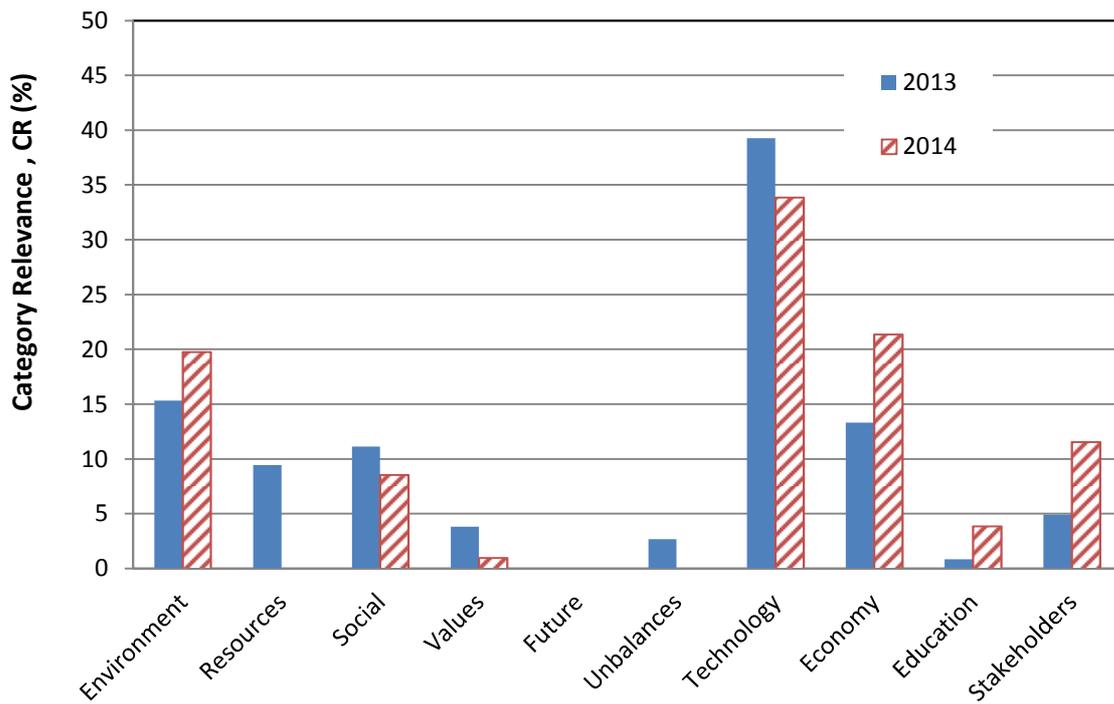
Figure 3 Category relevance (CR), 5th PjBL subject
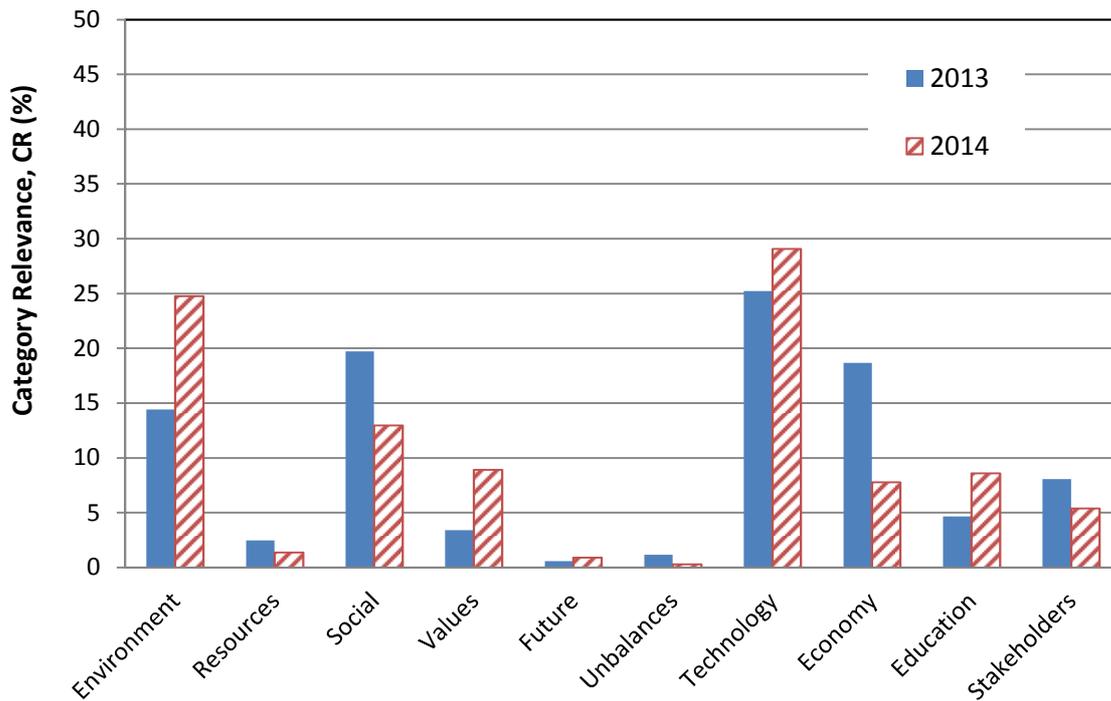
Figure 2 and Figure 3 show that several categories have a CR of less than 10%. In terms of direction for improvement in the curriculum, this suggests a stronger focus is needed on those categories, especially Future and Unbalances. Changes to the curriculum to emphasise these areas is planned.

4   DISCUSSION

The sequence of PjBL design subjects in the RMIT Chemical Engineering programs offer scope for a systematic and detailed analysis of the sustainability of alternative process designs. Decision making against sustainability criteria is facilitated by use of a publicly available decision management tool – the GEMI The Metrics Navigator™ - developed by a consortium of large companies [14]. The tool helps organizations develop and implement metrics that provide insight into complex issues, support business strategy and contribute to business success. It can be used by junior and senior students to make better design decisions.

Students demonstrate their grasp of the richness and complexity of sustainability issues relevant to their design through concept maps (Cmaps) [11]. Cmaps are analysed for the number of concepts, their interconnectivity, and the distribution of concepts in various categories [17]. Student knowledge of sustainability increased significantly in successive PjBL subjects. Their knowledge expanded in both breadth (number of concepts) and depth/complexity (number of links). The focus on technology weakens, and focus on other categories, especially social, increases with successive projects, which suggests that the students learning about sustainability is broader and deeper. Students are retaining and building on sustainability knowledge from earlier projects in subsequent projects.

Inter and intra-cohort variation is marked, and indicates the need for a longitudinal study to accurately assess the impact of a teaching innovation.

Students have a dominant focus on technology. This is reinforced by many influences including:

- most core subjects have a technology focus
- most engineering staff members have a technology focus
- student group supervisors have a technology focus
- literature on plant design is dominated by a technology focus
- a dearth of information on social aspects of plant design.

The RMIT students failed to achieve a breadth and depth of understanding of sustainability similar to European experts or European engineering graduates [17]. This was partly attributed to the European subjects being boutique electives, at Masters or PhD level, where students started at a much higher level of sustainability knowledge [18]. Hence there is potential for further improvement in teaching approach, curriculum and assessment. Unfortunately there is very little information available on the curriculum and assessment of other sustainability subjects.

 A longitudinal study is continuing to further evaluate this approach to teaching sustainability.

5   ACKNOWLEDGEMENTS

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Fostering sustainability competencies by using innovative instructional design?!

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ABSTRACT

The initiated paradigm shift in teaching and learning by the Bologna process requires a rethinking of the university's teaching and a redesigning towards students' learning needs. It entails to concept a course's design away from input-oriented teaching based on material curriculum towards respective learning outcomes, ideally competencies. For a sustainable development interdisciplinary competencies are crucial, however, not really practiced widely in learning contexts. This implies new interaction. The paper aims on theoretical foundation and empirical validation of the usefulness of new media-didactic tools, like lecture recording, mobile apps, learning software, and video quiz for fostering sustainability-related competencies in in-service courses. The question is to clarify whether new media didactical tools can enhance the learning outcome. In addition the ongoing research tries to find out how the use of new media tools in learning contexts is strengthening the sustainability-oriented ability to judge and act adequately, or whether the development of specific interdisciplinary interfaces is necessary. This question will be answered conceptually and with the help of practical examples and case studies. According to the didactic scientific literature, teaching materials must be proper for self-directed learning processes and have a didactic concept by which the targeted learning objectives can be achieved. Teaching-learning interactions are characterised as the results of learning processes that are actively initiated by lecturers and are supported in the virtual university teaching by means of modern educational technologies. Accordingly, content has to be represented on different devices. This is also crucial for interdisciplinary knowledge. Therefore, different frameworks combining current and forward-looking teaching and learning focusing on students' outcomes (skills, knowledge, expertise and literacies) with the help of innovative support systems, like OECD or P21, are analysed regarding sustainability-relevant competencies. The analysis of sustainability-related competencies is based on a two time inquiry realizing changes and part of an ongoing inquiry.

1   INTRODUCTION

The initiated paradigm shift in teaching and learning by the Bologna process requires a rethinking of the university's teaching and a redesigning towards students' learning needs [1]. It entails to concept a course's design away from input-oriented teaching based on material curriculum towards respective learning outcomes, ideally competencies [2]. For a sustainable development interdisciplinary competencies are crucial, however, not really practiced widely in learning contexts. This implies new interaction [3]. According to the didactic scientific literature, teaching materials must be proper for self-directed learning processes and have a didactic concept by which the targeted learning objectives can be achieved [4, 5]. Teaching-learning interactions are characterised as the results of learning processes that are actively initiated by lecturers and are supported in the virtual university teaching by means of modern educational technologies [6, 7]. Accordingly, content has to be represented on different devices such as PC, tablet, smartphone, e-book reader, etc.. This is also crucial for interdisciplinary knowledge.

The introduction of new teaching-learning interactions (esp. concerning sustainability) is no easy way to pass, yet highlights diverse starting points for discussing transformation and relevant tipping points in HEIs. In the sense of lifelong learning the question arises to what extent the acquired skills can be linked to it and be broadened and deepened in HEIs. How is high quality secured, and can the current

discussion about quantification of education symbolise a tipping point to foster good old established and approved structures and philosophies? Changes in traditional systems, like higher education institutions, are always accompanied by constrains. HEIs have to reflect their self-concept in order to relate new media tools to traditional learning designs or newly arising in-service study programmes and to make use of it to strengthen a sustainable development.

Therefore, different frameworks combining current and forward-looking teaching and learning focusing on students' outcomes (skills, knowledge, expertise and literacies) with the help of innovative support systems, like OECD or P21, are analysed regarding sustainability-relevant competencies. The analysis of sustainability-related competencies is based on a two time inquiry realizing changes. The question is to clarify whether new media didactical tools can enhance the learning outcome. In addition the ongoing research tries to find out how the use of new media tools in learning contexts is strengthening the sustainability-oriented ability to judge and act adequately, or whether the development of specific interdisciplinary interfaces is necessary. This question will be answered conceptually and with the help of practical examples and case studies. The paper aims on theoretical foundation and empirical validation of the usefulness of new media-didactic tools, like lecture recording, mobile apps, learning software, and video quiz for fostering sustainability-related competencies in in-service courses.

2   OBJECTIVES/METHODOLOGY/SCOPE

The Recommendation 2006/962/EC of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning has the goal to implement the acquisition of key competencies, such as knowledge, skills and capabilities in the areas of lifelong learning and national strategies as well as infrastructures permanently. Therefore, the basics are given for the development of modern teaching methods and suitable methodological settings, such as learning through discovery, experience, research, by solving problems through play, through learning by doing and other forms of experiential learning [1, 4, 8-11]. In particular, the connectivism as a young learning theory applies an understanding of individuals being more networked than isolated [12]. Collaborative learning theories promote social interaction as activities to learn [13, 14].

Back in the forties of the last century Dale [15] recommended more learning from reality or credible simulations as well as the use of different activating forms of learning and experiential learning in comparison to the widespread passive sitting, hearing, seeing and reading. According to Gardner's [16] theory of multiple intelligence men establish several different types of learning and information processing. Therefore, it is obvious to develop and apply new methods and tools combining several of these intelligences [1]. "The multimedia environment of the end of the last and the beginning of this century has been significantly enhanced by new media, which are highly suitable to improve everyday communication and satisfy the needs of those who learn how to communicate, to belong, to be confident, and to build self-esteem and self-actualisation." [1: S. 3290]

Following Matijevic [1] the new media and technologies offer new and diverse ways of inventing and designing new learning as well as to become an independent researcher. However, students often remain passively in using new media, technologies and learning forms. Research-based learning is using a different approach and brings the learner into action explicitly. Research-based learning can be understood as an independent, just slightly conveyed development and definition of research questions by the students themselves, the independent management of working processes aiming at the independent practicing of scientific practices and methods as well as the critical discussion, plausible assessment and clear documentation of research experiences and outcomes.[1]

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In that case Müller [17] sees also a high autonomy of the learners. According to the author in research-based learning courses the design of complex teaching and learning situations include - individually or cooperatively - independently conducted projects [17: 8]. However, it is important in this process that students are constantly supported by the teachers. Ludwig [18: 11] writes that teachers will hopefully have more knowledge, and have a say and are able to support the cognitive processes of the co-researchers in an appropriate way. This kind of learning can be postulated as research-based teaching and is most relevant for competency acquisition. The autonomy of learners (especially in the area of training and further education) should therefore be supported. This view is also supported by Fischer [19: 25] describing the change of the teaching staff from being an expert to a learning guide as well as highlighting the advantage technological media can provide to students for compiling their own learning program.
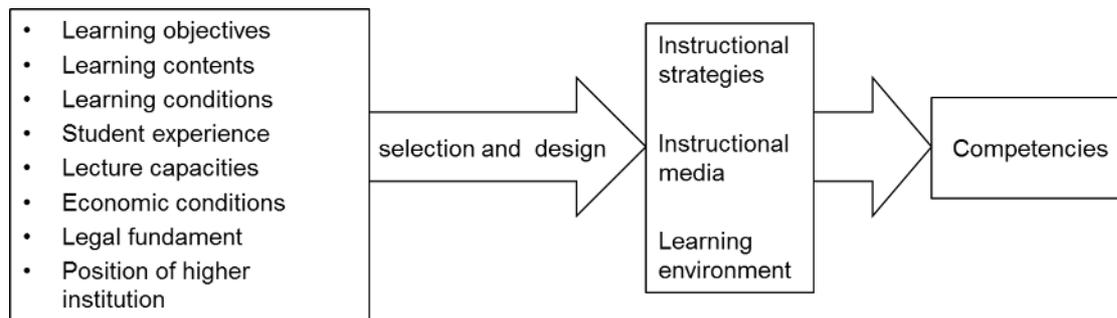
Figure 1: Design of competence-based learning process (amended on Matijević 2012: 3293)

Matijevic [1] argues that the existing scientific criteria, instructional media and teaching-learning strategies and learning processes must be reviewed and updated by the possibilities of educational opportunities that arise through the new media (see Figure 1).

This goes hand in hand with the discussion about competencies. Currently competencies are often not checked in the field of blended learning courses in further education, and play a subordinate role in education in general. Weinert [20: 27] defines competencies as follows: "Competencies are available or learnable cognitive skills and expertise by individuals to solve specific problems, and the associated motivational, volitional and social readiness and skills to use diverse solutions successfully and responsibly in variable situations." In a report prepared for the OECD Weinert [21] distinguishes between different aspects of the concept of competencies: (1) competencies as cognitive dispositions; (2) competencies as context-specific performance dispositions, i.e. knowledge, skills and routines that relate to specific requirements and situations; (3) motivational orientations for dealing with challenging tasks; (4) capacity building for the integration of the first three (e. g. in the professional environment) and (5) meta-competencies. The modeling of competencies is primarily found in academic and professional contexts, but the research about competencies in higher education has increased in recent years [22]. However, the questions how sustainability-related competencies can be modeled and encompassed, how their acquisition may be encouraged and how they can contribute to a sustainable development are still underexposed in HEIs.

With a view to a sustainable development the capability to take ecological, economic and social aspects equally into account while deciding is of particular importance. Interdisciplinary application contexts are crucial, however, they are not explicitly considered in many competency models. The design competence (Gestaltungskompetenz) [23] is of particular importance, such as the competencies for cooperative and long-term action. The Gestaltungskompetenz is divided into several sub-competencies [24]. Since decision making is central in complex contexts, the assessment of competence [23, 25] is an important requirement for design competence. For encompassing the

evaluation competence Eggert and Bögeholz [26] have developed a model that differ four sub-competencies and competency levels: (1) the knowledge and understanding of a sustainable development; (2) the knowledge and understanding of values and norms; (3) generating and reflecting factual information, and (4) evaluating, deciding and reflecting [26-30]. The OECD competency framework provides a unified structure for competence measurements concerning the developed key competencies in adult education [31-32]. The applicability of the reference framework on teaching-learning processes of lifelong learning is to underline. The following key competencies are addressed [32]:

- The interactive use of media and means (e.g. language, technology)
- Interact in heterogeneous groups (e.g. exchange and interaction)
- Autonomy, capacity to act (e.g. independent designing)

The coalition "Partnership for 21st Century Skills" (P21) has specified core competencies for the 21st century since 2002. This framework provides a good starting point for designing appropriate learning settings. The aim of this framework is to present a holistic perspective on learning outcomes (see also table 1). The reference system is divided into four areas of competence: core subjects, life and career skills, learning and innovation skills, information, media and technology skills. The P21 skills are essential prerequisites for teaching, the establishment of suitable learning environments (e.g. project work), professional development (e.g. constant qualification of teachers), an adequate curriculum, standards and modern learning assessment as well as examination forms.

There are several further concepts modelling sustainability competencies [33]. Murga Menoyo [34] developed a concept of four areas of competencies: (1) generic competencies, (2) generic competencies in sustainability, (3) specialized green skills for a green economy and (4) "top up" existing competencies in sustainability. According to Wiek et al. [35] five sustainability competencies are of importance: systems thinking competence, strategic competence, interpersonal competence, normative competence and anticipatory competence. We follow the key competencies frameworks of OECD and P21 as they provide a very good standardized and systemized structure of key competencies and their sub-competencies (see also table 1).

	Creation competence	Key competencies	
		OECD (2005, http://www.oecd.org/pisa/35070367.pdf)	**P21** (http://www.p21.org/about-us/p21-framework)
Acquire and use knowledge	• Gather interdisciplinary knowledge/findings and acting • foresightful thinking and acting • establishing knowledge by integrating cosmopolitan and new perspectives	• Use language, symbols and texts interactively • Use knowledge and information interactively • Use technology interactively	• Information Literacy • Media Literacy • ICT Literacy • Critical Thinking and Problem Solving
communication	• Shared planning and acting • Participating on decision processes	• Cooperation ability • Conflict solving	• Communication and Collaboration • Social and Cross-Cultural Skills

Table 1. Selective competencies according OECD and P21

Different learning settings were investigated. Students had the task to develop and prepare knowledge for a specific learning unit. Therefore they have several options; they can work with text-image representation, record own audio files or videos, filming own experiments and tests or conduct expert interviews, etc. In order to find efforts in competencies and sustainability-related competencies a questionnaire was developed. The questionnaire is based on the skills described in the P21 framework and integrates missing competencies from the OECD framework in the three skill areas: (a) Learning

and Innovation Skills, (b) Information, Media and Technology Skills, and (c) Life and Career Skills. In total 65 competencies were surveyed. The competencies were prepared by a Likert scale having the options from 1 (fully applies) to 6 (does not apply at all). The questionnaire was applied twice, first before the lecture started and a specific learning design was used, and second after the lecture was finished. The goal was to find out how the used instructional design has an influence on specific competencies of the students. The investigation is part of a pre study to select relevant competencies for sustainability. The competence descriptions were based on a self-evaluation.

3   RESULTS

Our first implication is that competence description in a self-evaluation setting is neither very helpful to find essential differences nor to identify crucial competencies for a sustainable development. Most students ranked their high values of single items in the first survey period. Thus, there was no significant difference recognisable compared to the second survey period. Giving a description of competencies we would not suggest using self-evaluations. Finding differences of a specific instructional element or changes in sustainable percipience, action and design a performance setting is more valuable. Competencies should make obvious real changes in action. Competence structure models do not seem to be appropriate for mapping changes and highlighting sustainability related competencies. Modelling the levels of competencies seems to be more appropriate.

	Dimensions	
Level	Interdisciplinary knowledge representation	Teaching-learning interactions by usage of new media like lecture recording, mobile apps, learning software, and video quiz
1	- apply knowledge to everyday scenarios - reproduce knowledge from the curriculum - taking at least one dimension of a sustainable development (environment, economic, social) into account	Lecture recording motivate to reproduce knowledge and deepen skills in an individual time-line.
2	- understanding scenarios - expert knowledge use in an interdisciplinary way - taking at least two dimensions of a sustainable development (environment, economic, social) into account	Mobile apps and video quiz are good opportunities to reflect interdisciplinary knowledge in different contexts.
3	- analysing scenarios on basis of interdisciplinary knowledge - determine professional and interdisciplinary concepts, values and norms and establish comprehensive relations between these components - taking all dimensions of a sustainable development (environment, economic, social) into account	Learning software can guide the students to reflect different theories and perspectives. Constrains and dilemma can be simulated and internalised.
4	- evaluating scenarios on the basis of interdisciplinary knowledge - developing ideas of problem solving - taking all dimensions of a sustainable development (environment, economic, social) into account	Not sufficient

Table 2. Indicators.

Our general findings concerning the teaching-learning interaction are presented in table 2. When creating own tutorials by the learners it is essential to reduce the degree of complexity on the technical side [6]. The technology should be supportive and not inhibitory. Some skills, such as mastery of programming languages, also should not be required in most areas, except in computer science for instance. In addition, an introduction to media creation is helpful [36]. Creating own learning apps as tutorials offers the advantage to represent small learning content in a meaningful, compact form. The time spent can be kept as low as possible for the learners. The growing proliferation of mobile devices

and high future prospects offer good opportunities for the integration of new instructional design in teaching.

4   DISCUSSION

The quality of study programs can be improved in virtual learning formats. It is useful to offer students instructional videos and other tools for acquiring knowledge in addition to the pure provision of written teaching materials. The reproduction of essential knowledge is improved and a deeper understanding is given. The findings also highlight that for international target groups, some tools must be culturally adopted, because of different expectations, objectives, and modes of communication and learning styles. Designing interactive teaching-learning situations it is equally important to establish either individualistic or collectivist learning arrangements (depending on the participants). Sustainability-related competencies can be fostered by interactive tools, but have to be anchored by repetition and diverse tools.

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1 **Corporate Sustainability integration; development of a framework to map**

2 **supporting approaches**

3   *Ir. Sjors Witjes*[1], Dr. Walter V.J. Vermeulen*, Prof. Dr. Jacqueline Cramer**

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5 # Abstract

6 Companies have become more aware of the impact they generate on society. Some

7 companies take up the challenge to convert this awareness in an added value to their

8 core business activities. There is an extensive amount of CS approaches (tools,

9 instruments and initiatives) available to companies enabling the integration of CS in

10 the core business activities. To understand the applicability of these approaches

11 scholars have been developing frameworks by looking from outside of the company,

12 its intentions and its structure, towards these approaches. These researches have

13 resulted in the conclusion that the application of these approaches does not guarantee

14 a successful integration of corporate sustainability in the core business activities of

15 the company. To contribute to the understanding of the intentions of CS approaches

16 and their application in businesses this research takes an inside-out perspective. A

17 framework was developed to question the intentions of the approaches within the

18 context of the company. The framework was validated by its application on the three

19 most cited CS integration approaches.

20 The conclusion of this research is that an inside-out perspective on the intentions of

21 the CS integration approaches can complement the already existing understanding by

22 an outside-in perspective. More specifically, mapping the three most cited CS

23 integration approaches with the developed inside-out framework shows indeed that

24 these CS integration approaches have specific intentions within the CS integration

25 process and therefore emphasizes the conclusion of other outside-in frameworks that

26 companies should use a mixture of approaches for a successful integration of CS in

27 the core business activities.

28 The insides of this paper can be used to collectively improve CS integration

29 approaches to be adaptable to the continuously changing business environment and to

30 support companies in their search for integrating CS in the core business activities.

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1

2 **Keywords**

3 Corporate sustainability, approaches, integration, sustainability reporting, life cycle

4 assessment, environmental management system, business system.

5 # 1. Introduction

6 Due to the growing awareness of environmental and social impact of business

7 activities the pressure of internal and external stakeholders on companies to address

8 corporate sustainability (Witjes et al., 2014) is increasing. Proactive companies take

9 these challenges and start integrating corporate sustainability (CS) in their business

10 system (Lozano, 2013). Over the last decades, several approaches have been

11 developed to support this integration process: i.e. tools, instruments, initiatives used

12 by companies to connect the Triple Bottom Line (TBL) issues of planet, people and

13 prosperity (Elkington, 1998; Jamali, 2006) to the business system (Azapagic, 2003;

14 Eccles, Serafeim, & Ioannou, 2011; Maon, Lindgreen, & Swaen, 2009).

15 Several scholars have shown, though, that companies have little success with the

16 application of these approaches ((Doppelt, 2003; Siebenhüner & Arnold, 2007) as

17 cited in Lozano, 2012): they are too specific in time or in scope not enabling

18 companies to comply with the full TBL scope and do not support the iterative

19 dynamics of the companies´ daily business processes (Azapagic, 2003; Jamali, 2006).

20 Besides, the large array of existing approaches is overwhelming for companies,

21 resulting in companies not knowing which approach to use at what moment and for

22 which cause (Van Der Woerd & Van Den Brink, 2004).

23 To better understand the variety of the different CS integration approaches, this paper

24 describes a framework linking the needs of the companies willing to integrate CS into

25 their business systems and the intentions of approaches with the potential of doing so.

26 To be able to do so, a framework was developed enabling the mapping of the CS

27 integration approaches.

28

29 Section 2 will discuss the literature on CS integration leading to the selection of the

30 approaches and the explanation of a framework to enable the analysis of CS

31 integration approaches. Section 3 describes the methods for data collection and

32 analysis. In section 4 the findings are presented; followed by the discussion of the

1 findings within the scope of the literature review; and finally the conclusions with
2 proposals for future research.

3 **1.1. Integrating Corporate Sustainability**

4 Sustainable development, as a normative concept outlining desirable development
5 paths of societies, has been increasingly receiving attention in business literature
6 (Bansal 2002, 2005; Dyllick and Hockerts 2002; Gladwin et al. 1995; Jennings and
7 Zandbergen 1995; Shrivastava 1995). By their contribution to the economy,
8 companies´ play an important role in sustainable development (Bansal, 2002). Being
9 sustainable development a society-level concept, individual companies cannot
10 become sustainable; they contribute to the achievement of the larger system in doing
11 so (Jennings and Zandbergen 1995). This has led to the manifestation of the notion of
12 businesses addressing CS taking responsibility to society in general (Gomez-Samper,
13 2011). As with the concept of CS itself, also the scope of this responsibility has been
14 evolved from eliminating negative effects of business processes, by means of an
15 efficiency focus, towards a broader view of how a company can contribute to
16 sustainable development in general (i.e. TBL), leading to an effectiveness focus
17 (Baumgartner, 2009). Therefore the integration of the company´s vision on CS into
18 the core business activities will result in the creation of value for businesses and
19 society alike. Some companies have been able to make this process of CS integration
20 lead to support the main goals of the company. As a result, these companies
21 outperform equivalent companies over the long term in stock market and financial
22 performance (Eccles et al., 2011).

23 **1.2. CS integration**

24 In 1987, the Brundlandt report (WCED & World Commission on Environment and
25 Development, 1987) emphasized, within the concept of sustainable development, the
26 importance of aligning companies´ impacts on the needs of current and future
27 generations with the main business goals. Since then, scholars and practitioners alike
28 have been exploring how companies can take up this challenge (Baumgartner, 2013;
29 Lozano, 2012; Robèrt et al., 2002). In their intent to describe this process of linking
30 the company´s vision on CS with the general business proposition, scholars have their
31 researched on organising (e.g. Graafland et al. 2003) and implementing CS (e.g.
32 Maon et al. 2009). A growing group of scholars have been focussing on the

1 integration of CS (Bonini, Görner, & Jones, 2010; Eccles et al., 2011; Moore &

2 Manring, 2009) though. In the research on how companies integrate CS in their core

3 business activities different theories unite.

4

5 Firstly, from an organisational theory point of view integration is understood by "the

6 coordination of activities through accountability, rules and procedures, liaison roles,

7 cross-functional team, or direct contact" (Hatch and Cunliffe, 2013, p.95). To achieve

8 a unity of efforts within an organisation, collaboration between the people is required.

9 These occurrences or experiences between people are referred to as phenomena, the

10 core object of study of sociology. Therefore and secondly, the structural functionalist

11 theory emphasises social stability, norms, control and the process of socialisation

12 (Merton, 1973; Parsons, 1971; Storer, 1966) while touching upon the concept of

13 integration. Consequently, integration refers to the relationships between elements of

14 a social system and their impact on the system as a whole (Parsons, 1971). For

15 conflict theorist, the relationship between the elements of a social system is taken as

16 an attribute of group life manifesting the group cohesion (R. A. Scott, 1976; Simmel,

17 1955). Social network theorists relate notions of integration additionally to the density

18 of the relationships resulting in social structure (J. Scott, 2000). Finally, the field of

19 social capital defines the cohesion and density of relationships between the elements

20 of the social system and their impact on the system as the value of the system itself

21 (Putnam, 2000).

22 Thirdly, the field of CS integration can be studied from an organisational culture

23 perspective. Graafland (2003) uses the concept of organising when aiming for

24 managers and other employees to act in accordance with established values. From an

25 organisational culture perspective the adoption of these values occurs through a joint

26 learning process attempting to solve group problems with, for example internal

27 integration (Edgar H. Schein, 2004).

28 Fourthly and finally, in the field of management sciences, the linkage between CS and

29 the core business activities has been used to describe the unity between different (i.e.

30 TBL) stakeholder issues (López-Fresno, 2010). Since the last 15 years, there is a

31 specific interest in researching business compliance with these different issues by

32 means of integrated management systems (e.g. a quality, health & safety and

33 environmental management system) with focussing on the subsequent standards (e.g.

34 ISO 9001, OHSAS 18001/ISO 45001 and ISO 14001). In their research on the

1   sustainability of integrated management systems Gianni and Gotzamani (2015)

2   emphasize the importance of cohesion, an orientation on performance management,

3   as is the case with social systems. Besides, the recognition of an integral control

4   system (i.e. by integral auditing) was seen as key (Gianni & Gotzamani, 2015). This

5   corresponds to the outcomes of an 18-year-long longitudinal study with 180

6   companies on CS (Eccles et al., 2011): CS encloses the assumption that companies

7   are faced with a broad scope of stakeholder issues in achieving societal objectives.

8   Apparently these objectives appear desirable and applicable in isolation but are

9   ''inextricably connected and internally interdependent'' (Bansal and Roth 2000, p.

10   123 as mentioned in Hahn et al. 2014).

11   For this research we take CS integration as the system´s value consisting of

12   the cohesion and density of the relationships between all TBL stakeholder-issues and

13   the physical and social-cultural impact of the business system processes with a

14   controlled (i.e. audited) impact of the business leading to enhancing the company´s

15   value for society.

16   **1.3. CS integration approaches**

17   To support companies with the process of CS integration, both scholars and other

18   professionals have been engaged in the process of developing and applying

19   approaches: tools, instruments, initiatives for CS integration (e.g. Baumgartner 2013;

20   Lozano 2011; Robèrt et al. 2002).

21   CS integration approaches, like for example The Natural Step (TNS), support the

22   strategy development process of the companies (Robèrt et al., 2002). These

23   approaches are merely based on the back casting process: by defining the future and

24   looking at the current situation a possible path forward can be determined (Robinson

25   (1990) as mentioned in Dreborg (1996)). Understanding the company´s vision on CS

26   and its current CS status is essential for these approaches.

27   Other approaches, like environmental management systems or CS management

28   systems, are based on the management system of the company. Several scholars have

29   been proposing CS management systems in order to capture the proposed holistic

30   character of the business system (Azapagic, 2003; Hahn et al., 2014; Jamali, 2006;

31   Maon et al., 2009). Consequently, these approaches tend to make the link with the

32   core business activities by integrating their CS vision in the different elements of the

management system. Hereby the scholars propose broadening the initial reduced focus of the management system (e.g. quality for ISO 9001) to the TBL issues.

Life cycle approaches, like CO2 footprint or Life Cycle Assessment, are based on the supply and/or value chain of the product and/or services produced by the company. The scope of these approaches can differ as the approaches differ in their scope (Searcy, 2014). In general, this kind of approaches is more focused on the physical side of the CS integration leading to an integration based on control. Other approaches, like the Global Reporting Initiative (GRI) or Integrated Reporting (IR), support companies with the reporting of their CS performance. The scope of these approaches range from just the reporting phase (e.g. CS self-declarations) to approaches that also include management system elements and therefore have the potential to cover not only part of the CS integration process but also completely (Lozano & Huisingh, 2011).

Table 1 presents an overview of the most prominent CS approaches and their search hits on prominent academic search engines (i.e. Web of Science, Scopus, Google Scholar and Google web search). This selection is not claimed to be complete but rather to symbolise the range and importance of existing CS integration approaches. The pre-selection of the list of CS approaches is based on the appearances of approaches in the sustainability literature (see for example Baumgartner 2013; Lozano 2011; Robèrt et al. 2002). In this way the above-mentioned back casting, management system, life cycle, and reporting approaches are extended with others. As can be seen in Table 1, the 10 most frequent appearing approaches are included.

CS approach	Web of Science	Scopus	Google Scholar	Google web search	Overall ranking
Sustainability reporting	53	97	6470	136000	1
Environmental management system	6	14	2320	43000	2
Life cycle assessment	8	13	2130	24700	3
Cleaner production	5	7	3970	18500	4
Green marketing	2	2	938	14400	5
Eco innovation	3	3	575	6210	6
Ecodesign	0	1	416	29200	7
The natural step	0	2	575	5520	8
Cradle to cradle	0	0	822	12600	8
Sustainable procurement	2	1	375	10900	9

Table 1 Appearance of CS integration approaches in scientific literature (3 April 2015)

The search was performed by using "corporate sustainability" and the approach name between quotation marks.
For example for Life cycle assessment the search was: "corporate sustainability" + "life cycle assessment".
Specific for each source:

- Web of Science (http://apps.webofknowledge.com.proxy.library.uu.nl/): the search was within "topic".
- Scopus (http://www-scopus-com.proxy.library.uu.nl): the search was within "article title", "abstract" and/or "keywords".

3   As can be seen in Table 1, sustainability reporting, environmental management

4   system and life cycle assessment are the most frequent mentioned approaches in the

5   context of CS. CS approaches are set up for a specific moment or to support a specific

6   process. This specificity does not enable the approach to reach a full cohesion of the

7   broad range of CS stakeholder issues (i.e. TBL) linked to business system processes.

8   Besides, it does not support the iterative dynamic nature of daily business, making the

9   integration of CS into business activities generate problems (Azapagic, 2003; Jamali,

10 2006). Moreover, an one-size-fits-all approach does not exist due to the diversity in

11 companies (Jamali, 2006). Several authors (Azapagic, 2003; Salzmann, Ionescu-

12 somers, & Steger, 2005; Weber, 2008) demand a descriptive research to increase the

13 internal validity of results or adopt a comparative approach to shed more light on the

14 effectiveness of CS integration approaches.

15   **1.4. Structuring CS integration approaches**

16 A multilevel-approach or the use of several approaches is necessary to assure a

17 successful support of the integration of CS (Hahn et al., 2014). To make the right

18 choice an understanding of the intentions of any of the broad range of specific CS

19 integration approaches is necessary: how could the application of a specific approach

20 lead to CS integration?

21 Robert et al. (2002) divided the field of CS integration approaches in 5 levels: 1.

22 principles for the constitution of the system, 2. principles for a favourable outcome of

23 planning within the system, 3. principles for the process to reach this outcome, 4.

24 concrete measures that comply with the principles for the process to reach a

25 favourable outcome in the system, and 5. tools to monitor and audit. A clear

26 understanding and synergistic application of these levels could help companies being

27 more successful with CS integration. Research on the application of individual CS

28 approaches shows that a successful application of the approach should be used

29 throughout the organisation (Baumgartner, 2009). Baumgartner (2013) therefore

30 classifies the CS approaches according to the three levels of organisational structure

31 as described by Ouchi (1978): 1. strategic (top management), 2. tactical (middle

32 management) and, 3. operational (shop-floor) level. The link between these levels is

33 key to assure a successful CS integration (Baumgartner, 2013). Lozano (2012)

structures the CS approaches according to the organisational departments and TBL including the time dimension. For a successful CS integration approaches should applied that result in an alignment of all these departments (Fernandes, Raja, Whalley, & Whallay, 2006) and top-bottom from strategic, over tactical to operational is key for successful CS integration (Baumgartner, 2013). By adding the external and internal dimension, Baumgartner´s framework complements the framework by Robert et al. (Robèrt et al., 2002). Hahn et al. (2014), completes the framework of CS integration approaches by improving the systems perspective on time and system.

Despite the development and testing of these different frameworks they do not enable the differentiation between specific sectors (Baumgartner, 2013; Salzmann et al., 2005) and there is still the need to understand the circumstances under which the companies use a combination of these approaches, leading to an integrative approach (Hahn et al., 2014; Lozano, 2012; Robèrt et al., 2002). Separate case studies could contribute to understand why companies use specific approaches (Hahn et al., 2014). Consequently, the intentions and experiences with the different approaches could give companies a better idea which approach should be used for a specific situation. Instead of focussing on the outside-in perspective: the principals (Robert), organisational structure (Baumgartner), departments (Lozano) or, additionally, the context and time (Hahn et al), these intentions can be covered by asking the companies about their vision of the use of CS approaches, why they apply them, what they applied, how they applied them, where and when the application took place. The same counts for the approaches themselves: what is the approaches vision on CS integration, why should a company use this approach, what is the focus of the approach, how should the approach by applied, where can it be applied and when should it be applied (see Table 2 Understanding the intentions for the use of CS approaches). This inside-outside perspective and understanding of CS integration approaches leads to the development of the MCSA framework.

Elements	Questions
Scope/Vision	Which scope does an approach have and how visionary does it get? Meant to assess the depth and level of development of the vision on CS integration
Why?	Assessing the reasons why the approach opts for CS.
What?	Gives insights into which actions were carried out to apply the approach.

How?	How is the CS approach applied on an organisational level?
Where?	Where was the CS approach applied: inside, outside the organisation, what part of the supply chain, life cycle of the product, etc.
When?	Referring the time dimension considered during application of the approach. When was the approach applied? But also the role of past and future activities in the application of the approach

1 *Table 2 Understanding the intentions for the use of CS approaches*

2 **2. The MCSA framework**

3 A systemic framework enables the mapping of the different CS integration
4 approaches. The general goal is to carry out a qualitative mapping where the
5 visualised answers provide even further insights into the approaches. This single
6 framework for mapping CS approaches (MCSA) was constructed based on the
7 elements mentioned in Table 2 Understanding the intentions for the use of CS
8 approaches, and was used to map a selection of the approaches mentioned in Table
9 1In order to gain more detailed information about the intentions of the approaches,
10 each MCSA elements (i.e. Vision, why, what, how, where and when; see Table 2
11 Understanding the intentions for the use of CS approaches) is supported by three bi-
12 polar sub-elements (see Table 3).

Elements	Sub-elements
Vision	1. All-inclusive focus: People, Planet, Prosperity versus limited focus on either: People, Planet, Prosperity 2. Focus on short term improvements versus focus on long term, cultural change 3. Single process/business unit change versus including entire corporation or even networks
Why?	1. Shared value and culture driven versus profit driven 2. Future market inevitability versus ethical pre-deposition (good for society) 3. Legally driven versus intrinsically driven
What?	1. Product-Service orientation versus product/technological orientation (material flow focus) 2. Incremental redesign versus radical redesign 3. Specific strategic guideline versus broad (customized) framework
How?	1. Circular/evolutionary approach versus linear approach 2. Target compliance monitoring & reward systems versus value based discourse and mutual control 3. Strong visionary leadership (top-down) versus interrelated, shared responsibilities (bottom-up & top-down)

Where?	1. Customer/Community including (i.e. stakeholder) versus purely focus on company (i.e. shareholder)
	2. Selective group versus throughout entire organisation
	3. 'Inside' components (purely internal) versus 'Outside' components (full value chain including – post consumer
When?	1. Back-casting versus forecasting
	2. Only consideration of future development versus consideration of corporate history
	3. One time project versus permanent improvement

1   *Table 3 MCSA elements and the sub-elements*

2

3   Due to the bi-polar nature of the sub-elements each MCSA element can be

4   represented by a 3-axes system. As can be seen in Figure 1, for each MCSA element

5   these 3-axes constitute a 2 dimensional space. In this way the 3 axes of the MCSA

6   sub-elements contribute to the x- and y-axis of the MCSA element.

7   The y-axis of this space represents the level of complexity of the CS integration

8   strategy of the company. The x-axis represents in the majority of the cases the

9   development of the CS integration in time. For the Why-element the x-axis represents

10   whether the CS integration is intrinsically or extrinsically driven. For the How-

11   element the x-axis represents the level of embededdness of the CS integration. All

12   elements with its 2 dimensional space constituted by the 3 axes form the MSCA

13   framework (see Figure 1).

14   **2.1. Data analysis**

15   The approaches are mapped in a comparative way: scientific and professional

16   literature was assessed in order to justify the positions on the axis scheme. The

17   position of an approach on the axis should but rather symbolize which approach can

18   be found on which side of each question. To determine the position of the approach

19   on the MCSA axes, the data was analysis and interpreted. According to Elliot (2000)

20   interpretive analysis leads to an understanding of why phenomena come about and

21   how these unfold over time. In most cases clear answers and thus positions on the axis

22   were given. However, in some cases the authors of the selected approaches did not

23   elaborate on specific MCSA framework questions and thus the position was based on

24   interpretations of the underlying philosophy and mind-set of each approach.

1

2

Vision

Complexity/Strategy development level

All-inclusive focus: people, planet, prosperity

Including entire Corporation or even Networks

Cultural Change (long term)

specific (single) business units (short term)

Single process, production change

Limited focus on either: people, planet, prosperity

(Development) Time

Why?

Complexity/Strategy development level

Intrinsically driven

"Value" driven

Ethical pre-deposition

Future market inevitability

Legally driven

Profit driven

Extrinsically driven

Intrinsically driven

What?

Complexity/Strategy development level

Strategic guideline (deep organisational integration)

Incremental redesign

Product-Service orientation

Disruptive redesign

Practical tool

Product/technological orientation (material flow focus)

(Development) Time

Where?

Complexity/Strategy development level

'outside' components (value chain including)

Throughout entire organization

Customer including

Mainly management focus

'Inside' components (purely internal)

Purely focus on company and value chain)

(Development) Time

When?

Complexity/Strategy development level

Permanent improvement

Consideration of Corporate history

Backcasting

Only consideration of future development

One time project

Forecasting

(Development) Time

How?

Complexity/Strategy development level

Interrelated, shared responsibilities (bottom-up & top-down)

value based discourse and mutual control

Circular approach

target compliance monitoring & reward systems/

Strong visionary leadership (top-down)

Step based approach

Level of embeddedness

Figure 1 The MCSA framework

3. Findings

To validate the MCSA framework the 3 most cited CS integration approaches were mapped: sustainability reporting, environmental management system and life cycle assessment (see Table 1). The visual results can be found in Figure 1.

3.1. Sustainability Reporting

3.1.1. Vision

Sustainability reporting is a voluntary activity to assess the current state of an organisation's TBL issues, and to communicate the company´s efforts and progress (Lozano & Huisingh, 2011). Consequently, sustainability reports have the organisation as scope. Within this scope the sustainability issues mentioned in the report have been developing from originally a single issue-focus primarily on the environment, towards a broader and integrated issue-focus also to include ethical/social and financial issues (Kolk, 2008). This is confirmed by the current discussions for an integrated reporting (IR). Applying IR, companies confirm that significant changes were made to what was measured in the past or had plans to do so in the future (IIRC, 2014). A direct link between sustainability reporting and the corporate culture could not be found in literature. Based on the strong focus of reporting on quantitative indicators this is not to be expected either. As can be seen in Figure 2, this results in the positioning of sustainability reporting in the right top quadrant of the MCSA vision-graph.

3.1.2. Why

Being sustainability reporting an approach backed up by accounting principals (Adams & Frost, 2008; Kolk, 2008), companies tend to apply it to communicate the efforts and progress on quantitative indicators for important stakeholders, leaving out the qualitative/cultural efforts and progress. Despite of this quantitative basis, IR has been trying to include shared value principles as: "new approaches to value creation and decision making require organizations to assess their performance in new ways" (IIRC, 2014, p. 5). Stakeholder inclusiveness, as one of the sustainability reporting guiding principles, motivates the reporting company to identify stakeholders and communicate the compliance with stakeholder requirements (Initiative & Global Reporting Initiative, 2012). It therefore depends on the reporting company if they

1 report on their ethical pre-deposition or their intrinsic drivers. As can be seen in

2 Figure 2, this results in the positioning of sustainability reporting in the left bottom

3 quadrant of the MCSA why- graph.

4 *3.1.1. What*

5 A sustainability report contains merely data on product and process results that

6 contribute to the efforts of the company in becoming more sustainable. Due to the

7 stakeholder/market oriented-view sustainability reporting is principally an approach to

8 communicate these organizations efforts. In order to do so, companies strive to

9 increase transparency and accountability (Ioannou & Serafeim, 2011; Kolk, 2008).

10 Besides assessing the organizations performance and compliance with stakeholder

11 requirements, sustainability reporting also supports the companies to continuously

12 improvement these same efforts over time (GRI, 2011; IIRC, 2014). In this sense, a

13 sustainability report could contribute to the incremental redesign of the organization

14 and its processes towards the CS scope, but this depends on the company and its

15 stakeholder demands. In principal, sustainability reporting is an approach to assess the

16 state of the organisation's TBL-issues and to communicate the efforts and progress

17 (Lozano & Huisingh, 2011) with the potential of becoming an approach that supports

18 the company on strategic matters as well. As can be seen in Figure 2, this results in

19 the positioning of sustainability reporting in the lower part of the of the MCSA what-

20 graph with a spread of the time-axis.

21 *3.1.1. How*

22 Due to the amount of data that has to be gathered and analysed, the publication

23 frequency of a sustainability report is often linked to the general year report of the

24 company: once a year. Although the goal of a sustainability report is to strive for

25 continuous improvement, this time interval results in sustainability reports making

26 their contribution in step-wised based improvement approaches.

27 Several authors have research this link between sustainability reports and general year

28 reports (Cooper & Owen, 2007; Kolk, 2008). In both cases the responsibility of the

29 success of the report lies in the hands of a single person or limited group of persons,

30 mostly positioned at the top of the organisation or maintaining a staff-function with

31 direct link to the board of the company. If the responsibility of top positions also leads

32 to a top-down or, in contrary, a bottom-up integration of CS cannot be found in

1   literature. Initially it can be the case that top positions drive the reporting process (i.e.

2   top-down), but with the knowledge of former sustainability reports people throughout

3   the company can generate input for upcoming reports by initiate sustainability

4   improvement processes (IIRC, 2014). Although IR has showed a vision for attempting

5   to include company´s efforts on internal socio-cultural issues in sustainability reports,

6   the focus on quantitative outcomes to improve the company´s performance has not yet

7   made this possible. As can be seen in Figure 2, this results in the positioning of

8   sustainability reporting in the lower left- part of the of the MCSA how-graph.

9   *3.1.1. Where*

10   Integrating CS with sustainability reporting support the company to report about its

11   performance on TBL-issues (GRI, 2011). These outcomes can be used for the internal

12   improvement programmes. Additionally, disclosed information can help stakeholders

13   to focus their decisions, related with the reporting company, without adversely

14   affected the company´s shareholders (Ioannou & Serafeim, 2011). Although a

15   selected group of people will take the responsibility of developing and publishing the

16   sustainability report, the impact of the outcomes can be used by a broad range of

17   internal and external stakeholders (Kolk, 2008). As can be seen in Figure 2, this

18   results in the positioning of sustainability reporting throughout the MCSA where-

19   graph.

20   *3.1.2. When*

21   By looking backwards to support a vision for the future, sustainability reporting has a

22   double time-focus: "measuring, disclosing, and being accountable to internal and

23   external stakeholders for organizational performance towards the goal of sustainable

24   development" (GRI, 2011). These past performances have been measured over the

25   period of the report: mostly one year. By analysing and comparing more than one

26   report, a continuous performance assessment can be achieved. Sustainability reporting

27   is therefore becoming an approach for companies for the long-term (Lozano &

28   Huisingh, 2011). As can be seen in Figure 2, this results in the positioning of

29   sustainability reporting in the right top-part of the MCSA when-graph.

30

1   **3.2. Environmental management system**

2   *3.2.1. Vision*

3   Environmental management systems are voluntary and focused on the structure,

4   implementation and maintenance of a formal single-issue management system: the

5   environmental impact of the company´s processes (Curkovic & Sroufe, 2011). The

6   proper implementation of an environmental management system enables the company

7   to take advance of long-term benefits. Yet, daily challenges can impede an

8   organization's long-term sustainability goals unless the environmental management

9   system clearly determines standard requirements for these daily activities (Logsdon,

10   1985; Carpenter, 1991; Willig, 1994; Bhat, 1998; Angell and Klassen, 1999; Melnyk

11   et al., 2001; Curkovic, 2003; Darnall et al., 2008 as mentioned in Curkovic and

12   Sroufe, 2011). Principally these activities depend on the scope set by the company

13   and, when certified, included in the environmental management system certificate.

14   This scope can range from a single process, or business unit to the entire organisation,

15   towards even multi-site certification covering more than one company.

16   As can be seen in Figure 2, this results in the positioning of sustainability reporting in

17   the right part of the of the MCSA vision-graph with a spread of the strategy´s

18   complexity level-axis.

19   *3.2.2. Why*

20   Environmental management systems "help organizations both to manage better the

21   impact of their activities on the environment and to demonstrate sound environmental

22   management" (ISO, 2009) and can lead to an improved organisation and

23   documentation of the organisational processes that generate an impact on the

24   environment, increased certainty of legal compliance, a better company image and

25   increased employee motivation (Morrow & Rondinelli, 2002). Recent research has

26   showed the ambiguous role of environmental management systems in assuring CS

27   integration: although the amount of management system certificates indicates a more

28   sustainable company, the management system itself is not used to integrate CS

29   (Witjes, Vermeulen, & Cramer, 2014). For companies the adoption of an

30   environmental management system has become a paper-driven process of limited

31   value (Curkovic & Sroufe, 2011) for improving the company´s internal processes and

32   environmental impact. In these cases an environmental management system is used to

33   comply with external stakeholders´ requirements, instead of an intrinsic motivation.

1 As can be seen in Figure 2, this results in the positioning of environmental
2 management systems in the left lower part of the of the MCSA why-graph.

3 *3.2.3. What*

4 As with Life Cycle Assessment, the environmental management system approach is
5 able to support a company with reducing its impact on the environment, but only by
6 the application of an overall perspective. In the case of environmental management
7 systems this perspective is the continuous improvement cycle constituted by plan, do
8 check and act (ISO, 2009). Environmental management systems, as strategic
9 guidelines, focus this continuous improvement on the impact of the organisation.
10 When applied in a right manner, the reduced environmental impact of the
11 organisation´s processes also require high employee participation and training
12 resulting in increased environmental awareness. Despite this correct application of
13 environmental management systems, it is difficult to attribute environmental
14 improvements directly to the adoption and certification of EMS (Morrow &
15 Rondinelli, 2002). As can be seen Figure 2, this results in the positioning of
16 sustainability reporting in the right upper part of the of the MCSA what-graph.

17 *3.2.4. How*

18 To apply an environmental management system, the company should assign the
19 responsibility for enabling to reach set objectives and targets for all relevant function
20 and at each level of the organisation, provide the means for fulfilling these objectives
21 and targets, and designate a specific time-frame for achieving these objectives (Clark,
22 1999; Abarca, 1998; Rowland-Jones et al., 2005; Albuquerque et al., 2007 as cited in
23 Curkovic and Sroufe 2011). The five requirements of an environmental management
24 system contain: 1. the formation of a policy and commitment to the environmental
25 management system, 2. the development of a plan for applying and, 2. maintaining
26 the environmental management system, and 3. a plan for monitoring and 4. possible
27 corrective action, and 5. top management review and continuous improvement
28 (Curkovic & Sroufe, 2011). Consequently an environmental management system
29 requires high employee participation and training (Azapagic, 2003) guided by a top
30 management´s commitment and results in more systematic and formal company´s
31 approach in the identification and management of environmental improvements

1   (Granly & Welo, 2014) . As can be seen in Figure 2, this results in the positioning of
2   sustainability reporting in the left top-part of the of the MCSA how-graph.

3   *3.2.5. Where*

4   The ambiguous role of environmental management systems, as shown in paragraph
5   3.2.2, shows that companies use the certificate to comply with stakeholder's
6   requirements. Besides, pressure from customers and the possibility of
7   environmentally advanced processes pull the company towards certification (Granly
8   & Welo, 2014). When going for the certificate, a selected group of people can enable
9   achieving this goal, but when the organisation wants to get maximum results out of
10 the application of an environmental management system, all levels of the company
11 should support its development and maintenance (Curkovic & Sroufe, 2011). The
12 crucial elements for the continuous improvement of the impact of the organisation
13 will be defined (Pojasek, 2012) by setting the scope of the environmental
14 management system. These elements can differ according the sector and geographical
15 context of the company (Curkovic & Sroufe, 2011). As can be seen in Figure 2, this
16 results in the positioning of sustainability reporting in the top right-part of the of the
17 MCSA where-graph.

18   *3.2.6. When*

19 After the development and application/certification of the environmental management
20 system, the continuous improvement cycle assures that companies are aware of the
21 past when establishing strategies and policies for future improvements of the impact
22 of the organisation. An environmental management system enables the company to
23 take advance of long-term benefits. Yet, daily challenges can impede this (Curkovic
24 & Sroufe, 2011). Therefore knowledge of the organisation´s historical development
25 and current situation and its processes is required to develop and apply an
26 environmental management system. As can be seen in Figure 2, this results in the
27 positioning of sustainability reporting in the right upper-part of the of the MCSA
28 when-graph.

1   **3.3. Life Cycle Assessment**

2   *3.3.1. Vision*

3   Life cycle assessment originally is a single issue-focused tool to understand the

4   impacts of human interactions with the environment by the identification and

5   quantification of environmental impacts of processes constituting the life cycle of a

6   product or service (Azapagic, 2011; UNEP, 2009). Developed in parallel, Life cycle

7   costing is concerned with optimizing value for money in the ownership of physical

8   assets by taking into consideration all the cost factors relating to the asset during its

9   operational life (Woodward, 1997). Recent developments show that the scope has

10   been broadened to include social and prosperity issues although challenges with

11   allocation are still to be overcome before getting to a full sustainability life cycle

12   assessment approach (Robèrt et al., 2002). Life cycle assessment has been primarily

13   applied for assessment to define impact improvement actions at product or process

14   level on short term or long term depending on the perspective (i.e. individualist,

15   egalitarian or hierarchist) chosen by the company (Goedkoop & Spriensma, 2001).

16   As can be seen in Figure 2, this results in the positioning of sustainability reporting in

17   the lower left part of the of the MCSA vision-graph.

18   *3.3.2. Why*

19   The outcomes of a Life Cycle Assessment support companies to identify which

20   aspects of their processes are efficient, and where they can improve efficiency and to

21   reduce TBL impacts (UNEP, 2009). Besides, the perspective of the assessment can

22   differ with regard to the company´s goal with the use of Life Cycle Assessment: "it

23   does not explicitly say how this is done, what is the overall scope, or for what

24   purpose" (Robèrt et al., 2002). Depending on the goal definition, a Life Cycle

25   Assessment can be focussed on specific or broader TBL issues and life cycle stages.

26   The motives for executing a Life Cycle Assessment can differ from assessing the

27   impact on TBL issues, through the interpretation of improvement-options for product

28   design or process optimization, to product labelling (Azapagic, 2011). As can be seen

29   in Figure 2, this results in the positioning of Life Cycle Assessment in the centre

30   between extrinsically and intrinsically but towards the top according the complexity

31   of the strategy.

1   *3.3.3. What*

2   Life Cycle Assessment focuses on the life cycle of products or services. Through the

3   assessment of the processes constituting the life cycle stages Life Cycle Assessment

4   contains a technological orientation. The initial product data scope can be increased

5   with full life cycles of other materials that are used in the making of the product or

6   service (UNEP, 2009). The quantification of the impacts of the TBL issues of the life

7   cycle stages enables the identification of the most significant impacts contributing to

8   these stages. This can then be used to address these impacts for system improvements

9   or redesign (Azapagic, 2011). As can be seen in Figure 2, this results in the

10   positioning of Life Cycle Assessment in the lower part of the of the MCSA what-

11   graph with a spread of the time-axis.

12   *3.3.4. How*

13   The Life Cycle Assessment as an approach to quantitatively assess the impact of the

14   life cycle of products or services is a linear approach existing of four mayor phases

15   (i.e. definition of goal and scope, life cycle inventory analysis, life cycle impact

16   assessment and life cycle interpretation; UNEP 2009). A thorough Life Cycle

17   Assessment is primarily possible when people at the operational and tactical level

18   gather and analyse the big amount of data necessary to create the basis for interpreting

19   and taking strategic decisions. To enable the interpretation of life cycle data and

20   assessment outcomes, an understanding of TBL issues and life cycle stages is a

21   prerequisite: Life Cycle Thinking. Both are characterized by their complexity due to

22   wide and far-reaching impacts and close links between issues and stages (Azapagic,

23   2011). The application of Life Cycle Thinking itself can contribute to the

24   transparency and accountability, as mentioned for the Sustainability Reporting

25   approach, necessary to define the company´s efforts for sustainable development.

26   As a unique phenomenon, Figure 2 shows on two axes of the MCSA how-graph twice

27   an indication for Life Cycle Assessment. In this case both the quantitative assessment

28   method and Life Cycle Thinking were mapped as being both elements of the Life

29   Cycle Assessment approach.

30   *3.3.5. Where*

31   While setting the goal and scope is open to the company, it depends on their needs

32   what part of the life cycle will be assessed (UNEP, 2009). The scope of the approach

1 itself has been recently increased from the assessment of environmental and economic
2 issues towards social issues. By doing so, Life Cycle Assessment enables the
3 contribution to the full assessment of products and services within the scope of CS.
4 Consequently this increase in issues also results in a larger group of stakeholders to
5 engage with (Benoît et al., 2010). To enable the improvement of the TBL issues it is
6 necessary to drive fundamental internal changes in culture and structure (Azapagic,
7 2011). As can be seen in Figure 2, this results in the positioning of sustainability
8 reporting in the right part of the of the MCSA where-graph with a spread of the
9 strategy complexity-axis.

10 *3.3.6. When*

11 When applying the quantitative assessment of the impact of the organisation's
12 processes is complemented by the qualitative perspective of Life Cycle Thinking, Life
13 Cycle Assessment can support a backcasting process aimed at reaching a total
14 reduction of material flow (Robèrt et al., 2002). When combined with an
15 environmental management system life cycle assessment can lead to continuous
16 improvement of the processes and the organisation (ISO, 2009). As can be seen in
17 Figure 2, this results in the positioning of sustainability reporting in the lower left part
18 of the MCSA when-graph.

19 **3.4. CS integration approaches**

20 Figure 2 shows the three CS integration approaches covering the broad range of the
21 complexity of CS strategies of the MCSA framework. The mapping shows that these
22 three approaches are supporting the companies more with long term then short term
23 CS integration. Especially the why-graph, consequently why the company uses the CS
24 integration approaches, shows that the three approaches can support extrinsically
25 driven companies. The where-graph shows that companies can expect a CS
26 integration support from the three approaches with a broader scope than just the own
27 organisation. Especially the when-graph shows a clear difference between Life Cycle
28 Assessment and the other two approaches. Life Cycle Assessment can support
29 companies with project-based and short term CS integration instead of permanent
30 improvement and long term integration.

31

1
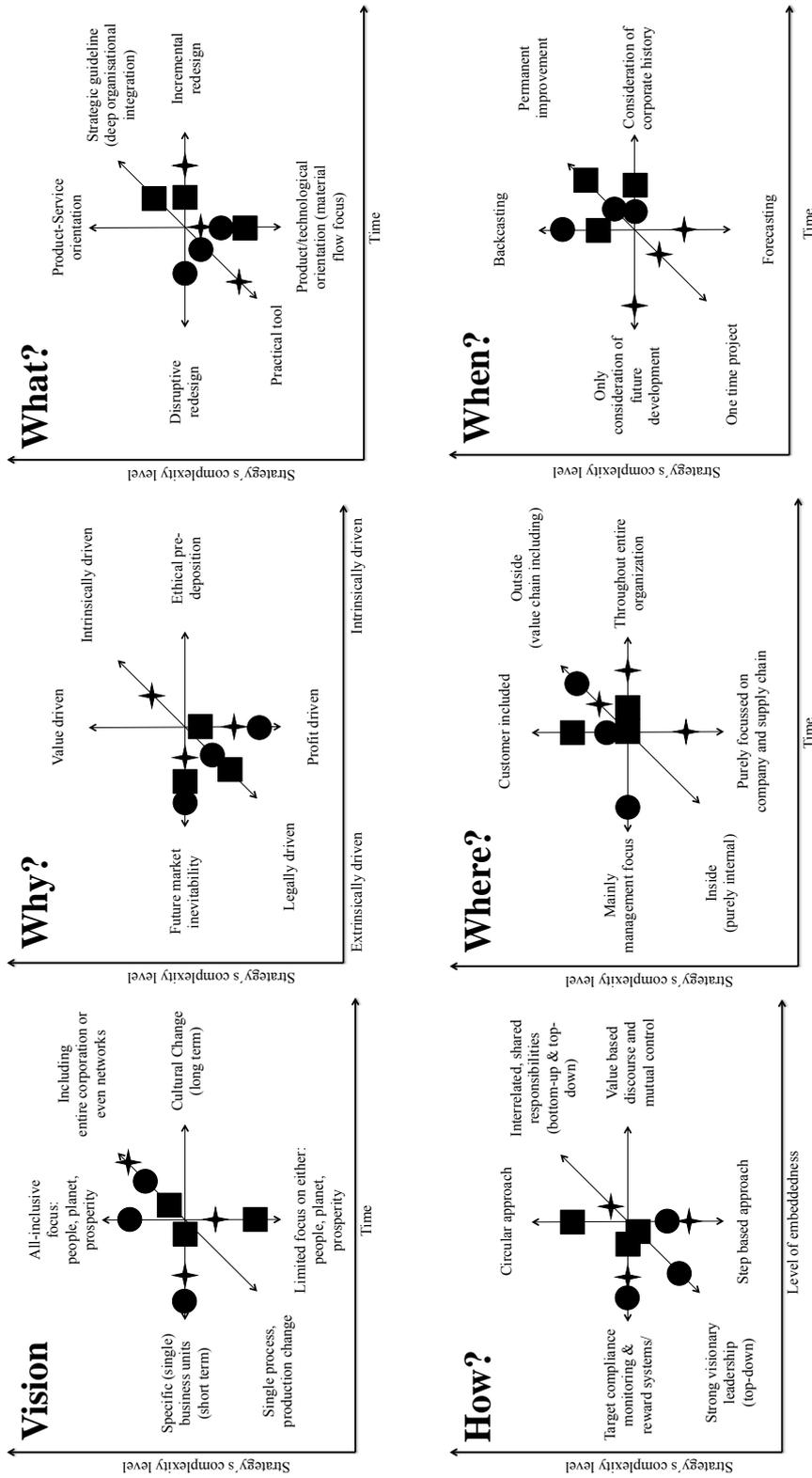
Figure 2 MCSA framework with CS approaches

- The circle represents sustainability reporting
- The square represents environmental management system
- The star represents life cycle assessment

The circles, squares and stars are centred on the corresponding axis

4. Discussion and conclusions

In this paper a literature analysis of CS integration and CS approaches is leading to the development of a framework. The MCSA framework was developed and applied to compare the intention of CS approaches. In contrary with existing approaches, the MCSA framework analyses the intentions of the CS integration approaches instead of mapping the approaches according to organisational structure as do existing frameworks (Baumgartner, 2013; Hahn et al., 2014; Lozano, 2012; Robèrt et al., 2002). To validate this framework the three most cited CS integration approaches are mapped through analysis of scientific and professional literature. This validation shows that the process of CS integration can also be analysed trying to understand the company´s and approach´s point of view. Within the MCSA framework the cohesion and density of the relationships between the different elements constituting the system (e.g. the people in the company, the processes generating the impact and the TBL issues), as mentioned in sociology (Putnam 2000; R.A.Scott 1976; Simmel 1955), management sciences (Bansal and Roth 2000) can be understood by the what- and how-graph. The adoption of the values resulting from this cohesion and density of the relationships, as mentioned in the organisational culture theory (Schein 2004) can be understood by the where- and when-graph of the MCSA framework. The overall value can be found in the vision- and why-graph. Finally, the integral control system to assure the right outcomes of the impacts, as mentioned in management sciences (Gianni and Gotzamani 2015) comes back in the when-graph of the MCSA framework.

Due to the uniqueness of every company and its business system, companies apply a mixture of approaches to support its CS integration process. Several scholars (Baumgartner, 2013; Hahn et al., 2014; Lozano, 2012; Robèrt et al., 2002) have set up frameworks to understand these CS integration approaches with an outside-in perspective. The MCSA framework was set up to complement the understanding of CS integration approaches by taking an inside-out perspective. The mapping of the three most cited CS integration approaches with the MCSA framework shows that these three approaches are supporting the companies more with long term then short term CS integration. Especially the why-graph, consequently why the company uses the CS integration approaches, shows that the three approaches can support extrinsically driven companies. The where-graph shows that companies can expect a

1 CS integration support from the three approaches with a broader scope than just the
2 own organisation. Especially the when-graph shows a clear difference between Life
3 Cycle Assessment and the other two approaches. Life Cycle Assessment can support
4 companies with project-based and short term CS integration instead of permanent
5 improvement and long term integration. In general it can be concluded that the three
6 mapped CS integration approaches can support companies with the integration of CS
7 with a high level of strategic complexity. Besides, the three approaches permit the
8 support over longer time periods.
9 For this paper the MCSA framework was validated with theoretical data. For
10 comparison with the empirical data, for example from case studies is recommended.

11 **5. Acknowledgements**

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'Past and future meets at present' - tradition at play in urban renewal:

a case study of Xintiandi, Shanghai

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Introduction:

'Xintiandi' refers to a shopping and entertainment precinct in Shanghai, located right at Shanghai's business heart. Sometimes dubbed as 'Shanghai's living room', Xintiandi offers leisure facilities of both local and international styles. Nevertheless, the precinct would not be as attractive to consumers as it is now, without a unique, traditional built landscape. In this precinct, buildings are kept in the form dating back to the early 20th century, the form called Shikumen, which is a typical folk dwelling style in Old Shanghai. Since its completion, Xintiandi has not only become a popular destination for both locals and tourists in Shanghai; its model has also been copied by other cities in China[1].

Obviously, traditional townscape is the main attraction of Xintiandi, which is also the case of other city rejuvenation projects in China. This seems somewhat at odd with the frantic development in all Chinese cities. Why does the notion 'tradition' draws public interest in contemporary Chinese society that seems fully engaged in the cause of modernisation? Or, from a different perspective, what is the position of tradition in our time, a time that is referred to as a globalized era? The building of Xintiandi, together with the consequent Xintiandi phenomenon, is also a topic for scholarly research, which includes a dedicated book by a Shanghai based historian[3]; as well as a number of scholarly journal articles by international researchers [4]. They have contributed to the literature on architectural and planning history, urban studies and tourism. However, it is worthwhile to explore the interaction between tradition and modernisation in a rapidly society amidst transformation, often reflected by urban renewal processes. This paper aims to explore the changed position of tradition in our times. It will contribute to literature on sustainable development, with a focus on the link between the past, present and future.

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[4] For example, He 2005; Wai 2006; Yang 2007; Ren 2008, Lu 2013.

The term traditional townscape in this paper refers to a historic inner city environment whose built form bears local, folk characteristics. With urban modernization, traditional townscape is disappearing quickly, replaced by modern development. Historic inner areas are transformed to meet contemporary consumption needs. Redevelopment of these areas often causes controversies. Critics are concerned about the loss of cultural meanings and the compromise of heritage values. In conservation discourse, traditional townscape and city modernisation are often taken as a pair of rivalries where modernization is seen as advancing at the cost of traditional built form because the latter is regarded as an obstacle. However, as the paper will reveal, the relationship between traditional townscape and the city's modernization goes beyond the familiar binary opposition.

It has been noted by some scholars that, in the globalised era, the established view of tradition as the repository of set customs, rituals and ways of life, has been de-stablised[5]. This paper argues that the relationship between traditional townscape and urban modernisation in developing societies, such as China, is more complicated than that of 'contestation' and 'tension'; in other words the pair do not simply stood in dichotomy or opposed to each other. As the case of Xintiandi will show, Shanghai's traditional townscape is deployed to supplement and justify the city's modernization process. Apart from contestations, 'collusion' is taking place between notions of tradition and modernisation. In the rest of the paper, I will first explore the conceptual position of tradition in the globalised era; then I will examine the revitalisation of traditional townscape in the process of urban modernisation, through the case study of Xintiandi.

The position of tradition in a globalised era

The literal meaning of the term 'tradition' is 'the transmission of customs or beliefs from generation to generation'[6]. Examining the root of the term, Anthony Giddens suggests that tradition basically means 'to transmit, to give something to another for safekeeping'[8]. The connotation of the term, from Giddens' point of view, can be seen in two major dimensions: transmission and continuity. While the definition of the term shows that 'tradition' is a process of 'transmission', we face the question about the content of tradition; in other words, the question of 'what is to be transmitted'. Although there is hardly a simple and explicit

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[5]See, for example, Alsayyad, N. 2014, *Traditions : the "real", the hyper, and the virtual in the built environment*, Routledge
[6] The Concise Oxford Dictionary, 2011, Oxford University Press
[8] Giddens, Anthony, 1999, BBC Reith Lectures: 3. Tradition, http://www.bbc.co.uk/radio4/reith1999/, accessed 15 January 2015

answer to the question, there appears to be a consensus that tradition is an entity consisting customs and beliefs. Then scholars' opinions vary in regard of what tradition means to our society. Edward Shils (1981) argues that 'it (tradition) is anything which is transmitted or handed down from the past to the present' [9]. In this sense, 'tradition' should not be seen as merely a slice of the past; it can be 'anything', yet it is not 'everything' about the past, as the process of handing down something from the past to the present does not take place in a wholesale manner. Perceptions of tradition form in contexts of societal changes and can become stereotyped. In the introduction to a landmark collection of essays on this topic, Eric Hobsbawm targeted a view about tradition: that 'the object and characteristic of traditions is invariance'. In such a view, the past to which traditions refer entails fixed practices, which means a constraint on present practices[10]. In this view, tradition is stagnated and backward, opposing to notions of 'change' and 'innovation'. Semantic interpretation of the term shows the view is an established one in our times. For instance, synonyms to the word 'traditional' include 'old', 'conventional' and 'historical'; whereas the antonyms of the term are 'new', 'original' and 'innovative'[11].

The stereotyped idea about tradition reflects society's obsession to progress and the neglect of the connection between the past and the present. Anthony Giddens observes that an anti-tradition sentiment stems from the 18th Century European Enlightenment, as leading thinkers such as D'holbach regards tradition as merely a shadow side of modernity, an implausible construct that can be easily brushed aside[12] . In post- Enlightenment eras the anti-tradition sentiments remained strong, and stretched right into the twentieth century. As Edward Shils noticed, 'W(w)hat we have inherited is as bad as can be'[13]. Shils considered the anti-tradition trend of thinking as problematic, incomplete, often falling in a paradox; because on the one hand, traditions as normative models of action and belief were regarded as useless and burdensome, whereas on the other, the operation of traditions was acknowledged and its results were admired (ibid). In his critique of anti-tradition thinking, Giddens pointed out that this perception indicated a single-minded pursuit of modernity with which people 'never intended a serious engagement with tradition and its role in society' – instead, they 'sought to

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[12] Giddens, Anthony, 1999, BBC Reith Lectures: 3. Tradition, http://www.bbc.co.uk/radio4/reith1999/, accessed 15 January 2015
[13] Shils, Edward, 1981, Tradition, London, Faber, p.3

justify their absorption with the new'[14] . Whereas tradition has been viewed in a negative light, regarded as representing the past in contemporary society, works by philosophers and historians such as Maurice Halbwachs and Eric Hawbsbawm are helpful to rectify this view. Their approach to the past is seen by Jeffery Olick as 'presentist' [15], engaged in three questions: What we do with the past; what the past does for us and what the past does to us[16] . It is arguable that the presentist approach to the past emphasises the connection between the past and the present, and that tradition represents such a connection, rather than the past itself. To recognise the role of tradition in the present society means to recognise the adaptability of tradition. Indeed, while acknowledging that 'invariance' is characteristic of tradition, Hobsbawm argues that tradition is not a frozen entity; rather, tradition allows adaptation and even invention. Hobsbawm points out that the adaptation, as well as the invention of tradition, takes places as a response to the weakening and destruction of old social patterns by the transformation of society. In other words, traditions are adapted and invented to suit new social purposes, in changed contexts[17]. In this vein, tradition can be adapted and deployed to legitimate the 'constant change and innovation of the modern world' (ibid) by suggesting a continuity and invariability from the past. Whereas modernity is considered as the break-away from the past[18], a perceivable expression of continuity from the past is vital to the legitimacy of modernisation processes at the present. Indeed, the adaptation and the invention of tradition are themselves innovative processes, as Hobsbawm puts it, 'I(i)n all such cases novelty is no less novel for being able to dress up easily as antiquity' [19].

The adaptation of any tradition is regarded as a construction process, which depends on what and how society memorises, therefore the adapted or invented traditions are the products of memories of the society – what is referred to by Maurice Halbwachs as 'collective memories'. Articulating the notion of invented tradition, Hobsbawm points out that tradition making can be a very creative process with which we choose the most symbolic and unique elements of past beliefs and practices, assessing their viability and usability against present needs, establishing connections between these elements and our present time[20]. This process

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[14] Giddens, Anthony, 1999, BBC Reith Lectures: 3. Tradition, http://www.bbc.co.uk/radio4/reith1999/, accessed 15 January 2015

[15] Olick, Jeffery, 2007, 'From usable past to the return of the repressed' in The Hedgehog Review, 9:2 (Summer 2007) p19

[16] Ibid.

[17] Hobsbawm, Eric & Ranger, T. 1983, The Invention of Tradition, Cambridge: University of Cambridge Press, p.4-5

[18] This point is made by Giddens, Anthony 1991, Modernity and Self Identity, Cambridge, Polity Press; and Berman, Marshall, 1982, All That Is Solid Melts into Air, Penguin

[19] ibid

[20] ibid

not only reflects the interests of the present society in the past but also signals the impact of the past on the present society.

Traditional townscape is the tangible representation of the connection between a city's past and the present.[21] The revelation of the position of tradition between the past and present helps us make sense of phenomena of the refurbishment of historic structures and streets in urban renewal. The globalised era witnesses a rapid modernisation and transformation of cities in developing countries, in particular Asian and the Pacific region, which is made possible by global capital flow, the increase of international agencies and global forms of communication. From a conservationist point of view, the transformation is threatening cultural traditions as the historic fabric of the city is disappearing, and traditional network of community is destroyed. Nonetheless, a dialectic analysis of tradition and modernisation would reveal that the binary is not necessarily one that contains tensions only. This means tradition and modernisation do not have to be the antipode to each other. While the contestation between tradition and modernisation deserves a thorough study, it will be beneficial to see the other side of the coin, that is, how tradition - most probably in its adapted form - helps to make sense of modernisation processes at the present. The following case study of Xintiandi in Shanghai aims to illustrate this less investigated relationship.

Shikumen: the built icon of Shanghai tradition
In 1986 China Post launched a set of fourteen stamps entitled 'Chinese vernacular dwellings', designed by Chen Hanmin, a Shanghai-born artist. Chen chose the image of a Shikumen style dwelling to represent his hometown Shanghai, because this built style is commonly recognised as the most typical living environment for the Shanghainese[24].

The emergence and development of Shikumen buildings paralleled with Shanghai's semi-colonial days. In 1843, after China's loss in the Opium War to Britain, Shanghai was opened as a 'treaty port' allowing for foreign trade and residence, which marked the beginning of Shanghai's semi-colonial era. Shanghai between the 1840s and the 1940s is now commonly referred to as 'Old Shanghai' in scholarly as well as popular literature.

Foreign settlement began in Shanghai after a land lease was signed by Chinese officials and the first British consul to Shanghai in 1843. In later years more land leases were signed

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[21] Alsayyad, Nezar. 2014, *Traditions : the "real", the hyper, and the virtual in the built environment*, Routledge
[24] Luo, Xiaowei and Wu, Jiang, 1997, *Shanghai Long Tang (Shanghai Alleys)*. Shanghai: Shanghai Fine Arts Press

between Chinese government and foreign consuls. Consequently, Shanghai was divided into three enclaves including the International Settlement, the French Concession and the Chinese City (the Old City). At the beginning, foreign settlements were not open to local Chinese but a change took place not long after. In 1853, a peasant uprising led by Little Sword Society broke out and the rebels troops occupied the Old City for 17 months. The uprising caused thousands of Chinese refugees to flee the Old City to flood into foreign enclaves for shelters. The influx of Chinese into foreign settlements not only ended the exclusive use of these enclaves by foreigners, but also caused a building boom within settlements. As a response to land shortage and the escalating land price, new residential buildings adopted the idea of Western terrace houses to maximise land use. Nevertheless, the early style of such row houses still retained some traditional Chinese architectural elements, the most distinctive feature being a stone framed gate[25] - called Shikumen in Chinese.

The Shikumen style was not of full Chinese origin but rather a mix of Chinese and Western architectural components. Its original model can be found in both Chinese courtyard houses as well as the Western terrace houses[26]. Shikumen houses were built in fishbone-like rows off main streets, the narrow alleyways between the rows were known as Lilong. For this reason Shikumen houses were also referred to as Lilong houses[27]. Until the 1980s, about three quarters of dwellings in Shanghai consisted of Shikumen structures. This built form and environment is considered as the seedbed of the cultural tradition of Old Shanghai. Haipai (Shanghai style) culture, as this tradition is commonly referred to, was in conjunction with, but in many ways breaking way from Chinese cultural doctrines. Seeking its origin, historian Hanchao Lu argues that Haipai is a cultural form that does not belong to either Chinese or Western cultural domains[28]. The development of Haipai culture parallels the journey of Shanghaiese accepting the presence of foreigners and the influence of foreign practices. Despite the initial hostility, fear, contempt and bewilderment, Shanghai locals proved open-minded and practical to imported ideas and practices. Arguably, Haipai culture as a new cultural tradition, is rooted in Chinese superstructure, and takes its shape under the influence of Western thinking and practices. Xiong Yuezhi, a renown scholar in Shanghai history, maintains that Haipai culture can be seen as the representation of 'the spirit of Shanghai',

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[25] Wu, Jiang, 1997, Shanghai Jianzhushi (the architectural history of Shanghai), Shanghai, Tongji University Press, p.42
[26] ibid
[27] For the convenience of reading and consistency, the term 'Shikumen' will be used throughout the paper, as Shikumen is regarded as emblematic of Shanghai's traditional built style.
[28] Lu, Hanchao, 1999, *Beyond the Neon Lights: Everyday Shanghai in the Early Twentieth Century*, University of California Press, p.184

Xiong argues that the collective characteristics shared by Shanghainese can be described as open-minded, innovative, entrepreneurial and practical[29].

The loss and revival of Shanghai tradition in societal transformations

Haipai culture took its shape while Western ideas and practices were adopted by Shanghai locals. The formation of Haipai culture is regarded as the response of Shanghai populace to the social transformation of the time. Haipai culture flourished during the so-called Old Shanghai period, namely, years between the 1840s and the 1940s, and became the core of the Old Shanghai legacy. After the regime change in 1949, however, Haipai culture lost momentum and began to fall. This is because, for three decades after 1949 China was under Mao's ideology and the whole nation was engaged in ideological campaigns against the Western imperialism and capitalism. History of the Old Shanghai was regarded as an epitome of China's humiliation under imperialist; not surprisingly, Haipai culture was seen as the product from either capitalism, imperialism or colonialism, or the combination of all three vices, therefore was despised and condemned.

China underwent another transformation at the turn of the 21th century, when the country was opened up to market economy. Economic reform and the opening up brought Shanghai back to the centre stage, with its former role as a world class finance and trade centre being restored. The arrival of new era evoked calls for the rethinking of the Old Shanghai legacy and Haipai culture. As a response, some pioneering research on the Old Shanghai[30] was sponsored by the Central government. Those research projects, for example the one undertaken by Shanghai Academy of Social Sciences, broke away from the Maoist class-struggle narrative to focus on the achievements obtained during the Old Shanghai period.

Alongside the flourishing research on the Old Shanghai is an enthusiasm with Shanghai's historic townscape. The enthusiasm is reflected by a growing list of properties under municipal protection. By the year 2014, 632 historic sites, 2138 buildings were listed as heritage properties; Apart from listing historic buildings for protection, the planning bureau of Shanghai Municipal Government also listed a number of 'historic precincts'. In justifying the move, Shanghai municipal planning officials and researchers argue that these areas are of

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[29] Xiong, Yuezhi, 2003, Shanghai Chengshi Jingshen Shulun (Shanghai City Spirit Review), Shilin, vol.5, 2003, pp.1-12
[30] For example, the Shanghai Academy of Social Sciences published *Jindai Shanghai Chengshi Yanjiu* (*Urban Shanghai in Modern Times: An Elaborated Study)*, a project sponsored by the Chinese government.

cultural significance to contemporary Shanghai, as they showcase cultural hybridity and a vibrant tempo of the city life in Shanghai[32]. From 1995 to 2015, this list has been expanded to include 44 'historic precincts' [33], including streets and neighbourhoods in the former foreign settlements. Among them is the Hengshan-Fuxing roads precinct, where the Xintiandi is located.

Xintiandi: a built icon of the connection between past, present and future

The Xintiandi precinct is at the heart of the former French Concession. Most residential structures in this neighbourhood are of typical Shikumen style. Benjamin Wood, the architect from Wood and Zapata in Boston, told his interviewer that Xintiandi project brought him to China for the first time, and that his initial impression of the future site for Xintiandi was overwhelming, as he had never seen such an architecture style like Shikumen: 'a vernacular architecture with some French motifs and organic elements'[35].

The project designers and their local consultants aimed to reconcile the seemingly tension between conservation and development, by converting a former Shikumen block into a commercial precinct and attract visitors with a Shanghai's traditional townscape[36]. This is also considered a practical solution to the massive costs of renovating the already 'sadly deteriorated neighbourhood'[37]. According to a well researched study, 1950 households in the neighbourhood were relocated in the preparation of the site for the development of the North block of Xintiandi [38]. Following the relocation, 25 per cent of existing houses were demolished and the remaining ones were either renovated or rebuilt for adapted use[39]. As if reflecting the revival of Haipai culture, Xintiandi project has strengthened the Old Shanghai image. Xintiandi's logo comprises key elements of a Shikumen: the stone gate frame, the black wooden doors, as well as the mixed style motifs. At the heart of Xintiandi is a museum

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[32] Shanghai Municipal Government, 1991, 2002, 2014, The Municipal operational guideline for the protection of heritage properties (Internal circulation)
[33] Shanghai Municipal Government Inventory of Historic Buildings 1991, 1997, 2000, 2004, 2014; Also the official website of Shanghai Municipal Administration for Planning and Land Resources, http: www.shgtj.gov.cn, access date: 23 May 2015
[35] Mina Choi Tenison: The architect behind Xintiandi, 2009, China International Business, October, http:www. http://www.minachoi.com/articles/benwood.php
[36] Ru, Naier and Ding, Ning, Shanghai Xintiandi: Xiao Ying Ba Fang Lai Ke De Cheng Shi Hui Ke Ting (Shanghai Xintiandi, a city's living room that makes every visitor feel welcome', Zhongguo Lvyou Bao 16 Jan, 2009, p.1
[37] Shui On Group: Shanghai Xintiandi, http://www.shuion.com/eng/sol/pptdev/xin.asp, accessed 28 Apr. 2015
[38] He, Shengjing & Wu, Fulong 2005, Property-led redevelopment in post-reform China: a case study of Xintiandi redevelopment project in Shanghai, Journal of Urban Affairs, 27:1, pp1-23
[39] ibid

'Wulixiang (Home)' as a complement to the built settings, emphasizing the continuity of the open-mindedness and cultural hybridity of the Old Shanghai days and the present.

Xintiandi has attracted controversies even before the project was completed. Xintiandi project has turned a crumbled neighbourhood of middle and lower-class housing into a sleek town for high end consumptions. To Shanghai natives, the renovated precinct seemed almost unrecognisable. Functional change of the precinct has been seen as typical example of gentrification of local neighbouhood. There is also a criticism that the everyday life of Old Shanghai is sanitised so that only the glamorous aspects of the past were exhibited whereas 'the mundaneness, messiness, scandalous and clandestine aspects of the everyday Shikumen houses of the past risk submersion'[40] (Wai 2006).

Conclusion

In the mid-19[th] century Shanghai was forced to open up to the outside world to become an international financial and trade harbour, its people were facing unprecedented societal transformation including changes to the city as well as their way of life. The transformation brought about a set of new practices, including a new housing style, which became Shahghai's vernacular built icon. Xintiandi project selected this style, Shikumen, to embody the Old Shanghai and its cultural tradition. The mix of international and Chinese, historic and contemporary elements at Xintiandi indicates the continuity of the Haipai culture and its core attributes: open, innovative, entrepreneurial and practical.

At Xintiandi, traditional elements are not deployed simply to provide a slice of Old Shanghai, but to make Old Shanghai relevant to the present. In other word, 'tradition' here is an agent connecting the past and the present. The phrase Xintiandi in Chinese language means 'new heaven and earth'. In a shallow sense, the term refers to the physical transformation of a dilapidated neighbourhood, a visible facelift; in a deeper sense, the term is adopted to express a restored confidence in Shanghai, the Haipai culture and the spirit of the great city. The slogan on the billboard at the main entrance to the precincet reads, 'Xintiandi, where yesterday and tomorrow meet'. Apparently 'yesterday' and 'tomorrow' in the slogan are put in a figurative use, meaning the past and the future. Although a 'new heaven and earth', the landscape of Xintiandi is intended to tell the Old Shanghai legend, and to show the continuum between the old and the new, where the past is an essential element to make the present meaningful.

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[40] Wai, A.W 2006, Place promotion and iconography in Shanghai's Xintiandi, Habitat international, 30:2, 245-260

The rise of design for deconstruction – a cradle to cradle approach for the built environment

Danielle **Densley Tingley**, Julian **Allwood**

ABSTRACT: Across the globe there is an imperative to reduce greenhouse gas emissions. One strategy to do this is to reduce the embodied carbon of the built environment, in conjunction with reducing in-use emissions, which is where the majority of current legislation targets. Embodied carbon reduction can be achieved through material reuse, but there is currently little supply of reusable materials. To address this, new buildings could be designed for deconstruction and material reuse to increase future reuse supplies. This paper outlines a series of case studies that have been designed for deconstruction, highlighting the perceived commercial benefits such as faster construction times and increased flexibility in-use. The case studies range from temporary structures to permanent buildings, and cross over a range of building types. The suitability of different materials is discussed, as well as the changes that will need to occur for this technique to move from the niche into mainstream construction. The rise in case studies that have been designed for deconstruction suggests that there is sufficient knowledge and commercial benefits for design for deconstruction to be integrated into an ever increasing number of new buildings. Additional research and development of new flooring systems would however assist in this approach. The paper concludes with some key lessons drawn from the case studies that could be adopted by projects seeking to incorporate this approach.

KEY WORDS: Design for deconstruction, embodied carbon, material reuse

1   INTRODUCTION

The construction sector consumes vast quantities of materials on a yearly basis, with 56% of steel and almost all cement used within the built environment. The environmental impacts of these energy-intensive materials in construction are considerable, amounting to approximately $3.2GTCO_2$ in 2008 for these two materials alone [1]. Reducing the use of these energy intensive materials therefore represents a significant opportunity for emissions reduction, which in the global context is increasingly important. At an EU level, there is a proposal to reduce greenhouse gas emissions by 40% relative to 1990 levels by 2030, building on a reduction commitment of 20% by 2020 [2]. With the UN Climate Conference in Paris fast approaching there are likely to be further commitments to reduce emissions across the globe. However, to date the built environment focus has been on in-use emissions, but greater reduction can be achieved if embodied emissions are addressed in tandem.

One strategy to reduce embodied emissions is to increase reuse of materials, thus extending the life of components where the energy has already been expended. However, many current buildings yield few reusable materials, particularly where the structure is concerned, as they were not designed with future reuse in mind. To address this, buildings constructed today could be designed for deconstruction to facilitate future reuse. The structure is a particular area of focus as steel and concrete are two primary materials utilised, thus making it an energy intensive area of buildings. This paper outlines the progress that has been made in the field of design for deconstruction, documenting the case studies that have arisen, particularly within the UK, and outlines some key lessons as this approach continues to develop and move towards mainstream construction.

2   STATE OF THE ART

There are a number of design strategies that can be incorporated when designing for deconstruction, as outlined in guides by Addis & Schouten [3], Morgan & Stevenson [4] and Guy & Ciarimboli [5]. These set a framework of key strategies such as ensuring connections are reversible and accessible, providing 'as-built' drawings, layering building elements by lifespan, developing a deconstruction plan, identifying component types and utilising a standard grid. Morgan & Stevenson [4] also outline the particular opportunities for the four main structural materials: stating that steel structures that show no signs of deformation should be suitable for reuse; the use of lime mortar rather than cement is recommended for masonry structures; structural timber reuse is highlighted as rare, but specifying a 'fixing-free' zone should enable large sections of timber to be reused; whilst concrete is most often down-cycled it is explained it could theoretically be reused but cement jointing, post-tensioning and hidden reinforcement could prohibit reuse. However, a case study by Dorsthort & Kowalczyk [6] outlined a reinforced concrete apartment block which was designed for deconstruction, disassembled and two new, smaller apartment buildings constructed from the components. Steel strips or bolted connections were used to join the pre-cast elements, with the exception of the floor, which had grouted connections that were cut through at disassembly. Some repair work was required to the different elements before reuse. This case study demonstrates what is possible with design for deconstruction and reuse of reinforced concrete structures. In recent years there has been an increasing emergence of the technique across a range of construction types, perhaps building on work from the earlier mentioned design guides. The next section outlines a series of case studies of buildings that have been designed for deconstruction.

3   CASE STUDY RESULTS

In this section a series of case studies are examined, exploring the motivations for the inclusion of design for deconstruction within the project. A mixed approach has been taken to document and analyse the case studies, using information from literature, informal discussions and interviews with those involved in the design and construction of these buildings. For each case study detail is given on the data sources, the range of benefits are clearly outlined, as well as any barriers encountered.

3.1   THE LONDON 2012 OLYMPIC PARK

The sustainability approach to the whole London Olympics site and future legacy meant the need for permanent and temporary structures was questioned at the start of the project, leading to many of the temporary structures being designed for deconstruction and reuse. As outlined by Aukett [7], Temporary Venues and Overlay Sustainable Design Guidelines were developed for use, which included aspects such as designing with materials in mind e.g. using materials with high reuse potential or designing for temporary removable infrastructure e.g. utility pipes above ground rather than underground. This set a backdrop for successful implementation, with several temporary, fully reusable structures constructed. This contrasted with the existing buildings across the site, which according to Carris [8] had negligible reuse rates. Although six steel portal frames were reclaimed for potential reuse, their actual reuse was not tracked. This type of structure is most commonly designed for deconstruction and reuse, with companies such as Portal Power, in the UK, incorporating portal frame reuse as a key component of their business model. Three Olympic venues are discussed in more detail in the following sections, the Olympic Stadium, the Water Polo arena and the Shooting Arena.

3.1.1   Olympic Stadium

The original design and intention of the 2012 Olympic stadium was that it would be downscaled to a 25,000 seat stadium after the games, with the top tier of 55,000 seats being designed for

deconstruction to facilitate this, as shown in Figure 1. This is reflected in the choice of tubular steelwork for the upper tier seating and reinforced concrete for the permanent lower tier seating. The motivation here was to provide an adaptable stadium to suit changing needs after the Olympic Games, any environmental savings from future reuse of the steel would be seen as co-benefits.
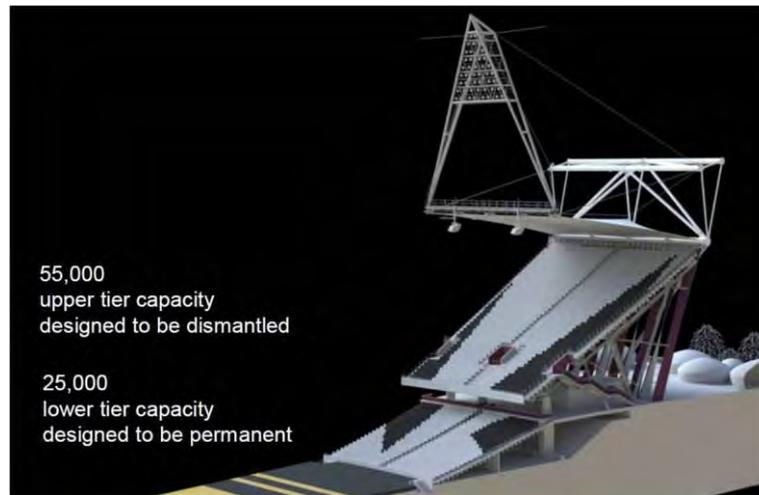
Figure 1: Olympic Stadium, design intentions [9]

Now, over two years after the games the stadium is being adapted into a 54,000 seat football stadium, home to West Ham United, who will lease the stadium for 99 years. In conjunction, it will become the national athletics centre, as well as hosting other sporting and music events. It is suggested that the adaptation could be costly, with up to £190 million being spent to reduce the seating capacity, add a retractable seating system (to cover the track during football matches) and expand the roof to cover all the seats [10]. The existing roof and floodlight towers will be deconstructed and a cable net structure constructed to support the new, 84m span, roof [11], [12]. However, it appears that the upper tier will be retained for use in the new stadium, with a likely lifespan of 99 years (the duration of the lease) it is unlikely that this steelwork will be reused in the future. This case study highlights the uncertainties when dealing with structures, the incorporation of a deconstructable upper tier of seating allows for the future possibility of a significant reduction in capacity, even if it is not being utilised now.

3.1.2   Water Polo Arena & Shooting Arena

Information about these two case studies was gathered from discussions with ES Global in approximately ten meetings over the last year. The 7,200m^2 temporary Water Polo Arena was constructed in six months to host the 2012 Olympic water polo competitions. It housed two pools – one warm up and one competition as well as 5,000 spectator seats and support facilitates [13]. Constructed from ES Global's truss system with a PVC covering, the structural envelope was leased so the client did not have responsibility for the structure after the Olympics. The leasing element amounted to approximately £1.2 million of a total project value of £25 million. As well as designing and constructing the arena, ES Global deconstructed it after the games. The entire truss system is suited for reuse and now forms part of ES Global's stock of materials for use in temporary events structures.

ES Global also supplied the temporary venues for the shooting competitions, with the same truss system and PVC being utilised to construct arenas for the 25m range, 50/100m range, the finals range and the Screen for the Trap and Skeet Range [14]. These venues were temporarily placed at the Royal Artillery Barracks in Woolwich which returned to normal use after the games.

The major components of both of these buildings, the steel trusses, supporting structure and PVC envelope form part of ES Global's stock of materials for temporary buildings. After use, the structural steelwork will be shot blasted, tested, certified and the used in other temporary buildings. Such is the recording and tracking system that the life of an individual truss could be followed, showing the different buildings in which it's been used, as well as the maintenance requirements over its life. This demonstrates that with the appropriate design and paper trail design for deconstruction and multiple reuse is feasible. Indeed, elements from these two 2012 venues could find their way into the temporary arenas that will be constructed for the Rio Olympics in 2016. These two case studies highlight the benefit of a set design system and reuse procedure, making reuse a reality. When one company holds the stock of materials, traceability is not an issue, and reuse is simple within a set system, although this will impose some design constraints. The next step for permanent buildings is to ensure traceability over longer time periods and across different companies so designers in the future have sufficient information to reuse the components.

3.2   CHOBHAM MANOR

Information on this case study was also gathered from the above mentioned conversations with ES Global. The project is a temporary marketing suite, situated on the Olympic park for a new housing development, it was built in eight weeks by Suitebox, a spin out of ES Global [15]. A foundationless system, with a full deconstructable steel frame, the structure can be removed from the site at end of life leaving no trace. 80% of the joints are constructed using a unique pin-jointing system, with only the vertical joints bolted, which makes construction and deconstruction much faster than a traditional build. The majority of steelwork in the 5m grid frame is reusable at the end of the five year life, whilst on this project the fit-out is not fully deconstructable, but standard design according to the clients request. For future projects a completely demountable system is currently being explored.

In an embodied carbon comparison between this structure and a 'standard' marketing suite Chobham Manor has a lower embodied carbon, largely due to the foundationless system. Studies, such as Densley Tingley [16], have shown that on low rise structures the substructure can account for a substantial proportion of the structure's embodied carbon, thus this innovative system, removing the need for traditional foundations, instead utilising metal spread pads on compacted ground can have a significant impact on the overall building's embodied carbon. Figure 2 shows the steel frame structure, foundationless system and finished building, demonstrating that a temporary building and look just like a traditional permanent building. The potential for marketing suites across the world to be constructed in this manner, used, deconstructed and re-deployed to new sites is significant. The costs were found to be equal to those of a traditional build and significant carbon savings are to be found based on the methodology proposed by Densley Tingley & Davison [17]. The smaller scale of this case study suggests that this type of system could be utilised for low-rise, short span construction, for example housing. The proprietary pin-jointing system is crucial for faster construction speeds, but may limit future reuse to the same kit of parts – likely constructed/deconstructed by the same company.

Figure 2: Chobham Manor, the steel frame, foundation pad, and finished buildings, photo credit: Rob Brown Photography

3.3 VULCAN HOUSE

This case study is based purely on a literature review. It is a BREEAM excellent rated office building has a steel framed structure (Figure 3), which unusually has been designed for deconstruction, utilising bolted connections throughout the steel frame. A report by the Office of Government Commerce [18], states that this is to facilitate the future removal of the building. However no specific mention of the reusability of the individual elements is mentioned; with 950 tonnes of structural steelwork in the building there is the potential for a good stock of reusable components in the future. A regular grid pattern of 6m x 15m and 9m x 15m standardises recoverable section lengths; with columns standardised at 203 and 254 UC sections [19]. However, one restriction could be the incorporation of a composite metal deck floor. Removing the floor beams from the deck without damage could be problematic, potentially limiting future reuse to the columns alone. The inclusion of design for deconstruction within this project demonstrates that only subtle tweaks are required to mainstream steel construction for future reusability to be significantly increased, even if as a first step columns alone were recovered. Alternative flooring systems such as pre-cast concrete units or cross-laminated timber floors, as investigated by Okutu [20] could prove to be suitable replacements to further advance future structural reuse potential.

Figure 3: Vulcan House, Sheffield, UK

3.4 WAREHOUSES

The following paragraph is based on the series of interviews with ES Global. Traditional portal frame warehouses lend themselves to being designed for deconstruction and reuse. However this is intentionally incorporated into few of these structures at present, and whilst the steel frames require subtle design changes, for example bolted connections rather than welded and bolting of columns into a floor plate rather than encasing the ends in concrete, there are more complications for the building envelope. This type of structure can be limiting for daylighting of the internal environment, which is

causing one global distribution company to explore warehouse solutions with clear spans in the roof structure to incorporate roof lights. Suitebox is developing a solution that utilises their truss system from the water polo and shooting arenas with enables a clear 70m span warehouse, with the potential for large sections of the roof to be constructed from ETFE to allow good daylighting of the internal space. The system will be entirely deconstructable, using composite insulation panels and PVC covered polyester to provide the building fabric, with glazing also incorporated. Additional benefits of this system will include the ability to easily reduce or extend the structure depending on space requirements –as well as moving a section of the building to another location. The rapid build speed is perceived as a huge commercial benefit as the facility will be operational quickly. The only section of the building that will not be reusable is the ground floor slab, which will be the standard concrete floor slab utilised by the distribution company as it runs various operating systems along it. This example demonstrates that adaptability and flexibility in-use is seen as a key benefit of design for deconstruction. This was also reflected in a study by Moynihan & Allwood [21] with a major UK retailer who explored designing a supermarket structure for deconstruction; here the ground floor was also key, with the need to keep a level surface for smooth passage of trolleys. In this example, the flooring system lead to a 16% cost increase compared to a 'traditional' build and so the solution was not pursued further. However, again flexibility in-use and the speed of construction were seen as significant benefits.

4   DISCUSSION & CONCLUSIONS

The series of case studies highlight the increasing emergence of design for deconstruction within the UK, from temporary to permanent structures there seems to be great potential for integration of this strategy into a range of buildings, thus significantly increasing the materials available for reuse in the future. Whilst these case studies were all steel framed structures, other structural materials can also be designed for deconstruction and reuse, as outlined in Section 2. There are several modern examples of timber structures that have been designed for deconstruction, as documented by WRAP [22] including, Chartwell School, California, Marks & Spencer's Cheshire Oaks store, England, and Glencoe Visitor Centre, Scotland. The frame and building envelope of Chartwell School was designed for deconstruction, with an exposed timber frame and structural insulated panels utilised, reversible connections were provided, with a structural properties labelled on the elements and a deconstruction plan drawn up. The Glencoe Visitor Centre has a similar strategy with an exposed timber portal frame and bolted or screwed joints. Cheshire Oaks has longer spans and thus uses glulam beams, with exposed bolted joints for ease of disassembly, it also incorporates hemcrete panels - a wall system which can be deconstructed. An end of life plan has been detailed for the building, showing the quantities of salvage materials and instructions on how to reuse, resell or recycle the elements.

This range of case studies with the majority of the building fabric also designed for deconstruction highlights the potential of material reuse across a range of building elements. This is a key strategy to reduce the demand for new materials, and thus reduce the emissions associated with them. Durability of materials is key when considering future reusability, which is why structural elements are ideal as they generally have the longest lifespan within a building. However, the ability to deconstruct and upgrade individual elements, e.g. services or insulation, when required is also a valuable proposition, which could extend the useful life of buildings and maintain minimal in-use energy. This in-use flexibility combined with other co-benefits such as faster construction times are key strategies for many more commercial projects, where the future environmental benefits are secondary. This raises the question of what else needs to change in mainstream construction for design for deconstruction to be integrated into a greater number of projects.

For steel framed structures, as picked up in in the Vulcan House case study, composite floors can be problematic and limit future reuse, whilst Moynihan & Allwood [23] outline a reversible shear connector which uses a bolt rather than welding, this would both be labour intensive to remove all the connections and would leave beams with a significant number of holes in their top flange. This highlights a need to investigate alternative floor systems that could be used in a fully deconstructable and reusable building, which is an area for further work. The other change that is required is bolted joints between steel sections, this is often not an issue, and discussions with a global steel fabricator suggest that this is both easier and more cost effective than welding on-site. Concerns were raised that architects prefer the visual aesthetic of welded connections, but follow-up interviews with a range of architects revealed this to be subjective and only in a small proportion of cases, with a preference for bolted connections in some cases as well. Added to this, the architects suggested they would only comment on structural connections if the steelwork were exposed. This suggests that a transition to bolted connections is already underway, facilitating the move towards design for deconstruction.

The case study examples are predominately low rise, with Vulcan House the tallest structure at seven storeys, this may suggest that the strategy particularly lends itself to this sub-set of construction, or that this sector is more commonly a pilot for new ideas. The applicability of design for deconstruction of taller structures should also be considered as part of further work. Clear documentation and dissemination of case studies and the benefits, as well as discussion of the different approaches, hopes to raise awareness of those in the construction sector of the viability of this strategy. Design for deconstruction will need to be deployed at scale in order to provide sufficient reusable components in the future. The increasing number of case studies over the last decade suggests that the construction industry is starting to adopt the idea and that this could become a key strategy to reduce the whole life carbon of buildings and thus assist meeting greenhouse gas reduction targets.

The following key lessons, taken from this set of case studies, can be applied to future projects targeting this approach:

- Design for deconstruction could apply to the whole building envelope and structure
- Steel or timber construction lend themselves to the approach
- Provision of reversible connections, pin-joints were shown to also decrease construction/deconstruction times
- Traceability of structural elements –e.g. marking structural grade on the elements
- Standardised grids and element sizes may increase future reuse potential
- A single company developing and owning a deconstructable system can facilitate reuse due to more standardisation and retained value in components
- Co-benefits such as future flexibility and faster construction times may be better drivers than the potential environmental impact savings

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The role of natural materials in low carbon architecture

Theme: 4: Sustainable Land Use & Sustainable Cities

Track: 4b: Sustainable Architecture, Design & Infrastructure

Justification of paper: The majority of research on natural materials is specific to a single material and solving a particular technical challenge. This paper takes a much wider scope and questions the overarching role natural materials could play in constructing lower embodied carbon buildings.

Purpose: This paper debates the role that natural materials could play in forming the built environment.

Theoretical framework: Research has shown that embodied carbon can typically account for 30% of the whole life emissions of a house and 45% of whole life emissions for an office (Sturgis & Roberts, 2010). This percentage contribution will only increase as legislation moves buildings towards lower operational energy. Embodied carbon is therefore the next likely target for reduction. Reducing this will require using less energy intensive materials within construction (Allwood & Cullen, 2012); one option to achieve this is to replace these with natural, low carbon materials. However, in the UK, construction with natural materials is far from mainstream, this paper explores if they have the capacity and potential to become a common building type.

Results and Conclusions: The following natural building materials are explored: timber, straw-bale, hemp-lime and rammed earth. Different material properties and embodied carbon are compared and contrasted, leading to a discussion on the building or component type they are best suited to. The availability and potential competition for land-use is also considered, with the implications this might have for significantly scaling up the use of these materials debated. Finally the architectural quality and phenomenological feel of these materials is pondered.

Implications for Tipping Points: To effectively reduce carbon emissions the whole building life cycle should be targeted, including embodied emissions. One solution is to increase the use of low carbon materials. This paper explores the extent to which natural materials could form a part of the built environment, moving the built environment towards a sustainable future.

Key words: Timber, straw-bale, hemp-lime, rammed earth

BEING ON THE EDGE OF A SHIPWRECK IN PLANNING DECISION-MAKING: DESIGN AS AN ANCHOR AND FUTURE MAKER

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ABSTRACT
This paper investigates recent attempts to Masterplan tourism planning and landscape development of the town of Port Campbell based on the concept of community-driven tourism planning. The Masterplan process generally sought to upgrade tourism facilities and to re-plan a core part of the Great Ocean Road corridor the proposed scheme little engendered community confidence nor encouraged the use of local community public resources of the Masterplan proposed outcomes. While analyzing broad range of aspects of the township and the national park, this design thesis attempted to identify the possible initiatives and landscape development models and also applied landscape narrative theory to focus on tourism experience making and landscape with layers of content embedded such as local history, environmental stories that would enrich the experience. The need for this paper is to articulate an alternate and more robust approach to designing on the fragile coastal edge whilst engendering community engagement and ensuring their aspirations are addressed. It is main contribution is both offering an alternate process but also demonstrating the use of design as a vehicle to reach this outcome. The research gap addressed is to challenge a conventional planning practice that was very much constrained by upper-level Melbourne-based parochial and managerial imperatives than lower-level community aspirations and perspectives.

KEYWORDS
Sustainable development, landscape planning, community engagement, tourism development model, tourism experience design, Great Ocean Road

1   INTRODUCTION
In 2013 Parks Victoria commissioned McGregor+Coxall to prepare an integrated Masterplan for a major segment of the Great Ocean Road corridor affectionately known as 'Shipwreck Coast' [5]. Located on the southern edge of Victoria, looking across the Bass Strait to Tasmania, the 28 kilometre-long study area, from Princetown to the Bay of Islands, includes spectacular limestone stacks and coastal formations, of which the Twelve Apostles and Loch Ard Gorge are among Australia's best-known coastal features, drawing millions of visitors per year. This narrow, fragile coastal environment, encompassing the Port Campbell National Park, the Twelve Apostles Marine National Park, The Arches Marine Sanctuary and the Bay of Islands Coastal Park, is also home to a rich and diverse natural and cultural heritage, townships (Princetown, Port Campbell, Peterborough) and their communities. The soft limestone of the coast is constantly changing and undergoing erosion by the elements, aided by wind and water causing stacks of limestone or entire cliff faces to break down. This natural process has historically caused constant realignments to the Great Ocean Road but also narrowing the actual designated national and coastal parks to 6 and 20 metres in width at some places. While many recreational and educational opportunities and experiences exist along the Shipwreck Coast, its hinterland and its towns, they are not universally promoted.

While the intrinsic nature and high scenic character of the place have made it a much-visited attraction, parks Victoria, local residents and tourists alike all have concluded that the current approach to visitation, management and engagement in this corridor is not sustainable and a new approach is required. It is also clear that the area suffers from low economic yield despite the large number of visitors each year, with length of stay being short and expenditure per visitor low. Despite this visitors place considerable demands on Parks Victoria and community infrastructure and this environment leaving little contribution to sustaining the environment or the regional economy. Visitor's perceptions of the Shipwreck Coast record that, while it is clearly a world-class attraction, it currently over-promises and under-delivers on its overall visitor experience [5]. For example, the current over two decades old infrastructure barely meet of demand of fast growing tourists numbers, current dated tourism facilities largely concentrate around the Twelve Apostles with few unconnected walking trails leading to a concentration of tourism activities are only occur within or immediate surroundings of those attractions, and the average day visitor stops at the Twelve Apostles for about forty minutes only and spends about eighteen cents through an entry levy [6, 10].

A key conclusion by visitors is that there is a stark and widening gap between what people are looking for in their experiences and what is currently being offered by way of accommodation, "local place" and produce, as well as the logistics of getting to the coast, navigating and interpreting it. This leads to a low return for the local and regional economy and little benefit for the local communities.

In response to the above factors, qualities and values, the new master plan sought to present "a bold, innovative and visionary plan for the future of this world-class landscape" [5: 4]. Included was a package of initiatives that sought to initiate fundamental change in the quality of the environment and tourism experience to:

- *begin to repair and heal the fragile natural landscape;*
- *strengthen the character of the local townships and their relationship to the parks; and*
- *increase the economic return and associated benefits to the region and the State of Victoria* [5: 4].

Where previous masterplans in the region [11] examined single sites or considered tourism in deference to environmental protection, the Shipwreck Coast Master Plan sought to consider the relationship differently. Sites, facilities, townships and the coastal hinterland were to be planned and managed in an integrated manner in order to enhance the visitor experience and support long-term regional economy growth. Thus, the master plan sought to not change visitation patterns dramatically but incrementally through a comprehensive suite of measures to address gaps in tourism offerings and to builds on the Coast's comparative advantages.

The Masterplan's aim was therefore expressed as:

> *Enhance the Shipwreck Coast as a distinctive, cultural and remarkable world-class destination, underpinned by the character of its hinterland and local towns coupled with the conservation and protection of its national, coastal and marine parks.*
> - *Conserve and protect the national, coastal and marine parks*
> - *Support and enrich the coast's local and hinterland communities*
> - *Create a distinctive visitor experience for a world-class destination*
> - *Benefit from tourism*
> - *Create long-term value for Victoria, its south-west region and the local communities* [5: 5].

In terms of this paper, it is argued that a key flaw is the 'top down' institutional approach taken in the masterplan inquiry, and the lack of real listening to the township residents, in particular the Port Campbell residents that are considered in this paper.

During the first stage of design process, few insights were drawn on the paper from the comments articulated at the community meetings and several workshops held by the design team from which the draft vision and principles for the second stage were derived [5]. While five parallel objectives were derived at the second stage, with associated place principles that explained what are the important elements need to be emphasized and weaknesses need to be mitigated, little to no attention was given to the townships and their potential contribution and role in enhancing visitor appreciation and expenditure other than assuming that they would and could serve as accommodation venues. Moreover, some key directions listed were highly abstractive, the design implications of which were obvious (such as 'strengthen each town's physical connection with park'), but which informed and underpinned stages three and four.

Stage three involved a thorough physical and statistical analysis of several key aspects (tourist experience, change traffic patterns, linking walking trails and hinterland) and attempted a holistic approach of organizing currently available elements (such as tourist lookouts) where large number of visitors assemble and disperse to create a transport hierarchy. While this process included successive iterations, the Stage 4 design derived from Stage 3 master plan strategies was driven by Experience + Wayfinding, Access + Movement, Environment + Landscape values resulting in a series initiatives and recommending corresponding strategic locations including townships and tourist attractions for activations and interventions [5]. These initiatives and activations such as lookouts, tourist pads, drew largely from inspirations offered by the Norwegian National Tourist Routes Project and the new Stonehenge Tourist Centre Project. Stage 5 involved design refinement and reinforced a 'top down' institutional approach that satisfied Parks Victoria's requirements, as paying

client, and not local requirements, as permanent users [1, 5]. Thus the masterplan and design approach predominately focused upon upper-level imperatives has generated considerable controversy from the local communities, particularly Port Campbell.

Although the design investigation was robust, the resulting masterplan beautifully illustrated, conflicts were not ignored and dogged the consultant, but it is clear that little local compromise occurred.

In summary, Parks Victoria [5] believed that:
1. *Overall consideration:* that strategic planning should focus on tourism-product development-orientated initiatives, such as the Twelve Apostles, and that a reconsideration of the role of the three townships should occur including access reorganization to explore the potential of hinterland tourism product range such as accommodation, farm culture tours, wind taste activities etc., rather than the assets of the existing towns themselves;
2. *Design process:* a conventional community engagement, including community consultation, design workshops and public commenting on the plan draft, would acquire a sufficient level of comment from stakeholders and address issues and concern during the engagement process;
3. *Economical:* to identify possible initiatives, locations where necessary to permit and enable infrastructure and private investment including tourist pad, high-end accommodation etc., to disperse economic benefits instead of concentrating them in one or two spots;
4. *Environment:* protection of the fragile environment and minimization of impact from the tourism industry; and,
5. *Tourist's experience:* adopt a tourists' experience focused landscape design approach to underpin quality tourism product development and content including walking trails, lookouts and bicycle tracks etc.

In contrast, the Port Campbell [8, 12] community believed that:
1. *Environment:* that 'careful design with the fragile ecosystem' to enable accommodation and activation establishment, and that these inventions would only speed up the degradation of the environment they are so dependent upon resulting irreversible damage of the environment;
2. *Economical:* that the overall 'fragile and sensitive' natural habitat is the tourism product together with the 'isolated beauty', and by enabling a 'world class' upgrading would inevitably heighten the capital return required from such investments directly impacting upon long standing small and medium size business that could not compete, and as a consequence the very nature of Port Campbell as boutique tourism resort village character will vanish; and,
3. *Planning approach:* that the Masterplan should explore the whole region as a holistic tourism product instead only focusing upon the Shipwreck Coast enabling linkage to the hinterland area, in the belief that it is the hinterland's lack of planning and infrastructure development for tourism that is causing an uneven benefit distribution.

Figure 1: Image source: [5].

2   OBJECTIVES/METHODOLOGY/SCOPE
In this paper, the design applies the general approach of community driven tourism landscape planning informed by above mention factors and aspects. It also draws upon the assumptions that have made, resulting in *evolvable design approach* [13]. For this analyse the village of Port Campbell has been selected to demonstrate the approach and outcomes rather than reviewing all three villages.

The approach:
- identifies the urgency level of challenges needs to be dealt with, in other words problems have to be solved; identifies community strengths and weaknesses to seek tangible projects that can be favoured by the community in which to generate a sense of ownership;
- identifies the advantages that can be explored without structurally interfering with the physical environment;
- seeks long term community involvement in possibilities that harness community passion and energy to incrementally create a healthy competitive business environment;
- exam institutional objectives to find the possible common ground.

Accordingly, the following assumptions and questions were prevalent.

Both sides (the community and the Parks Victoria) agree that the environment is very sensitive [5, 8, 12]. Increasing tourism pressure urgently needs to be dealt with. The benefits should be more evenly distributed to the hinterland rather than concentrated in the Twelve Apostles precinct. Simply identifying initiatives with little community involvement creates limited capital game that potentially destroys the existing long standing business model in the community [1]. Visitors experience and tourism content definitely need to be enhanced and enriched. *The questions* are then, is the controversy created by a 'top down' design approach from Parks Victoria appropriate? Can landscape planning can find a common ground by plan and design from community perspective?

In terms of layers, site analysis and assessment of what is out there, *the urgent issues are:* the Great Ocean Road has geological risks that require urgent road re-alignments [6, 10]; there is a need to facilitate new accesses that link hinterland communities to the Shipwreck Coast; there is a need to upgrade township infrastructure to strengthen the role of Port Campbell town without change its character [12]. And, above all, a minimal disturbance to the environment and habitat approach is required [4]. The community is concerned about the invaluable experience of the local tourism industry and that no comparison in the category in the region, the boutique characteristics of town that has evolved over generations -- 'The storybook of the town might be dusted but is still there' – the highly unified consensus among the community over the issues, and that vegetation conservation has been pro-actively undertaken by the community for years [1, 2].

Nature, geographic advantages and existing infrastructure elements that can be captured include the fact that the town is located at a centre point of the Great Ocean Road and also a major intersection for regional routes. The town and its Foreshore is protected by the Headland, located on the eastern side and cliff face on the western side, however there is no direct linkage to both side over the creek mouth. The Headland currently offers no use and wasteland appearances, yet is a perfect example of an apostle formation arising from nature forces onto this Bass Strait edge in real time motion [8, 10]. The unique coast line vegetation in this location offers different habitats [4].

The weaknesses of Port Campbell include the 'un-miss-able' apparition of Port Campbell due to a road bypass; that from the east Port Campbell can only be viewed after passing over high ground; the sudden viewing of the town from the west despite no obvious signage; the north and west road merging with tall vegetation that obscures a view of Port Campbell; that while eastern walking trails link with the Twelve Apostles they end on the Headland and do not enter before into Port Campbell, whereas the trails at western side of the creek ended on the cliff face [5, 6].

The Foreshore facilities were built decades ago; provide seating, shower, a strip of lawn, a drinking fountain and phone box, but with no shade. The surf club building is a formidable building mass for visitors and its two stories provides function services for 200 capacity. Both visually are tired and outdated and in contrast to national park facilities. Yet, these assets are owned by the community and community driven tourism development opportunities.

Port Campbell's tourism structure has peak and off peak seasonal shifts, corresponding with summer and winter seasons as reflected in accommodation pricing fluctuations resulting in an unstable employment, economy and inefficient use of tourism resources, etc. The winter season has been considered by Parks Victoria as not the best for tourism travel, yet it is the peak travel season for northern hemisphere visitors.

With projected future tourism numbers from international market, the perception of peak and off peak, which created the contrast between two seasons, needs to be reconsidered.

4   PROPOSED EVOLVABLE DESIGN

The *evolvable design approach* proposes several initiatives at three main sites; the Port Campbell Foreshore, the Headland, and the East town entrance:

- the Foreshore is considered the centre of the town necessitating the old surf club building becoming the connecting node and hub to accommodate functions including café, information centre and cycling while retaining its traditional surf club use. Critical in its location, and in the town's topography, while re-positioning its value in the town the design reconnects tracks and trails on the both side of creek by proposing board walk extensions and a bridge. In addition, the beach waterfront design introduces facility and structure 'flows' that draw into the Club House and Foreshore 'magnet'.
- creation of a landmark and a 'coastal wonder' comprising a coastal botanical garden southeast of the town to act as an additional sub-node for the entire landscape plan and a main hub for the national park offices.
- a Headland open board celebrating the theme 'Road to The Past', that utilizes a former section of the Great Ocean Road that used to pass across the headland to demonstrate the overwhelming force of nature, that is also linked to the Foreshore area the 'Coastal wonder'.
- all three are linked by the 'thread', a circulation system.

Figure 2: Re-generation through 'way finding'. Image source: [13].

This evolutive design approach results in a 'must go' that offers several options for visitors [13]. The thread is the backbone of this landscape design and planning with most of the building and landscaping work taking place along it. It reconnects the old broken trails and tracks, also form a formal landmark for Port Campbell that offers all visitors a sense of arrival and sense of welcome through landscape. The Headland open board park links the bay and the botanical cross over as the interface between wild nature and the town. Trails and track from here to the cross create many possibilities of experience. Views here are sometimes obscured, sometimes wide open with many textural changes of ground materials stones, gravels, and boards that offer unexpected, yet exciting experience by using all senses.

The narrative of the Park focuses on the 'Road to The Past' theme [13]. It includes an elevated platform designed to allow visitors be able to see the former Great Ocean Road with replanted vegetation and edges highlighted by horizontal luminaires. A continues narrative of the story of the, the history of the region and the geology information is displayed along the boardwalk platform to explain and depict this former apostle-

forming process. The design incorporates the fragile geological of the Headland, seeks to avoid all caves below and projected cavities; permits no heavy structures and requires that all platforms are of a light suspended structure; directs the boardwalk structure to only 5m in weight to minimize plants and fauna disturbance.

The Foreshore area involves renovated waterfront infrastructure including a built-up – lawn seamless link to the beach through ramps. Included are a timber board amphitheater to create a natural cozy feeling, new shops and cafes offering views for both ocean outside of bay and the foreshore area, a connecting with the Headland Park by a weathering steel tunnel-like structure that funnels visitors to the top that provides shelter and gives a sense of approach for visitors, a refuge with prospects all rounded.

On the northwest side of foreshore and the creek mouth, the design proposes to renovate and transform the surf club building into a multi-function venue. By recognizing advantages of its location, the design focus

three sides that the building facing, the road, the beach and the creek. Each side has a specific task; the beach side serves as the major elevation that highlights the area with sets of curved perforated steel panels allow the wind sweeping past. Infinite possibilities of lights and shadow are cast into the interior. Stay inside or outside on the beach boardwalk, both are tempting. The foreshore side serves as the tourism information centre and it is another space transit tunnel pass the building that link the foreshore area and the creek band board walking, the building entrance of foreshore side embrace people as they pass through it and transform their mind between two sides, because they about to entering a new journey across. The creek-side entrance connects with the crossing bridge to the west side of trails. The Foreshore building therefore becomes the anchor of the foreshore and a true centre that links all the possible routes in and out of the town.

The new main hub of the national park has regard for location to become a landmark, but also an interchange where the Great Ocean Road disperses traffic, permitting changes in speed limits and car harmonization, facilitates new methods of tourist transport, and adds another attraction node reflective of the Roads' environmental design qualities. Included is a plant-fauna bridge to link nature and enjoin two different ecosystems, using architecture to link different function, and creating a botanical centre node from which paths radiate through themed botanical plantings. The bridge also offers a café, gallery, high-end accommodation, conference facilities, etc., and is a hub that centralizes all layers of traffic for the entire national park and the garden needs the community to keep planting and caring.

The following diagrams depicts these proposals and the circulation flows:
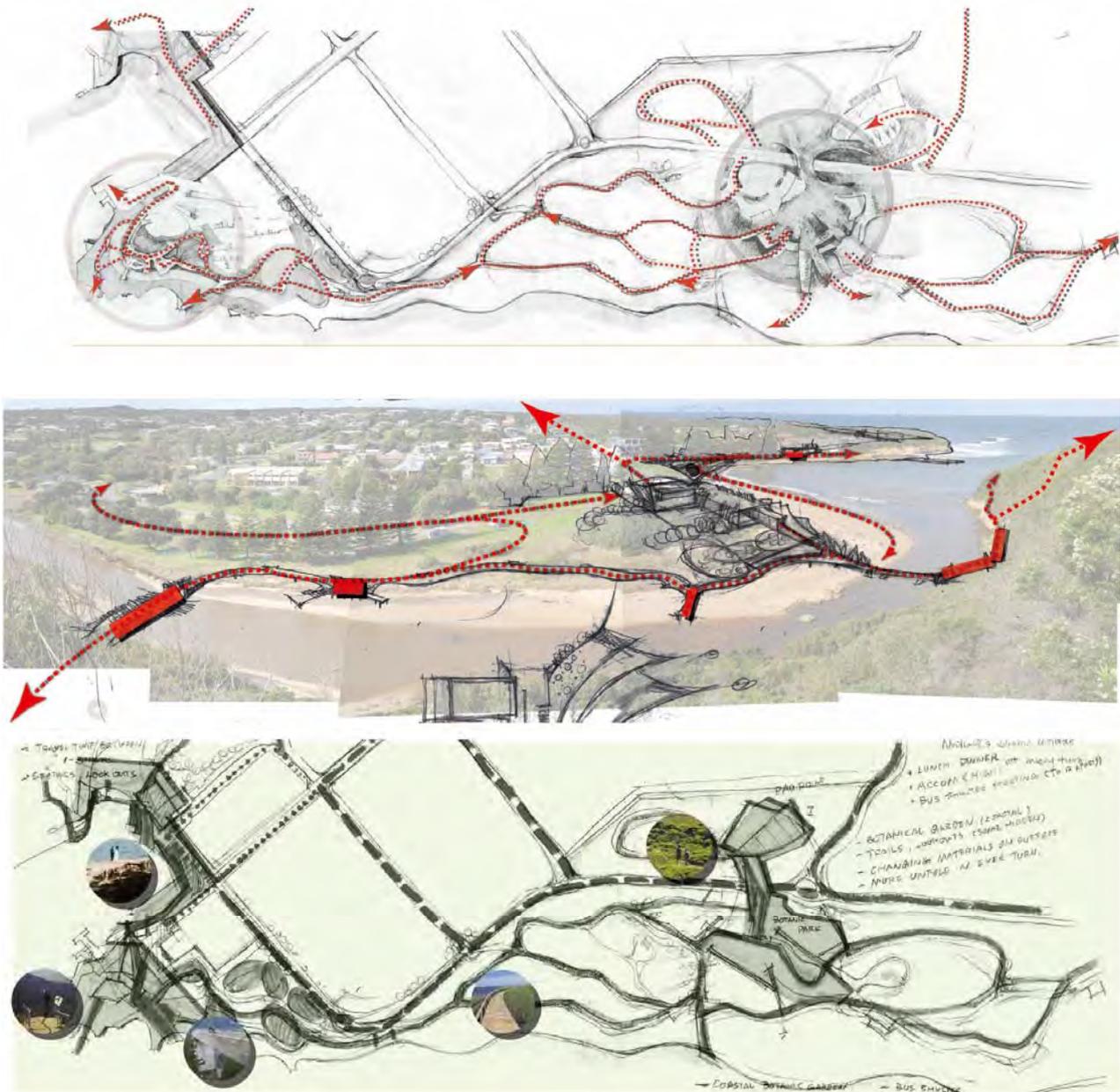
Figures 3-4 Image sources: [5].

5   RESULTS

While the new draft Shipwreck Coast Master Plan [5] addresses many aspects facing the Great Ocean Road corridor between Princetown and Peterborough, the Plan will inevitable disturbance to the local economic character of the landscape and its villages. Thus, the Plan is a political and social issue as well as a physical infrastructure renovation tool. While the local communities have offered their experience and wisdom in the Plan's engagement process they have commonly expressed serious concern against an imposing idea from institutional perspective being driven by Parks Victoria. Designers have always had discretion to choose their point of view having regard to various perspectives whilst serving the client, stakeholders and nature. In this example, a tangible credible platform to voice the community perspective is needed for them to compete in the middle ground with the institution perspective and offer an alternate physical landscape and human healthy and sustainable direction.

Community driven design should not be a standard procedure that expects a series meeting and workshops that would source common and collective support and approval from a local community [1], especially where the communities have relevant industry experience and understand the gravity of major implications of the proposed Master plan upon their environment and economy. Good intentions and purposes have not receive satisfactory feedback in this case. Identifying achievable and community owned initiatives is the key to this approach. A project requires long term efforts from the community, instead of a 'quick fix' approach to a

problem that will not only will empower the community and create a sense of ownership, but also will yield more resilient outcomes especially to those places where environment is extremely sensitive and the business dynamic is in balance. In other words, an *evolvable design approach* is needed [13]. While shifting traffic and traffic infrastructure will inevitably reshape the old paradigm economically and environmentally, it may be wise to focus on the implicit problems present instead of creating a new model and a new set of problems.

While eco-tourism planning celebrated nature as being environmentally sensitive of nature it can also be over exploitive of nature [2, 3]. Nature does not give us a second chance. The contrast between increasing pressure from an economic market that desires to host greater and greater numbers of people also results in greater needs to for accommodation and quality road infrastructure and associated services. This conflict trajectory cannot be easily mitigated by merely introducing more investment, nor constructing a design that claims 'eco-friendliness'. Instead, it is essential to identify and recognize those available resources in order to repackage tourism products in a longitudinal perspective that enriches the health of the host landscape as well as its residents and visitors alike. In this instance, as pointed out by the community hinterland linkage and tourist experience design is essential to allow visitors to better plan their diverse trips, otherwise, places like the Twelve Apostles would only benefit from commuter transport companies carrying return express daily visitors from Melbourne. Moreover, from the community's and the Plan's perspectives, while the current accommodation facilities are well prepared to cater visitors to stay, but there are little well-planned activities for visitors and most of are car-dependent activities negating the possibility for people to choose to stay. Hence, the *evolvable design approach* suggests that initiatives should focus on exploring the possibilities of empowering attractions around the town nodes and improving linkages to other attractions.

In this example, the *evolvable design approach* offer a continuous narrative approach to respect the primary narrative, enriching it but not letting it deteriorate and loose the essence of its construction and values to epitomize its essence.

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A study into energy saving of lighting system and visual comfort in an open area office

Abstract

Globally office buildings use a significant amount of energy and electrical lighting accounts for a large proportion of total energy use in these buildings. Furthermore lighting is an important parameter for workplace environment in the field of occupant satisfaction and increase productivity.

Improve environmental sustainability and reduce energy consumption in existing building in one hand and improve quality of indoor environments and user comfort on the other hand, have become a critical objective for architects, designers and engineers.

This study aims to study on lighting performance of an office building in the field of energy consumption and indoor environmental. An experimental test was conducted in an open area office from 19 to 29 July 2011 in an open area office. During the test indoor illuminance level and electric lighting energy were systematically measured and analysed. Moreover to evaluate the quality of the indoor lighting environment and visual condition, 118 office workers were requested to fill out a questionnaire based on workplace productivity after each test.

1. Introduction

The building sector consumes typically one-third of global final energy consumption, which means it is responsible for about one-third of total energy-related carbon dioxide (CO_2) emissions [1]. As a result, reducing energy consumption has become an agenda to minimise heavy environmental impacts of buildings. Office buildings are one of the biggest energy consumer and carbon emitters within this sector, accounting for about 50% of the total energy consumption for non-domestic buildings [2-3].

Final energy consumption of lighting accounts a significant amount of total energy use in office buildings [2-4]. On the other hand, lighting quality is an essential part of occupant comfort and occupant satisfaction in working place environments and visual comfort plays an important role in increasing working productivity by enabling employee to perform their work comfortably and efficiently [5-6].

Therefore, lighting energy consumption in offices buildings investigations should include the lighting visual performance to avoid visual discomfort for occupants. This paper presents a qualitative and quantitative approach, focusing on energy consumption and user satisfaction in order to optimising lighting system for an open area office in Tokyo, Japan.

2. Objective/ Methodology/Scope

The objective of this study is to optimise lighting system of office buildings in terms of energy efficiency, lighting performances and visual comforts. A field investigation was carried to measure available lighting level, investigate visual comfort of occupants and monitor lighting energy consumption in an office.

An open area office (Fig.1) with the area of 850 m^2, positioned in 4th floor of building complex was selected as a case study. This building, located in Akasaka one of the busiest commercial and residential districts in Tokyo is surrounded by commercial buildings.

Fig1. Office where the test was carried out

A field investigation conducted from 19-29 July 2011, consisting three main parts: measurement of lighting level by mounting lux logger; distributing questionnaire survey among office workers enquiring about individual and lighting quality; and observation and recording of lighting energy use data. The test was carried out in 4 different situations considering sky conditions, internal illuminance and natural lighting availability (table 1).

Table 1. Details of lighting measurement

	Schedule	Daylight availability through blind condition	Artificial lighting brightness (illuminance)	Weather condition
Condition1	19-20 July	Close	300 lux	Rain
Condition 2	21-22 July	Close	300 lux	Mostly cloudy
Condition 3	25-26 July	Open	300 lux	Mostly sunny
Condition 4	27-29 July	Close	500 lux	Rain

Fig 2. Lux logger used for lighting measurement

Artificial lighting system of the office was adjustable between 300 lux to 750 lux during a day. In an ordinary working day, available lighting level was changing between 350-450 lux in working areas and 450-500 lux in corridor and meeting areas.

9 lux loggers with the range of 0-2000 lux were used to measure and record the lighting level. Interval recording time was adjusted as one minute for each logger. To avoid disturbing the staff, the lux loggers (Fig.2) were fixed above the partitions in 140 cm elevation. For mounting the loggers and lighting measurement, office area was divided into 3 main rows considering the daylighting availability and artificial

lighting level according to the numbers of lamps in different areas. The map of lighting circuit and the location of lux loggers are illustrated in Figure 3.
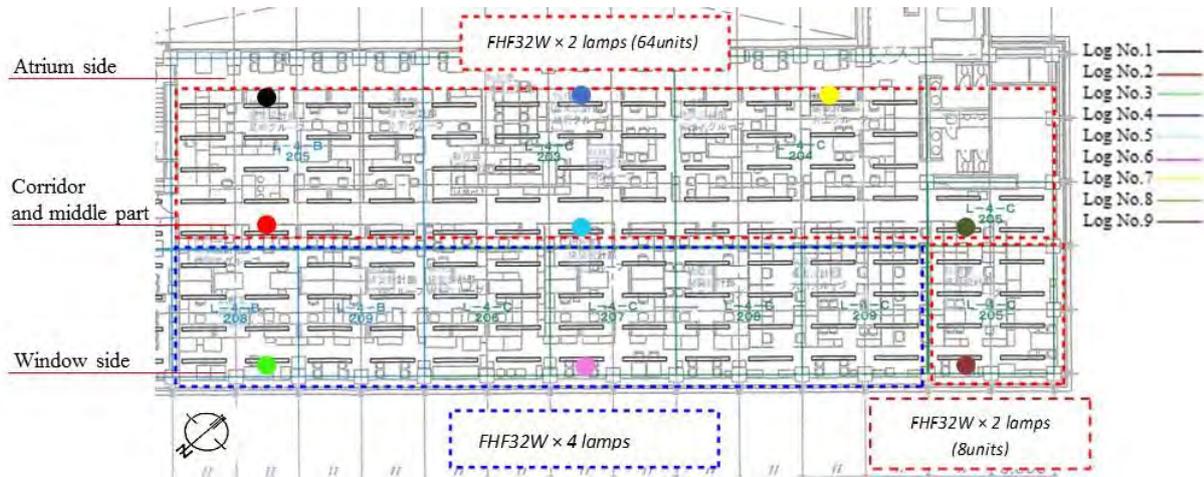
Fig3. Details of office layout, lighting circuit and place of lux loggers

In order to evaluation the indoor lighting environment and assess the level of visual comfort during the test, questionnaire survey was conducted adopting subjective evaluation technique called SAP system (subjective Assessment of workplace Productivity) [7]. 118 office workers, 88% male and 12% female, were asked to complete SAP questionnaire 5 times; first time a day before starting the test and 4 times during the test. Lighting energy consumption was monitored by office service system during the test.

3. Result

3.1. Lighting measurement results

Figure 4 illustrates the lighting measurement results in 4 different conditions. During the test it was asked to turning off the artificial lighting during lunch time (12 noon to 1 pm).
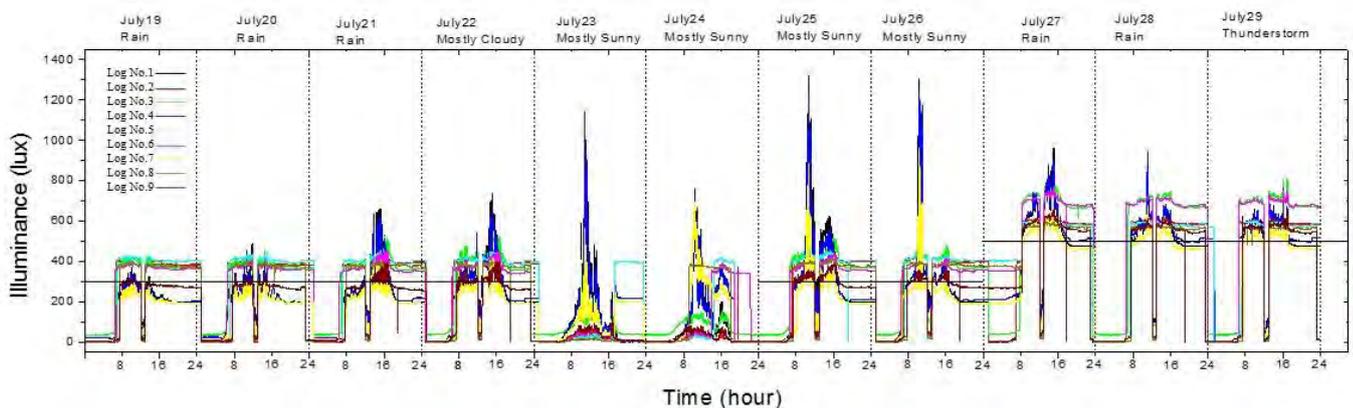
Fig4. Summary of lighting measurement results

Measurement of lighting level in condition1, 19-20 July, was carried out under rainy and dull sky. The blinds were asked to be completely closed during these 2 days and available brightness of lighting fixtures was adjusted at 300 lux. Recorded lighting level indicated that the available internal illuminance in window side

and middle part of office was above 400 lux. However, due to lack of solar radiation in this testing condition, in atrium side with fixtures including 2 lamps, the average lighting level was below 300 lux. In comparison with condition1, because of high solar radiation in condition 2 the average of lighting level in atrium side was higher during the day time but still the lighting was not sufficient in the evening after 6 pm.

In condition 3, on 25-26 July, which was conducted under sunny sky, the blinds were requested to be opened during the test. As a consequence of daylighting availability and high solar radiation the average internal illuminance of entire office was higher than 400 lux. During the morning especially in atrium side, the ratio of brightness part of view was excessive and could cause visual discomfort. Same as test condition 1 and 2, there was lack of lighting at atrium side after 6 pm. Condition 4, was conducted under rainy and dull sky and closed blind condition and the lighting fixtures were adjusted at 500 lux. The average internal illuminance in the office was above 600 lux which is higher than standard level for working place environment and could result in glare visual discomfort for employees.

3.2. Questionnaire survey responses

Figure 5 summarises questionnaire survey result on lighting environment during the test perceived by employees. One day before beginning of the test office workers were asked to answer the same questionnaire which is shown as condition 0 in Figure 5.

More than 60% of office workers believed that lighting environment plays an important role in the office to perform their work comfortably and efficiently. The result of questionnaire survey indicates the preferred illuminance level related to visual comfort and productivity of occupants of the office. According to survey result, 88% of office workers spending most of the time at their desk, therefore, the quality of lighting at the desk is a significant factor to evaluate the visual comfort and lighting performance. In all 5 conditions, regardless of internal illuminance level, more than 60% of respondents believed that the lighting level is quite appropriate at their desk. The level of darkness is less and the level of brightness is higher in condition 4 which lighting fixtures were set to 500 lux. There are similarities in evaluating the level of lighting brightness at room and working desk, because the staff generally filled in the questionnaire at their seats. Roughly more than 50% of office workers were satisfied with the lighting environment in each test conditions. Comparing to other conditions, the level of dissatisfaction is higher in condition 3. Glare of lighting equipment in condition 4 and closed blind in condition 0, 1 and 2 were determined as the most unsuitable objective source in lighting environment.
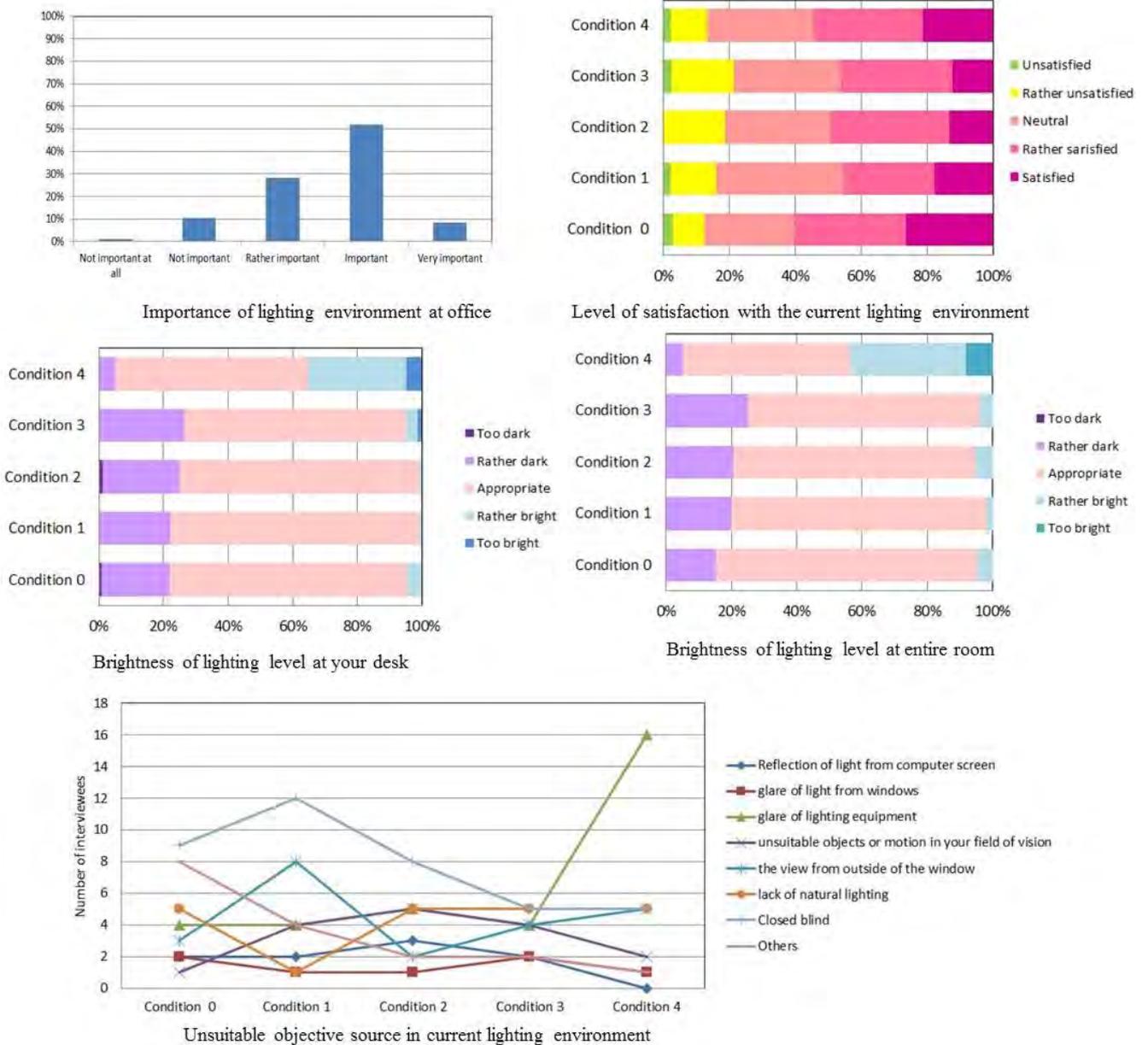
Fig5. Summary of questionnaire survey results

3.3. Lighting energy consumption

Figure 6 shows the hourly average of lighting energy consumption for various conditions during the test. The average lighting power consumption per unit area for 3 conditions by 300 lux illuminance availability, was almost constant and equal to 9 w/ m^2. For condition 4 which lighting fixtures were adjusted at 500 lux, the average lighting energy consumption was 11.5 w/m^2.
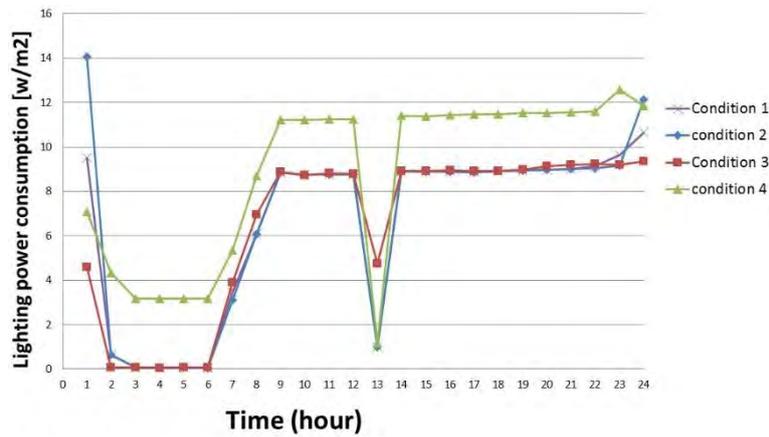
Fig6. Lighting energy consumption for various conditions

4. Discussion

The purpose of this study was to optimise lighting of workplace areas in terms of energy efficiency, visual comforts and performances. A field investigation of open plan office, carried out 19-29 July 2011, indicated that there is a close relationship between visual comfort and the available internal illuminance in working places. When office is neither bright nor dim the level of satisfaction with the lighting environment is high. Monitoring the lighting energy consumption revealed that when the illuminance level of lighting fixtures increases by 1.7 times, the energy consumption increases about 20%.

5. Acknowledgments

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GOLD FOR THE GOOD OF THE GREATER LOT: AN INDIGENOUS NOTION OF AND PURSUIT FOR SUSTAINABILITY

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ABSTRACT

The paper looks into the aspirations of members of an indigenous community to carry on with their livelihood into the future, protect their natural resources, and fully control the exploitation of the minerals within their ancestral land. Indigeneity and locality are played out in the villagers' notion of and pursuit for sustainability. The value of 'fair play' emerges in their justification of guarding their resources and territory. They articulate clearly their ethos that to 'do right' means to ensure that benefits of natural resources like minerals accrue to those who live on and nurture the land. Being embedded in a cash economy, they depend on gold mining to earn income. Thus, gold mining activities have intensified in recent years in the village. The 'tipping point' involves the critical locus at which the villagers must ensure they too must play fair towards adjacent communities whose livelihoods also depend on fragile water sources, but are threatened by the villagers' current mining practices.

1   INTRODUCTION

This paper aims to contribute to a better appreciation of the intricacies of social sustainability by examining the pursuit of sustainability by indigenous peoples whose livelihood includes a combination of farming and gold mining. The community is Mainit, a village with a population of 1,067 (NSCB, 2010) who belong to the *Bontok* people. The *Bontok* are among the major ethno-linguistic groups in the Cordillera highlands of the northern Philippines. Like many of the indigenous inhabitants of the Cordillera region, the people in Mainit assume the appellation 'Igorot' (Chaloping, 1996; Finin, 2005; McKay, 2006; Scott, 1974), a term with a long history imbued with resistance to foreign subjugation during the Spanish colonial era, and defence of ancestral territory and resources during modern times. In this paper, the value of 'fair play' emerges as a key element of the villagers' definition of sustainability. Indigeneity is played out in their attempts at maintaining well-being. Fair play is a core justification of the villagers' duty to secure their resources.

The minerals industry of the Philippines comprises two major sectors. First is the large-scale corporate sector, which includes Filipino-owned and foreign-controlled companies that undertake huge mechanized industrial operations. Second is the 'small-scale' sector, which subsumes scores of thousands of individuals and hundreds of loose miners' organizations or groups who, unfortunately, are associated with 'illegal' operations. The majority of them lack permits to carry out their activities. The present paper focuses on local-traditional small-scale mining in Mainit, a *barangay*[1] (village) within the municipality of Bontoc, Mountain Province.

2   OBJECTIVES/METHODOLOGY/SCOPE

Objectives

In line with the theme of this conference, this paper discusses a specific 'tipping point'-- a juncture in which mining practices in Mainit are showing changes which some villagers repudiate. The few villagers who are opposed to certain mining practices are calling for urgent responses. The needed actions, which are re-echoed by some sectors outside the village, make up the positive tip that must happen lest un-sustainability takes place.

Methods

This paper is based on data generated by a research that utilised mainly qualitative methods such as semi-structured interviews and focus group discussions. Research participants included male and female workers

who have carried out activities associated with gold mining, heads of households, community elders, and barangay officials[2]. In addition, the research team also looked into life histories of selected participants in gold mining to highlight specific aspects of their working lives and key challenges they have faced. Data gathering took place in November 2014 to January 2015. Discussions included impressions of villagers about 'sustainability'. In March 2015, the author conducted a consultation with village elders and barangay officials during which she presented key research findings for comments or corrections.

Definition of terms

In the Philippines, small-scale mining has several forms configured by varying historical-cultural and geographic-ecological circumstances. Based on entry and participation, there are at least two extreme types: a) 'local-traditional', and b) 'migrant-gold rush'. The former is locality-based, in which a specific ethno-linguistic group in a particular community began the venture and presently comprise the majority of mining participants. This type is restrictive in which geographical belonging and genealogy warrant access and participation. Meanwhile, the migrant-gold rush type involves tens of thousands of miners, largely migrants, who draw themselves to certain mining sites to scamper for the chance to earn 'jackpot' incomes. They include sojourners who transfer from one site to another. They are guided by what is known as 'hit-or-miss' schemes which involve going to one area then leaving in case production prospects are bleak, and moving to other areas where there may be more promising production.

In preparing the questions for discussion with research participants, the author has to adopt a working definition of sustainability. Thus for a start, the author took this broad and simplistic meaning of sustainability: the capacity to continue functioning or doing something. This basic definition incorporates the element of futurity, a key component of the most widely accepted definition of sustainable development, defined by the World Commission on Environment and Sustainable Development (1987, Chapter II.1), i.e., "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

3 RESULTS AND DISCUSSION

The broad and simplistic definition of sustainability, as noted above, served as a point of reference for conversations with research participants. In describing their economic activities and livelihood in the village, the research participants offer details to expand this working definition. They emphasise the need for ensuring the continuity of their activities indefinitely while they talk about the benefits resulting from engaging in farming and mining. The ideas of 'continuity' lead to their impressions about what it is that must be 'sustained' (i.e., maintained or continued), and how.

As discussions focus on resources in the village, research participants make references to entitlements and rights to these resources. They explain that their resources -- not only the farms on the surface but also the minerals underneath -- must be protected to ensure a future in which well-being continues. They then talk about their families and their village as the rightful recipients of benefits that these resources offer. Research participants bring up their insights and observations about past problems and current constraints to ensuring 'continuity of well-being'. As will be shown below, this understanding of sustainability takes an ethical perspective.

Farming and complementary economic activities

The people in Mainit have always been traditional wet rice cultivators. Like their neighbours within the broader Bontok culture area, social duties and economic commitments in Mainit have revolved mainly around the rice paddy (*payew*). This has been the case since time immemorial, with community rituals accentuating various phases in the agricultural cycle. It has been said that almost everyone in a Bontok village is born to do farming (*in-samar*) particularly rice cultivation in the paddies. All households have rice paddies to tend. Some households are engaged in swidden gardening (*uma*) along hill slopes usually located farther from main settlement areas. A swidden garden is usually a part of a forest or grassland that has been

cleared of original vegetation to make the site available for growing crops like beans, corn, sweet potatoes, among others. A number of adult men engage in a few non-farm occupations that bring in cash to the households. These include carpentry within the village or in nearby barangay. Other paid jobs include stonework (*in-tuping*) sometimes within Mainit particularly in restoring embankments of rice paddies; at other times, they are contractual jobs carried out in urban areas, which involve erecting retaining walls for public road works or stone cladding and landscaping for private estates.

Ismol iskeyl[3] mining and gold-related activities

Gold mining (*in-valitok*) is a venture that some households in Mainit have increasingly depended on for income. Gold mining consists of sifting for alluvial gold in streams and other waterways, a type that locals refer to as *barkis*. Gold mining also involves excavations in specific sites to build tunnels (*usok*). Compared to farming which has always been the livelihood of people as far back as villagers' memories go, gold mining is relatively recent and an intermittent activity in Mainit. This means some young and middle-aged men had engaged in gold mining at one point in their life and stopped but may do it again in the future. Others have continued to engage in gold mining for years. Not every household in Mainit has a member who participates in gold mining although there are households with more than one miner. There are also people in Mainit who have never done gold mining.

The relatively discontinuous and sporadic nature of gold mining prompts one barangay official to suggest that the word 'mining' is an inappropriate term for the gold-related activities in Mainit. He explains that what one finds in Mainit are '*ismol iskeyl*' (small-scale) workers, and to call them miners is not accurate. During the consultation where the author presented the results of the research to village elders and leaders, the barangay council official clarified:

> There is no mining in Mainit. The '*ismol-iskeyl*' that we carry out is not considered mining. When you use the word 'mining' to refer to what we do here, you are implying that there are full-scale operations in Mainit. That is not the case. We are not doing what large companies are doing.[4]

As explained by the official, the term 'mining' (*in-minas*) denotes full-blown production. This rather intuitive awareness and forthright correction of the assumed misuse of the term 'mining' is an expression of a desire to protect Mainit from the entry of large-scale corporate mining companies, a subject discussed in detail below.

Gold as a major income source for villagers has its beginnings in the 1970s. Through the decades that followed, sieving for gold from sedimentary silts along creeks and rivers has been an off-farm occupation of men and a few women, and an off-school activity for some adolescents and teenagers. In certain sites, ore extraction involves digging with the use of hand tools like pickaxes and shovels. Over the years, gold panning and tunnelling have attracted an increasing number of people. The tunnels also appeal to those who had previously been employed in large-scale industrial mines outside the village; these are men who have returned to Mainit with their families upon retirement or retrenchment from employment. Those who had left the village many years ago to look for 'greener pasture' in urban areas have come back to Mainit and found gold mining as a remunerative occupation.

At present, there are several mine operators in Mainit. A mine operator, indistinguishable from a financer, is an individual who serves as the 'owner' of a mine. He has the finances required to open a mine, hire workers, and manages the mine. In other words, he is the entrepreneur in the village. His being financially capable warrants his 'self-appointment' to operate a mine. The more capital the operator has, the higher the level of mechanisation is involved in his operation. The largest operation employs 23 to 33 persons[5] while the several smaller ones involve workers ranging from four to about a dozen. The levels of technology used in ore extraction vary according to the size of the operation as well as the availability and amount of capital that the operator-financer is willing to invest. The largest mining operation in Mainit at present is equipped with a drilling machine and backhoe for excavations, rod and ball mills for ore crushing, and trucks for transporting

ores from Mainit to sellers outside the village. Some relatively smaller operations, which are usually carried out by informal and loose groups (*grupo*) based on kinship, continue to rely on hand tools like hammer and chisel but have facilities such as air compressors. Whilst miners have adopted improvements in technology, farming has remained the economic activity of majority of households.

Access and Rights to Minerals

The villagers consider the minerals in Mainit as 'owned by the community'. Likewise, lands bearing the minerals are owned by all villagers. Thus, the right to extract the minerals in Mainit vests on no one else but the *I-Mainit* (people of Mainit)[6]. These include the ancestors, the village members at present, and their descendants. As one elder participant emphasised,

> We, the I-Mainit, are the owners of the gold here. The gold is *komyunal*[7]. Only the I-Mainit are entitled to get gold in this place. We do not allow anyone from outside to come and mine the gold here. We continue to protect our village to ensure that it is us who benefit. This has been what our parents and grandparents had stood for. They had chased away prospectors who attempted to come to Mainit. We have continued to do the same. [8]

People from other places can participate in gold mining in Mainit, but they must be labourers under the command or supervision of an operator-financer who must be I-Mainit. Likewise, a person from outside the village who is married to an I-Mainit is allowed to be a labourer in a work site but must not become an operator. This scheme of access to a particular resource follows the traditional custom governing communal properties such as forests.

The village as homeland

The concept of the traditional village is important in understanding how villagers regard land and other resources, how they perceive themselves as a community, and how they assume duties as members of a collective unit. The villagers refer to Mainit as their *Ili,* an inclusionary place where they trace their ancestral roots. They share genealogy and history, observe community rituals, and participate in ceremonies and other village affairs. They speak the same language that is different, although mutually intelligible, to their neighbouring villages. They accede to the responsibility of nurturing the lands that they inherited from their forebears. The ili is the domicile of villagers who are conscious of their common ancestry and geographical belonging. This self-reflexive identity corresponds to the external ascription accorded to them by people in surrounding villages. For example, the I-Guinaang[9] recognise that the I-Mainit trace their ancestry to nowhere else but the village Mainit.

The anthropologist June Prill-Brett, an expert on land tenure and resource management particularly in the Bontok culture area, defines the ili as follows:

> The *Ili* refers to a physical or geographic area, historically inhabited by a homogeneous population who can trace their descent from common ancestors, who were the original founders of the village, and who share and manage common property resources, governed by customary law. Citizenship is primarily based on relationships of consanguinity (blood), and of affinity (marriage), and the exercise of rights and obligations in relation to shared common resources within a well-defined territory (Prill-Brett, 1998, p. 21).

Among the Bontok, the ili is the prime and largest socio-political unit with its own distinct territory and boundaries, which are recognized by adjacent villages. As a traditional community, the ili has pre-existed before the present generation of villagers (*umili*)[10]. The villagers as members of an ili have reciprocal responsibility for each other in recognition of their being a people of one kin. The ili has a long settlement history that spans many generations, which allowed villagers to establish a firm attachment to a territory or domain (Crisologo-Mendoza et al., 2006). Hence, the ili is the locale for socio-political identity as a villager assumes the label of where he/she is from.

To the I-Mainit, the landscapes of their ili include the biophysical resources such as rice paddies, uma, forests, springs, rivers, hot springs, and mining sites. Equally important, the ili provides irreplaceable testaments of their cultural heritage, which include myths and legends about their origins as a people. The ili is the repository of known customary practices that govern internal village affairs, relations with other villages, and agricultural activities. The ili is the storehouse of knowledge about peace pacts forged with other villages, rituals and ceremonies concerning healing and invoking the ancestors' blessings, and cultural systems of organising social relations.

People who trace their genealogy to a Bontok ili, including those who are based in urban centres as well as those who have left the Philippines to work overseas consider themselves very much part and parcel of their ancestral village. Equally, those that have remained in the village count all people who trace their lineage to the village -- by either consanguinity or affinity -- as full-members. Beginning at least the 1950s to 1970s, there has been continual migration of Bontok men and women away from their villages. Adult men looked for employment and students pursuing tertiary studies moved to the cities where they eventually work and settle. Since the 1950s, there has been a continual hiring of Bontok men to work in the large mines of Lepanto Consolidated, Benguet Corporation, and to some extent Philex Mining. These mines are all in Benguet Province. Part of the fringe benefits for mine employees is to bring their families with them. A good number of Bontok men and women have also found opportunities to work outside the Cordillera and even overseas such as the United States especially those in the medical profession. From the 1980s, overseas contract work in the Middle East attracted tens of thousands of Filipino engineers and a few of these come from the Bontok culture area. The social media, particularly Facebook, includes countless 'community pages' where people coming from various Bontok villages discuss issues back home.

Well-being and betterment

Discussions with research participants on the theme of sustainability include insights about 'well-being' (*in-gawihan*) in broad terms. The subject on well-being emerges as the research team poses to the participants the question, 'Do you think it is important to do mining in Mainit? Why (or why not?)' The responses, which are largely in the affirmative, describe the compelling need of households for cash, which they consider as imperative in present-day living. As such, gold mining that brings about cash definitely contributes to household and village well-being.

Synonymous expressions to describe 'well-being' (*gawih ah matagowan*) include impressions associated with advancing from a present level of social and economic condition to a higher one. *Sumya-an* and *luman-oyan* are terms that both denote 'improvement' or 'enhancement'. These concepts refer to welfare of individuals and households, and it is no different in application to the case of the village as a collective unit. There is general well-being in Mainit because families are considerably thriving economically. With the availability of gold, which has brought gratifying incomes to a considerable number of families in Mainit, there are perceptible improvements in the living conditions in the village. Protein-rich foods such as meat, fish, poultry, and other provisions are not too difficult for families to procure. Adult household members are able to earn more than enough cash to purchase day-to-day provisions from Bontoc, the town centre. Many women also explain that gold mining enables them to pay tuition and accommodation of students who pursue tertiary studies in Bontoc or in cities like Baguio. In addition, undertaking important household chores is no longer as strenuous as it was in the past. For example, women ceased from pounding rice manually which takes hours using mortar and pestle; instead, they avail of the paid services of rice mill operators. To a large number of families, cash is obtainable to pay for major expenses such as renovation or expansion of their house.

The income that families derive from gold-related activities symbolises not merely attainment of economic goals such as meeting expenses for daily food, better housing, and shorter time to accomplish house chores. Rather, income embodies the fulfilment of family aspirations such as education for children, a sense of realisation that adequate cash is available, and the transformation of their village where many people attain better living conditions without having to leave Mainit to look for work elsewhere.

Socially, the village is a peaceful and safe community where individuals intimately know each other as all family names are recognisable. Every year is marked by traditional activities in which all families participate. For example, the *saknit* engages families to bring their harvests of sugar canes to the community's milling area for threshing and processing. Juice extracted from the crushing machine is fermented into wine which each family brings home. Both young and old anticipate special occasions like the saknit because it allows people to come together. In addition, the saknit also gives the barangay officials and elders a reason to call for a halt (*te-er*) of work in both the farms and mining sites.

Environmental risks and damages

Barangay officials and village elders in Mainit claim that mine operations have, thus far, not brought major environmental problems in their community. They explain that soil erosion in certain places as well as murky water in some streams result from natural processes. Thus, there is no cause for people to re-consider engaging in mining. Research participants also assert that ever since mining began in Mainit, no one lost life in any work site and no dangerous event has taken place in any of the mines. However, a few mine labourers suggest that in the long term, as mine tunnels deepen, the need for ground support using timber, which entails cutting more trees in the communal forests, would not stop, but will even become more imperative.

While the benefits from gold mining are fully acknowledged by villagers, and as barangay officials maintain that there are no major environmental problems caused by mining, one family in Mainit resorted in 2013 to legal action against a group of miners. Adjacent the Okoren family's private land are five mine shafts which, as described in an inspection report at the Mines and Geosciences Bureau - Cordillera Administrative Region had caused sinking of rice paddies (MGB-CAR, 2013). The Okoren family's legal complaint noted that the activities of small-scale miners adjacent the family's rice fields 'was illegal and if left unchecked, would lead to the denudation of the Mainit forests due to the cutting of trees to supply the timber needs of the tunnels'. In 2014, the Regional Trial Court in Bontoc ordered the cessation of illegal mining activities in Mainit 'to prevent untold danger to human lives and irreparable damage to the environment arising from crude, indiscriminate, unsupervised diggings, and the illegal cutting of trees (Baguio Midland Courier, 2014). A community page on Facebook called 'Mountain Province' which presents "issues and concerns about what happened, what's happening, and what's going to happen in Mountain Province" drew considerable discussion when it posted on August 2013 the news about the Okoren family's legal action. It is significant to note that the comments of many members on the subject include praise and support to the Okoren family.

In a separate expression of disapproval, a resident of California (USA) who traces his childhood to Mainit publicly declared, through print media his opposition against mining operations in his ancestral village. He directed his letter to the Department of Environment and Natural Resources (DENR), and two other government agencies and environmental advocates to look into the potential 'environmental and cultural deterioration' that would result from mining activities if no urgent mitigating measures are implemented. In a weekly newspaper (Baguio Midland Courier, 2015) that has the widest coverage in the Cordillera, part of his letter on the front page states:

> It is disheartening to be going home one day only to find out that the so-called communal mountain (*ramoram* in local dialect) that has always captivated my view whenever I walk home to Mainit from Guina-ang is already claimed and developed by a now-moneyed and influential person. Most of the pine trees have disappeared, including some rice fields, which made me wonder if there was any environmental compliance certificate or permit issued for such kind of a major development that completely changed a natural landscape if necessary.

Complaints about environmental deterioration associated with gold mining in Mainit are not limited among the villagers themselves -- both those residing in the village and those who are outside. Neighbouring villages along a major water source for irrigating ricefields downstream, also assert their opposition to mining activities in Mainit due to the alleged mercury pollution finding its way to Chico River (Northern Philippine Times, 2013). Most recently, the adjacent barangay of Maligcong prepared a petition early in

February 2015 asking government agencies to protect their village's watersheds that are threatened by mining activities in Mainit (Todcor, 2015).

Sustaining well-being

Villagers have no single word or phrase to refer to 'sustainability' but ideas of ensuring long-term gains and improvements in current living provided by natural resources are well-explained and intensely averred. To the villagers, 'well-being that lasts' means continuing provisions that they draw from their ricefields. Incomes from the gold mines support and enhance the subsistence level of benefits from rice cultivation.

Villagers talk about their exclusive rights to the minerals under the earth *always* in relation to their being the people *in* and *of* Mainit. They emphasise that the gold in Mainit must benefit the present population and their children (*anan-ak*) whose future must not be disadvantaged in any way. They assert that to guard their minerals and benefit from them is the right thing to do to ensure their integrity (*katatagho*). In the words of a male elder:

> Our village Mainit has gold. It is wrong for outsiders especially large mining companies to come here and dig the gold. It is plain and easy to understand that every people belong to their own place. Just like yourself, where you are from is where you belong. The owners of mining companies are not from Mainit and they have no business coming into our village. We know well what happened in Benguet. The *I-Beng-nget*[11] people had been disunited as their place was dug out (*naguskaw*) by mining companies. We will not allow that to happen in Mainit.[12]

As early as during the research team's first community consultation with elders and leaders in early November 2014 to inform them of the research objectives, responses to the subject on mining as livelihood have surfaced the themes on '*what is right*'. Elders emphasise that it is wrong (*lawa*) for anyone to use someone else's resources. *Nan vatog mo ya vatog mo*, stressed a male elder to say "Mind your own business" in a profound moral tone. They explain the need for well-being for families and the village as a whole to both continue and improve, but this requires villagers to maintain their unqualified rejection of large-scale mining projects in Mainit. The question asked by a 70-year old elder sums up an ethical dimension of their defence of territory: *"Ay tago ka ngen no maumash na ilim?"* which inadequately translates to "Would you still consider yourself a human being if your village is dissolved?"

The right to reject state-supported development projects

The Philippine Constitution (1987), Section 2 Article 12, declares that the State is the owner of "all lands of the public domain, waters and minerals", and other natural resources. While the State is the owner of all lands including minerals, the rights of Indigenous peoples to veto are protected by the Indigenous Peoples Right Act (IPRA). Their free, prior, and informed consent (FPIC) is imperative for any project that may be proposed within ancestral domains of indigenous peoples. The IPRA provides that indigenous cultural communities have the right to halt a project that has not secured the required consent from them through consultation (Republic Act No. 8731, 1997, Section 59). Under the IPRA, indigenous cultural communities are able to negotiate the terms and conditions under which project proponents from outside may use the resources within indigenous territory. The Cordillera region, particularly Benguet Province, has been the centre of large-scale mining for over a century. Many of the region's mineral resources are untapped. Beginning the mid-1990s, the Cordillera highlands have drawn scores of prospective exploration and mining projects with the majority pursued by global mining companies. However, many of these applications for mining tenements have remained dormant because indigenous peoples withhold their consent.

Corporate interests attempting to enter Mainit could not be more real to villagers both in past years and at present. As early as the 1970s, some personnel of Benguet Consolidated Incorporated camped in Mainit to carry out exploration activities. However, about 200 women and men in Mainit got together and drove the mining prospectors away[13]. Another mining company, Lepanto Consolidated Mining Company (LCMC) has had a long-standing tenement application in Mainit to mine gold within a 20-hectare area. However, the

company has not been able to complete its application because villagers never allowed LCMC personnel to enter Mainit[14]. Villagers in Mainit wanted to discourage every company intending to undertake resource extraction of any form in Mainit. In stark contrast, the barangay officials welcomed the application of a person in Mainit for the mine area, previously eyed by LCMC, as a *Minahang Bayan* ('mine for townsfolk'). Under Executive Order 79 (2012), all small-scale miners are required to register with MGB for approval. In November 2013, this person in Mainit registered at the MGB-CAR his "assumed control" of the 20-hectare area where he has been operating in 2012 anyway. The long process of registering this mine operation, since 2013, is still ongoing, as MGB has not issued approval. Many villagers in Mainit describe the virtual takeover as important in their efforts at dislodging all mining interests from outside to come to Mainit.

In mid-2014, the I-Mainit demonstrated their strong opposition to geothermal projects under the auspices of the Department of Energy (DOE). Mainit is one of the several communities identified in the Cordillera region where geothermal projects are in the pipeline for developing more fields for electricity production through geothermal resources (Balangue-Tarriela & Mendoza, 2015; Pastor, del Rosario, & and Ramon F. Papasin, 2005). The barangay officials did not permit personnel from the DOE, who intended to conduct consultation, to lay their feet on village grounds.

Under the IPRA, there is rights protection to ensure that the previous struggles of Cordillerans against huge development projects into their ancestral territories shall not happen again. In Cordillera history, the most noteworthy and successful opposition to state encroachment into Cordillera territory threatening the existence of several villages was the resolute uprising against the Chico River Hydroelectric Dam Project in the 1970s (Leonen, 1998). The affected indigenous cultural communities particularly the Kalinga and Bontok, formed strong alliances and fought the government forces. Lives were sacrificed but the building of the World Bank-funded dam stopped.

Tipping Point

The case of the I-Mainit is not about indigenous peoples as defenceless victims of development and unable to do anything to chart their own futures. The paper shows that an indigenous community whose members' innate rootedness to their ancestral land *does not* make them immune to causing jeopardy to their own ecosystem and those of other communities. Being embedded in a cash economy, villagers depend on gold mining to earn income. Wet rice cultivation and uma gardening provide subsistence-level benefits to households and do not allow much improvement in day-to-day living. Income from gold enables households to stretch to further levels their economic and social gains.

Among the I-Mainit people including the non-residents in the village, there is recognition that resource extraction has its irreparable costs. The sinking of ricefields resulted to a legal action by a family against a number of miners with the court decision drawing widespread approval. This indicates that gold mining, while a profitable provider of income, is not acceptable to all I-Mainit as well as to other Bontok people if the methods of mining are bereft of duties of care and prevention.

Villagers are resolute to do two things: a) reject any large-scale mining company that intends to enter into their territory, and b) exploit the minerals exclusively by and for themselves. Villagers regard these two actions as legitimate because they are entrenched in their ages-old value of cultural integrity as a people. The village is their traditional homeland. As such, they are duty-bound to protect it from the incursion of outsiders to guarantee the continuity of their livelihood. To do so is to realise a future for themselves and their descendants.

The case of the I-Mainit demonstrates the principle of 'fair play' in their notion of and pursuit for sustainability. The idea of what is right or fair is often incorporated in the gigantic word 'social justice'. While the I-Mainit clearly articulate and assert the ethos of their defence of resources and territory, the Tipping Point involves that critical locus at which the villagers must ensure they too must play fair to adjacent villages whose livelihoods also depend on fragile water sources.

4 ACKNOWLEDGEMENTS

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[1] The *barangay* is the smallest and most basic administrative political unit in the Philippines. In turn, a number of municipalities constitute a province.

[2] A total of 23 individuals participated in in-depth interviews involving one-on-ones and duos. Focus group discussions involved numbers ranging from three to six individuals. These numbers do not include those who attended two community meetings. The first one was held on November 2014, and the second on March 2015.

[3] '*Ismol iskeyl*' as a term used by villagers refers to 'small scale mining', which is mainly-kin-based as differentiated from large-scale mining which is the venture of large corporations.

[4] A statement of a male elder during validation meeting on 16 March 2015. Mainit, Bontoc, Mountain Province

[5] National Commission on Indigenous Peoples (NCIP) Field Based Investigation Report on Minahang Bayan for Upland Mineral Resources. Mainit, Bontoc, Mountain Province. April 2014.

[6] *I-Mainit* means 'people of Mainit'. The pre-fix *I* denotes 'of' or 'from' or 'dweller in'

[7] *Komyunal* means 'communal' or 'owned and shared by the community'

[8] Interview on 18 December 2014. Mainit, Bontoc, Mountain Province

[9] People from the neighbouring village Guina-ang

[10] *Umili* has the root word *Ili*. The prefix *um* denotes 'of' or 'from'. Thus, *umili* means 'people of the village'

[11] *I-Beng-nget* is a general term of the Bontok to refer to the people of Benguet Province

[12] Statement of an elder during the community consultation on the research project. 3 November 2014. Mainit, Bontoc, Mountain Province

[13] Benguet Consolidated Incorporated, renamed as Benguet Corporation, is the first and oldest mining company in the Philippines. It was established on August 12, 1903 in Benguet Province where it has been operating until the present. The aim of the women leading was to avoid violent confrontation. The women disrobed themselves to curse, shame and drive away the BCI personnel. The women then burned the campsite and threw the exploration gadgets, a message that the prospectors must leave the mountains of Mainit forever (Cordillera Peoples Alliance, 2006).

[14] Other reasons include the company's inability to meet capital requirements required by the Mines and Geosciences Bureau hence in October 2013, the application by LCMC was denied. The denial gave way for other interested tenement applicants, thus a mine operator in Mainit 'took over'.

THE BIG FIX – Scaling Innovation for Societal Transformation

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ABSTRACT

This paper proposes that humanity urgently needs to shift to a new tipping point, 'The Big Fix'. This is a point of social transformation in which society acts en masse, or in a swarm, to develop and embrace solutions for its many messy, multi-faceted issues, or wicked problems, in order to build social and environmental resilience.

It argues that these problems are most effectively tackled by systems design strategies and collective impact approaches. The paper draws on multi-disciplinary research, including research about social norming and social facilitation, which indicate that human behaviour is strongly influenced by what people think other people are doing, or what they are seen to be doing. It therefore argues for media to play a more pro-active role in telling the stories that will provide models for change - providing solutions, not just problems.

The paper reviews current solutions journalism sites and identifies gaps, proposing a conceptual model to scale up innovation with the urgency required. It suggests that a cross-sector multi-partisan solutions journalism network, collaborating with the citizen sector, could be an antidote to fear and apathy. It could grow motivation and inspire action to tackle seemingly insurmountable problems. Working cross-culturally with the creative industries to compellingly communicate these solutions, this network could grow local and international cooperation to re-imagine the world as a united front creating 'The Big Fix'.

The paper's premise is that when media becomes part of the solution, rather than part of the problem, it can help scale social and environmental innovation to reach this tipping point.

1 INTRODUCTION

In 2006, the American magazine *Mother Jones* featured a compelling article by Julia Whitty entitled "The Thirteenth Tipping Point – Twelve global disasters and one powerful antidote [1]." Whitty described the twelve global-warming tipping points that had been identified in 2004 by John Schellnhuber. He had proposed that the triggering of any one of these could be catastrophic for life on earth. [2]

Whitty described the 13th tipping point as "the shift in human perception from personal denial to personal responsibility [1]." She argued that without this shift we could not hope to avoid "global mayhem [1]."

This paper proposes a range of strategies to help humanity shift to the 13th tipping point, or what this paper identifies as 'The Big Fix'. It starts by analysing and responding to the main views articulated in Whitty's article, and ends by creating a conceptual model for a systems framework within which to build a cross-sector solutions journalism network capable of diffusing research and innovation and growing cooperative and collaborative social networks able to adapt to the challenges ahead. Whitty broadly identified 6 areas that she believed needed to be addressed in order to shift society to the 13th tipping point. These can be summarised as the need to understand human behaviour, increase cooperation, share knowledge, adapt urgently, have trustworthy media and imagine a better future [1].

2 METHODOLOGY

This paper has approached the challenging question of how to shift rapidly to the tipping point of societal transformation by conducting a multidisciplinary [4] literature review, a content analysis of existing media sites and by proposing a conceptual model for an alternative media framework to assist all sectors to scale innovation as a means of growing social and environmental resilience. It has taken a systems overview approach by exploring research in biology, economics, psychology, sociology, network science,

neuroscience, behavioural science, communications, arts and political science. From this overview a gap analysis has identified an additional range of needs.

The needs for more positive behaviour modelling, cooperation, knowledge sharing, having trustworthy media and imagining a better future led to a search for, and content analysis of, English language solutions journalism news sites. Searches included the keywords: solutions journalism/constructive journalism/good news/positive news. Single-issue media sites, like *Treehugger*, were excluded. Thirty-three solutions journalism sites were identified. The urgency to address the gap between what is clearly needed to catalyse societal transformation, and what our current media environment is actually providing, is the basis for the conceptual model proposed.

3   DEVELOPING A CONCEPTUAL MODEL

UNDERSTANDING HUMAN BEHAVIOUR
In 2006, Whitty squarely put the responsibility for reaching the 13th Tipping Point onto individuals [1]. Her claim that human perception should shift from personal denial to personal responsibility was grounded in the dominant view of social change at the time – one which heavily influenced policy and which was derived from theories of planned behaviour in psychological literature [5]. This view presumed that individuals are responsible for taking action on climate change and that their choices can make a difference. It has been described as the ABC framework ("A" for attitude, "B" for behaviour and "C" for choice) [6].

In 2010 sociologist Elizabeth Shove [6] vigorously challenged the dominance of the ABC framework, questioning whether it was capable of influencing social change enough to create significant societal transformation. She believed its domination of the policy agenda meant that other areas of research could not gain policy traction. Shove discussed Abernathy and Clark's suggestion [7] that "radical innovations are those which redefine the rules of the game [6]" and suggested that, rather than persuading individuals to make sacrifices, the status quo should be called into question. She claimed that placing responsibility on the individual deflected attention away from the many actions that could be taken by institutions and the state [6] and quoted Andrew Darnton who argued that "government-led interventions, the targeted delivery of public services or upstream solutions [6]" are more likely to achieve sustainability goals than behavioural change by individuals. Shove identified an example of building sustainable transport into new developments as an example of a planning intervention. She also highlighted that political interests were preventing the change required, with the ABC being a strategy for governments to abdicate responsibility for providing solutions while sustaining "unsustainable economic institutions and ways of life [6]."

Shove's argument that the magnitude of the tipping points we are facing requires a multi-pronged approach beyond just the ABC framework does not, however, diminish the need to understand the psychology of individual behaviour. All governments, corporations and institutions are, after all, made up individuals. Research by Helliwell [8] also identified that people value bottom-up approaches to policy design and the political process because these give more freedom and responsibility to local communities.

Social norming research tells us that imagining what other people are doing can strongly influence our behaviour, both positively and negatively [9, 10, 11, 12]. Social facilitation research tells us that individuals are more likely to take environmental action when they are seen to be doing so [13, 14]. Based on this research, it appears that there need to be more mechanisms in place to provide positive social norming models for all sectors of society, and to facilitate communication between communities, institutions and government. Optimal outcomes will be achieved if responsibility is shared across sectors and globally.

COOPERATION
Whitty argued that to mitigate and survive the global challenges coming our way we need to cooperate in unprecedented ways. She discussed the evolutionary strategy of "obligate cooperation [1]", which she described as reflecting "the individual's inescapable dependence on the group [1]" and which can move species from selfishness to altruism; she discussed West's study [15] which demonstrated that small groups, repeatedly interacting, are more likely to cooperate and share resources if they see competition for resources

occurring on the global rather than the local scale [1]. This underpins the need to focus cooperative change efforts in small groups and local communities.

Nevertheless, the scale of the "wicked problems [16]" we are facing requires a whole system cross-sector and cross-silo response and there is an urgency to design new ways of working cooperatively and collaboratively to tackle these problems, both locally and globally.

In 2011 Kania and Kramer [17] described five conditions for achieving progress at a large scale via a disciplined approach to collaboration called Collective Impact. These conditions were "a common agenda, shared measurement systems, mutually reinforcing activities, continuous communication, and the presence of a backbone organisation. [17]"

The Centre for Social Impact has identified six categories for collaborative and participative social design: "systems thinking, measuring outcomes, funding outcomes, scaling innovation, collaboration and leadership [18]."

Dr Danielle Logue sees such system design thinking as:

> "human-centred, integrative, optimistic and collaborative … it requires input from people with different disciplines and backgrounds; it is argumentative, and requires integrative thinking. It's about 'failing forward', rapid prototyping and using the wisdom of crowds … The evidence is mounting – these are successful alternative platforms for creativity, design and problem solving. [19]"

Most progress is made working cooperatively in small groups, though this is complemented by working collaboratively across sectors. Having a backbone organisation with continuous communication, leadership and a common agenda strengthens the collective impact of groups working together, and shared measurement systems assist in learning from successes and failures in order to innovate responsively.

KNOWLEDGE SHARING
Scientific knowledge, in particular, needs to be shared if we are to shift to the 13th tipping point. For many in the community, however, scientists are not to be trusted [20] and the environmental movement has created an "unlikeable voice [21]". This is partly due to a "compromised media [1]", climate fatigue, denial, and a growing cynicism, further exacerbated by the "sequestering of knowledge [1]" by the academic community.

Tackling all of the above requires a multi-faceted approach. This includes making scientific and environmental research available in the knowledge commons; exploring new strategies to communicate knowledge; and delivering this information via trustworthy evidence-based media outlets, that reach across sectors and link to communities, so that information can be widely disseminated and diffused.

Scientist turned filmmaker Randy Olson argues that:

> "if an issue is urgent, it needs literal-minded communication that gets right to the point - "Your building is on fire, get out!" But if an issue is non-urgent (like climate change consequences that are 20 years off) then it needs non-literal communication - which means using humour, emotion and stories - anything to arouse the disinterested audience [22]."

In January 2011 the goal of communicating science to the public was the driver behind Olson training 25 early career researchers at the Arctic Frontiers Young Scientists Forum in Norway. They created informative and entertainingly humorous videos to communicate their research [23]. Olson's premise is that scientists and environmentalists need to adapt to a world that is driven, not by facts, but by narrative dynamics or storytelling [24]. There are many who agree including Haas, Eigler and Van De Carr [25, 26, 27].

There is also a need to share research in a way that enhances society's capacity to solve problems. Rather than being delivered in isolation, research should be presented within a framework that also seeks to find or report on solutions, and for it to have any real impact it needs to "take root in communities [9]". For a whole society to shift requires that the knowledge of scientists must enter commonplace beliefs and norms. Contractor and DeChurch [9] propose a Structured Influence Framework (SIP) to explain how communities

are influenced by social networks [9]. They point out that the blame for science not being communicated adequately is usually directed at scientists, the media or the general public who are not "getting the gravity of the problem – because if they did, how could they fail to act? [9]" Troldahl argued that while mass media is the vehicle for informing people about issues, to some degree their attitudes and behaviours are still often shaped by opinion leaders in their communities [9].

The SIP framework suggests that there is a need to understand the interconnectedness of both communication networks and who the key influencers are, in order to achieve social influence at scale [9]. Network science focuses on the opinion leaders (or groups of individuals to be influenced) and the peers who can influence them so that they will act as multipliers in order to scale up behavioural change within communities. To ensure that opinion leaders will adopt and champion desired behaviours requires that these behaviours are achievable and aligned with core social motives [9]. This integrated framework of social influence appears to be instrumental to the translation and diffusion of scientific knowledge.

For new knowledge to have real impact it needs to enter the knowledge commons and tell a compelling story in a noisy world driven by narrative dynamics. Actionable solutions need to be provided alongside problems, and a delivery framework needs to take into account key influencers in communities. Media outlets need to be impartial to deliver this knowledge without distortion.

URGENT ADAPTATION
Whitty wrote that humans can adapt quickly and history has precedents for rapid social change, initiated by individual citizens and magnified by visionary leaders [1]. Rayner has argued that:

> "every major social transformation, from the Age of Revolutions to the present day, has been driven by a catalytic swarm. Swarm movements do not expend their energies by contesting the status quo. They reinvent it. Norms slide in all directions and political institutions are forced to keep up [28]."

The last century has provided many examples of scaling social movements and businesses globally: from McDonalds, to not-for-profit organisations like Rotary and Scouting, to Permaculture and Transition Towns [29, 30].

With the advent of the Internet, the last few decades have seen a major global power shift with the "collective explosion [31]" of millions of groups rising up to tackle social and environmental issues. The rise of this "citizen sector [32]" represents the "largest movement the world has ever seen [33]." The extraordinary output of this sector is disturbingly under-reported and there is an increasing need to provide a global commons to connect these many groups and strengthen their cumulative impact.

One of the limiting factors for the growth of action from the citizen sector is the lack of successful business models to retain commitment from participants who are usually volunteers. Turnover is high and expertise is continually being lost. There is also inadequate succession planning to fill key positions when founders retire [34, 36]. Training in social entrepreneurship has attempted to address these issues, however many social enterprises also fail because they are unable to build large enough networks and get the necessary traction in the media to assist in attracting financial buy-in [35].

Alvord, Brown and Letts, authors of "Social Entrepreneurship and Societal Transformation: An Exploratory Study" identify three basic forms of innovation that are associated with successful social entrepreneurship: "building local capacity, disseminating a package, and building a movement [36]." The School for Social Entrepreneurs has also identified that for social entrepreneurs to help create social transformation, international expertise needs to be linked to local knowledge in order to build local capacity so that the unique needs of each community can be met [35]."

"Breaking Through", the United Nations Development Programme flagship report [37], analysed inclusive business initiatives and identified five key strategies that companies are implementing to achieve scale, from carefully-chosen partnerships to creating greater willingness to pay, using ICT to unlock new opportunities, turning regulation into a positive force, and securing appropriate finance and internal buy-in for investment in the model [37].

The model of "Frugal Innovation [38]" is more popular in developing countries and "is characterised by solutions that are low-cost, robust, easy to use, efficient and targeted at large populations [38]." Its success lies in solutions being developed in response to local constraints and problems. Scaling up in frugal innovation occurs via replication and customisation. The benefits of replication are economies of scale (a cost saving gained by increased production). The downside of customisation is that it is "time consuming, inefficient and expensive [38]". The best approach to scaling up innovation combines elements of both models, replicating parts of a system as well as adapting and customising other elements to suit local variables.

In "Beyond Great Ideas: A Framework For Scaling Up Local Innovation" [38], the authors suggest five points to consider in creating a hybrid model of frugal innovation – low adoption cost, delivering a good value proposition to create active demand (including economic, indirect and experiential benefits), creating a sustainable business model (often developing multiple innovations at once), demonstrated outcomes (systematically measured and presented as evidence of impact) and effective leadership with a very clear mission and flexibility to surmount barriers and adapt to new markets and trends [38].

Three hybrid models are suggested: The Contiguous Model (which spatially expands out from the original hub), The Distant Replication Model (locally generated solutions are replicated and adapted to distant sites but barriers may be encountered and success is not guaranteed) and the Transfer and Translation Method (involving transfer and translation of knowledge, better for not-for-profits; may not work for a for-profit organisation, as it will need to ensure that revenue is attached to diffusing its innovative ideas). Their evidence shows that the best global solutions are often built brick-by-brick at a local level [38].

Swarm organisations, on the other hand, like the Occupy Movement [28], the Swedish Pirate Party [39] and *Shareable* [40], are decentralised, collaborative efforts of volunteers working on a common goal, who operate with 'blinding speed' and minimal operational costs thanks to the Internet.

Combining the speed of the swarm with the long-term sustainability of frugal innovation requires localised and decentralised collaborative efforts to achieve a common goal and build a movement. These need to be customised to suit local variables and build local capacity. Business models and partnerships need to be developed to create viable long-term pathways for more volunteers to become paid workers in order to grow their contributions and share their commitment and experience. Systems need to be put in place using ICT that allow replication and dissemination, as well as international collaboration and learning. These efforts will scale up more rapidly if they are low cost and well reported.

TRUSTWORTHY MEDIA

Whitty [1] claimed that a compromised media is fuelling complacency and denial. She suggested that even well intentioned citizens begin to focus on family-size problems and appear indifferent because the looming global catastrophes are so overwhelming that denial is their only way to cope [1].

Research shows that the News is now responsible for increasing stress levels [41] and in 2008, Associated Press published a study highlighting the need "to counter the audience's anxiety and overload with compelling content delivered in innovative ways [31]."

As a result of the internet's fragmentation of media [42], exposure to news is no longer a common experience and this threatens the existence of a common ground on which to meet and debate contrasting views. Traditional news media are becoming "political actors [42]" and there has been increasing polarisation [43] of political opinions following the development of online media. Partisan outlets merely reinforce existing views, which reduces the opportunity for multi-partisan action.

In a readership currently suffering 'news fatigue' and overload, and craving well edited, independent and meaningful news content, there is a vacuum waiting to be filled by solutions journalism, the 'citizen sector' and a multi-partisan cross-sector cross-cultural news environment.

IMAGINING A BETTER FUTURE

Whitty wrote of the need to envision a better future: "History proves that when we behold a better world, we move toward it, leaving behind what no longer works [1]." Journalist Walter Lippmann commented, "The way in which the world is imagined determines at any particular moment what men will do [31]."

Bornstein, from the Solutions Journalism network, has pointed out that:

"journalism is a feedback mechanism to help society self-correct. We know from behavioural science that information about a problem is rarely sufficient to generate corrective action. People need to know what they can do – and how. That doesn't mean including a little "good news" now and then, but regularly presenting people with innovative ideas and realistic pathways and possibilities that remain outside their view frame [31]."

Sean Dagan Wood, editor-in-chief of *Positive News* and Co-founder of *The Constructive Journalism Project* in the UK, said "a more positive form of journalism will not only benefit our well-being; it will engage us in society, and it will help catalyse the potential solutions to the problems that we face [44]."

Mainstream media are also responding to recent research by marketing experts, psychologists and neuroscientists, which reveals that good news spreads more quickly than bad news [45, 46]. Given that social media has changed the news dynamic, and everyone, particularly sponsors, want their stories to be shared, good news stories are now good business (especially as brands prefer to be associated with positive news).

While journalists have always reported on positive news stories, albeit in a very minimal way, research of English language media conducted for this paper revealed that the first example of a news site devoted to solutions journalism appeared in the United Kingdom in 1993. Shauna Crockett-Burrows' *Positive News* had as its by-line, "Inspiration for Change", and described itself as the world's first solution-focused newspaper, reporting on people and initiatives that are creating a just, sustainable and fulfilling world. [47]

In 1995, *The Intelligent Optimist* (founded as *Ode*) was founded in the Netherlands. Since 2004 it has also operated from the US, and complements solutions-news online with online events and courses. [48]

In 1998, Susan Benesch [49] wrote a frequently quoted article identifying the founding of *The American News Service* (ANS) by Lappé and DuBois in 1995, as the emergence of solutions journalism. This news wire bore the slogan "the pioneer of solution-oriented journalism" and for over five years its stories appeared in over 300 newspapers. She wrote of the *The San Diego Union-Tribune* starting a regular "Solutions" feature in 1996, and the launch of two new magazines: *Hope* and *YES! A Journal of Positive Futures*. She included the 1997 series called "What Works", from *Nation Magazine,* and highlighted how North Dakota's *Grand Forks Herald* won the 1998 Pulitzer Prize for their coverage of constructive solutions. [49]

In August 1997 Geri Weis-Corbley launched *The Good News Network* (GNN) "to report on outstanding citizen action, innovative solutions to the world's problems, and to shatter negative stereotypes." [50]. Since 1997 numerous websites have purported to deliver solutions journalism, although many of these have only been sources of 'feel good' stories or public relations. Excluding these, this research has identified 33 solutions sites, or regular sections within mainstream media, that have emerged over a period of 22 years (1993-2015), the most recent being "What's Working" in *The Huffington Post*, launched in January 2015.

Rahual Anand from *The Better India* (est. 2008) describes himself as being "enamoured by how networks interacting with cultures, institutions and markets lead to social impact, innovation and social enterprise in India [51]." In 2009 *Shareable*, a Swarm Organisation, launched its "nonprofit news, action and connection hub for the sharing transformation [40]." Its goal is to show that we can solve the world's biggest challenges, like poverty and global warming, by unleashing the power of collaboration.

The Conversation launched in Australia in 2011 "to create an open site … to share best practices and collaborate on developing smart, sustainable solutions [52]." Content is evidence-based and sourced from university scholars and researchers with deep expertise in their subject.

In February 2013 the *Solutions Journalism Network* launched in the U.S. with the goal of "increasing the volume and quality of solutions journalism through [its] online learning platform, journalism development, and community-building [52]." It champions "rigorous and compelling reporting [53]." In August 2013 *NationSwell* was launched to drive action behind solutions to America's greatest national challenges. It emphasises telling stories about change, providing people with tools take action and hosting in-person events to connect with those in need [54].

The influence of a 'sharing' social media culture, which prefers to share good news, means that solutions journalism is now a viable business option. It is, however, still tokenistic and drowned out by other

competing interests. The 33 sites analysed offer a range of strategies to deliver solutions journalism. The conceptual model developed for this paper takes elements from all of these, including the need for rigorous evidence-based reporting combined with compelling storytelling, though differs in a variety of ways from the models currently on offer, most notably in its bottom-up cross-sector approach.

THE CONCEPTUAL MODEL

The goal of this model is to create a swarm movement [55] to catalyse societal transformation. It proposes establishing a new multi-partisan creative commons, sharing evidence-based cross-cultural and cross-sector solutions journalism.
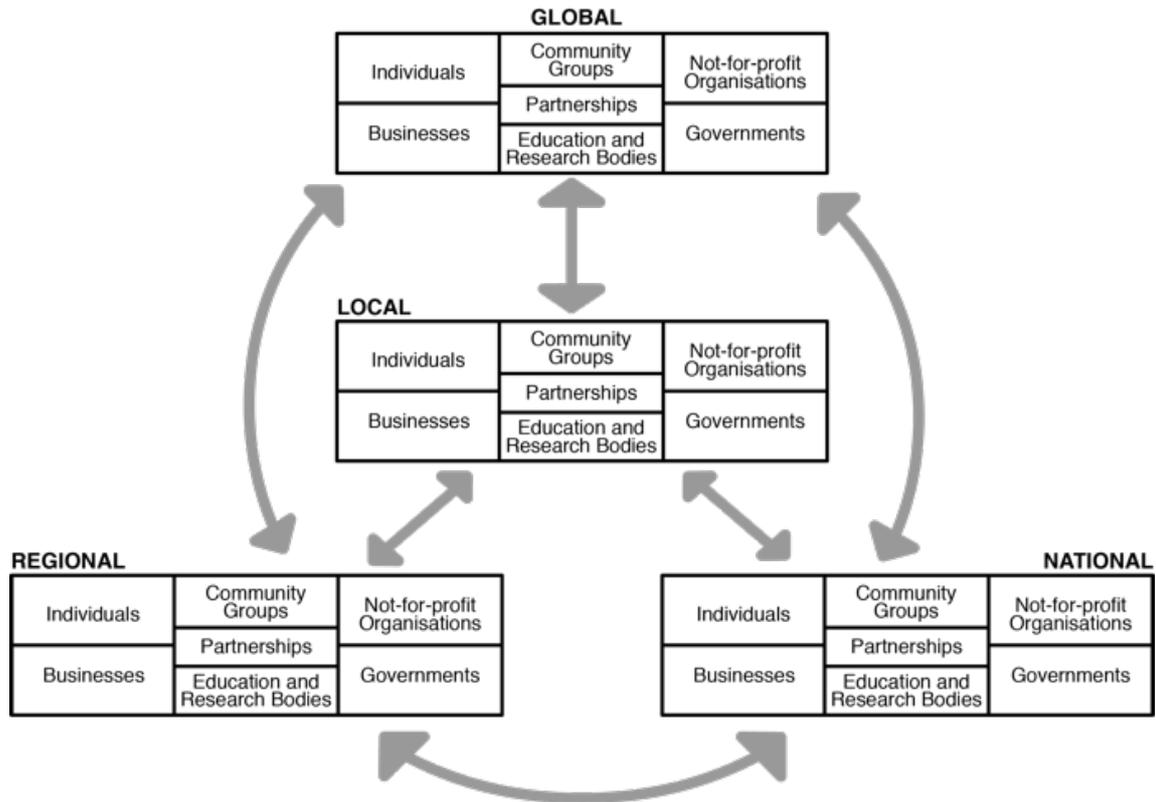
Figure 1: Framework for Cross Sector Solutions Journalism Network

Working in partnership with existing solutions journalism sites, and groups within the citizen sector which are focused on developing solutions, it would also connect individuals, community groups, NFP organisations, businesses, education and research bodies, partnerships and government. It would share research, expertise, resources and examples of successful projects to inspire positive social norming.

It proposes using a systems design strategy to grow local community networks focused on being part of 'The Big Fix'. These would include new and existing groups responding to local community needs. They would collaborate to create their own 'newspaper' with business models and editorial structures customised to their local needs. The newspaper would showcase solutions from each of the 7 sectors - individuals, community groups, NFP organisations, businesses, education and research bodies, partnerships and government. Content would be provided by the creative community, traditional journalists and citizen journalists working "with" the community rather than "for" the community [56]. Strategies would be designed to evaluate both the short and long-term outcomes of stories reported. Follow-up reporting would increase shared learning, and cooperation would grow each community's capacity to find solutions for local problems.

These local news sites would be supported by evidence-based solutions content from the regional, national and global sites to complement local news and counter parochialism. Revenue for all sites would come from local, regional, national and international partnerships and collaborations.

This framework is designed to prevent hijacking by government or business interests, giving equal weighting to content from individuals, community groups, NFP organisations, businesses, education and research bodies, partnerships and government. This model allows a direct line of communication from local to regional, national and global and the feeding in of local news to these larger sites. While there are overlaps between the 7 sectors, this division gives special weighting to education and research bodies, which are essential for the development and diffusion of innovation. Unlike other media sites, the news stories are not divided by topics but by the social groups producing the news and taking responsibility for their role in being part of the 'The Big Fix'.

4 DISCUSSION

In her article "The Thirteenth Tipping Point [1]" Whitty identified that 6 areas urgently need to be addressed to shift humanity 'en masse' into a new state of living harmoniously in an increasingly unstable world. This paper sees this as a swarm movement to create societal transformation, or 'The Big Fix'. These 6 areas (human behaviour, cooperation, knowledge sharing, urgent adaptation, trustworthy media and imagining a better future) were discussed in the light of recent research. In response, a new systems approach has been proposed. It incorporates growing local capacity, community networks and participative civic journalism within a framework of independent evidence-based cross-sector and cross-cultural solutions journalism delivered locally, regionally, nationally and globally.

It proposes that this model would scale up rapidly by initially implementing models that would be customised to a range of different communities, then replicated by "disseminating packages" [36] and the Transfer and Translation Method [38]. The key to this model's success would be the development of collaborations, partnerships and international cooperation, as well as strategies to systematically measure and report on demonstrated outcomes as evidence of impact. Further participatory action research will test the viability of this model.

5 ACKNOWLEDGEMENTS

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Challenging the attitude: Family-farm succession and rural community sustainability

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Abstract

Family-farm succession has been and remains a highly gendered process in Australia such that sons are predominately favoured over daughters as successors to family farms. The 1984 Anti-discrimination Act to allow women equal opportunities in paid work has done little to overturn the patriarchal practices of patrilineal inheritance and succession in the majority of farming families. However, these practices may be contributing to the significant out-migration of young people from farming communities as young non-successors leave to seek opportunities elsewhere, for example in urban centres, interstate and overseas. Hence, rural communities appear to be at tipping point in terms of retaining or attracting sufficient numbers of young people to replace older retiring members of rural communities. My current PhD research with Monash University reveals this exodus and loss of rural population is partly due to the patriarchal attitudes of parental generations and many current male farmers, men who position themselves as heads of farm households and who hold the dominant decision-making positions in their families. I assert that farming families and their communities are faced with a significant attitudinal 'tipping point' which, unless acted on, will see further declines in rural farming populations through the outmigration of non-successor farm children. This attitudinal tipping point is one which is endogenous to rural communities seeking to remain sustainable, and farm owners themselves must and can institute changes to their patriarchal attitudes to help sustain their rural communities.

Key words: farm succession, patriarchy, equal opportunity, rural community sustainability

Introduction

Rural farming populations in Australia, as in comparable regions in the Western world, have been declining for many decades [1]. Factors such as the changing technologies in farming and the consolidation of small farms into larger farming properties are seen as the major factors leading to fewer people involved in farming, and hence to the reduction in the number of people residing on family farming properties [2], [3]. As one farming family expands its farm size and at the same time also invests in newer technologies that require fewer farm labourers, the actual farming work force diminishes. Families that were once living in farm communities move off their former farms into r local rural towns or they leave the region altogether. The population is further eroded by the remaining farming families with larger holdings requiring fewer family members to provide year-round labour for the farms, so fewer sons are nominated as successors, and non-successor sons along with daughters, as in previous generations, are expected to move off the family farms of their childhoods [2].

Earlier successive Australian governments from the late-1800s to the mid-1900s regarded the populating of rural spaces as significantly important, but the change in Australian government to neo-liberal policies towards the later part of the 1900s saw a withdrawal of much of the financial support provided by the government for farming people, such that many families were no longer able to operate their farms to sustain their families let alone to contribute to the local and wider regional and national economies [4], [5]. Gray and Lawrence [5] provide an excellent analysis of the restructuring of Australian family farming since this time and its effects within farming families and within farming communities. Many families were able to adapt their productive activities and to reduce their expenditure to ensure the survival of the family farm; however, this program also saw an increase in rural to urban drift which, in turn, exposed the social inequities in the remaining rural farming populations. Additionally, other industries (such as mining, blue-gum and wind generators) provided incentives for farmers to either sell up or lease their land, further contributing to the exodus of people from former farming regions. The result of the movement of people from farming regions has seen a decline in rural infrastructure and social services [5], [6]. The decline in population has been gendered, with more young women than young men leaving rural communities, thereby creating an imbalance in the number of young men and women in these rural communities, the very people who should be contributing to the social and economic wealth of rural communities [6], [7]. Interestingly, this population decline and loss of services and infrastructure has not challenged or brought a "fundamental change to the patriarchal structure of farming" [5, p 56]

While this loss of service and population decline in rural areas has been, and continues to be the focus of much research and public discussion, my own interest is in the effect of prevailing attitudes which may also be contributing to the negative connotations associated with rural living and which may, in fact, be active drivers of this decline. Until my research there has been little research engaging people who, because of their families' decisions on succession and perceptions of the viability of farming futures, have moved off farming land and out of rural farming communities [8]. Crosby [9] in her paper 'Changing families, challenging futures' does bring non-successors directly into discussion on farm succession with one respondent speaking of the way her parents were giving the farm to the oldest brother and who is quoted as saying "This is not fair … There is very little by way of compensation." In presenting this example, Crosby demonstrates that feelings of non-successors about farm succession may be important considerations for future relationships within farming families. However, the main thrust of Crosby's [9] paper is on the stresses felt by farm family members in approaching the processes of succession and not of the enduring effects following succession.

Russell and Hermiston [10], Muensterrmann [11] and Geldens [7] have also engaged directly with children from farming families who have made lives, or planned lives, away from their family farms. Their research provides space for daughters and sons to represent their own views and concerns; however, their focus is not on children as farm successors but more on how farming *per se* influenced personal feelings and choices for future off-farm lives. Most recently, Cassidy and McGrath [12] examine the personal sense of place attachment, responsibility to family farming tradition and identity in non-successor farm children. This is important work in bringing non-successor farm children into view on farm succession and the personal effects of family decisions on farm succession. However, the article does not address the wider social ramifications of the continuing gendered order of farm succession which favours sons.

Social research into farming families and rural spaces over the past thirty years has highlighted the prominence and continuity of patriarchal institutions that place rural males primarily in the dominant social position and women as subordinate in both their families and in rural society in general [13], [14]. The notion of equal status in work opportunities and rewards and in decision-making, while being accepted as desirable for society and being enshrined in Equal Opportunity Legislation (for example, in Australia 1984), appears to have had little effect on how rural people determine who makes decisions about intergenerational transfer of farm land and who has opportunities to actually own and operate farming properties [15]. Except for Norway, with its equal opportunity legislation on primogeniture inheritance of private farming properties, most other farming families in Western capitalist countries still adhere to the notion that sons are the children to be nominated as farm successors, while daughters and non-successor sons, where possible, are provided with opportunities to further their education and to pursue off-farm careers [16].

Adherence to patrilineal inheritance may, at first glance, appear to enable the continuity of family farming, the sustainability of farm production, the viability of farming properties and the contribution of farming to the local, regional and national economies. However, as mentioned above, social problems in rural communities that appear related to patterns of patrilineal inheritance include the out-migration of non-successor children especially in the age group from 19-24 years. Alston [6], [17], [18] in acknowledging the prevailing patriarchy of rural farming areas, analyses attempts to address rural patriarchy through 'gender mainstreaming'. The mainstreaming agenda aims to transform social, political and economic policies, legislation and action so that "gender inequalities are not perpetuated through institutional means" [18, p. 287]. However, Alston, like Gray and Lawrence [5] above, states that previous crises and changes in agriculture appear to uphold the status quo such that "gender and power relations are unaffected by extreme conditions … [and] if anything, are reshaped along patriarchal lines to incorporate new roles and expectations" [6, p. 178]. It appears that patriarchy is so deeply entrenched in rural farming regions that men and women reform their roles which uphold former power relations in rural farming regions.

The research of the previous four decades into farming relations has illuminated three main factors relating to gender in rural farming communities. Firstly, it brought farm women and their contributions to agricultural production and rural communities into view [13], [19]. Secondly, the research highlighted the enduring patriarchal relations entrenched in rural farming communities [18], [14], [20]. Thirdly, the promise of gender mainstreaming in changing the persistent gendered inequality in rural farming regions has been found to have limited success in overturning rural patriarchy [6], [18]. During the time of this research, rural farming populations have diminished and the disproportionate out-migration of young women has brought other crises which directly affect the social lives of people remaining in rural areas [21], including the marriage prospects young farm successors, that is, of finding suitable life-companions to continue family farming [22].

While Alston [21] reports the outmigration of young women from rural areas as significant, none of the research to date appears to address or question the enduring negative impact that prevailing patriarchal attitudes may have in pushing possible residents away from rural areas. Fischer and Burton [23, p. 2] come close to pursuing this topic in that they do question the value of what they call previous "factor-based" research into farm succession suggesting that factor-based research misses the "complex and long-term character of succession processes and the socially constructed and hence subjective nature of succession". However, in examining the complex endogenous processes involved in farm succession to ensure that there is indeed a successor to the family farm in order to keep farmers on the land and to maintain existing farming communities, they leave unexamined the social consequences of patriarchal attitudes, inherent in farm succession, on the maintenance of local rural communities. My research interest follows their line of questioning the socially constructed phenomenon of farm succession, and it also focusses on the possible long-term consequences of adhering to patrilineal farm succession patterns for the whole community.

The recent declines in rural farming populations and of the towns which interact with farming communities appear to be indicating a tipping point where, unless action is taken, rural farming society may diminish even further so that instead of self-sustaining rural communities occupying Australia's rural farming spaces, the farming regions become more sparsely populated and more like the remote regions of the country. According to O'Riordan [23, p. 33], tipping points could materialize in four ways that influence social sustainability: "unintended worsening" (unintentionally creating conditions which could result in the onset of negative tipping points), "induced vulnerabilities" (risks generated through inbuilt tendencies that create tensions), "incoherence" (inability to recognise or predict when tipping thresholds have been reached or passed) and "restorative redirection" (purposeful action to move towards sustainable development). It is this last manifestation of a social tipping point, restorative redirection, which is the subject of this paper. Further, following O'Riordan [23], I argue that addressing the negative aspects and impact of gendered rural relations puts human-well-being to the centre of the rural sustainability project.

The next section discusses my two research projects undertaken, firstly, in 2012 (as part of my Arts Honours research program) and, secondly, in 2014/15 (as part of my current PhD research project) to identify and expose underlying patriarchal attitudes which I consider may be contributing to the continuing decline in rural farming populations and the consequent rural social issues related to population decline.

Objectives/methodology/scope

My 2012 research project aimed to give daughters of farmers a voice in rural social research into farm succession as it affected them. For this project ten daughters ranging in age from 36 to 74 years participated in one-on-one confidential semi-structured interviews. The research grew out of my own experiences as a "disinherited" daughter of a farming family [9]. This research was undertaken in the Shire of Southern Grampians, Victoria, Australia, the shire in which I grew up and to which I returned, after a sixteen year absence (see Figure 1, next page). My personal interest of whether other daughters of farmers felt as I did was not only answered in the Honours project, it opened up more questions and opportunities for further study into the whole process of how farm family members negotiated farm succession and what enduring personal and social effects arose from these processes.

My 2014/2105 research project engaged a greater variety of farm-related people ranging in age from 19 years to 97: farming people, retired farm-family members, non-successors and non-farming people related to farming families. The location of the research was broader than the 2012 research to capture a variety of viable farming enterprises ranging from dairying, mixed farming with beef and sheep (for wool and meat) to cropping and was conducted over eleven shires in Western Victoria, Australia. The process of data collection was mainly through semi-structured interviews, but it also included 40 mail-out survey/questionnaires posted to targeted individuals located through the livestock sales results in regional newspapers to fill gaps in the interview data. Sixty individuals were interviewed (46 farm family members comprising parents, successors, non-successors and retirees and 14 farm associates, two of whom were also sons of farmers). A further twelve farming family members responded to the mail-out survey questionnaire.

The two main objectives were:

1. In 2012 - To provide space for daughters of farmers to relate their experiences of farm succession and inheritance as it relates to and affects them.
2. In 2014/2015 – To investigate the different social consequences arising from families' negotiation of farm succession, through interviews with different farm family members (farm owners and their children including farm successors and non-successors) and through interviews with

associates who either through professional work or family relations assist farming families with issues related to farm succession,

During the recorded interviews, notes were also taken to record bodily and emotional responses during the discussion to provide situated, embodied evidence of individual subjective experiences of family farming and family farm succession [25]. All interviews were fully transcribed in both research projects and analysed following grounded theory principle of open-coding to identify relevant themes and events [26]. Stories and themes of the rural were drawn from the compilation of each participant's situated knowledge to provide a constructed grounded theory of intergenerational family farm transfer in rural spaces as it affects the different family members and the wider rural communities [27].

I followed Phillips [28] call to rural researchers to think across the public and private realms in linking agricultural sustainability (a public, state-supported, albeit changing, enterprise [29]) with individual farm family dynamics (the private domain). This research, hence, leans towards a feminism [30] that dares to examine the politics within the farming family that determines intergenerational farm succession processes, and therefore, does not hold the liberal democratic notion that political examination must be "kept out of private life" [30, p. 155]. This approach enabled a rich and deep knowledge to emerge of a social phenomenon that is regarded as a stressful and difficult process for many farm family members [9], [31]. In this way, my research provided daughters and non-successor sons 'a voice', alongside other rural voices in sociological and human geographical research that, until very recently, has been missing. It also provided the opportunity to examine the actual position of non-successor children of farmers within their own farming families and childhood communities.

Results

Table 1 (below) presents a general summary of the 53 farm family participants' who expressed strong feelings about living in rural spaces, farming as a career and socialising in rural communities. Three other interviewees expressed neither positive nor negative feelings about farming, country living, or rural spaces; they are not represented in the table.

Table 1. Family farm members' feelings about farming, rural spaces and country people
(Combined results for 2012 and 2014/2015)

Interviewees	Being a farmer		Living in rural spaces		Socialising with country people	
	Like	Dislike	Like	Dislike	Like	Dislike
Sons	4	1	4	1	4	1
Daughters	8	9	14	3	11	6
Farm wives	8	10	16	2	12	6
Farm husbands	13	-	13	-	13	-

We can see that most interviewees enjoy living in rural spaces and most enjoy socialising with country people in the farming communities. However, there are more women who expressed dislike for socialising with country people than men. There are also many more women than men who express a dislike for farming as a way to earn a living, but most of these women enjoy rural spaces and country social life. Only one male expressed dislike for farming as a career and this was the youngest male interviewee; he has rejected everything about farming and rural life to pursue tertiary education and a career in urban areas.

The most telling data concerns daughters who would have liked to be included in family farm succession but were not, and who then moved out of the family farming region to pursue non-farming careers. Overall there were eleven daughters interviewed who expressed a desire to continue their association with the family farms of their childhoods through some formal business arrangement, either to work as farmers or to be involved the business of farming through management and/or investment. Of these eleven daughters, while five have secured continuing involvement with their family farms only one daughter actually works full-time as a farmer on the family farm of her childhood. However, even in being acknowledged in the farm succession plans, not all is as fair as it may appear to be. This will be discussed further in the following section.

Of the many themes that emerged in both the 2012 and 2014/2015 data, the following are relevant to this paper:

1. Personal identity (including attachment to place and family) and ambition
2. Commitment to farming as a career and/or to local farming community
3. Opportunity to continue association with the family farm in adult life.

These themes form the basis of the discussion in the next section. (Note: In the extracts from interviews used in the next section, the changes in pitch are represented in changing font size, change of voice style is represented in italics, and where emphasis in speech is used the words are in bold. The ages of the interviewees are placed in brackets.)

Discussion

Each of the themes listed above provide entry points for the discussion of attitudinal tipping points in rural farming communities. The enduring patriarchal relations within families and between members of local farming communities appear to play a noticeable part for many farm family members in their impressions of themselves, their relationships with family members and their relationships and opportunities within the local farming communities and surrounding regions. While successors of family farms and their wives (or partners) may align with patriarchal attitudes that provide them with opportunities to remain on the family farm, to ensure that there is a farm to pass onto the next generation or to feel at one with the attitudes of their surrounding community [19], [32], for other members of farming families interviewed the feelings can be of lack of identity with local attitudes, resentment that patriarchal attitudes limit their own opportunities, or alienation from spaces they would otherwise enjoy. The data gleaned from interviews to illustrate these points on these themes listed above is presented in the following discussion.

Personal identity (including attachment to place and family) and ambition

Over both research projects, many individuals (including daughters, incoming wives and successor sons) felt at one and at home within farming communities and enjoyed their lives as they had turned out without any questioning of the gender order of their lives. Variously they were attached to their family farms, their rural livelihoods, the local rural communities and the people with whom they engaged in the course of their productive and recreational activities. Life in the country for them was far better than they imagined living elsewhere would be. Their main concerns were to do with commodity prices, taxes, unreliable weather patterns and what was happening in neighbouring properties. Some did express concern at the falling population and the effect that this had on the continuity of rural services and social clubs. None expressed any great concern with the gendered patterns of social existence and opportunity, even though it did feature in discussions on the gendered roles men and women played on the farm and in the community, such as who did which jobs on the farm (men generally did more physical outdoors work) and who was the main carer in the family (generally the women). Indeed, some stated that this is the way things are in farming. The major concern was whether a successor son would find a suitable partner, someone who was used to the farming way and not someone who would split the family and the farm. Other interviewees, mostly daughters, who were also comfortable with their life paths were people who had chosen non-farming careers either in the local community or distant from it. These people accepted that their lives were going to be different from their farming families' lives and that they had desires and ambitions which led them off the family farms, often out of the local communities.

On the other hand, there were a number of people, most, but not all, of whom were daughters, who expressed various feelings indicating that they were saddened, disappointed and upset at the way succession decisions were made. They felt left out, rejected and in some cases angry with the way succession turned out in their families. Other farm family members, once again mostly daughters, also felt alienated by the prevailing patriarchal attitudes that informed rural social relations within their communities. These people, where they could, left their families and communities to find more accommodating attitudes which aligned more readily with their own self-concepts. It is these interviewees who provide a view into the negative effects of the prevailing patriarchal attitudes for local community sustainability. For example, the strength of feeling against the attitudes within the local community comes through strongly in this extract from a daughter, interviewed in 2014, who only returns to the farm community to care for her elderly mother:

Interviewer: Would you like or have liked to inherit the farm or be included in the farm succession plans?
Daughter (61): NO WAY cannot think of anything worse
Interviewer: Was there a time when you were a child though that you thought it was fantastic and great and it may have been you
Daughter (61): Ohh   NO I mean I sort of one stage I was interested in doing something like agricultural science but not really seriously not for long   that's much more that's one of the lasting things I mean the farm for me was a nightmare to escape from um but even you know like the small community oohhh
Interviewer: Mmm now tell me about what it was you escaped from in the local community
Daughter (61): Oh god   narrow-minded   prejudiced   unquestioning   unthinking   no critical thinking conservatism

Interviewer: How did that play out first   when did you first become aware of that
Daughter (61): Oh I've always had trouble at school cos I asked too many questions
Interviewer: And you chose to stay away
Daughter (61): Yeah but I also chose to you know I didn't   well I didn't stay away as much as I was contemplating to
     one stage cos at one stage I was ready to just walk out totally and never go back **ever**   no absolutely not
     I feel no attachment to that bit of land whatsoever   piece of dirt

In contrast to the above daughter's sense of alienation and difference from other farming people and the family farm, the following daughter, interviewed 2014, feels attached to the family farm and family of her childhood. She also acknowledges the importance of the family farm to her father:

Daughter (29): So I think if [brother] had made the decision not to come home   the farm would have been sold
     and I don't think that would have been great for dad   um   but he would have then had a bit of a life as
     well because some of his mates have sold their farms   and they are working and doing stuff elsewhere
     and been less stressed and been able to value   family time   so I think   to some degree when it was
     something that he was kind of could of been looking forward to   just that backing off   but   deep down
     a fear of not having the farm
Interviewer: Mmm yes fair enough   so okay   that's an interesting one there   so what about you and your sense of
     the farm   being sold   does it have any effect on you
Daughter (29): I don't want it being sold   I just didn't   that's where I grew up and I wanted my children to be able
     to be on it   so I've encouraged   I didn't say anything to [brother]   but I really wanted him to choose
     farming
Interviewer: Yes   because you see that your children   will have continuity there
Daughter (29): Yes that's exactly right   yes
Interviewer: So   at the moment you feel comfortable because it's still partly your home
Daughter (29): Yea yeah   exactly right

This same daughter also acknowledges that the men, her father and brother, in her family have a tendency to downplay the position and roles women play in this family.   She realises that these patriarchal attitudes are affecting her mother who feels so under-valued that she spends a lot of time away from the family farm and the local community.

Daughter (29): Little things that build up like   it's probably a lot like   um   ah actually I've just put my finger in it
     it's a lot like the way   dad   treats mum in terms of value and importance and what   is um of
     importance to her   he doesn't have high on his priority list   it's probably how [brother] has treated me
     so if it matters to me   if something   better comes up it doesn't matter oh it's just [I'll]   it's like she'll
     always be there now I've just thought   now that I'm just doing this   it's put it altogether
Interviewer: So like father   like son   like mother   like daughter
Daughter (29): Yeah   yeah that's exactly right
Interviewer: Mmm interesting   but I think   it's really interesting that you actually identified it   that the father and son
     do exactly the same to the mother and daughter
Daughter (29): And I think by brother has the same attitude to mum because she is just the mum   she feels   just the
     mum   I think when [brother] has children of his own he will respect her so much more

Other interviewees who felt strongly attached to their family farms and possible careers as famers also reflected on the prevailing patriarchal attitudes that negatively affected their own positions within rural farming communities. One daughter (57) interviewed in 2014 cried as she related her passion for farming, and of being left out of the farm succession, her own brother's bullying towards her and the eventual loss of the family farm when her bother sold it in 2014. Two other daughters (36 and 74, interviewed in 2012) also had tears in their eyes as they spoke of the loss they felt at being disinherited and alienated from the very place they loved and which, as daughter (36) stated, was her "heart home".

Comments from two single sons (26 and 30, interviewed in 2015) who have returned to their family farms, after completing off-farm education, on the promise of being successors to the farms and the farm enterprises indicate that patriarchy still inhabits male thinking. Both young men explained that while they could look after themselves, they would like to find a wife who would do the home things and who could help on the farm when needed, even if she did have an off-farm job. The model of farming wives now apparent to these young men is that the wife is educated and has an off-farm job which can contribute to the household income but will take leave to have children and run the family. Neither expressed wanting a wife who would be a fulltime working farmer as a life-partner. Son (26)'s comment was "Someone needs to do the housework and I'll be the one running the farm".

Commitment to farming as a career and/or to local farming community

Most interviewees expressed satisfaction with farming as a life style, a productive enterprise and who were also committed to assisting and sustaining the local farming community through their participation in community events (see Table 1 above). However, there were factors which distanced other interviewees from farming and the local communities. Daughter (29) (also above), who was given the chance to be a farmer and who could have made a career of farming on the family farm, is no longer farming or on the farm. Finding a suitable partner to share farming life with was a problem. She realised that while she is attached to her family, the farm and farming as a career, her lack of choice of suitable partners in the community drove her away from the community. In the end, she chose a non-farming partner and life off the family farm. Noticeable in this daughter's account is her negative assessment of character of possible partners from family farms:

Interviewer: So you thought that you were going to be a farmer then
Daughter (29): Yes yes I thought I was   but then I had to find someone that was going to live on the farm too and that's not easy if I didn't want to marry a farmer myself   and yeah all the farmers I knew were jerks and I wasn't even going there   and then my partner come along   out of the blue so
Interviewer: And so that changed things   you didn't know him before   so you had considered the possibility of being a farmer   that was not going to be a problem for you   but having a marriage partner of sorts was going to be a problem
Daughter (29): Mmm mmm
Interviewer: Because what you saw in terms of the farming stock wasn't that appealing
Daughter (29): Mm mm   (Laugh)   and [partner] hates it   mmm he hasn't   has no idea has no desire to live out of town   um he hated travelling out there and I wanted it to work   hell or high *so I moved into town*

In the following passage this same daughter talks about her observation of the lack of social skills in young male farmers as being the one of their major problems, but that these problems would be eased with more socialising by the young farmers so that they can learn how to behave with potential life-partners.

Daughter (29): **And I do think a farm attracts women   I really do** *it's stability*
Interviewer: Mmm   interesting   so why are there so many farm men without women
Daughter (29): Personalities   I think a lot of farmers have to have a certain personality   to stay out there and be so isolated   and their personality turns the women off   this is from when I went to quite a few farm dos they try to bat well above their average   and tend to not succeed   and they want the stunner   the gorgeous one   and they are **butt ugly   and that is no joke** that is a farming thing I was like   oohhh *there is no way I am going to get within ten feet of you*   you're so ugly   and you've got the personality of a snake like because they don't sometimes socially they don't get off the farm um so I think   the young farmers need to make a very very   good balance of getting out   knowing how to socialise to   and getting within their social groups   because   females will find their um worth I really do think that and some of them don't   like they live and work
Interviewer: Yes (laugh) I'm just really interested to hear you say that   because you were not attracted to these farmer men
Daughter (29): No *I could of and would of*   I would have considered it [marrying a farmer]
Interviewer: Oh right (Laugh)   okay so there is hope if they're socialised
Daughter (29): There is   they've got to be socialised   otherwise it's like a little puppy   they go out and bite and hump everything they see (Laugh)   without a filter (Laugh)   that's exactly what it's like

We see Daughter (29)'s assessment is that the inbuilt nature of farming sons can be altered through socialisation so that farming sons do learn to respect and to behave respectfully towards women in farming communities. However, until sons do change their disrespectful ways she considers them not worthy as marriage partners. Daughter (61), on the other hand, saw no redeeming features in farming or in the people of her childhood farming community:

Interviewer: Tell me a little bit about that tell me why you wanted to escape from the farm
Daughter (61) Just one of the reasons I became a public servant for such a long time was   I like to know how much money I had in my hand each week and how long it had to last   on the farm you got one or two cheques a year and you never knew whether it was going to last until the next year or it had to last you ten years because of the drought rain and god and it didn't matter how good you were at it   it wasn't in your hands and that was one of the reasons I became a wage slave I had to have that security

Farming, for daughter (61), was an unpredictable life. While other farming women admitted the difficulties in earning a living on the farm, their commitment to their families and their enjoyment of country living was stronger than their desires to move off farms and out of local communities. However, daughter (61) did not share these commitments.

Interviewer: Did you ever think in some other period that you might have married a farmer
Daughter (61): Never   N E V E R (laugh)   and the point of being educated for [mother] in [mother's] eye was to look after yourself until you are married   and then if necessary you did marry a farmer you could have an off-farm income source so there was that there   but um most of the farmers around were Lutherans anyway so they wouldn't have been acceptable   (Laugh)   but you know I was always clear that I didn't want anything I'd got my inheritance I got the education and I got OUT **THANK YOU** laugh
Interviewer: So about your own attachment or not
Daughter (61): Lack there of   (Laugh)
Interviewer: You were ready to leave
Daughter (61): Oh yeah   oh no I made my community somewhere else oohhh no I won't go [back]   and that's the thing that's why I like C particularly   being so involved in a particular community within C it's like a village

Daughter (61) is adamant that it is the attitudes of rural people which make living in farming communities an unattractive proposition. She is grateful that she was able to win scholarships to university which provided her with an education and status in the workplace and an exit from the small-mindedness of rural people. Interestingly, it was not only daughters who disliked the attitudes they experienced during their childhoods in their farming families and wider farming communities. Two sons (19 and 28, both interviewed in 2014) felt that their fathers were overbearing and that they did not value their sons as individuals with their own personal preferences and interests. Both sons felt alienated from the family farms, especially following childhoods where their fathers bullied them into working on the farm. Son (19) has rejected farming and rural life entirely wanting nothing more to do with rural places and people. His mother has also moved off the family farm to live in the nearby city while the farmer lives and works alone on the farm. Son (28), after many years of travelling and working off-farm, realised that it was his father's attitude which was the problem for him and not farming *per se* or other people in the farming community. He has since returned to the family farm to live on the farm with his wife and new baby and to work as a farmer in partnership with his father. He is currently working off-farm during the week and works after hours on the farm because he loves farm work. His frustration now is not with his father's lack of respect for his own skills and views on which farming enterprises to develop, it is with his father's lack of addressing the actual process of farm succession. The problems of succession-planning remain prominent for many farming families. They have been considered adequately elsewhere and are not examined in this discussion.

Opportunity to continue association with the family farm in adult life
A number of children who have moved off their family farms to pursue non-farming careers are happy in still maintaining contact with these farms and with the successors to the farms. Contact is achieved in a variety of ways: such as, through social visits, informal weekend assistance with farm jobs, receiving farm goods such as wood and vegetables and through formal business partnership arrangements. In the cases of business arrangements, two daughters (56 and 44, interviewed 2012) retain ownership over the part of the farm properties but undertake no work on the farms; the work in one family is carried out by other family members, while for Daughter (56) the farm is leased to a share farmer. Another daughter (60 interviewed 2014) does work on the property on weekends in partnership with her siblings, but she is happy for her brother to attend to the financial side of the business.
Of the two daughters (44 interviewed 2014, 74 interviewed 2012) to inherit and work on the childhood family farm, only Daughter (74) has lived and worked full-time on the family farm she inherited. For her it has been a mixed blessing. She has pursued the career she absolutely loves, but her father, in transferring the farm partnership to herself and her brother, assigned the power of attorney over the financial side business to her brother. So, while Daughter (74) is able to act as a farmer on the land and work with the sheep and machinery she loves, she has no financial autonomy to make business decisions for the farm and for other off-farm necessities (such as caring for her ill-husband who moved off-farm into nursing care) or for personal recreation.   Her brother controls all the earnings from the farm and apparently grants only meagre amounts to his sister, while his own family enjoys a comparatively richer lifestyle from the farm's earnings. Initially Daughter (74) thought that her father was being fair in making provision for her to inherit

part of the family farm, now she sees the situation differently and regards herself as having been a slave to her brother and his family.

Daughter (74)'s life exemplifies the difficulties arising from enduring unequal gender relations in farming communities. Farm succession is not only an issue of equal opportunity to farm or to own farming property. What is at issue is the underlying assumption in rural communities that men ought to be the ones who hold greater responsibility for how money is managed, even if it mostly the wives who do the bookwork as is the case for many wives in this research. Controlling the money provides power to the controllers, and in most interviewees' farming families, even with wives contributing to the family income, it is mostly the farming men who control the finances of the family farm. In most cases it is the male farm owner who determines who succeeds that family farm, when succession occurs, who gets which share of the farm income and when the farmer and his wife-partner retire from farming.

Patriarchy adversely influences many people who could or would consider remaining in rural spaces. It affects family members' identities (including attachment to place and family) and ambitions; their commitments to farming as a career and their commitments to local farming communities; and it affects farm family members' opportunities to continue their associations with the family farm in adult life. Hence given these factors and the continuing net out-migration of young people from rural farming regions, I suggest that the 'tipping point' in rural population size and demography has been reached, and the time is right for transformative action to address the negative consequences of enduring gender inequality in rural farming communities brought about by pervasive patriarchal attitudes. The sustainability science view of tipping points, of identifying the problem and searching for a solution that counteracts non-sustainability and inequality can find purchase in rural social crises [24]. Just as sustainability science is "revelation", my own research is revealing in demonstrating that rural people can, by their attitudes, drive potential rural citizens away from rural areas [24, p. 33]. While I acknowledge that many of the issues faced by rural people are beyond their control, how rural people relate to each other and create power hierarchies based on gender, which in turn alienates people who would or could otherwise make the rural spaces their homes, is endogenous to rural farming communities. I argue that this aspect of rural relationships currently contributes to rural population decline, and it is one of the factors that rural people themselves can change.

Acknowledgements

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Psychological Barriers that Limit Community Adaptation to Climate Change; Special Reference to Sri Lanka

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Abstract

The increasing scale of potential climate impacts on communities highlight the urgency for successful adaptation. Although there are many potential adaptation options available for marginal changes of weather conditions, the persisting deficiency of adaptation in developing countries has recently received much attention for barriers to adaptation within both academic and policymaking agendas. Except the limits which can be analysed as structural barriers, there are psychological factors relating to human cognition which impede behavioural choices that would facilitate community adaptation and social sustainability. Individual human cognition or their cognitive appraisal about the risk and coping capacity is strongly related to person's adaptive behaviour and outcomes. Limited cognition about the risk and available coping resources, lack of belief about the authorities and empowerment, and attitudes that depicted by community narratives are some of the psychological barriers that would influence for less motivation to act against climate change. However, there has been little empirical research on psychological barriers that influences community adaptive behaviour in the social sciences and the sustainability research domain, although, a few social scientists have focused on some of this factors. Therefore, the primary purpose of this study is to examine the role of psychological barriers in limiting community adaptive behaviour as well as adaptive capacity in the context of climate change. An examination of collective behaviour of rural community in Hambantota, Sri Lanka provides ample illustration of how those barriers limit the community adaptation to climate change impeding the social sustainability of Sri Lankan rural community.

Key words: Climate Change vulnerability, Adaptation, Psychological Barriers, Cognitive Process

1. Introduction

In order to minimise global uncertainties caused by climate change induced calamities, such as floods, famine and droughts, it is vital that the global community should capitalize heavily in adaptation strategies for communities identified as being the most vulnerable. In a new, deliberative and self-conscious way, however, adaptation to climate change has now become part of the current discourse of the politics and economics of global climate change [1]. Although much of the earlier international climate policy debate in the 1990s and early 2000s was focused about mitigation, during the past decade the growing attention has payed to adaptation [2, 3]. While the term adaptation is in widespread movement, it is difficult to find a single definition that can be applied universally [4]. The Intergovernmental Panel on Climate Change defines adaptation as 'adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities' [5]. Adaptation, however, cannot avoid all climate change impacts, adopting climate change adaptation strategies may not reduce or impede the vulnerability to climate change [6].

While there is a well recognised need to adapt to changing climatic conditions, there is an emerging dialogue regarding limits to such adaptation increasing the social vulnerability while diminishing the social sustainability [4]. Although there are barriers, limits and costs, none of these are fully understood". Generally, limits are traditionally analysed as a set of indisputable thresholds in biological, economic or technological parameters [1]. As a result, the facilitation of adaptation strategies needs to recognize and address key barriers to ensure that societies are resilient in the face of a changing climate and promote

successful adaptation [4]. Limits to climate change adaptation can be categorised into four major groups: (i) biophysical limits, (ii) economic limits, (iii) technological limits, and (iv) social limits [1]. However, within the social barriers there are psychological factors relating to human cognition which impede behavioural choices that would endow with community adaptation and sustainability. This paper contends that limits based on human cognition are endogenous to society and hence subject to beliefs, commitments, ethics, knowledge and perception of risk of a specific community. This research aims to explore the influence of cognitive barriers to adaptive behaviour of community using insights drawn from field work in rural subsistence community in Southern Sri Lanka. Understanding the limits to climate change adaptation is important for decision-making about adaptation strategies for community planning and management in order to achieve social sustainability. It helps to understand social values and their priorities and also, it helps prioritise adaptation strategies in order to minimise social vulnerability [7].

2. Human Cognition and Psychological Barriers

According to Gifford, (2011), same as the structural barriers, psychological barriers influence for decision making of adaptive behaviour, and for social sustainability [8]. He further mentions that community and individual functioning towards adaptation emerges as three broad phases. First one is genuine ignorance which prevents taking action. Secondly, if one is aware of a problem, cognitive processes can restrict taking action. Finally, although, action is taken by people, it can be insufficient. Gifford, categorised psychological barriers into 7 types, such as limited cognition about the problem, ideological worldviews that tend to preclude pro-environmental attitudes and behaviour, comparisons with key other people, sunk costs and behavioural momentum, discredence toward experts and authorities, perceived risks of change, and positive but inadequate behaviour change. He suggests that these barriers are clarification of the significant questions surrounding the remarkable gap between attitude ("I agree this is the best course of action") and behaviour ("but I am not doing it") with regard to environmental problems.

The process of adaptation provides the foundation for identifying and categorizing barriers. It can be used common phases of a rational decision-making process, including understanding the problem, planning adaptation actions, and managing the implementation of the selected option(s). In each stage of process phases barriers can be identified. However, as Lazarus and Folkman (1984) say, that there are three main phases between the changing event and the adaptive outcomes: the changing event (impacts of climate change as a stressor!); cognitive appraisal and coping mechanisms; and coping outcomes [9]. This cognitive appraisal mediates between the event and the coping outcomes. Simply, cognitive appraisal is the process through which the person evaluates whether a particular environmental event is relevant to his or her well-being (a threat, challenge or an opportunity) , and if so, in what ways he or she reacts for the crisis situation.

According to Lazarus and Folkman (1984), the cognitive appraisal can be divided into two major forms as primary appraisal, through which the person evaluates the significance of a specific climatic event with respect to well-being, and secondary appraisal, through which the person evaluates coping resources and options. The personal judgments about the impact of a climatic event are irrelevant, non-threatening, benign-negative or positive or stressful referred to as primary appraisal. They further explain that commitments, beliefs and situational factors moderate the cognitive process. A wide range of general beliefs (e.g., religious) and specific beliefs (e.g., in a particular person) are also factors which influence the primary appraisal to impede the adaptive behaviour. Commitments also are important determinants of primary appraisal. On one hand commitments reveal what is important to the person, what the person most value, what has meaning to him or her, and what are his goals to be achieved in the future. They

can be defined at many levels of abstraction, ranging from values and ideals (e.g., parenthood) to specific goals. On the other hand situational factors provide the information including the nature of the harm or threat, whether or not the event is familiar or novel, probability to occur, when it is likely to occur, and how obvious or uncertain the expected outcome is. According to the situational factor the perception of risk can vary and encourage or discourage the adaptive behaviour.

According to Lazarus and Folkman (1984), the evaluation of coping resources and options is taking place during the second cognitive (secondary) appraisal. It addresses the question, should I response, what and how can I do? Do I have resources for that? In secondary appraisal, coping resources, which include physical, social, psychological, and material assets, are evaluated with respect to the demands of the situation. Situational appraisals of control are part of secondary appraisal [9]. As noted earlier, they refer to the person's judgment or belief or perception about the controllability of a specific encounter. If the person perceives the event as uncontrollable, it can negatively affect for the adaptive behaviour.

3. Psychological Barriers and Community Adaptive Behaviour

There are psychological barriers which can be identified in each phase of the primary and secondary appraisal. Limited cognition or in other word individual thinking acts as a barrier to perceive the true risk, threat or challenges of climate change and its impacts. Many sociologists mentioned that ignorance also critically blockade the adaptive actions in two ways: firstly, not knowing that a problem exists, and sometimes, although those they aware of the problem, they do not know what to do and benefits of different adaptive strategies [10].

According to Gifford, R. (2011), environmental numbness is also a cognitive barrier which obstructs the adaptation [8]. Climate change is a natural phenomenon outside immediate human attention because it is not causing any immediate personal complexities. Similarly, topic of the climate change is very common in the social media resulting numbness to the message and it may turn down the ability to identify the risk and adaptive behaviours that would facilitate the risk reduction.

Uncertainty about climate change also most probably functions as a root of inaction relevant to climate change, which in turn, increase the social vulnerability and limit the adaptive capacity. Underestimation of climate change risk on the vulnerable community could be an adverse result of this uncertainty about impacts of climate change. According to the social sciences research that an individual's action and behaviours are fashioned by deeply rooted cultural and societal norms and rules [11]. According to Gifford, (2011), how people perceive, interpret, and think about risks and their management, what information and knowledge they value, what concerns have standing and so on based on deeply held values and beliefs of a society [8]. Further adding, individuals view new problems, tasks, and answers through the community narratives about pre-existing values, preferences, beliefs, norms, and experiences [12].

Place attachment is another element which moderates the adaptive behaviour of the community. There is a more possibility to care for a place when they have a strong attachment than for people which they are not attached. Thus, Gifford, R. (2011), describes that on one hand weaker place attachment often limits the positive adaptive behaviour. On the other hand, when people have weaker sense of community, it is less likely to take collective community actions [8]. At the same time, people who have less feeling about their community can take various forms of negative attitudes ranging from a general lack of trust about others, belief that what the other offers is inadequate, utter denial of the legitimacy of the other's beliefs, reactance against following the other's advice and finally lack of trust in leadership and its benefits to the society. Trust is essential for collective adaptation strategies - when it is absent, between public and the institutions, confrontation can be occurred. While mistrust obstructs the adaptive actions, trust in others

facilitates the positive adaptive behaviour. Uncertainty and mistrust can easily lead to active denial of the problem (e.g., Norgaard, 2006) [13]. This often leads to turn in to religion and engage in religious practices believing that nothing they can do for the natural consequences.

4. Methodology

The study location is Yahangala Village situated within the context of Sri Lanka, 15 km away from Hambantota Town area in Yahangala West Grama Niladhari Division in Hambantota District, Southern Province of Sri Lanka. Yahangala, tranquil farming village in the Hambantota District was on the road leading to Badagiriya off the 155th milepost on the Matara-Tissamaharama-Kataragama Road. The area is dominated by the curd making farming community, and it was visible that in front of each house, the skull of a buffalo hangs on a tree or from the house itself. It is highlighted that most of the respondents are suffering from poverty and the adverse impacts of expected (droughts) and unexpected (floods) extreme weather conditions. Yahangala is very remote and being isolated due to long distance from a town area,   inadequate public transport system and less attention from government and other relevant authorities.

The study builds on a number of qualitative and quantitative assessments and tools developed to explore vulnerability and their adaptive behaviour and to climate stimuli at the local level. Data collection had been undertaken through a questionnaire survey, focus group discussion and field observations. The sample consisted of 70 farmers in Yahangala West DN Division. The questionnaire comprised questions on socio-economic background, agricultural production, perception of climate change and its risk, responses to climate change and their effectiveness, barriers to climate change and other non-climatic factors influencing farming. Two focus groups were selected, with representation of 8–10 full-time and part-time farmers from the area. Rainfall and temperature trends were identified, based on published research related to the study area.

According to the report of Droogers (2004), observed temperatures for the Hambantota Meteorological Station in the plains of Walawe basin indicate a clear trend with rising temperatures over the last two decades of almost 0.5 ∘C based on regression analysis of the annual mean temperatures over the period 1981–2000 [14]. For the period 1950 onwards, he plotted the years where the average temperature is more than 1% different, so hotter or cooler, from the last 30 years. According to his report it is clear that the number of extremes has increased substantially during the last 15 years. Although debates in the past have been whether these increases can be caused by changes in measurements, the latest IPCC reports (IPCC-WG-I, 2013) have shown sufficient evidence that global temperatures are indeed rising [15].

5. Results and Discussion

Community of Yahangala represent a homogeneous social group signifying a purely Buddhist community who primarily depend on agricultural activities. The average household size is around 4. All respondents are farmers who engage in traditional farming systems such as rice (paddy) cultivation; chena ("slash and burn") cultivation; home-stead; and livestock (animal husbandry). More than 75 % of the farmers had farming experience of more than 30 years and on average they had lived in the study area for four decades. Of the interviewed farmers, 57 % were full-time farmers and the rest were part timers. Average land holding size is 0.53 ha and about 70 % farmers own an extent between 0.41 and 0.61 ha. Of this land, more than 70 % is lowland or rice paddies. According to questionnaire survey, the average farmer age was on the higher side with more than 80 % of the farmers above the age of 40 years implying that younger generation was not enthusiastic to choose farming as a livelihood.

It is a common problem to the area that the returns farmers earn are declining over time. Additionally, the low yields they can gain from small land plots and poor incomes keep these poor farmers locked into an endless cycle of poverty. As an evidence for that the results of the questionnaire survey recorded that the income level of 75% of the respondents lie under 10,000 rupees (approximately $100) a month, whereas 25% of them get a monthly income of between 10,000 to 30,000 rupees a month. Those are the people who have an extra income source making cured, hiring three wheelers and tractors, doing labour works and small scale businesses. Hence, it shows that in general these households are falling in the category of poor to lower income group. The people who are under low income level has high economic vulnerability as they are fully depend on natural resources based primitive production. Their income activities not diversified enabling them to survive in an extreme weather conditions. This circumstance has created lower level of economic resilience and adaptive capacity among majority of farmer community.

Apart from the income dimension of those peasants, social dimensions are manifested among rural marginalized communities in many forms, including lack of basic needs, food, health, shelter and education, inability to engage in productive endeavour, lack of access to basic social and economic services, and exclusion from economic, social and political processes. The educational level of 58% of the sample lies under grade 8 examination, while 42% completed grade 10. It is highlighted that nobody has completed the secondary school. Meantime, they have strong place attachment since all respondents live in their own houses with valid property rights since their birth. According to the lengthy discussions I had with them, they convinced that they have a sense of community sharing the common rural identity and having shared emotional connection in time and space.

It is necessary to have a clear understanding of the farmers' perception of climate change, how they perceive the risk (primary appraisal) level and what psychological factors constrain their decision to adapt (coping or secondary appraisal). During the questionnaire survey and focus group discussions, farmers were asked what the weather was like a long time ago, which factors led for the introduction of their perception of the 'normal' seasonal rainfall pattern and the temperature, and afterwards what the weather was like today. Further, they have been asked how they perceive the impacts of climate change in relation to their current living pattern and their future plans and what strategies that they have taken to overcome the situation.

Farmers' perceptions of general change over time reflected in seasonality, distribution, amount and intensity of the rainfall, temperature and the wind. Farmers are strongly aware of the climatic condition and have clear opinions on changes, especially about rainfall and the frequency of climate events. Of the total 96% households generally agreed on increased temperatures and rainfall during the past 20 years. While the great majority of interviewees (65%) indicating an increasing trend, one quarter (25%) of them signifying decreasing trend. Wind is mentioned by 50% of the respondents; everybody mentioned the changes in the wind pattern, especially in the dry season. Finally, 42% of the respondents commented about an increased drought and flood frequency. Nearly, half of the respondents felt that there has been a change in seasonality during the past 20 years shifting their farming seasons. In addition to that, more than 50% of respondents attributed a decrease in yield, and 88% confirmed increase incidence of crop damage due to an increase in pest. Majority (91%) of the respondents complained that their income has reduced as a result of the above consequences. Apart from that, almost all respondents perceived about the limited resilience and high vulnerability characterizing regions dominated by economic poverty, subsistence food production, and a low and highly variable natural production potential.

Everybody in the focus group mentioned that they got stressed due to the unpredictability and uncontrollability of the amount of rice production and the income that they could have based on that yield. However, as they ranked their issues related to agricultural activities and the income, the problem of climate change lied on bottom of that list. They complained that they have no adequate farmlands,

government loans, fertilizer subsidies and the proper scientific advices from agricultural officers, what generally available for farmers in other parts of the country. However, it should be noted that the economic constraints would have been more prominent, if not for the fertilizer subsidy offered to farmers, where a 50 kg bag of fertilizer is given at a fixed price of US$ 3.07 regardless of the world market price. About 36 % farmers ranked climate-related factors such as lack of irrigation water as a most serious challenge. Although, farmers perceive temperature rise, they do not consider it as an issue affecting crop cultivation. Because, they think that the slight rise in temperature would not affect crop cultivation. It is obvious that their risk perception about the climate change was the least problem prioritizing the struggle of daily survival on top of the problem list. Reasons for least prioritization were due to the different goals, values and aspirations of community which are not compatible with climate change adaptation.

With regard to the impacts of natural hazards, social networks play a primary role in coping and recovery. In relation to the social networks and relationships only 54% of the sample stated that they like to talk with neighbours to get advices or share their common worries or to get information about common problems which have common threats. Further, 42% of the respondents do not like to get help from the neighbours believing it as an extra trouble. Weakened relationships and networks not only obstructed the collective actions, farmers' beliefs and less commitments for community and lack of perception of effectiveness of the collective actions also influenced for less collective efforts. Some of the farmers are pointed out that they have no trust about the ability of their neighbours in supporting at critical situations or they have no idea about the benefits that can be gained through the leadership. However, in ancient rural farmer villages, their norms, values, attitudes and beliefs were influenced to be cooperative and take collective actions. The norms of trust and reciprocity have often been taken as forms of cognitive social capital to initiate collective adaptive bahaviour. Further, the values of truthfulness, attitudes of solidarity, and beliefs in fairness similarly created and maintained an environment for mutually beneficial collective actions. Consequently, since the post-colonial period most of the rural traditions, values and beliefs have been diminished with the influence of the highly centralized government decision making process, which denied gathering of people for communication of their needs and desires. Instead, new values began to spread through the island, transforming how people interacted with each other and with their land. Moreover, as the intrusion of government into village life gathered pace through the 1960s and 1970s with trade liberalization, it changed its form in ways that decisively affected psychologically to keep social relations within the village. Today, most of the farmers in Yahangala trust on their individual ability and capacity to get adapted for the changing events. Hence, they missed lots of adaptation strategies through value of local or indigenous knowledge and recognize and respond to changes in climate parameters.

In relation to community leadership, most of the villagers do not believe that community leaders will contribute social benefits or they simply reject the help of leaders. Their comments highlight the disappointment that they have about the community leaders and their inadequate service to the community. Indeed they felt that their problems and difficulties were used only to support the interests and political purposes of the leaders themselves. In ancient Sri Lanka, village leaders had been men who have demonstrable influence within the village which based on their prominence in agriculture. When village leaders of an earlier generation petitioned authorities for construction of a school, or improvements to the tank, or relief work in times of drought, they could plausibly claim to be acting on behalf of the whole community. This system has changed over the years, and in general now, effective connections with politicians have become relatively more important as a basis of power within the village. When current community leaders devoted their energies to influencing the individual distribution of jobs, or houses, or scarce agricultural in-puts, they were quickly perceived by their fellow villagers to be acting in pursuit of purely personal or factional advantage. With all these negative experiences, the beliefs and attitudes of community members have changed and they attempted to reject

community leaderships and they do not believe the benefit of leadership to overcome common problems. Thus, this view of community leadership is significant cognitive barrier for community adaptation to climatic adversities.

Further, community has negative perceptions of effectiveness of community adaptation efforts to overcome climatic adversities. Specifically, they have negative perception of the effectiveness of past collective adaptation measures, featuring it as an important barrier to collective outcomes. This was confirmed during the focus group discussions as some farmers stated that the ambiguity of the effectiveness of collective measures made them think twice about whether or not to commit for collective practices.

In addition to the above factors, it was highlighted that the community members have less enthusiasm to commit for their own community. Discussions with respondents revealed that they largely concentrate on their own family matters and have less time and energy for community commitments. Firstly, they think that working together with the community made them face for unexpected problems, secondly, due to political deviation, which resulted by the party politics. More than their own agricultural issues, they have focused about two political parties as existing government and the opposition party. The members of the opposition party always tend to think that the active members of the existing government enjoy more benefits and resource than other members due to the close connection with the political leaders. On the other hand, as a practise, the opposition party members do not participate for any kind of activities that run by the government, whether it is beneficial for them or not. Instead, opposition party members always tend to criticize the program as a norm of the party politics in Sri Lanka. The main reason for that was corrupted political system which popularised for misusing of government resources for the entertainment of political patronage of party supporters.

In this discussion the meaning of less commitment for community does not indicate that they have no any kind of interaction with the community and no collectivism in the society. They have community gatherings to help people in their traumatic events such as deaths, sever illnesses and other activities such as arms giving, weddings and etc. In those events, people expect that fellow members in the village would come voluntarily and spontaneously to provide some assistance due to values of solidarity, norms of mutual aid, and shared attitudes and beliefs about how people should help each other in times of need. Apart from that all their income generation activities are doing in household level with very occasional interference with outsiders.

Sense of powerlessness is another element that obstructs adaptation efforts. Marginalized people in this area are generally more vulnerable and the economic, institutional and technological capacity to adapt to climatic change is often very limited. A highly centralized government planning and decision making process has deteriorated the opportunity for public to communicate their goals, needs and aspirations. Their participation in governance has remained to the election of political representatives every five years. There is no effective mechanism in place to hold all the local government and public administration officials accountable to their local constituency. Community empowerment was not significant in the area highlighting the lack of attention from the government and non-government organizations in respect of community adaptation to climate change. Being isolated with less attention from relevant institutions have been distanced them participation in decision making for disaster risk reduction. According to the interviews, the bureaucratic pressure on citizens and lack of belief about the benefits of public participation were negatively affected for community participation in decision making of adaptation strategies.

Perceived program inadequacy and feeling of insufficiency of knowledge and communication that they should get from the government agencies are also obstruct the adaptation process. However, individuals and communities had been adapted to climate change throughout the history and will continue to do so.

The findings revealed that farmers' perception of ongoing climate change were based on such experiences and, even the most of farmers in the area use their traditional knowledge to forecast weather, mainly due to poor access to such information and their lack of trust on weather forecasts made by government agencies.

Additionally, the research found that the farmers were using avoidance techniques as adaptation strategies; "we try to forget what has happened as nothing happened", "I just think about daily needs of my family". Specially, they have demonstrated high level of apathy and cynicism saying "nothing to do this is our fate" and "everything happens according to Karmaya[1] (turn into religion), or who can change it". In addition to that some members selected "doing nothing" as a best option to handle the difficult situation. Further, it is highlighted that high percentage of those economically and socially marginalized people always waiting for help from outsiders by doing nothing (minimum own commitments to get rid of sorrowful situations), blaming themselves and relevant authorities and institutions. Those all cognitive factors limit community adaptation for climate change threatening the social sustainability of the country.

6. Conclusion

The primary purpose of this study is to examine the role of psychological barriers in limiting community adaptive behaviour and outcomes in the context of climate change. There is a possibility to aggravate the severity of climate change impacts in the future, requiring farmers to be prepared beyond autonomous adaptation measures practiced at present. Hence, it is necessary for agricultural systems to adjust to new environments which are likely to evolve in the future. Many people mostly in developed countries already are in action in response to the impacts of climate change, but many others in developing countries are held up by one or more of these psychological barriers to action. Individual human cognition or their cognitive appraisal about the risk and coping capacity is strongly related to person's adaptive behaviour and outcomes. This is particularly relevant for marginalised groups in developing countries. A failure to recognise psychological barriers can limit the adaptive capacity to cope with climate hazards, variability and change. This understanding is vital in developing and promoting effective local adaptation strategies to achieve social sustainability.

The case study indicated that mainly, adaptation to climate change is limited by the beliefs, values, goals, aspirations, apathy and feeling of less empowerment within society. The study further revealed that farmers were able to perceive the risk of climate change, but minimum adaption efforts were visible in the area. It is significant that the centralized political system, historical social changes highly influenced the way of life of people and their cognitive process of decision making.

Overall, this study informs policy makers and organizations working on climate change in agriculturally dominant developing countries of the significance of understanding cognitive aspects of the local communities prior to formulating and implementing climate change adaptation strategies. This will require the state and other supporting institutions to take rigorous efforts to ensure that a favourable environment is created to facilitate sustainable adaptation. Socio-psychological research and preparation are required to scrutinize each psychological barrier more carefully in the context of climate change.

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[1] According to the Buddhism The effects of karma (actions) are inevitable, and in previous lifetimes we have accumulated negative karma which will inevitably have its fruition in this or future lives.   When a person accepts the concept of karma, and tries to live ones life accordingly, the effect is certainly not a negative acceptance of suffering it gives thoroughly satisfying explanation for suffering and loss" in which believers take comfort .
Certainly it is to accept the current experience without feeling bad about it and cope up with positive mind to get rid of that. However, Buddhism does not teach that karma makes a convenient excuse for leaving bad things as it is without an effort to overcome.

Further, it is need to understand the scope or scale of barriers faced by individuals members and different community groups. Apparently, different communities in different socio-cultural contexts have face with different cognitive barriers and therefore will respond in their own way to different kinds of policies, and planning interventions; understanding these diversity will increase the efficiency and effectiveness of adaptation and mitigation efforts while minimising the social vulnerability. This can be achieved by elevating the socio-economic standing of farmers through giving access to markets, credit and agricultural inputs and providing necessary technical knowhow and farm-level adaptation technologies. Except those, effective leadership, establishment of equity and equality, sufficient infrastructure, the growth of norms, the setting of reasonable goals, and dissemination of social norms through social networks, and appropriate personal rewards and empowerment of community would help to overcome the psychological barriers.

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Institutional Complexity and Climate Change Adaptation in the Reconquista River Basin, Argentina

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Abstract

This paper focuses on institutional complexity by examining climate change adaptation processes in the Reconquista River Basin in the north-west metropolitan area of Buenos Aires, Argentina. Findings draw on research conducted in 2013 funded by the Lincoln Institute of Land Policy [1] ('2013 Lincoln study'). First, the paper introduces the concept of adaptation and institutional complexity. Then, a brief overview of the Reconquista River Basin in the context of climate change is provided utilising a three-tiered understanding of 'urban risk' [2]. Based on this conceptual framework and local contextual factors, the paper then explores key strengths in existing modes of adaptation. The paper also uncovers key challenges, with a particular focus on the complexity of institutional interplay and coordination as a barrier to adaptation. An argument for a hybrid understanding of adaptation between 'planned' and 'spontaneous' processes is developed that reflects institutional complexity. Finally, future adaptation scenarios explore 'tipping points' that may build a pathway for constructive change.

Introduction

Adaptation is increasingly recognised as a necessary means of tackling climate change impacts [3-8]. Furthermore, adaptation to climate change has transitioned from a phase of increasing awareness to the development and implementation of "actual strategies and plans in societies" [5]. Such strategies and plans often involve both top-down and bottom-up approaches, as well as multilevel and multisectoral institutional participation [5]. This paper explores some key strengths and challenges facing adaptation in the Metropolitan Region of Buenos Aires (MRBA), Argentina based on empirical findings from research conducted in 2013. In particular, it explores the characteristics of and the nexus between autonomous and planned approaches to adaptation. Furthermore, the paper examines the complexity of institutional interplay and coordination as a barrier to adaptation planning and implementation in the area of the Reconquista River Basin (RRB). Finally, the paper tentatively explores future adaptation scenarios and associated 'tipping points' that may build a pathway for wider-ranging adaptation planning.

Background: framing adaptation and institutional complexity

Climate change adaptation refers to "adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" [5]. This research is based on an understanding of adaptation as a process "involving the complex and often conflictive interplay of ecological, social, political, and economic forces" [1]. Adaptation strategies are typically categorised as autonomous or planned. Planned adaptation is "the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state" [5]. Autonomous adaptation is action that does "not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems" [5]. Autonomous adaptation is usually associated with smaller systems and is frequently reactive [9]. This research addressed both types of adaptation, but focused especially on autonomous adaptation.

In the context of this study, complexity in adaptation for climate change could be characterised in at least two ways. First, it might be considered analogous to the spatial planning challenge of 'wicked problems:' [10] issues that are difficult to define, interconnected and often irresolvable in the sense of having straightforward or static solutions. Building on this idea, some authors have argued for a stronger link between complexity sciences and spatial planning [11], illustrated for example through recent work on the study of cities as 'complex adaptive systems' [12, 13]. For the purposes of this study on adaptation processes in the RRB, the Mehrotra et al. framework on 'urban risk' was employed as it considers the complex interplay of climate hazards, vulnerability and adaptive capacity [2]. Within this framework "climate hazards are defined as climate-induced stresses, such as heat waves, droughts, sea level rise and floods. Vulnerability refers to the physical and socio-economic attributes which determine a city's degree of susceptibility, including flood-proneness, land area, elevation, population density, economy and percentage and composition of poor populations. Adaptive capacity refers to the city's ability to respond to climate-related stresses" [1, 2]. In this framework, and similar to other 'wicked problems,' addressing urban risk involves working with inconsistent or incomplete information and mutual interdependencies.

Based on the Mehotra et al. framework,[1] adaptive capacity relies largely on institutional factors, like formal and informal structures, local knowledge, public resources, social networks, information, political willingness, public participation and other governance-related considerations. These considerations introduce the second aspect of complexity relevant to this study specifically relating to institutions. Institutions can be understood as "systems of established and embedded social rules that structure social interactions" [14]. Following Oberthür and Schram Stokke, institutions might include both 'negotiated' arrangements to shape governing practices, which are codified in laws or policies, as well as 'spontaneous' arrangements, which emerge in practice settings [15]. Ideas about complexity in institutions are informed by a range of theories and may be defined as "the dynamical properties and structural transformation of non-linear, 'far-from equilibrium' systems" [16]. Hillier has summarised some of the key characteristics of complexity based on Cilliers (2005) work on 'Knowing Complex Systems,' including for example the vital nature of relationships, the defining nature of the contextual environments and history of interactions, as well as the likelihood of non-lineal and unpredictable characteristics that can emerge [16, 17]. Specifically for this research, institutional complexity is understood to arise whenever "incompatible prescriptions" emerge "from multiple institutional logics" [18].[2]

Institutional settings for environmental governance are complex and institutional interaction is fundamental to effective environmental governance [15]. Studies of urban governance have also shown the importance of understanding institutional interaction and institutional change for climate change adaptation. Matthews, for example, suggested that climate change can act as a "transformative stressor," whereby "crisis moments" may trigger stresses that can generate processes of institutional change by amending or introducing new approaches to governance [19]. Such stressors may have immediate impact whilst others may coalesce over time to produce incremental change. Both are conditioned by 'change-oriented preferences' and institutional capacity [19]. The analysis and scenarios explored below consider intuitional interaction, coordination and change as aspects of institutional complexity.

Background: 'urban risk' in the Reconquista River Basin

The MRBA is among the largest urban agglomerations in the world with approximately 15 million inhabitants [20]. The region is comprised of three main river basins: the Luján River Basin in the north, the Matanza-Riachuelo River Basin to the south and west and RRB in the north and west. The Reconquista River has been significantly modified from its natural state through anthropic intervention. The headwaters of the river is inland in a rural district, then the river flows through a heavily industrialised and populated segment of the northern metropolitan area and becomes progressively more contaminated (with little or no dissolved oxygen in the middle and lower parts of the basin [21]). The RRB covers an area of 1,738 km^2 and comprises 18 municipal government jurisdictions. Presently, the basin's population is over 4.6 million people, which makes up one third of the entire population of the MRBA and nearly 11% of the national population [20]. Very high population densities in the middle section of the basin area are often associated with informal settlements. Climate hazards are worsening throughout the RRB, particularly as a result of increased precipitation and flooding. This section provides a concise overview of the RRB context through the three-tiered Mehrotra et al. framework on climate hazards, vulnerability and adaptive capacity.

Climate Hazards

Climate hazards in the RRB include growing risks associated with extreme weather events (particularly flood and heat waves); increased localised precipitation; growing storm intensities; increases in the mean sea level; and increasing temperatures, as well as inequalities in the distribution of impacts and aggregate impacts [1]. Risks interact with existing vulnerabilities and urban development dynamics. Flood hazard in particular is compounded by anthropic interventions, including "the impermeabilisation of surface areas and loss of green spaces, changes to waterways through channelling or rectifications that increase water flow, modifications of land masses (excavation, earthworks, etc.), the occupation of floodplains by development (informal and otherwise), the presence of waste in waterways that restricts flow as well as the saturation and rising of groundwater sources" [1]. Flooding leads to property damage and risks to human life, with many experts interviewed as part of the 2013 Lincoln study suggesting that floods "will hit harder and harder (…) especially in the most vulnerable settlement areas" [1].

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[1] The Mehotra et al framework of urban risk was used -as opposed to the IPCC concept of vulnerability- as it disaggregates biophysical hazards from the other qualities of a system. This enabled a clear focus on local characteristics that exacerbate or mitigate hazards, including mainly institutional factors.
[2] Logics help understand the social world; however their prescriptions may be incompatible. For example, the logic of the capitalist market and that of vulnerability reduction may present incompatible expectations.

As part of the 2013 Lincoln study, the research team administered a survey of municipal and provincial government agencies.[3] Results based on 'perceived climate change hazards' showed greatest concern for increasing precipitation rates as well as severe meteorological events. Property damage was identified as the main climate-related concern, which aligns with results of a worldwide precedent MIT/ICLEI survey where "damage to local government property" was the most widely reported impact among 468 local government respondents. Notably, the eight municipalities surveyed in the RRB as well as the provincial government (COMIREC) reported experiencing damage to government property, private residences and businesses. In addition to property damage some concern was expressed about human health, in particular exposure to pathogens or impacts of urban heat islands. There were few perceived impacts of climate change on the local economy and livelihoods. While the provincial government expressed concern about short-term displacements and long-term migration, none of the municipal respondents identified these as problems. No official studies quantifying the potential impacts of climate change in the RRB relating to public and private property, human health or the local economy were uncovered as part of this research. However, research conducted by Argentine experts Barros et al. indicated that without significant change to current conditions in the RRB "there would be a considerable increase in exposure to recurrent flooding" [22]. Furthermore, the cost of losses relating to built structures in the coastal region of Buenos Aires with no adaptation measures adopted "would range between 5 to 15 billion USD for the period 2050–2100" [23].

To enable a better understanding of climate hazards, vulnerability and adaptive capacity, interviews and community workshops were also held as part of the 2013 Lincoln study. Community participants explained that floods were more frequent and devastating in recent years. For example, in one community local residents described the short-term impacts of flooding as witnessing unpaved streets "turned into rivers." In another workshop, participants explained that a group of houses was washed away in a severe 2010 flood. The primary impacts discussed included extensive damage to built structures and household appliances, damage to infrastructure connections, electrical fires and work-animals deaths, such as horses. Other impacts noted by residents were the loss of work days, children missing school time and the interruption of caregiving regimens. Workshop participants also identified health-related impacts, including skin rashes and diarrhoea, which were attributed to stagnant water and the proliferation of mosquitos and rats, the contamination of drinking water and the accumulation of solid waste in public areas.

Overall, the 2013 Lincoln study indicates a growing awareness about the impacts of changing climate conditions on behalf of government agencies and the community. However, these impacts are "often attributed solely to localised anthropogenic modifications, including incomplete basic infrastructure networks, land filling, watercourse modifications and urbanisation characteristics" [1]. There appeared to be limited understanding of how urbanisation processes specifically interact with climate change [1]. Similarly, the secondary impacts of flooding and heat waves, like the disruption of the local economy or population health impacts, weren't widely acknowledged.

Vulnerability

In informal settlements, the impacts of climate hazards are exacerbated by pre-existing biophysical characteristics and socioeconomic disadvantage. Local development initiatives and government investment in infrastructure and public services over recent years have helped to reduce vulnerability in some areas, for example through the expansion of basic infrastructure networks to previously subserviced communities. However "patterns of marginalization remain and structural inequalities related to land and housing, access to employment and participation in the public decision-making continue to elevate the vulnerability of informal settlements in the context of climate change" [1]. Many informal settlements are located below the flood line and close to waste facilities, heavy industry or excavation pits. In addition to biophysical hazards, the relative socioeconomic disadvantage of informal settlements contributes to vulnerability, including for example the lack of household savings and assets, informal employment conditions and heavy reliance on public transportation.

Based on the projected impacts of climate change, vulnerabilities may result in increased threats to property, infrastructure and human health throughout the RRB. These tendencies are already emerging, particularly in informal settlements. Survey responses demonstrated that the majority of the eight municipal representatives saw informal settlements as highly or somewhat vulnerable to the following problems:

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[3] The survey was inspired by a study carried out by MIT and ICLEI and was informed by the UN Habitat publication 'Planning for Climate Change.' It targeted municipal employees, who were asked to provide information for their specific territorial jurisdictions within the RRB. Within the survey pool of 18 municipalities and the COMIREC, there was a 47% response rate in the 2013 Lincoln study: eight municipalities completed the survey and the COMIREC provided responses applicable to the entire basin. The descriptive statistics provided here refer only to the entities surveyed and do not constitute general findings for the entire RRB.

damage to property or goods (88.9%), exposure to pathogens or diseases (77.8%) and exposure to the elements (66.7%). Most often, respondents attributed this to precarious housing conditions and the lack of physical infrastructure, such as sewage systems, potable water and stormwater drainage. Fewer respondents qualified informal settlements as not at all vulnerable to these problems due to ongoing resettlement efforts, neighbourhood improvement plans or public housing expansion plans. The degree of perceived vulnerability to short- or long-term migration, climate-related economic shocks and interruptions to food supply was lower and varied among municipalities. Overall, the RRB is considered an area of "maximum social risk" [23], due to high levels of poverty, unemployment and informality.

Adaptive capacity: strengths for adaptation in the Reconquista River Basin
Climate hazards and vulnerabilities in the RRB inform an understanding of adaptive capacity that is impacted by an interconnected range of preconditions and changing climate dynamics. Entrenched socioeconomic disadvantage and unfavourable biophysical conditions clearly position informal settlements as worse off compared to the broader MRBA. Uneven spatial development defines the context for developing an ability to respond to climate-related stresses. As previously mentioned, adaptive capacity relies heavily on institutions. In the following section, institutions are divided into different levels of government and civil society is also considered. Adaptation in the RRB is supported by top-down national and provincial level action. It materialises at the local level, sometimes from bottom-up community action or led by municipal authorities with support from higher levels of government and many times without consciously responding to climate stimuli. The purpose of the proceeding section is to provide a brief overview of some of the key institutional strengths emerging in relation to adaptation.

National-level commitment and emerging climate change action
A key strength for adaptation planning in the context relates to national-level commitment and action. Argentina is a signatory to a number of international environmental agreements[4] and, under the auspices of the National Secretariat of the Environment and Sustainable Development, several administrative bodies have emerged to define and implement adaptation-related programs, including the Climate Change Program (2001), the Climate Change Unit (2003), the National Advisory Commission on Climate Change (2003), the Civil Society Liaison (2004), the National Climate Scenarios Program (2005), a multi- sector Government Committee on Climate Change (2009) and an 'ad hoc' Commission on Climate Change within the Federal Environmental Council (COFEMA), which offers a platform for coordination between national and provincial environmental authorities. Within this milieu, the Climate Change Unit (CCU) is the lead body for advancing and coordinating climate change action at the national level. Adaptation is one of its four main areas of work.[5]
Important initiatives at the national level include the formulation of UNFCCC-mandated National Communications, the most recent of which focuses on strengthening the national adaptation agenda to enhance action in specific sectors, including land use planning.[6] The Federal Ministry of Planning has also moved from a general risk reduction focus to adopting a more specific focus on the impacts of climate change for the federal Territorial Strategic Plan (PET). Over recent years a stronger tie has been developed between the CCU, Civil Defense and the Subsecretariat of Territorial Planning on "the points of contact between planning, risk reduction and adaptation to climate change" (Interview, Gonzalez 2013). Such institutional arrangements highlight the importance of interplay and coordination for information-exchange and capacity-building, as well as the important role played by exogenous forces (i.e. international project financing). Other projects at the federal level include 'Increasing Climate Resilience in the Southwest of the Buenos Aires Province Project' and the development of a vulnerability assessment manual for local governments (though take-up of this has been limited). Argentina also is developing a National Climate Change strategy. Overall, the national-level framework and projects provide encouraging signs for increasing awareness and action in

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[4] Argentina is signatory to the following agreements: the United Nations Framework Convention on Climate Change (UNFCCC) and the related Kyoto Protocol, the Hyogo Framework for Action, the UN Convention on Biological Diversity and the UN Convention to Combat Desertification, among others.
[5] For more information on the Climate Change Unit and SAyDS see: http://www.ambiente.gov.ar/?aplicacion=normativa&IdNorma=851&IdSeccion=29.
[6] Outputs of the project include: Compilation and downscaling of climate models; Specific studies on climate change vulnerability and impact scenarios conducted for eco-regions and their potential environmental services, and key sectors: health, tourism, agriculture, energy, urban areas, fisheries and water resource management as well as employment aspects of possible response measures; A technical report including proposals of potential adaptation actions in areas/sectors identified as particularly vulnerable to CC; A discussion paper to set plausible policies and measures for adaptation to climate change, including design of regulatory frameworks, implementation strategies, and institutional arrangements; strategies and courses of action to address identified barriers to enforcing policies and measures laid out in national communication; Technical reports with economic, social and environmental impact assessments of the implementation of the designed policies and measures based on the socioeconomic baseline scenario. Full project document available at: http://www.thegef.org/gef/sites/thegef.org/files/documents/document/09-02-2010%20ID3964%20Council%20letter_0.pdf.

climate change adaptation. Or as described by the Adaptation Coordinator, CCU "…little by little this office is acquiring a capacity for production previously unknown, because before there were fewer of us, we didn't have projects, we had limited financial resources…now we are in a situation of relative wealth and experiences which are only just beginning" [1].

Provincial-level commitment and emerging climate change action

The RRB and MRBA are within the Province of Buenos Aires (PBA), where there is initial commitment and some emerging action on climate change adaptation. The Government of PBA, as the executive power responsible for a range of planning functions, has the maximum authority over environmental and urban governance questions in the RRB. In terms of environmental management, the government has a Provincial Agency for Sustainable Development (OPDS), which created an office dedicated solely to climate change in 2006. The mandate of this office includes "the compilation and systematisation of information, to create baselines and develop adaptation strategies, as well as training and public outreach on issues of climate change vulnerability, mitigation measures, and adaptation tools" [1].[7] Since its inception, the office has focused on developing an early warning system relating to climate events to reduce the negative impacts of climate-related hazards.

Another important initiative at the provincial level is the inter-jurisdictional governance of the RRB led by the Committee of the Reconquista River Basin (COMIREC).[8] The COMIREC is responsible for coordination between municipal governments, civil society groups and provincial authorities. The COMIREC works with the Buenos Aires Provincial Ministry of Infrastructure on the IDB-sponsored project entitled 'Sustainable Environmental and Urban Management in the Reconquista River Basin' (PMUAS). While neither the COMIREC or the PMUAS project specifically target climate change adaptation, many of the activities undertaken, like expansion of potable water, sewage and waste collection services, as well as environmental rehabilitation with the reduction of clandestine waste sites, building new green spaces, some public rectification and hydraulic works that account for changing precipitation rates, etc., work towards reducing flood risks over time, reducing vulnerability and improving quality of life outcomes generally.

Municipal-level commitment and emerging climate change action

The 18 municipal governments throughout the RRB work across diverse areas of environmental and urban governance. They are subject to provincial level land-use, infrastructure and environmental laws and are required to have sector-based strategies. For this reason, the competencies of local governments provide opportunities for localised climate action. Furthermore, involvement in regional programs run by provincial government bodies opens opportunities for resourcing adaptation-related activities and increases exchange of experiences and information. In this regard, other external initiatives also appear to be stimulating adaptation planning, like the Network of Municipal Governments on Climate Change (two municipal governments are members) and involvement in the first meeting of mayors against climate change in the region in June 2013. Such initiatives increase awareness about risks, but also stimulate information exchange on locally-appropriate response options. One part of the survey conducted a part of the 2013 Lincoln study, asked respondents to indicate the status of municipal planning efforts in sectors relevant to climate change, including land use, economic development, energy, transportation, water and sanitation, stormwater and wastewater, solid waste, public health, informal settlement upgrading, emergency response and climate change.

Many local government authorities had developed or were developing plans in climate-related sectors. Only four municipalities (50% of respondents) reported having energy plans and only one reported having a specific plan for climate change action. The absence of formal plans for a range of these areas presents a constraint to developing links between sector-based activity and adaptation planning. The survey also examined how municipal plans accounted for climate change or indirectly promoted local adaptation capacities. Strategies uncovered include: the analysis of land capability, suitability and the feasibility of different development alternatives to determine appropriate spatial relationships and future land use maps (87.5%) as well as the identification of development 'hot spots' or 'no development areas' where climate change impacts are likely to be most severe (50%). Other common areas of focus were on poverty reduction and three respondents also attested to localised promotion of 'green development,' 'green energy,' recycling and 'waste reduction.' The main focus was on emergency response planning as well as on improving hazard identification, for example risks relating to heavy rainfall in order to prioritise investment in infrastructure. Finally, two representatives mentioned specific efforts to identify and quantify climate-related risk.

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[7] See website: http://www.opds.gba.gov.ar/index.php/paginas/ver/area_cambio_climatico.

[8] The COMIREC is mandated with the holistic management and preservation of hydrological resources (water quality and quantity) in the RRB (Law 12.653). Its responsibilities include planning, coordination, and supervision of the basin management; coordination with the national government, other provinces, municipalities, and non-governmental organisms; the implementation and administration of public works; the creation of information systems to inform provincial authorities about RRB management; compliance control for BID project 797/OC-AR; the formulation of environmental policies for the preservation of hydrological resources in coordination with other, legally-competent institutions; the enforcement of environmental protection laws; and the leadership of expropriations or resettlements necessary to achieve its objectives (Ibid).

Survey data indicate an incipient awareness of climate related risks with a general focus on assimilating risk reduction with poverty alleviation. In this sense, vulnerability reduction could be considered as the current practice-based approach to adaptation. Generally, modifications to existing sector-based policy is decoupled from projections on climate change and are more often linked to other trends, such as rates of urban expansion. Existing mechanisms are incrementally being modified to account for some risks without taking an overarching, holistic or necessarily 'conscious' approach to climate change adaptation. This research considers such 'unconscious' responses largely as a mode of 'spontaneous adaptation' within the public sector. Although, there have been incidences when severe climate events have induced 'conscious' and prolonged adaptation responses. This is consistent with Matthews's (2013) theory of climate change as a 'transformative stressor' that can set in motion processes of institutional change. Matthews has noted that some stressors may produce immediate effects whilst others may accumulate over time to produce incremental change. Overall, in the RRB it appears that incremental change towards adaption occurs through the combined impact of repeated 'crisis moments' as well as through experimental 'unconscious' changes to policy and projects.

Civil society and local business climate action

In addition to government-led forms of adaptation, reactive community-based action by businesses, civil society groups and individuals was observed throughout the RRB in response to climate impacts. Findings from this research indicate two categories of community-based action related to adaptation: First, reactive short-term solutions tied to emergency response efforts, such as housing modifications; and reactive longer-term action, including collective drainage planning and building, or household relocations. Both approaches are 'unconscious:' they respond to impacts of climate change, particularly flooding, without explicit knowledge or reference to present or projected climate stimuli. This section describes some of the emerging responses.

Climate events trigger responses that serve to strengthen existing social networks and solidarity movements. Informal systems of mutual assistance and reciprocity are a key aspect of community adaptation strategies, since it is through 'social capital' that a sense of belonging to a group is developed in a network of lasting social and institutionalised relations [24]. In this regard, some authors, including Dr. Jorge Karol interviewed as part of the 2013 Lincoln study, suggest that those communities that bear a disproportionate burden can offer learnings and inspiration for scaling-up adaptation efforts: "much can be learned from informal settlements, in particular their capacity to "defend their right to life and organise their time and communities to define and effect change" [1]. Furthermore, costly and periodic losses lead local businesses, households and community groups to take action, in particular to adapt their behaviours over time.

As part of this research, a workshop participant explained that "after twice having his house flooded and watching his waterlogged wooden furniture rot, he now only furnishes his house with things made of metal pipes or glass" [1]. Household- based adaptation also involves the elevation of structures and service infrastructure, building stormwater drains and using scrap materials to build up protection. Some households with more resources have opted to move out of vulnerable areas; however this is not an option available to most people in informal settlements. Non-profit organisations and business also undertake forms of reactive adaptation in the RRB, like building flood barriers, replacing materials and building more resilient structures. Despite these often disjointed and at times incompatible adaptation actions (where one adaptation strategy might worsen conditions elsewhere, downstream for example), civil society efforts create a space for broadening climate action.

Autonomous or planned? Linking-up adaptation concepts

This research on adaptation processes in the RRB detected both planned and spontaneous forms of adaptation. However, adaptation actions didn't always fit comfortably within just one of these categories. "Rather, a hybridisation can be found whereby reactive spontaneous measures to tackle climate change are introduced and then embedded as planned measures without conscious response to climate stimuli" [1]. Adaptation is often thought of as a continuum with 'pure' spontaneous (and reactive) adaptation by individual agents on one end and planned (and anticipatory) adaptation by government on the other [25]. However, reactive measures occur both as top-down local government led or bottom-up community-based action throughout the RRB. Reactive autonomous adaptation at a small-scale is occurring throughout the community, particularly among informal settlement households and non-government organisations, but also with local businesses. In addition, the public sector displays a form of incremental adaptation in response to exogenous factors. In this regard, small scale adaptation actions like stormwater policy changes or piecemeal

infrastructure upgrading, like creek channelling, can occur quickly in response to the impacts of flood events, but also over time as part of broader development programs to upgrade urban areas and reduce poverty. However, responding to climate change does not explicitly form part of such reforms. Therefore, it appears that the categories of 'spontaneous' and 'planned' adaptation are "ill-fitted to the RRB, where state-led land use and emergency response planning may overlook or discount links to climate change, but nevertheless constitute a type of autonomous state-led adaptation to changing climatic conditions" [1].

The IPCC and other research findings suggest that both top-down and bottom-up adaptation strategies are common in tackling climate change, presenting both opportunities to strengthen adaptation planning [5] as well as challenges to traditional models of governance due to increasingly fragmented multi-actor and multi-sector settings [26]. Adaptation strategies are generally triggered by human welfare concerns, often linking up with existing poverty reduction strategies. The practical blurring of the lines between traditional understandings of 'spontaneous' and 'planned' adaptation in the RRB represents the union of two kinds of logics. One the one hand, it represents the reactionary logic of immediate and necessary measures to ensure and enhance quality of life by different institutions, from civil society to the public sector. Local experiences also highlight the capacity for institutional learning and the incorporation adaptation measures over the longer term in a planned way.

According to recent literature on climate change adaptation, a range of factors can contribute to conscious action, from exogenous pressures like damage to property, negative impacts on human welfare or positive incentive such as financial support from multilateral agencies, foundations or lending agencies or access to new information or ideas about climate change [27]. Another driver may be "a perceived lack of progress at international and national scales to secure significant reductions in GHG emissions," which can encourage social movements, political pressure and locally-led initiatives to respond to climate change [28]. There are also endogenous factors, like having "a local champion or entrepreneur who is instrumental in initiating institutional change" [27]. While these are all important considerations, strengthening the foundation for 'conscious' and comprehensive adaptation planning in the future is important. One important step is building an account of existing practice-based experiences to build on strengths and overcome entrenched challenges. In this regard, this article focuses on important advances towards adaptation (described above) and institutional complexity, particularly on institutional interplay and coordination as barriers to adaptation planning. The next section explores aspects of institutional complexity.

Adaptive capacity: challenges for adaptation in the Reconquista River Basin

Despite some advances in climate action, adaptation in the RRB faces a number of challenges. The nature of these challenges is largely institutional and involves a range of structural, functional, behavioural and resource-related factors. Challenges relating to institutional interaction and coordination are critical for adaptation. In the 2013 Lincoln study, an analytical tool was employed that was previously developed by the World Resources Institute (WRI): the National Adaptive Capacity Framework (NAC) [29] to categorise the analysis into key functions: assessment, prioritisation, coordination and information management. Main findings for each function are presented herein with a consideration of institutional complexity and a focus on coordination barriers.

First, challenges for adaptation relate to information management. Specifically, this consists of "collecting, analysing, and disseminating knowledge in support of adaptive activities" [29]. Information management faces three main challenges in the RRB: lack of systematisation and analysis, insufficient information sharing and inadequate public dissemination. Despite availability of high-quality data for climate analysis and adaptation planning, information has not been comprehensively systematised for this purpose. For example, there is no system of indicators to monitor climate change effects. Similar to other contexts, information sharing between institutions is limited and there is limited information available to the general public about climate change and adaptation measures. Second, "the process of examining available information to guide decision-making" [29] is a challenge for adaptation in the RRB. Specifically, few official assessments have been undertaken on the vulnerability of the population and potential impacts of climate change in the region.

Third, prioritisation by "assigning special importance to particular issues, areas, sectors, or populations" [29] is needed to account for variable impacts and differential vulnerability. Climate change is an emergent issue on the policy agenda in Argentina, but is not seen as a priority issue. There are exogenous forces that have influenced climate change action. However, a major challenge is the prioritisation of adaptation as an issue. As one interviewee lamented, "as soon as the waters subside, so does political interest" [1]. Generally, projects rely on individuals or specific projects, which are hard to sustain over time without ongoing political commitment and enhanced technical capacity. Changes in government can lead to changes in priorities and organisational structures which impact climate action. According to Barros, "the

organizations related to flood management are not stable, and even when they persist over a long time, usually their policies change frequently…even the little planning and the few successful programs and projects in flood management unfortunately were not always continued with each change of government" [23]. At the local government level, low prioritisation of climate change action is strongly linked to lack of resources and a need to deal with an already crowded agenda of concerns. Despite the fact that climate change has not been specifically prioritised, adaptation is occurring through incremental change to existing programs.

Coordination refers to linkages that help "avoid duplication or gaps, and can create economies of scale in responding to challenges" [29]. Numerous experts noted that the challenge of coordination is one of the main obstacles to adaptation in the RRB. "The competing logics of government and non-governmental organizations, their strengths, weaknesses, competencies, timelines, priorities, and bottom-lines, make coordination among stakeholders difficult" [1]. Lack of coordination between different institutions, particularly the "fragmentation of policies and uncoordinated measurements increases social vulnerability and generates a high degree of uncertainty that could amplify the damages from each disaster" [23]. Currently, a sector-based approach to development prevails in the RRB, whereby programs often run along sector lines including, among other areas, transport, housing, health, environment and sanitation infrastructure. At the local level, municipal governments have limited scope to effect coordinated planning efforts and are dependent on the transfer of resources from the provincial and national governments. Municipal governments often don't have direct involvement in the planning and implementation of regional projects.

Furthermore, there is no clear 'leader' or coordinating body for adaptation in the RRB. The National Secretariat for the Environment and Sustainable Development (SAyDS) is the national authority of issues of climate change, but has limited influence over provincial decision-making across a number of sectors. The COMIREC is the organism best positioned to coordinate strategic planning efforts in the RRB, but climate change adaptation functions exceed its past experience, current mandate, institutional structure and budget. De facto leadership for bio-regional planning in this case is the national-provincial-COMIREC institutional structure, with most progress being achieved via sanitation improvements and vulnerability reduction strategies. However, these kinds of projects are focused on the provision of essential infrastructure and do not explicitly address broader climate change considerations [1].

Overall, there are a range of barriers to effecting adaptation that relate to institutional factors in the RRB. In particular, there are challenges to achieving coordination between different political and administrative levels. For example, it is difficult to ensure local reach of national programs or even distribution of provincial government initiatives. It is also difficult to effect horizontal interplay between different institutions and sectors, for example to coordinate planning efforts across municipal government boundaries. Achieving both horizontal and vertical coordination requires engaging multiple actors, aligning multiple programs and acting collectively where divergent institutional logics often prevail. Herein lies the institutional complexity. Sustaining programs for adaptation is challenging with fluctuating resources and political commitments. Moreover, the RRB doesn't have a political-administrative body to lead coordinated action on climate change. In sum, and not unlike other contexts around the world [5], multi-level and multi-sector coordination of institutions presents a key barrier to adaptation planning and implementation in the RRB.

Conclusion: Tipping point scenarios for climate change adaptation

Climate change adaptation in the RRB occurs in a context growing climate hazards, widespread vulnerability and emerging adaptive capacity. Despite increased investment in poverty reduction programs and improvement in many baseline conditions over the last ten years, advances towards adaptation are surpassed by ongoing challenges. One key barrier to adaptation planning relates to managing institutional complexity. Based on existing conditions, possible future scenarios were developed that consider tipping points: possible circumstances that might lead to broader, more significant adaptation efforts. The scenarios envisaged include: incremental change through either a business-as-usual or climate mainstreaming approach; abrupt change post climate-related catastrophe and transformative change through integrated adaptation planning for the RRB.

A business-as-usual approach would continue to see incremental improvements in quality of life throughout the RRB. Improvements would primarily result from government-led improvement projects and infrastructure upgrading, as well as community-based adaptation. However, the ongoing sector-based or 'silo' approach to policy as well as pre-existing socioeconomic disadvantage, combine with increasing hazards to undermine the efficacy of a business-as-usual scenario. Alternatively, pursuing incremental change through climate 'mainstreaming' would see the explicit incorporation of climate change considerations into relevant policies and projects. Opportunities could be taken advantage of to access funding for adaptation initiatives, for example through international lending agencies, as well as to participate in international forums.

Mainstreaming could be supported by the national government's CCU and the provincial-level COMIREC to incorporate risk assessments and specific adaptation measures. Mainstreaming would, however, require considerable change to improve information management and institutional coordination.

Another scenario for adaptation is abrupt change following a climate-related catastrophe. In this scenario, a severe climate event may act as a 'crisis moment' to trigger a process of institutional change and a reorientation of governance structures to comprehensively address climate change adaptation. Climate events, according to Matthews, can act as the stimulus for "episodic institutional change" and the "operationalisation of climate adaptation" through the incorporation, codification and implementation of climate change adaptation as a central tenet of environmental and urban governance" [19]. This model has unfolded in other contexts, however there are known challenges to sustaining change where there are limited resources and governance challenges.

Finally, another scenario is achieving transformative change through a comprehensive approach to adaptation planning. This would necessitate better alignment and coordination between the parallel initiatives of government agencies as well as broadening engagement civil society. Other important variables are political leadership, creative resourcing, a capacitated workforce to assess and interpret climate behaviour and a commitment to raising awareness about climate change. This kind of transformative approach would require a holistic perspective on climate change adaptation that is both anticipatory and planned.

Overall, complexity manifests in the RRB through the multivariate nature of addressing urban risk. One key barriers to adaptation relates to managing institutional complexity, including limitations to institutional interplay and coordination. The parallel logics of institutions sometimes overlap and are complementary, but at other times they are unaligned and competing. More fluid institutional interplay would enhance synergies between institutional logics and increased coordination would build linkages to minimise and mitigate contradictions between sectors and institutions.

Similar to other 'wicked problems' facing cities, planning for climate change adaptation in the RRB is a complex issue with no easy solution. In particular, institutional interplay and coordination present some barriers to adaptation. Furthermore, adaptation planning presently lacks a lead agency with a clear mandate supported by a high degree of political commitment and commensurate resources. However, it is considered that climate change adaptation has the potential to serve as an articulating force that could strengthen existing efforts to reduce vulnerability. The linking-up of autonomous and planned action for adaptation could stimulate coordination and optimise positive impacts. Resolving incompatibilities between the often divergent logics of institutions is not a prerequisite for action, but having the institutional capacity and structures for managing their interplay seems important. Consolidating and expanding existing action, including strengthening capacity to manage divergent institutional logics, may support constructive change for climate action. The critical question remains, however: Will incremental action suffice to create a tipping point for transformative change?

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Exploring the Spatial Association of Local Vulnerability: A case study of flood-prone areas

ABSTRACT

Vulnerability is a key concept in global climate change, and geographic feature and social feature are major factors while measuring the vulnerability. The perception of disaster, inaccurate resource distribution and various loading of environmental goods and bads, especially the excessive land use consumption result in unproportioned vulnerability and leave high vulnerability area facing adverse living environment. Many studies applied aggregated indices to connecting multiple factors to real events and comparing the different intensities across regions. Nevertheless, not only the integration and weighted rationality challenge current research but the disregard of potential spatial variation and disaster capacity might result in inaccurate explanation on local vulnerabilities. Therefore, this study discusses the following issues: (i) Due to various conditions (exposure, sensitivity and adaptive), is there any difference of vulnerability across spatial units? (ii) Due to the spatial variance of vulnerability, is there any different impact during the flood impacts? We utilize Geographically Weighted Principal Component Analysis to analyse the potential attributes and spatial features result in different vulnerability. The result of Spatial Autocorrelation Coefficients Analysis can help identify the hot-spots and cold-spots of potential impact category and adaptive capacity category which represent high degree of potential danger or differences with distribution of resources places while flooding. The results of Geographically Weighted Principal Component Analysis can provide information of different factors across areas. The results can apply to the discussion of disaster mitigation under global climate change.

Key words: Vulnerability, Spatial Association, Geographically Weighted Principal Components Analysis (GWPCA)

1   INTRODUCTION

Climate change receives lot more attention among all the environmental issues in twenty-first century. Vulnerability has become the central concept in climate change research and policy [1]. Vulnerability encompasses a variety of concepts and elements including sensitivity or susceptibility to harm and lack of capacity to cope and adapt. Taiwan is an island country, and may be the place on Earth most vulnerable to natural hazards, with 73 percent of its land and population exposed to three or more hazards [3]. Therefore, it is necessary to find out the disaster impacts, local capacity, and the most vulnerable people and place. In addition, both UNFCCC (United Nations Framework Convention on Climate Change) and Hyogo Declaration have mentioned the key action on disaster mitigation is cutting down risks and vulnerability. The purpose of vulnerability assessment is to evaluate diverse disaster impacts on society, economy and environment and further to raise awareness on disaster response in those high vulnerable areas [4].

Vulnerability originates from "vulnerare," which results in harms to others. Some studies believe vulnerability came from "impact assessment, disaster risk, and food security [5]." Generally, it is often to refer to Füssel (2007) definition on vulnerability which can be divided into spatial aspect and knowledge base [6]. Studies on interior spatial aspect usually discuss the system status before impact events (e.g. disaster) [7,8]. Studies on exterior spatial aspect emphasize the impacts on the system [9, 10]. Bio-physic knowledge base studies inherit previous disaster research and emphasize the impacts of variances on people [11]. Social economy knowledge base believe vulnerability came from people intrinsic features [12, 13].

The vulnerability discussion has transformed from single aspects such as interior, exterior, bio-physic, and social economy to a multifaceted structure [14]. Overall, the concept of vulnerability has been broadened towards a more comprehensive field encompassing susceptibility, exposure, coping capacity and adaptive capacity [15]. Therefore, the integrated index model is able to integrate multiple concepts into real events to compare vulnerability among areas. Nevertheless, the integration method is a great challenge while some indicators constituted vulnerability might be correlating or overlapping. Besides, the general statistic models apply to the hypothesis there is no any difference among areas which ignores spatial autocorrelation issue. As matter of fact, the traditional measure neglects the intrinsic difference and interaction between neighbourhoods.

This study applies vulnerability theory to flood disaster, and this exploratory research takes spatial association into vulnerability assessment. The key issues in this study are 1) how to integrate and weight indicators under multi factors, and 2) how to take location into the evaluation process to get spatial variances. Therefore, this article applies Principle Component Analysis to flood-prone areas of Yunlin County in Taiwan. The factors will then be classified into potential integrated indicator (local development intensity and disaster sensitive area) and adaptive integrated indicator (urbanization and medical resources, short-term emergency response capabilities and long-term care capacity). Afterwards, we apply Spatial Statistical Analysis to investigate hot-spot and cold-spot of local vulnerability. Finally, we used Geographically Weighted Principal Components Analysis to get the different key impact indices in different areas. The ultimate outcome can be referred to local disaster prevention and management.

2   OBJECTIVES/METHODOLOGY/SCOPE

2.1 Study Area

13 townships in Taiwan Yunlin County where serious land subsidence areas locate has been chosen to be the study area, and the total area is 75,455 ha. In order to construct "local" vulnerability assessment framework, this study applies the smallest administrative boundary to be the basic unit, and there are 238 units inside the study area.

Fig. 1 Study area

2.2 Indicator Database

Year 2011 is the main temporal section while collecting data in this study. Due to some data do not output every year, we will then use the latest one to substitute year 2011. Except some data such as the depth of the potential flooding, serious land subsidence area, impervious surface area, and disaster experience can be referred to years before 2011.

Table 1 Indicator Database

Object	Indicators		Source	Year
Potential Impacts	P1	The Depth of the Potential Flooding (DPF)	Water Resources Agency, Ministry of Economic Affairs	2009
	P2	Serious Land Subsidence Area (LSA)		2005
	P3	Impervious Surface Area (ISA)	Land Use Investigation of Taiwan	2006
	P4	Special Cultural Asset (SCA)	Yunlin County Government	2011
	P5	Population Density (PD)	Department of Household Registration, Ministry of Interior	2011
	P6	Proportion of Minority Group (PMG)		2011
	P7	Average Income (AI)	Ministry of Finance	2011
Adaptation Ability	A1	Number of Emergency Shelter (NES)	Yunlin County Government	2011
	A2	Number of Hospital (NH)		2014
	A3	Community Mobilization (CM)		2011
	A4	Number of Conservation Centre (NCC)		2014
	A5	Disaster Experience (DE)	Water Resources Agency, Ministry of Economic Affairs	2006
	A6	Degree of Urbanization (DU)	Yunlin County Government	2014

2.3 Local Spatial Autocorrelation Coefficients Analysis

Spatial autocorrelation statistics detect the degree of similarity between objects occurring in nearby locations by measuring and testing their clustering/dispersal. This is done by considering both the locations of objects and their attributes based on what Tobler (1970) statement, that everything is related, but near things are more related (his "First Law of Geography"). Our analysis tested the significance of the spatial pattern using Moran's I. If a significant positive spatial autocorrelation exists, objects with similar characteristics will tend to be in close proximity to each other. Alternatively, a weak or nonexistent spatial pattern indicates a lack of similarity or a random pattern. The formula for Moran's I can be defined as (1):

$$I(d) = \frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}} \times \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} W_{ij}(X_i - \bar{X})(X_j - \bar{X})}{\sum_{i=1}^{n}(X_i - \bar{X})^2} \dots\dots\dots\dots\dots\dots\dots\dots\dots(1)$$

where I(d) is the Moran's I value of spatial correlation of farmland use changes and farmland transactions amount under a d-order neighbourhood; d is the spatial lag representing the 1st, 2nd, 3rd, and other higher-order neighbourhood patterns; n is the number of spatial units; x_i and x_j are the farmland use change and farmland transactions amount in units i and j, respectively; and $\bar{x}$ is the mean of the farmland change amount in all spatial units. Finally, w_{ij} is the spatial weights matrix (under the d-order neighbourhood, the number of ways two corresponding spatial units can be connected to each other is 1, otherwise 0).

Table 2 Spatial Distribution Pattern

Pattern	Spatial Unit Value	Neighbourhood Value
High-High	High	High
Low-Low	Low	Low
Low-High	Low	High
High-Low	High	Low

2.4 Geographically Weighted Principal Component Analysis

It is common to use Principal Components in social and physical sciences which developed by Pearson in 1901 [16], and the details of extracting components for a data matrix and their interpretation were presented in Hotelling (1933) [17]. Many applications ignore any spatial characteristics in the data and simply apply a standard (aspatial) PCA [18]. In fact, PCA can be replaced with geographically weighted PCA (GWPCA) for a certain spatial heterogeneity. A well-known application of GWPCA is provided by Lloyd's study concerning population characteristics which is beyond the Fotheringham et al. work in 2002 [19, 20].

GWPCA follows the notation of Fotheringham et al., the vector of observed variables at location *i*, which has coordinates (u,v). In order to obtain geographically weighted principal components, the decomposition of the geographically weighted variance-covariance matrix provides the geographically weighted eigenvalues, and the geographically weighted eigenvectors. Bandwidth selection is another essential component of the GWPCA methodology. Two measures of bandwidth are available: a fixed-distance kernel and an adaptive kernel. A fixed-distance kernel applies to a constant radius centred upon each observation. An adaptive kernel selects a constant number of neighbours without considering distance.

3   RESULTS

3.1 The Weighted Aggregated Indices

The result of PCA reveals two significant components in "Potential Impact (table 3)" and three significant components in "Adaptive Capacity (table 4)." The potential impact represents the exposure condition and sensitive features to flood in local areas. In PC1, factors including ISA, PD, and AI have

highly positive correlation to the potential impacts, and we name it as "development intensity." According to "Local Spatial Autocorrelation Coefficients Analysis," the "hot-spot" for development intensity concentrates on the west side which is urban planning area (Fig. 2). In PC2, factor LSA has highly positive correlation to the potential impacts, and we name it as "disaster sensitive area." The "hot-spot" for disaster sensitive area concentrates on the serious land subsidence area (Fig. 3).

Table 3 Component Matrix about Potential Impact

	Indicator	PC1	PC2
P1	the depth of the potential flooding	-.649	.398
P2	serious land subsidence area	-.205	.751*
P3	impervious surface area	.896*	.162
P4	special humanities assets	.435	.398
P5	population density	.860*	.055
P6	Proportion of Minority Group	.298	-.355
P7	average income	.657*	.232
	Eigenvalue	2.715	1.090
	Proportion (%)	38.791	15.571
	Cumulative (%)	38.791	54.362
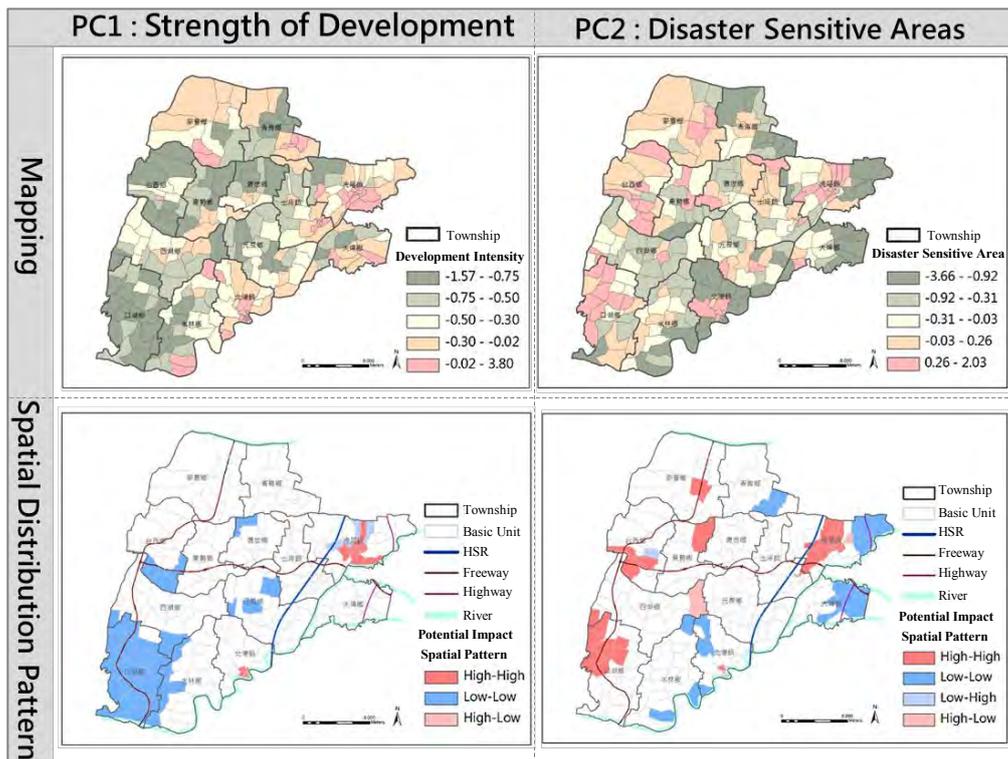
Fig. 2. The Result of PCA in Potential Impact

The adaptive capacity represents the active ability to response flood disaster. The adaptive capacity affects by "urbanization and medical resources", "short-term emergency response capabilities", and "long-term care capacity." In PC1, factors DU and NH have highly positive correlation to the adaptive capacity, and we name it as "urbanization and medical resources." The "hot-spot" for urbanization and medical resources concentrates on urban planning areas. In PC2, factors NES and DE have highly positive

correlation to the adaptive capacity, and we name it as "short-term emergency response capabilities." The "hot-spot" for short-term emergency response capabilities concentrates on the north east where flood affected areas is. In PC3, factors NCC and DE have highly positive correlation to the adaptive capacity, and we name it as "long-term care capacity." The "hot-spot" for long-term care capacity concentrates on along the coast and HSR.

Table 4 Component Matrix about Adaptive Capacity

	Indicator	PC1	PC2	PC3
A1	number of emergency shelter	0.42	0.71*	-0.27
A2	number of hospital	0.71*	0.38	-0.06
A3	community mobilization	-0.63	0.44	-0.03
A4	number of conservation centre	0.37	-0.10	0.75*
A5	disaster experience	-0.27	0.49*	0.62*
A6	degree of urbanization	0.85*	-0.14	0.03
	Eigenvalue	2.01	1.12	1.02
	Proportion (%)	33.47	18.65	17.04
	Cumulative (%)	33.47	52.12	69.16
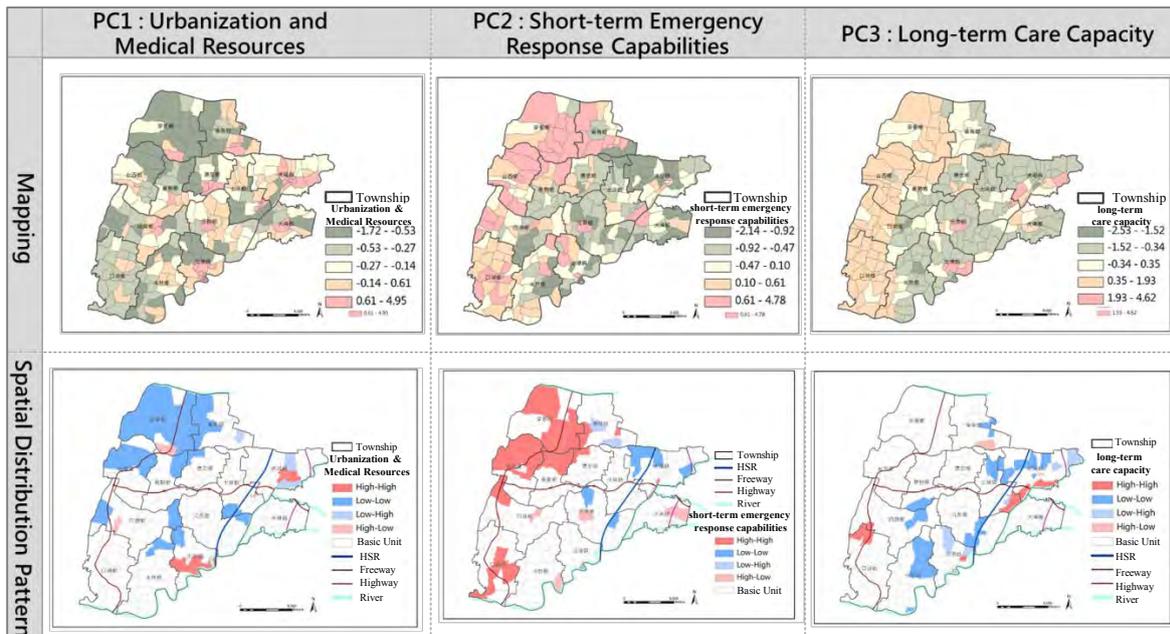
Fig.3. The Result of PCA in Adaptive Capacity

3.2 The Aggregated Indices under the Effect of Spatial Association

Due to traditional statistic builds under the assumption of spatial stationarity, it will be unable to describe the variances between areas. Therefore, this study applies GWPCA to take into "location" into PCA analysis to solve the variances of vulnerability among neighbourhoods.

The result of GWPCA reveals two significant components in "Potential Impact. (Fig. 4)" In GWPC1, factors including ISA, PD, and AI have highly positive correlation to the potential impacts. DPF is the key factor affecting the variance in local areas. In GWPC2, factor LSA has highly positive correlation to the potential impacts. PMG is the key factor affecting the variance in local areas.

The result of GWPCA reveals three significant components in "Adaptive Capacity. (Fig. 4)" In GWPC1, factors DU and NH have highly positive correlation to the adaptive capacity. DU is the key factor affecting the variance in local areas. In GWPC2, factors NES and DE have highly positive correlation to the adaptive capacity. NES is the key factor affecting the variance in local areas. In GWPC3, factors NCC and DE have highly positive correlation to the adaptive capacity. It has huge variance in GWPC3.
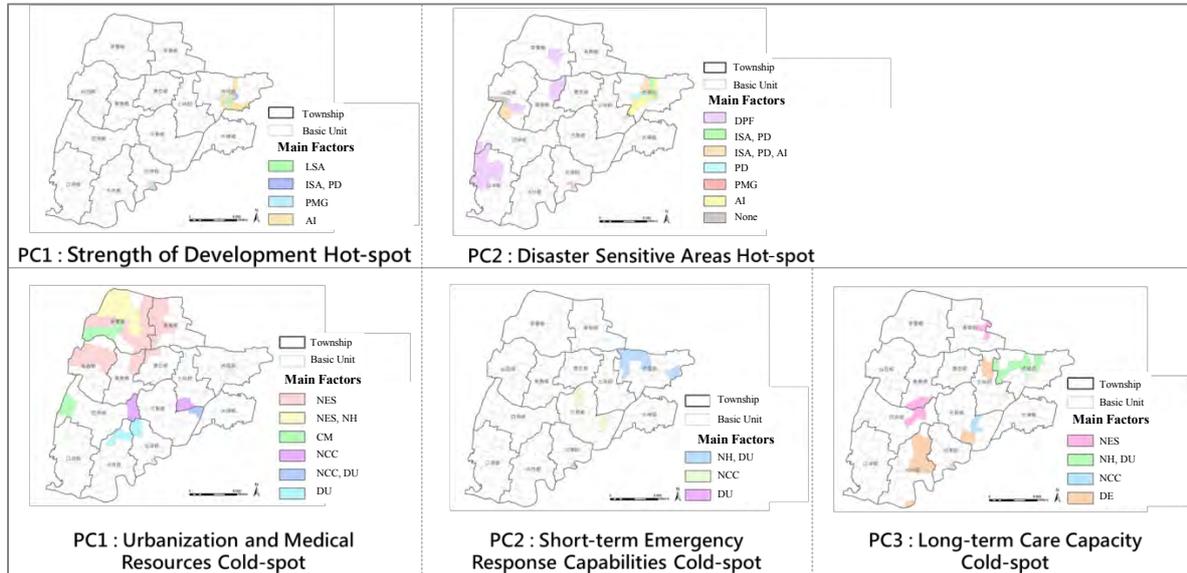
Fig. 4. The Result of GWPCA about the Most Important Factor in Hot-Spot and Cold-Spot

4   DISCUSSION

"Aggregated Indices" can connect multiple factors to local vulnerability, and we used "Principle Component Analysis" to combine indicators and calculate the degree of vulnerability in different places based on different "Aggregated Indices".

"Spatial Autocorrelation Coefficients Analysis" can help us find out the "hot-spots" about the "Potential Impact" and "Adaptive Capacity" places and this kinds of places represent high degree of potential danger or differences with distribution of resources places when flooding.

We used "Geographically Weighted Principal Component Analysis" to get different factors in different places but we also find that this method can't use to compare difference about degrees of vulnerability because different explained variance.

The method of this study is greatly affected by indicators and data sources, so the result can only explain the information based on the indicators. And this method still has some limitations when described the complex concept about vulnerability.

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Impact of Climate Change on the Bedey Community in Bangladesh: Issues and Ways Forward

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Introduction

Bangladesh is a deltaic land, majority portion of which has been formed by the alluvial deposition of three mighty rivers namely the Brahmaputra, the Ganges and the Meghna. Of them, the Brahmaputra and the Ganges originating from the Himalayas at the North joins together in Bangladesh, and then flows towards the South eventually reaching to the sea: the Bay of Bengal. The country accommodates 57 rivers flowing from outside its borders while about 405 rivers now flow inside the country [1]. History reveals that in the 11th century there were about 1500 rivers flowing which have been reduced now to this present number. Over time not only the numbers of rivers have decreased but their depth, width and length are also being reduced. The total length of the river run was about 24,149 km in 1971 (the year of independence) which now has been reduced to 3800 km [2]. Unfortunately the decline of rivers is still a very much ongoing process due to the various natural phenomenon and human interventions.

The Bedeys are a nomadic ethnic group living in boats on the rivers of Bangladesh, the country which now has a population of 160 million within a land area of 1.47,570 sq.km. The Bedey community is severely deprived of almost all the basic needs of life like education, healthcare, civic facilities, financial supports, etc. The continued struggle for survival and existence by the Bedeys in the country is further compounded by the additional threat of climate change. This paper discusses how the climate change in Bangladesh is posing threat to the living and livelihood of the Bedeys and also highlights some ways forward for their mitigation.

Bedey in Bangladesh

The Bedey or the Bede has been living in Bangladesh for generations, most probably since 1638. They are conceived to be the descendent of the ethnic group of Mong-Tong (Mangta) of Arakan in Myanmar who first arrived in Bangladesh and settled in the Bikrampur district under Dhaka division [3]. Presently Bedeys are found in many districts. Figure 1 shows the districts where the Bedeys are now seen:

Some group of the Bedeys also relate themselves to the Arab origin on the basis of having similarity with the Arabic word "Bedouin" [4]. This may not be the main cause however many of the Bedeys claim themselves to be Muslims, which helps to protect them in the Muslim majority Bangladesh. Among others Hinduism, Shamanism, and even Animism are also practiced too. There are over 40 groups of indigenous people inhabiting in country, mostly in the hilly regions of Bangladesh excepting the Bedeys who love to live on the flowing water. The Bedeys generally speak in Bengali although they have their own tribal language called "Thet" or "Ther".
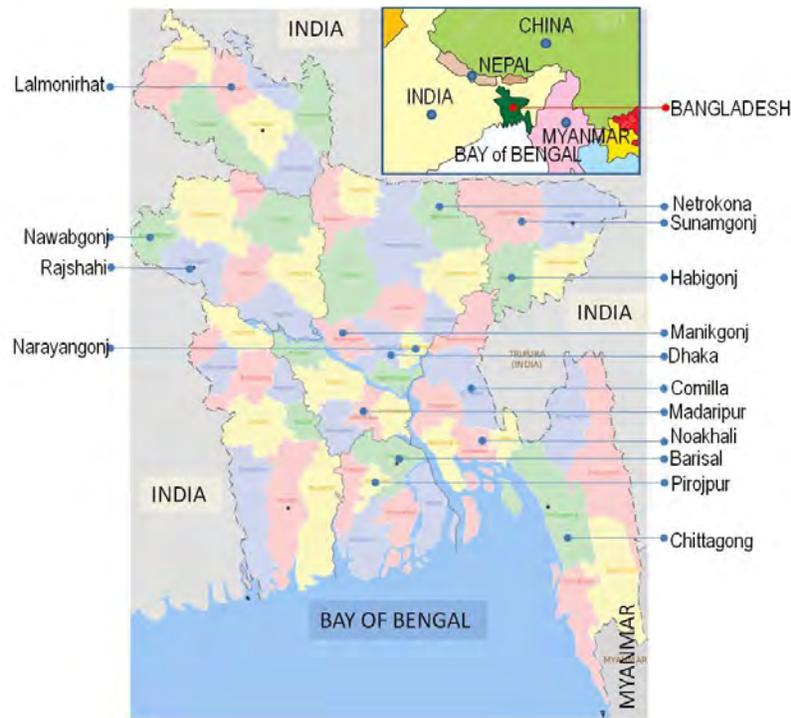
Figure 1: Districts of Bangladesh with location of the Bedeys

The Bedey people are distinctive in their traditional lifestyles. They generally live on the rivers between the month of May and December and on the land for the rest of the year. They move from place to place by the river ways in family groups. Boat is not only the home but also the mode of transport for the Bedeys. The houseboats of the Bedeys are very tidy, having rooms for garments, bedding, utensils, etc. Each boat houses a family including two or three children and a few elderly Bedeys. They live their whole life afloat. The Bedey women are the main bread-winners for the family while men traditionally stay at the boats. They travel in groups for 10 months every year. The other two months are for rest, marriage, and other social activities. In winter many of the water bodies dry up when the Bedeys return to the mainland and live in make-shift semi tubular shaped tents, covered by polyethylene or other sheets, on the open river banks.

According to an earlier estimate in 1987 they were about 1.5 million Bedyes living in Bangladesh. However a recent estimate have shown this number reduced to 500,000 [3], living in 10,000 nomadic Bedey groups. The average Bedey family size is 7.5 against the country average of 4.2 [4]. An estimated 98% of the Bedey people live below the poverty line, 95% are illiterate, and child marriage is very much prevalent. They have almost no education and no alternative livelihood skills although their family size is increasing [5].

Ironically the census of Bangladesh Bureau of Statistics (BBS) does not count Bedeys as an ethnic group. So they are deprived of being benefited from the various programs targeted for the ethnic minorities or marginalized groups in Bangladesh. Due to not having any official recognition per se, this community cannot establish their needs for socio-cultural development including health. Subsequently Bedeys are being deprived of establishing their rights as a citizen. The basic necessities like food, shelter, education, medical care, etc are therefore severely compromised for the Bedey community.

Bedey women are generally snake charmers, snake catching and selling are their main source of livelihood. Besides they perform magic, have trained monkeys; offer spiritual and traditional healing services, including removing insects from teeth, ears and eyes, sell herbal medicines, etc. A traditional healing practice of the Bedeys is "Shinga" in which a cow horn is used to suck impure blood from the waist to reduce pain of the patient [6].

Figure 2: A row of narrow boats belonging to the Bedeys [6]

Climate Change: Bangladesh

The phenomenon of climate change is due to the increment of atmospheric concentration of greenhouse gases (GHGs), especially Carbon-dioxide which forms an enveloping layer that traps the heat of the terrestrial radiation. The rise of global temperature occurred by $0.74\pm0.18\ ^0C$ over the past 100 years (1905-2006) [7] and if this trend continues, it is obvious that present climate will change its trajectories negatively in the 21st century.

In IPCC's first report in 1990, projections were made that global average temperature increase would be between 0.15°C and 0.3°C per decade for 1990 to 2005. This is now observed that it is about 0.2°C per decade [8].

The IPCC also forecasts that global temperature would rise by 0.20 to $0.50\ ^0C$ in each decade during the 21st century. Temperature rise will also result in melting of ice and the global mean sea level will have a consequent

rise of 0.2 to 0.4 meter by 2050 [9]. It is assessed that global warming in the Asia Pacific region could cause sea level to rise by 3.00 to 16.00 cm. by 2030 and 7.00 to 50.00 cm. by 2070 [10].

Prediction of climate change at the global level has been made known to all; however it is difficult to know the situation at the regional or local level. The magnitude of prediction will also vary from region to region. Its distribution would be uneven from regional to continental scale. It is obvious that Bangladesh cannot escape from being affected by the changed climatic situation. The mean temperature in Bangladesh has increased by about 0.75 ^{0}C in the last century and about 0.30 ^{0}C over the past 40 years. According to IPCC's fourth assessment, in Bangladesh, average temperature registered an increasing trend of about 1 ^{0}C in the month of May and 0.5 ^{0}C in November during the 14 years period from 1985 to 1998 [11]. According to Kafiluddin, it is projected that in Bangladesh, by 2030, the mean temperature rise will be about 2 ^{0}C in winter and 0.65 ^{0}C in monsoon and by 2070 the mean temperature rise will be about 3 ^{0}C in winter and 1.5 ^{0}C in monsoon [12].

Bangladesh is one of the countries which are most vulnerable to climate change having already been exposed to many damaging weather events and its low level of development means. Environment and people are particularly vulnerable to the impact of colossal events of climate change. Scientists and researchers have revealed that Bangladesh will be facing following major threats stemming from climate change:

A sea level rise of about 0.5 meter over the last 100 years has already eroded 65 per cent land mass of three islands- Kutubdia, Bhola and Sandip islands of Bangladesh [13]. It is feared that 1.5 meter seal level rise of the Bay of Bengal will inundate about 16 per cent land mass of Bangladesh. For temperature rise by 2 ^{0}C, around 20 to 22 percent of land will also be inundated. Cyclone intensity would increase; hailstorm and storms would also be increasingly more intense. If sea surface temperature is increased by 1 ^{0}C in the Bay of Bengal then tropical cyclone intensity would increase by 10 per cent in the adjacent areas including Bangladesh [14].

Floods would be more frequent, irregular and increased rainfall, becoming more intense during the monsoon, would make flash floods more difficult to manage. On an average, approximately one quarter of the country is inundated by flood each year. It is predicted that by the year 2030 an additional 14.3 per cent of the country would become extremely vulnerable to flood, while the present flood prone areas will face higher level of floods [15].

According to IPCC 2001, 1.0 meter rise in sea level would displace about 14.8 million people in Bangladesh [16]. Rising sea-water will level enhance inundation which will be moving further inland than at present and will be leading to increased salinity. During the dry seasons saline water from the Bay of Bengal is reported to have already penetrated 100 km or more inland along the tributary channels (IPCC 4th assessment). The severity of salinity problem has increased over time with the desiccation of the soil. Out of 2.85 million hectares of the

coastal and offshore areas about 1.2 million hectares of arable land would be affected by varying degrees of soil salinity [17].

A sharp decline in rainfall in the region would be responsible for the unusual dry spell with high humidity in the monsoon coupled with increased hailstorm, and mists. North-West region of the country would become drier intensifying and spreading draught.

Climate change during the past 17 years also caused the Himalayan glaciers to melt at an unprecedented rate, restricting water supply and sanitation access for millions of people in Asia. Bangladesh is also experiencing the fate.

Anticipated Impact of Climate Change on Bedeys
Since the Bedeys are nomadic, traditionally live on the water and their life and livelihoods are mostly dependent on natural environment, so this community is more vulnerable to climate change than any other ethnic groups of Bangladesh.

The Bedeys belong to the lowest earning group in Bangladesh. They become severely stricken by the poor or no income during flood when almost all Bedeys have to stay in their boats without having any opportunity and scope to earn through selling goods or services. Thus the Bedeys fall prey to multidimensional crisis for at least two months during and after the flood. It is then not very difficult to conceive the heightened magnitude of struggles the Bedeys need to face due to increase occurrence of flood with respect to its duration and area of inundation.

Water and sanitation are the perennial problems of the Bedey communities although they live on the water. They have to defecate and urinate in the river water. At the same time they have to bathe and wash utensils by the same water. When the Bedeys travel from place to place they always face difficulties in collecting safe drinking water. Sometimes the villagers do not allow the Bedeys to anchor near their land because of fear that the Bedeys might pollute the surrounding environment through open defecation both on the land and in the water. There are many evidences when the Bedeys were assaulted by the villagers because of polluting environment through open defecation. Bedeys are reported to be physically tortured by the settlers even when they go for collecting fuel-wood from the neighboring areas. Due to the adverse impact of climate change, the availability of water will further decrease. So their miseries in these regards will be further deepened.

The Bedey communities are also very much vulnerable groups due to natural disasters and rough weather. Due to storms, heavy rains and wind their boats sometimes get drowned in the river. Most of the lands where the Bedeys settle temporarily are on the bank of the rivers. River erosion destroys the shelters of the Bedeys every year. Due

to climate change, the phenomenon of falling of the water level during the dry and the rising of water level during the monsoon may be comparatively rapid resulting in severe river bank erosion. So the temporary shelters of the Bedeys on the river banks will be more threatened due to the climate change.

Snake is the principal attraction of the Bedeys for their livelihood. A large number of the Bedeys live on snake related trading. Reduction in availability of snakes will be a big blow to the livelihood of the Bedeys. Snakes are mostly available in marshy lands and forests. Reduction of these two types of lands will cause reduction in snake niche and thereby population. Availability of snakes will also be reduced due to rise of atmospheric temperature. Due to climate change the forest land might shrink, water bodies will dry up and the temperature will go high posing negative impact on snake niches thereby reducing its population in future. Reduction in availability of snakes will greatly hamper the traditional livelihood of the Bedeys.

Inundation of land mass is another big adversity for the Bedeys as they have to search for their livelihoods and run business on land. Climate change will make more land inundated shrinking the boundary of hunting ground for the Bedeys.

Ways Forward

Bedey's life and livelihood holistically depends almost directly on the natural resources. So any natural or manmade activities having negative impact on the natural environment directly affects the living of the Bedey communities. Therefore to uphold life of Bedey communities, degradation of natural resources shall have to be stopped anyhow. No community wants to leave their traditional culture and the Bedeys of Bangladesh are no different. So they have all the rights to live in the traditional way as their ancestors did in the past. At the same time their socio-economic and cultural development is the prime need. With a view to achieving their socio-economic and cultural development, having cognizance of the adverse impact of climate change on their living and livelihood, various pragmatic measures may be undertaken as discussed below:

1. Drying up of rivers and canals must be curbed. The navigability of the rivers and canals those are frequently used by the Bedeys, shall have to be maintained on priority basis, through regular dredging and other means.

2. To ensure collection of medicinal herbs and snakes by the Bedeys deforestation must be checked. Where possible new forestation shall have to be created. More plantations of medicinal herbs should be taken into consideration in forestation programs.

3. Wetlands and river banks are continuously being grabbed by the unscrupulous people. Unplanned development on the bank of water bodies is also going on unabated. So these water bodies are shrinking

and the Bedeys are losing suitable places for their landing. In this backdrop wetlands shall have to be protected from encroachment and unplanned development.

4. Bedeys landing points are to be developed as landing stations providing facilities for secured anchoring of their boats. All the landing stations are to be supported by sufficient numbers of sanitary latrines and tube wells.

5. Programs are to be taken to educate the Bedeys. Both formal and non-formal education system shall have to be run for their socio-economic development. Floating school on boat (as shown in Figure 3) for the Bedeys, as developed by Subornogram Foundation, is an inspiring example in this venture [6].

Figure 3: A floating school on boat [18]

6. The Bedeys should be trained for aquaculture and water based agriculture e.g. Floating "Dhap" system as shown in the Figure 4.

Figure 4: Floating "Dhap" system for agriculture on water [19]

7. For capacity building they shall have to be trained on snake farming and herbal medicines so that their services can effectively contribute other societies in the neigbouring areas.

8. The male Bedeys shall have to be motivated to get involved in the educational and economic development activities particularly in the supporting activities of the females.

9. Government need to ensure their all human and citizen rights. Where needed new or revised rules and regulations are to be made to establish the rights of the Bedeys.

10. Researchers should be engaged in the development of Bedeys habitat. Concept of floating house incorporating water and sanitation facility might be the option in this regard.

Conclusion

The Bedeys, although an ethnic group, are supposed to enjoy all the human and citizen rights of Bangladesh. The reality is that they are remaining more isolated from the government and private facilities than the other ethnic groups in the country. The Bedeys shall have to be assisted then to retain their culture and tradition. Their backwardness in the society is not only for their own belief, lifestyle or culture but also for the emerging adverse situations in the natural environment which is further adversely affected by the climate change. The impacts of climate change in Bangladesh are severely affecting the habitat and livelihood of the Bedeys. Most importantly the rivers and wetlands are shrinking; also the forest lands are disappearing through cutting off trees and shrubs. Various mitigating measures need to be tried to counter the negative impacts of climate change. Similarly innovative approaches and measures are required to ensure the security of the traditional life and culture of the Bedeys. Concerned authorities also have to take sustainable measures to uplift their social status through facilitating all sort of socio-economic business of the Bedey communities.

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Deep Thinking for Sustainable Times
Arne Naess's Deep Green Future

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Abstract

Deep Ecology grew out of the deep thinking of its founder, the 'swashbuckling' Norwegian philosopher Arne Naess (1912– 2009) (Whitaker 2006, p. 113). Naess's refusal to follow a singular path of inquiry was shaped by his life's mission to face the challenges of life and still find joy (Rothenberg 1993, p. 84). Naessean Deep Ecology was at once characteristically philosophical, profoundly contemplative and unavoidably tactile.

In this Conference Track (*Deep Ecology and Ethics*), papers will argue that the insights of a Naessean Deep Ecology might lend great wisdom to lasting sustainability policies and practices. This paper offers an introduction to the Track that will shed light on Deep Ecologically inspired approaches to sustainability across a spectrum of views. Here, I suggest that infrastructural, technological and pragmatic sustainable solutions to contemporary development conundrums would benefit from foundational ethical values that reflect an authentic depth of Self in connection with human and other-than-human Others. The focus of this Track is consequently to bridge the gap between Deep Ecology theory and praxes as integral to forging an authentic and deep green future for all of life on Earth.

This is no small undertaking. The notion of 'embracing' rather than 'conquering' is necessarily at the heart of the papers that follow my Track introduction. I initiate the discussions to follow with a focus on Naess's capacity to embrace unique notions of love, compassion and interpenetration for all of life. I demonstrate that, while Naess was a pragmatist at heart, the more erotic element of the Self in Nature is essential and an emotionally compelling aspect of authentic sustainability theories and praxes. I argue here (and trust that my colleagues will too) that this 'deeper' approach to our engagements with life is essential for modern Western civilisations and indeed the future fecundity of the Earth.

To introduce this Track on Deep Ecology and Ethics, I note that we have much to thank Deep Ecology's founder Arne Naess. He offered us a pluralised path towards inner-outer unions of the Self with Others suggesting that through the practice of Deep Ecology, each person can seek a unique path towards a deeper encounter with human and other-than-human Others. This more 'erotic' awareness of one's place in the broader scheme of things empowers us to live with Earth rather than on it.

Deep Caring for the Earth as Self

Industrialisation in the West accelerated rapidly after WWII. And while the enthusiasm for growth was understandable and appropriate for rebuilding a tattered world, the accelerated consumption

of natural resources that ensued resulted in an accelerated ecocidal view of Nature as 'resource' for human exploitation. Responding to the ecological stressors that ensued, two global schools of environmental thought arose. The first one suggested that policy reform would suffice to avert further harm to our livelihoods and ecological systems upon which we depend. By contrast, the other (which took a little more time to develop) sought transformational responses that would assure the future sustainability of all life of Earth. According to Naess, these two environmentalisms are respectively referred to as (1) a 'shallow' or 'business-as-usual' and (2) a 'deeper' or 'total view' of life (Naess 1973, p. 96, Fox 1990, pp. 37-39, Glasser cited in Naess 2002, pp. xxv-xxvi, Drengson cited in Naess 2008, p. 27).[1]

The former view is instrumental and anthropocentric. This reformist view considers Nature to be a resource through which our societies can keep pace with desired trajectories of exponential growth that place human needs and wants at the centre of our economic, social and political pursuits. This shallow environmentalism accompanies a belief that human ingenuity can fix any trouble that might emerge, suggesting that resource consumption can continue so long as technology and the innovative capacity of human stewardship serve as guiding hands to keep progress on par with resource exploitation. This approach advocates checks and balances that can address global problems, such as industrial pollution regulations, recycling and slowed population growth through improved living standards for all (Naess 2005a, p. 24). However, as living standards have continued to rise for many, the balance between industrial supply and consumer demand has failed to remain within sustainable limits. Shallow environmentalism has consequently fallen short of placing sufficient limits on human uses of the Earth's resources, prioritising short-term socio-economic benefits instead of longer-term policies and practices that are truly sustainable. These human-centric priorities have resulted in considerable declines in the health and integrity not only of ecological systems the world over, but the lives of many individual humans as inequities within our societies have widened. Alarmingly, growth has become a great divider, benefiting some while being devastating for most human and other-than-human Others. It has become clear that shallow environmentalism's fundamental limitation is its focus on a human needs and wants instead of broader Earth care (Daly 1996, p. 1). This shortfall in social, economic and political management systems calls for a more radical environmentalism that is ecocentric rather than anthropocentric. Ecocentrism acknowledges the full richness and diversity of all life as equal to that of human life, and might be considered a 'deeper' ecological worldview. By the early 1970s, this 'deeper ecology' began to emerge to help us address the personal, social and environmental problems that all planetary citizens face, which a reformist or shallow environmentalism has failed to address (Naess 1973, Drengson 1992). Arne Naess deserves credit in large part for the articulation of this revolutionary ecocentric view.

Naess first coined the term 'Deep Ecology' at the Third World Future Research conference in Bucharest in 1972 and then published his landmark paper, 'The Shallow and the Deep, Long-Range Ecology Movement: A Summary', the following year. He defined this new form of environmentalism

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[1] Note that 'total view' was not intended to define a particular position as a complete or absolute system. Rather, Naess (2006) defined 'total view' as a conceptual framework that reflects the individual's unique sense of reality, which is unexamined and unarticulated precisely because it can be taken for granted. However, it would be tested by a set of internal, coherent and mutually supporting beliefs, ideas, values, concepts and categories that reflected the individual's understanding about the Nature of Nature, and their role within it. Total views are then dogmas, belief systems, philosophies etc., which comprised the foundations of the individual's ecological wisdom or Ecosophy T that results in an integrated way of thinking and acting that is personalised (Quick 2006, pp. 59-60).

as necessarily deeper, whereby 'deeper' meant to go right down to our assumptions about the world and our presence in it so that we might wholeheartedly support its flourishing along with our own (Naess 2002, p. 7). Naess intentionally juxtaposed Deep Ecology against the reformist tendencies of 'shallow' environmentalism. Rather than prioritising human needs and wants, Naess subscribed to a belief in the intrinsic value of all life, effectively placing human beings on an equal footing with the rest of Nature. As Rothenberg explains, Naess aimed to uncover a thoughtful environmentalism that prioritises the vital needs of all Others, human and other-than-human alike (Rothenberg 1993, pp. 129 & 145). For Naess:

> … the world participates in that which I feel, and the other way about. The world and I are not that far apart, perhaps not even by so much as a millimetre. I have no very clear idea what are the limits of the self; perhaps it flows out and expands, or contracts within. It is never the same. It seems more like a flow than anything solid. Is the diversity of feelings that I register only within myself, as if in a kind of box? Is consciousness like some sort of container with pictures of external things? That seems nonsensical to me, like an alienation of the world out there and a degradation of the great flow of consciousness (Naess 2002, p. 23).

Building on Naess's foundational work, Alan Drengson describes the movement as a philosophical inquiry that 'aims to reopen the conversation with nature and between communities of beings that has been largely interrupted by certain developments in modern industrial society' (Drengson 1997, p. 2).

Deep Ecology explores the ways we think, feel and act towards with all Others. It is philosophically derived, ethically transformative, and guides human actions to assure that non-human life is treated with as much consideration as our own vital needs. As a pioneering ecophilosophical discourse, Deep Ecology is based on spiritual, literary and social/scientific premises. Native American traditions, Buddhist and Taoist philosophies, Christian principles, the Yogic and Vedantic philosophies of the Bhagavad-Gita, as well as pre-Socratic spiritualities of European paganism form the spiritual basis of Deep Ecology. Reflecting Naess's philosophical influences, Deep Ecology echoes the writings of Spinoza, Kant, Emerson, Thoreau, Whitman, Bergson, Whitehead, Muir, Jeffers, Leopold, Jung, Fromm, Carson and Snyder who collectively echoed his 'total view' of life. Deep Ecology is shaped by the scientific and social influences of ecology, autopoiesis,[2] Gaia theory, systems thinking, along with Gestalt psychotherapies. These three principal influences (spiritual, literary and social/scientific lineages) were predicated on logical inquiry, forging a deeper global environmental movement that is not simply sustainable in practice, but in principle as well. To fully appreciate the benefits of Deep Ecology in forging a sustainable future for all, it is helpful to gain deeper insight into Naess the man.

Deep Thinker: Naess the Man

Trained as a Western Philosopher, Arne Naess founded Deep Ecology as an environmental movement that revered a contemplative view of our place in the broader scheme of things. Deep Ecology was the product of Naess's refusal to follow a singular path of inquiry. He was, after all, a pluralistic philosopher. According to Rothenberg, he conceived his life's mission to "… see how bad things are and still be able to smile at them … [as] the most solid kind of joy" (Rothenberg 1993, p. 84). Thus, he articulated Deep Ecology as a series of " … basic norms within the ecological movement and an application of [his] analytical training to talk in a bureaucratic way. Not to inspire,

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[2] Autopoiesis refers to natural and human-made processes that are self-regenerating (Maturana & Varela 1972).

show style, or be poetic. [He left] that to the artists" (Naess cited in Rothenberg 1993, p. 133). Naess declared that humans do not have the right to dominate and destroy the richness and diversity of life. Rather, he argued, we must draw only from the Earth's resources in order to satisfy those vital needs that sustain the self and/or give life deeper meaning. He encouraged us to achieve this through the rigors of reason rather than the whims of emotional tumult—a distinction that reflected Naess the man.

Naess possessed an austere *Panzercharakter*,[3] which placed a premium on logic. McKibben argues that his deep love of Nature and his enduring sense of youthful play were minimalist, phlegmatic, aloof and independent (McKibben cited in Naess 2002, pp. ix-x). Naess acknowledged the power of connectivity, celebrated and practiced Gandhian non-violent direct action, and was renowned for making friends of potential adversaries—from Nazis to academic naysayers (Drengson 1997, p. 2). He was a living paradox: predictable and evasive, wise and youthful, grounded in the Earth and nymph-like all at once. Naess went to inordinate lengths to divest himself of the drama of daily life in order to contemplate the Zen of dishwashing and the anguish of a dying flea (Naess cited in Rothenberg 1993, pp. 67 & 108, Naess 1995, p. 14). He considered emotional whims to be the stuff of non-philosophers who sought out distractions from the inevitable pain of thinking. Moreover, he argued that one must face and contemplate that pain, since it was associated with the solidity of an unnerved inner calm or 'serenity within oneself', which—he believed—Nature could best help each of us find within. It was Naess's view that this is particularly important during the impressionable years between ages five and fifteen (Naess 2002, pp. 13, 21 & 85).[4]

Naess's embodiment of reason brought him fully into the present. He pragmatically reflected on an inescapably plural reality of 'concrete contents', which made up a single norm that he called a 'total view' of living Others (Naess 2002, pp. xi-xii). For Naess, this was 'Self-realization!' in situ; a process that would enable the vital needs of all living beings to come into our consciousness in ways that were consistent with the ecological maxim that "… everything hangs together" (Naess 1986b, Drengson 1997, pp. 2-3).[5] He challenged each of us to embark on our respective journeys towards this Naessean Self-Realization! in order to achieve the utmost respect, responsibility and care for all life on Earth (Drengson cited in Naess 2008, p. 41, Naess 2008, pp. 84 & 101). As an example, Drengson argues that, "Naess thought that our sense of identification can be extended through care, to include a more complete ecological Self. We do this by giving full attention to the things and

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[3] Panzercharakter is borrowed from the Freudian term defined as the impenetrable shell that a man uses to protect him from the vagaries of life and keeps others at arm's length (Naess 2005a, p. xxxi). The term is used here to distinguish the Protestant influenced stoicism of Aryan males that was internalised and even celebrated by Naess.

[4] It is important to note that Naess's perspective on feelings was not intended to demonise them. On the contrary, rather than reifying the Cartesian division between self and the world, Naess (2002, p. 15) considered the human experience as both emotional and relational. He believed that it was not possible to stand outside of the self, as our thoughts, emotions, and relationships, were, in his view, inescapably part of our moment-to-moment experiences of living. The emotional aspect of the human experience provided one an opportunity to 'pull themselves together' in order to liberate the self from the grip of negative feeling. Ideally, one would achieve this on their own but Naess acknowledged that for most, outside help was of incalculable worth (Naess 2002, p. 38). Naess (2002, pp. 16 & 29) also considered feelings to be an opportunity to delve deeply into the journey of analytical abstraction because emotions could be reduced to variations on the two principal emotive themes of desire and revulsion.

[5] Naess noted that Self-realization! required 'selfless action' through the reduction of the dominance of the narrow or ego self. It was ' [t]hrough the wider Self [that] every living being is connected intimately, and from this intimacy follows the capacity of identification and its natural consequences …' (Naess 1986b).

beings in our surroundings" (Drengson 2010, p. 29). Naess conceptualised Self-realization! as the pull to understand " … the being from which one proceeds" as an integral part of universal oneness (Anker 1998, n.p.). Through this Self-realization!, the individual can acquire an intimate awareness of the 'Self' as Nature, beyond the individual 'self'; an awakening of ecologised wisdom that would emerge through the struggle to live a liberated life in communion with all Others. Drengson (1997, p. 5) suggests that this could be accomplished in practical terms by identifying with a myriad of other living things, cultivating care and affection towards them, and achieving these caring imperatives in an infinite number of ways, as deeply transpersonal, psychological, and individually acquired.

From this foundational mosaic, Deep Ecology continues to invite us to embrace rather than conquer the living world. We are asked to divest ourselves from the ego self and in doing so prioritise altruism as a morally driven duty towards all Others and self concurrently – an imperative to be pursued with much vigour (Naess 2008, pp. 94-95). Deep Ecology is not only a transformative environmental ideology, but also pursues systematic changes in human attitudes, behaviours and institutions by transcending ecological ideas to create an ecologised identity within (Katz et al. 2000, p. ix, Seed 2006, p. 98). The movement aims to reduce human suffering, while preserving the rhythms of non-human Nature as well (Rothenberg 1993, pp. 130-131, Naess 2008, pp. 187-191).

Deep Ecology does attend to human emotions. Naess sought deeper ecological wisdom by nurturing the positive aspects of the feeling self. He identified with all of life through love and compassion as 'richer forms of reason', suggesting that the healthiest of selves symbiotically aligned reason with emotions, resulting in Self Realization! (Naess 2005a, p. xxiii). For Naess, Self-Realization! brought forth an individual's unique ecological wisdom that arises through listening to one's mind and body concurrently. Naess claimed, for example:

> If anything is to be rational … it must not conflict with what a human being has adopted in his heart of hearts, both as an individual and a member of society. At this level mature feelings and reason come together. Reason loses its function where there is no motivation, and motivation is absent where there are no feelings either for or against (Naess 2002, pp. 3-4).

However, the dominant variable in Deep Ecology was Naess's penchant for thinking. He aspired to turn negative feelings into real happiness through a conscious and thoughtful communing with the Earth; his deference to the powers of the mind was intended to facilitate the reaching of one's fullest potential or 'full humanness'. Naess's Self-realization! awakened pleasure at Other's pleasure and sadness at Other's sadness. His approach reflected a love for all of Nature–human and other-than-human alike. This resulted in positive or active emotions that stimulated the greatest capacity within the individual to care for Others as an integral part of themselves (Naess 2002, pp. 2 & 9, Naess 2008, p. 84).[6]

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[6] Naess made an important distinction here. While he did not deny the presence nor dismiss the importance of emotion, he was particularly enthusiastic about encouraging individuals to transcend negative emotions with reason, resulting in '… the best side of human Nature … even in a 'bad lot' … that ensures the possibility of activating the positive emotions' (Naess 2002, p. 89).

Earth in the Self/Self in the Earth

Naess formulated Ecosophy T[7] as his unique praxis of Deep Ecology's eight-point platform (Drengson cited in Naess 2008, pp. 3 & 32).[8] Ecosophy T was born from Naess's particular engagement with his adopted 'father' and beloved Norwegian mountain range, *Hallingskarvet*, upon which he built his cabin retreat (*Tvergastein*), the place where he did much of his writing on Deep Ecology. Ecosophy T invites us to discover an ecosophical (re)awakening for ourselves by "… always digging down to get to the roots of questions and issues", and in this way, to manifest ecocentric praxes reflective of our personal experiences and insights or 'ultimate values' as they are confronted and challenged in our interactions with the world around (Drengson 1992, p. 3). In other words, there is no specific or prescribed ecosophy in a Naessean Deep Ecology; rather Naess advocated an ecological wisdom for every person who steps towards Self-realization! through their individualised deep engagement with non-human Nature (Drengson 1992, Drengson 1999). Alan Drengson and Bill Devall (2010, p. 58) describe this Naessean pluralism accordingly:

> … Naess was doing something more subtle than many thought. He was not putting forth a single worldview and philosophy of life that everyone should adhere to … . Instead, he is making an empirical claim based on overwhelming evidence that global social movements, from the grass roots up, consist of people with very diverse religious, philosophical, cultural, and personal orientations … [who] can agree on certain courses of action and certain broad principles, especially at the international level.

Defining an ecosophy is therefore an individual pursuit. Naess challenged each of us to add our unique suffix to our personal ecosophy as a distinguishing self-identity. Elaborating on Ecosophy T, Anker (1998, n.p.) suggests that the ecosophised human is on the path to reaching "… an adequate understanding of his or her being-in-nature, an understanding that may be seen … as an epistemological re-entry into creative nature." Ecosophy T enables the individual to develop norms that serve as a moral guide for daily life. An ecosopher would in these ways also come to recognise

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[7] Ecosophy = oikos (household) + sophia (wisdom). Naess acknowledged the inherent biases of individual people's lives, and constructed a means to harmonise the resultant array of beliefs about the world. This diversity of total views increased the possibility of richer, deeper and wider creative insights about humanity and the other-than-human world that resulted from what he considered was a healthy process of constant re-evaluating of ideas (Quick 2006, p. 63).

[8] Deep Ecology's eight-point platform:

1. The flourishing of human and nonhuman life on Earth has intrinsic value. The value or worth of a non-human is independent of their usefulness for human purposes.
2. Richness and diversity of life forms have intrinsic value and contribute to the flourishing of human and nonhuman life on Earth.
3. Humans have no right to reduce this abundance and diversity except to satisfy vital needs.
4. The flourishing of human life and cultures is compatible with a substantial decrease in human population, and the flourishing of nonhuman life requires such a decrease such that are fewer resources being consumed by humans, and more left to be consumed by non-human Others.
5. Present human interference with the nonhuman world is excessive, unsustainable, and the situation is rapidly worsening.
6. Policies must therefore be changed. The changes in policies affect political, social, economic, technological, and ideological structures. Were these changes accomplished, the resulting state of affairs would differ from the present considerably and would make a more joyful experience of the connectedness of all things possible.
7. The ideological change is mainly that of appreciating life quality, rather than adhering to an increasingly higher standard of living.
8. Those who subscribe to the foregoing points have a direct or indirect obligation to participate in attempts to implement the necessary changes (Devall & Session 1985, p. 70, Naess 1986a, pp. 509-510, Drengson 1992, pp. 4-5, Drengson 1997, pp. 3-4, Naess 2002, p. 108, Drengson cited in Naess 2008, pp. 28, 31, Naess 2008, pp. 11-12).

the need to reach an inner unity that perceives the non-separate whole as a mosaic of parts—in other words to prioritise the Self-realized! self as Nature in the human form (Seed et al. 1988, p. 61).

I emphasise these embodied elements of Deep Ecology for a specific reason. According to Deep Ecologists, an individual ecosophy is acquired through the positive feelings about Nature that emerge from communing with a familiar locale on intimate terms – a kind of bioregionalism. Naess's deeper approach to the human/Nature relationship extended towards that place as a benevolent entity unto itself, worthy of our utmost respect and care. Naess argued that there was enough care to go around for all life, without detracting from human vital needs, since:

> It is possible to extend care, reinforce it, and cultivate it. Care is not constant or immutable. It is for that reason that I have proposed the motto 'Extended care for nonhuman beings, deepened care for human beings.' The latter is a reminder that there are people living in completely unacceptable destitution, not only ordinary poverty. Everywhere there is deprivation that must be eradicated … Such deprivation is simply unacceptable (Naess 2002, p. 107).

In this sense, the Naessean formulation of Deep Ecology not only motivates one to action for and with place, but also insists that we take great care of it and all life that it supports. Naess's 'ecological self' represents an internal state of being, achieved by the individual through various identifications with home (Naess 1986a, p. 3, Naess 1986b). He argued that the ecological self arises as we express an understanding of being in, of, and for Nature, from our very beginning and this "… naturally and beautifully follows norms of strict environmental ethics," resulting in individual and community values and actions that heal our relationships with all living beings; effectively closing the gap between Others and ourselves (Seed et al. 1988, p. 29, Naess 1995, p. 14).

An important lesson to be drawn from Deep Ecology is its simultaneous attention to the individual and the universal, the subject and the object, the ego and the metaphysical, reason and emotion. Naess's Self-realization! was not an abstract exercise. Rather, as Mathews states, Naessean Deep Ecology is "… grounded in recognition of the metaphysical fact of interconnectedness …" that we cannot escape, even if we attempt to deny our presence in the universal wholeness of life (Mathews 1991, p. 148). It is for this very reason that any theory or praxis that supports sustainability has much to gain from Deep Ecology as a foundational ethical guide. Were we all to dedicate ourselves to the gift of intimate localism and in doing so allow our respective ecosophies to emerge, we would likely find it increasingly difficult to turn a blind eye to the degradation of that place, which shallow or unconscious human industriousness can cause. My hope is that this Conference Track further demonstrates the power and potency of Deep Ecology as a pathway to a deeper ethics of Earth care, which facilitates sustainability not simply for the sake of more comfortable human lives, but also for the fullest flourishing of all life on Earth.

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Dingo's Smile

Fasting for a glimpse of my true Self

Dr. Paul M Pulé (with Richard Beavitt, Glenis Taylor and Gary Williams)

Beyond the Threshold

(Note: This paper compliments the works of Steven Foster and Meredith Little from The School of Lost Borders in the USA, who for more than forty years have been translating the ancient Earth wisdom of Vision Fasting into a language for moderns. Their work is honoured as guiding and foundational, while being adapted to Australian context).

Abstract:

There is much to be said for being with, sitting in, and remembering that we are of this Earth. In an interview with Stephen Bodian, Arne Naess reminded us that a life lived "simple in means, rich in ends" is a noble cause, bringing to our awareness a reverence for the Earth's diversity and our presence as an intimate part of it (Bodian 1995, p. 26). Naess's declaration was an Earth wisdom for and from the ages that bridged the gap between modern and indigenous life. He suggested that there are many different paths that lead us this realisation.

In this paper, I introduce the work of *Beyond the Threshold* (BTT) as one such path (Beyond the Threshold 2015). BTT is a Perth-based community association offering contemporary Rites of Passage referred to as Vision Fasts, which are ritualised twelve day Earth immersion experiences held in remote locations throughout Australia. Vision Fasting has been translated and popularised by Steven Foster and Meredith Little from *The School of Lost Borders* for more than forty years. Vision Fasting is a time of fasting, seclusion and exposure where one is removed from the usual rhythms and demands of life. With the support of a team of experienced guides, the Vision Faster is encouraged to gradually move away from the company of other humans, as well as the distractions of food (with a focused period of solitary contemplation over four days of the twelve day journey). Vision Fasters drink only water while during this solo time, embarking on a journey of intentional contemplation to (re)discover Nature itself and their own inner nature. The Vision Faster is supported to brave the elements in this four days of solo time, stripping bare so that they might come home to themselves with a renewed awareness of their intimate connection with all others. In this place of Earthen reflection, the Vision Faster is encouraged to take stock of all four stages of their life (Summer – childhood; Autumn – adolescence; Winter – adulthood; Spring –

eldering/rebirth) to (re)awaken their most essential elements within. As clarity emerges, the Vision Faster enters a fifth stage of life, that being integration or their becoming "more fully human" through a kind of death that brings forth new life within and towards others. From this place, the Vision Faster is better able to offer themselves in service to their loved ones, their community and indeed all life on Earth.

In *italics* and interwoven throughout the paper is the story of one journey that unfolded through a Vision Fast in the Gold Fields of Western Australia in 2013. Beginning this story with a final flashing visit from Dingo as he emerged from his ordeal, the author demonstrates the power of Vision Fasting as a particular form of ecosophy[1] that Naess eruditely advocated (Naess 1995, pp. 8-30). The narratives woven together in this paper offer an insight into Deep Ecology theory and practice concurrently, demonstrating through the principle author's experiences how Vision Fasting can simultaneously support the enrichment of modern life both within and without, for the betterment of the person and the planet. The paper is intended to appeal to both theoreticians and practitioners of sustainability, featuring Vision Fasting as an important contribution to the ecosophic practice of sustaining self and Earth.

Cross-referencing eco-therapeutic insights about the powerful impact of Nature on the human soul, this paper argues the case for "(re)membering" how the human spirit is integral to sustaining all life on Earth.

Dingo smiled, tongue-lapping air as if drinking primordial soup. I had come home and he knew it, perhaps even better than me, his cheeky grin the humour of my folly, beckoning me to stick around and play for a while longer in the parchment of that Great Western Woodland. I had died and been reborn. I had entered my death lodge, lingered longer than I had intended, come through to the other side on the same two feet and yet was now so very different.

For aboriginal poeple, dingo is "big boss" (Bird-Rose 2011, p. 1). He is to be listened to, not feared, and certainly not ignored. He is conveyor of the birth-death cycle, reaching beyond past, present and future, a timeless emblem of the Moon's defiance and symbol for the perpetual self as interdependent with all others, who, " … like his human descendants, is

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[1] Naess considered ecosophy to be a kind of personalised ecological wisdom acquired when an individual sinks deeply into a local ecology to find their own unique relational exchange with a place. For further information on Ecosophy, see Naess (1995, p. 8).

open to life, sharing the finality of death and the continuity of parts" (Bird-Rose 1992, p. 105). Dingo's quest for eternal life is that of the Moon, desire, sexuality, procreation, fecundity, dominance over everything in the world and yet nothing, walking that fine line between self and cosmos, reminding us that both life and death come wrapped in blood (Bird-Rose 1992, p. 105). He has much to teach us about being everything and nothing.

This desiccated land called Boorabbin *is a maze of whispering shrubs and heath, dotted with samphire and salt lakes shimmering molten silver in the semi-arid sun. A rich mixture of squat scrub heath and broombush thicket (known locally as* Kwongan*) is pocked with Mallee shrub-lands clinging together on isles of higher ground, in what might broadly be thought of as 'sand country'. This country is a hallmark of the Great Western Woodland – about half way between Southern Cross and Kalgoorlie in the Western Australian Goldfields,* Boorabbin *refers to a large rock revered by the* Bibbelmun *people who have served as custodians of this land for more than fifty thousand years. This country is as powerful, rich, diverse and compelling as it is ghostly, timeless, parched and unforgiving. One ought to know this Country to survive it. That's a talent too easily lost to televisions, couches and beer. The staff of* Beyond the Threshold (BTT) *have been taking small groups of seekers to this land for the last five years.*

Humans visit this country so seldom that a century of garbage to my left and right, discarded by prospectors, woodcutters and hermits over the last century, lay like museum dioramas capturing peeps of lives long lived and lost. Beer bottles sit in the soil like marooned ships, their contents long wasted on an inebriated soul seeking solace in this wide-open place. One might be forgiven for thinking that Boorabbin *is synonymous with bosom. But this country place is bosom not for the faint-hearted. I was to find this out viscerally. Dingo reminded me of this when I returned from the journey about to unfold.*

I rubbed the coarse silica between my hands, pausing on the track as we drove towards basecamp.

In their work as Vision Fast Guides, North Americans Stephen Foster and Meredith Little speak to the power of the Four 'Shields' (or 'Directions') that mark a Vision Faster's journey. They guide us through the notion that we are all inescapably wedded to four great phases of life that follow the four long seasons of the Sun in a wide clockwise arch: Summer – childhood; Autumn – adolescence; Winter – adulthood; Spring – eldering/rebirth. Each lived to the fullest brings us to the Fifth Shield where we become "fully human" (Foster and Little 1998, p. i). In the Northern Hemisphere, these quadrants of life and season correspond with

the cardinal directions South, West, North and East respectively. Consistent with the localised potency of this work, those of us living in Australia are asked to sink in with the presence of Country, while also remaining connected to our place in the whole, reversing the cycle of the Four Shields counter-clockwise in honour of our hemispheric aspect. We here in Australia are asked to map Foster and Little's four phases of life in reverse to match the Coriolis Effect such that here in Southern Hemisphere the Northern aspect becomes the place of childhood, the Western aspect the place of adolescence, the Southern aspect the place of adulthood and the Eastern aspect the place that greets the stasis of eldering and rebirth. This is an important distinction: the adaptation of going within that brings with it the need for localism, honouring of Country, and an ability to translate from one geo-metaphysic to another.

Having slowed from food as integral preparation, I noticed my attention pull away from the fleshen world toward an enigmatic samphire horizon. I wondered where I might wander and what I might find. I felt a tinge of fear, but more an annoyance, an impatience to stride forth and find, to know more about the unknown that lay in sight but unreachable, both terrifying and intoxicating at the same time. For a long time I have considered myself on the seeker's path. Focused on the challenge and mystery of a new lens, I wanted to look there, where my eyes could not focus, where detail gave way to patterns awash in colours revealing broad forms but little indication of function; the place where imagination runs wild and anything is possible. I was not present to the now. I had already embarked on the journey to find, to do it right, and to grasp a destiny that was not calling me quite yet. Jumping the gun yet again. I have long been the frustrated sprinter, unpractised, wavering from routine, bored with regimen, trusting that I knew enough to forge forth. And Boorabbin *laughed.*

At the heart of this journey, the Vision Faster is charged with the task of coming home to their truest self. The majesty of this work is its complex simplicity – time to stop and dwell as if raptured by a narcissistic fascination with one's self, only to have the insanity of this egoistic vanity yield to being simultaneously miniscule *and* an intractable piece in the vast puzzle of this broad universe (Foster and Little 1998, p. iii). The power of arresting this paradox is to dwell in it – to be miniscule and yet immersed within vastness – as if to say that life pulses within and without at the same time. Vision Fasting teaches us that we are closer to Nature than modern life would have us believe. We are, in fact, Nature in the human form. Embarking on stopping – yes the movement implicit in *not moving* – is at the core of this work. Vision Fasting is primitive, ancient, and cellular; a great (re)membering – as in bringing back together the ancient parts of ourselves that have been flung asunder by our modern lives.

This (re)membering is what Foster and Little (1989, p. 2) refer to as a "self-thus" awakening. "Self" here refers to the individual interlinked with a community of other individuals, as I am in proximity to the ringtail possum, who casts hollowed passionfruit at my doorstep as I write. "Thus" refers to the narrative of living; cycles within cycles, the mind, the ways we express, contest, love, and are connected, including the transition from season to season, the passage of time, the accumulation of experiences that form a history or memory, the inflection from day to night, our current states of being, even expressions of the soul. Through a self-thus (re)awakening, the Vision Faster consciously enters a moment's pause where distractions are arrested, defences removed, stops pulled, a pathway cleared, to touch "essence", "force", "intelligence" and "spirit" within and without (Foster and Little 1998, pp. 2-4). Drawing back to Naess, we find his philosophy of Earth wisdom ushers us towards this same "self-thus-ness." Like Foster and Little, Naess sought interpenetration through individualised self-discovery in and with Nature through what he called Ecosophy T: a process of self-realization that facilitates an "ultimate norm" within and provides a "total view" of self inextricably connected with a broader universal or "cosmic" Self (Naess 1995, p.14). According to Michael Zimmerman, all this is possible for the following reason: "… the value of [individual] selves stem from their activity of self-realization, … all selves are interconnected, the self-realization of any particular self is somehow bound up with self-realization of all other selves including the cosmic Self" (Zimmerman 1994 p. 43). Vision Fasting provides a frame for Ecosophy T, taking the Vision Faster by the hand into the cosmos, helping them face moment after moment of deepened interpenetration into the immersive solitude of wild places as a mirror for the wild places within.

I took very little time to find my place for my four days of solitude – a mini isthmus jutting towards the direction of childhood in the north, that stage of my life that was such a blur I can hardly remember. My chosen home on the southern shore of a saltpan protruded north before me. From there I could gaze towards the unreachable north across the expansive crust of salt before me. Metaphor for my life to-date, the place I chose was in the southern aspect of adulthood, childhood visible but cut-off by a bleak expanse – a single exposed shrub was my only shelter and axis to the wheel of life I would ponder. I drew my Shield, small stones and offerings placed carefully in each of the cardinal directions, linked them in a counter-clockwise meditation of breathe and step, the sun following my every move as if with baited breathe. Water at the ready, knots tightening hootchie² against the wind, sleeping bag sprawled, firewood collected, matches in my pocket, clothing bagged as insurance against the possible rain, wind howling, darkness falling rapidly. I was ready. So I thought. Slumber stole me away from ghosts that lurked in the shadows of the lake land ahead, my fire and brief prayers yielding to dreams of more pleasant things. Morning came quickly. As if logic and determination were preordained, my day was defined: to seek strength, wisdom and

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² Hootchie: a military surplus tarpaulin, traditionally used by Australian soldiers, which is suspended between two or more trees by running cord through its eyelets.

resolve the stuckness within that had me single for so long, cowering from the promise that I might love again. I strode southeast shortly after waking, on a magnetic trajectory towards the direction of eldering and rebirth in quest of some oracle's counsel in matters of the heart. I had been bush many times so I felt the familiar feeling of being emboldened by my steps into the unknown. At each significant intersection and turn, I made note of my path, even counting my paces and leaving large stick arrows on the ground to help me find my way home. I felt no concern: I was playing the game by the rules. Resting after some two hours of exploring the whispers of eldering and rebirth, I slumped, pressing my back up against a large tree that called me to stop. There, lubricated only by a few mouthfuls of water stirred with electrolytes to replenish my salts, I slept, my dreams searching for instructions on how to let someone close again.

Foster and Little are explicit in reconciling this paradox of self-thus. The tensions between the two are eased when we realise that: "… there is no center – that the entire earth is not the center, that our home galaxy is not the center. Nevertheless, we must persist in perceiving ourselves at the center, for without this perception there would be no means of balancing. We would not be able to stand on our two legs" (Foster and Little 1998, p. 7). The Shields are Directions that enable is to navigate from our individual lives on Earth towards wholeness. Height, depth, width, cycles and spheres pervade the Shields and – when they are considered together define the biosphere in a universal context, offering us our place in the broader scheme of things. This insight demands that we embrace cooperative oneness with Nature as the only way to fully live our lives; our cycles around the sun from our respective vantages on planet Earth – taking us through ebbs and flows of expansive connection towards (incorporation) juxtaposed against retreat (rejuvenation) (Foster and Little 1998, p. 14). Vision fasting might therefore be considered iteration in action, a hallmark of fractal geometry, taking the concept of Systems thinking to the point of praxis in the human psyche and lived experience, providing a rite of passage that passes us through to the realm of oneness in a visceral way that moves from the isolated self to the Universal Self.

As a practice, Vision Fasting stretches us towards the fullness of each season of our lives so that we might, when arriving at the Fifth Shield of incorporation, become well rounded, reaching our fullest potential through an immersion in our fullest natures at each step of our journey. The transition of self-flourishing to planetary flourishing is implicit here. Compassion and self-love (or freedom from pain) must begin internally, and from there can radiate throughout the systems in which we are immersed. With such a framework as our guide, it is enriching to embrace death as a simple and essential part of the cycle of things – we become less concerned about gratifying the bodily self and more committed to serving this life well while we have the chance.

Awakened by a sun sliding to the West, I felt the call back to my isthmus home. No bother, I thought, a simple task of back bearings on my compass, collecting my markers along the way. What I had not expected was the vertigo about to unfold. The woodlands on these samphire isles are armies of ghosts. Trees standing Spartan, yet many, austerely whispered me on as the wind combed through their leaves. As certainty fell from my mind's eye, I tumbled. Like Hansel, I panicked and grovelled for crumbs to trail me home only to discover that they were nowhere to be found. I later learned that I had veered from my marks by only few metres but that was enough for me to miss the reassuring signs of my competence. I lost touch with what I thought I was: competent, capable, adventurous and alive. As I forged forth searching for the next crumb, a mist of bony fingers encroached – I was entering into a massage parlour of death, a place beyond my comprehension and confidence, an unknown forest. My heart raced. I ran, and as I did I kept nervously inspecting my compass to reassure myself that I was reading it correctly. I swore I was. Trees yielded to thicket and suddenly I was surrounded, breathless, thirsty and lost. I was committed to my ritual death in ways I could not have imagined.

In that moment, my only job was to arrest my stricken breath. I stopped. And for two days, I sang, I danced, I prayed, I slept, I rummaged through my daypack for what morsels of comfort I could find – a knife, a plastic bag, a space blanket, a lozenge, a cylinder housing my last electrolyte tablet, a few matches. I collected wood to warm me at night and by day huddled in the shadows to dodge the sun, savouring my last drops of water. It was there, off an ancient track, that thicket and tree became my bedfellows. And Dingo watched me wearily from afar.

In a compelling account of Stephen Foster's life and death, palliative medical practitioner Scott Eberle (2006) reminds us that we are all mortal, that we are animal and that we will all die. Eberle speaks of five essential phrases that can see us through to our imminent demise with grace and closure: "Please forgive me; I forgive you; Thank you; I love you; Goodbye" (Eberle 2006, p. 51). When we die as indeed we all must, we enter into what Foster and Little refer to as our Death Lodge. All of us end this life there, but some seek an early death in this life, taking what time they have left to complete their healing of past wounds so that they might be more fully present with themselves and others for the remainder of their days. Vision Fasting is one way to enter the Death Lodge by choice and ahead of fate. In doing so, we are able to generate an authentic forgiveness for others and ourselves. Eberle (2006, p. 53) reminds us that if we counter the strain of justice (the struggle to be right) that so many of us seek in life, we can find the release of compassion and extend that firstly

towards our wounded selves, then towards those we have wounded, and then towards those who we have felt wounded by. Through his understandings of the teachings of Foster and Little, Eberle reminds us that we are all fallible human beings:

> Even if we have the best of intentions we often hurt the ones we love. We say or do something we shouldn't. We fail to say or do something we should. …
>
> [So] Find a physical place that has the feeling of "a [death] lodge" – perhaps in a large hollow in the ground, under a tree, or in a closed-in canyon. Mark "the doorway" with rocks or other natural objects, step inside the space, and then close "the door" behind. Sit down and wait patiently to see who comes to visit.
>
> To each person, speak what needs to be said, perhaps even out loud. When done talking, listen for what each of them has to say in return … When finally done, give thanks to the surroundings and then close the [death] lodge behind (Eberle 2006, pp. 72-73).

Such is the deepest work of the Death Lodge: choosing to get complete as one ritually dies so that new life can emerge for the self and with others. This ritual facilitates the (re)membering of the self that enables us to wash this life with our gifts while we still have more days to bring our unique magnificence to the fore. It is here that we find the great promise of Vision Fasting; a psycho-therapeutic coming home before we are literally returned to stardust.

My last sips of water moistened my tongue. My urine was a few meagre dribbles, burning and dark. My body was weak. I had made a tripod for the search chopper to find me. I had dug a trench with my knife, stuffed it with leaves and covered it with the plastic bag I had in my daypack – yielding but a few drops of condensation in the early morning. The wind continued to the whisper through the leaves that I might actually die. Surely, they would know I was lost by now and would come looking for me. I climbed a tree in defiance of the wind's whispering and heard a faint call. Enough to embolden me to make a fateful choice: I could either stay here and risk dying of thirst, or take a chance that what I heard was real, no hallucination but one of my party looking for me. I chose life or death trying to find it again and stepped towards the voice. Stepping away from home of 3 days by that fire circle, lost and alone, my heart ponded. This could be it, my dogged final march. But no, a footprint (mine!), then another, then a familiar shoreline. I wheeled to my right and in the distance caught a flash of red – my guide's shirt at my camp. I fell to my knees and wept. He strode towards me. And as he reached me he put his hand gently on my shoulder and said: "You must be thirsty mate – drink this."

The next day, water rehydrating my flesh, my guide and I returned to break down my rescue tripod and spread the fire pit that had anchored me. As we turned for basecamp I caught a

flash of Dingo smiling and begging me to stay a while longer and play. I had faced my death, a place I have avoided and denied. My Vision Fast was in some ways incomplete for I still have conversations that the shadows of my creeping death distracted me from having. On the other side of being lost I have found a life that I might not always consciously know. But it seems somehow familiar, correct, pulling me along this path I am on as if that inner courage to step towards a faint voice has always been within me and will always be. Boorabbin *still calls.*

At the heart of a vast body of conceptual wisdom, conveyed through thousands of words that speak to the Deep Ecology movement, lies something very simple. The practice of Deep Ecology is not about rational or fixed frames anchored in black and white through words on a page. Rather, developing an ecological awareness of one's self is a living exercise in humility. Implicit in this journey is a felt experience where fear, grief, guilt and anger gain as much credence as joy. Instead of shrinking back from our own suffering, we must find moments to face the full spectrum of ourselves as Universal beings. If we are to embrace such a journey, we must be willing to greet the death of our egos and let go. In doing so, we can then blend with the living Earth systems that sustain us and experience that which is greater than our individual selves are. Stripped bare of the self we get to see, touch, taste, smell, speak with and listen to Earth as Self, and Self as Earth (Devall, 1988, p. 46). Vision Fasting is one way to usher in this (re)membering, offering a deeper sense of out-there-ness and in-here-ness simultaneously, as a kind of kinship that, in reality, we have always known.

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DEEP ECOLOGY AND AUSTRALIAN SUBURBIA: LEARNING FROM ABORIGINAL AUSTRALIA PHILOSOPHY

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ABSTRACT

Naess' *Deep Ecology* [50] represents a fundamental philosophical and conceptual shift from the dominant Western thinking that can be traced back to the Greek and Roman Empires. Like all philosophy, Naess' *Deep Ecology* was born of and is most relevant to a specific time and place being northern Europe. Although the fundamentals of the *Deep Ecology* philosophy were new to modern Western thinking, it is not new to traditional Indigenous cultures, including the world's oldest culture, that of Aboriginal Australia. While the past four decades has seen an increasing recognition of Aboriginal philosophical approaches, there is very little understanding of what this philosophical approach is and means for the management of the Australian environment in which humans are a central part. Since European arrival, Australia has been one of the world's most urban societies. Unlike northern Europe, urban Australia is low density and suburban, a legacy of British and North American influences. Nearly 90% of Australians live in detached houses surrounded by gardens. Managed by individual residents, this land use accounts for about 70% of the total area of cities like Melbourne. Deeply culturally embedded, the Australian desire for living in low-density suburbs is unlikely to change soon. Contemporary cities are widely recognized as causing severe environmental degradation and are not sustainable. Yet in Australia introduced philosophical and design approaches are still used to address the unsustainable impacts of urban forms introduced from another time and place. While impractical to remove the existing suburban form in Australian cities, there is a significant opportunity to retrofit them using Australian Aboriginal philosophical and land management understandings developed and tested over tens of thousands of years. This paper establishes a contemporary Australian *Deep Ecology* philosophical approach to sustainably living in the suburbs that recognizes and works with the legacies of Australian Aboriginal, English, North American and contemporary Australian influences.

PROFESSIONAL' ENVIRONMENTAL PHILOSOPHY IN AUSTRALIA

In 1973, the Norwegian Arne Naess, published his *Deep Ecology* philosophy later known as *Ecosophy T* [50]. Naess was strongly influenced by the philosophies of Benedict Spinoza [42:49] and those of Eastern [6:212] and Indigenous societies. The term *Ecosophy T* was derived by combining the root words from ancient Greek *ecos* (household place) and *sophia* (wisdom to mean ecological wisdom of place) [14:107]. Central to Naess' *Deep Ecology* is a deep questioning approach, the importance of protecting the wilderness, acceptance that both people and the broader environment have needs and rights, that people and the environment are inseparable, that people should live in voluntary simplicity with a high degree of self-reliance to meet their vital needs, that academic philosophers are a small minority of participants and that a grassroots social movement was needed for *Deep Ecology* to take effect. Naess' conception that people and the environment are one and the same, was the basis of his notion of the ecological self or eco-self- that by harming the environment you are infact harming yourself. Naess (50:91) believed that "the dominant modern Western trend has been unrealistic and self-destructive".

Naess' philosophy found a resonance with 'professional' philosophers in Australia. Passmore's *Man's Responsibility for Nature* [54] is recognized by many later important Deep Ecologist philosophers such as Callicott [5] and Fox [19] as being a classic contribution to the field. Seddon [66] calls *Man's Responsibility for Nature* a "major intellectual event". However, in recent years both Cooper [8] and Mathews [45] identify that Passmore's approach was shallower and more resource focused than the *Deep Ecology* movement. Fox

himself was seen by many to have picked up mantle of *Deep Ecology* in the 1990's following the release of his book *Towards a Transpersonal Ecology* [17] while Mathews [45] identifies that Gare [22, 23, 24] has made significant contributions in the past two decades.

Mathews [45], in her summary of the environmental philosophy movement in Australia, shows the historical development of 'pure' environmental philosophy in university departments of philosophy over the past forty years. In this history, Mathews states that Australia has 'punched above its weight' in environmental philosophical circles [45]. She believes that this is because Australia, like the United States of America and Norway, was at the forefront of the Western development of an environmental ethics that was born out of the counterculture movement of the 1960s. This may be true, but one of the criticisms of the work of professional Australian philosophers such as Passmore, Fox and Gare is that none of them specifically apply their philosophies to actual places in Australia, nor do they investigate Aboriginal environmental philosophy and ethics. This is despite each of them living for significant periods of time in Australia. The lack of consideration of Aboriginal place based elements is somewhat surprising given that one of the beacons of the *Deep Ecology* movement, Callicott argues in his *Earth's Insights* [5] that Aboriginal philosophy or worldviews are the exemplary example for other Deep Ecologists to follow.

Mathews [45] does investigate a small range of academic Aboriginal philosophy. She also explores the notions of becoming 'native' [44]. However while Mathews history makes it clear that it is just the history of environmental philosophy in university philosophy departments, not including the philosophical and theoretical work of academics specifically involved in the design and management of the Australian landscape, both Aboriginal and Western, but not physically located in philosophy departments is a major weakness. Such Western-born scholars include Seddon [65, 66], Rapoport [56, 57, 58, 59,60,61], Muecke [49] and Memmott [47, 48]. Nor does Mathews' history investigate other important Australian environmental literary works by academics such as Flannery's *The Future Eaters* [15] or Gammage's *The Biggest Estate on Earth* [21] that brought discussions on the Australian environment and its past, present and future management into mainstream society. While Mathews does refer to a few Aboriginal scholars in her history of environmental philosophy, namely Graham [27] and Grieves [28], she again does not refer to numerous other Aboriginal academics and authors who have written extensively on Aboriginal philosophy and how it relates to place. These include Kerwin [35] and Pascoe [52, 53].

All these works are the lived experiences of this place, Australia, and resonate the wisdom of place that is the essence of Naess' *Ecosophy T* [50].

THE REDUCED IMPORTANCE OF PHILOSOPHY IN `MODERN' AUSTRALIAN SOCIETY

At its broadest level, philosophy is defined in the Oxford Dictionary as "*the study of the fundamental nature of knowledge, reality, and existence, especially when considered as an academic discipline*". Or, as Callicott [5:3] says, "*How people ought to treat one another and the natural environment is the subject of philosophy- of social ethics and environmental ethics, respectively*". In contrast, Callicott identifies that how people actually treat one another and the natural environment is the subject of the behavioural sciences- of history, psychology, sociology, anthropology, geography. A criticism of current philosophy, and an area that Naess sought to resolve through *Ecosophy T*, was the lack of relationship between normative philosophy and its application.

Gare [23] has highlighted that the standing of philosophy in academic and non-academic circles has fallen markedly over the past century. He attributes the decline of philosophy to many university philosophy departments being `anti-philosophical' in their approach, meaning that "*... philosophy is now regarded as an academic parlour game irrelevant to everything and, for the most part, of no interest except to other philosophers who have not yet retired or been retrenched*" [23:3].

In addition, Gare [23:2] believes that "much of the most important philosophy over the last hundred years has come from mathematicians, scientists, historians, artists, writers and public figures who reflected deeply on their particular disciplines, crafts and professions and related their work to broader developments and problems of civilization". Or, in the Australian landscape context, from the likes of Seddon, Rapoport, Muecke, Memmott, Kerwin, Flannery, Pascoe and Gammage.

Part of the decline also stems from what Oppy and Trakakis [51:11] identify as conflict between those who undertake philosophical inquiry and prevalent anti-elitist sentiments in Australasian societies. Similar accusations were leveled at Plato and Aristotle, who although focused on how to live a good life, were less interested in the practical application of these investigations as their predecessor Socrates, who Meagher [46] calls the midwife of Western philosophy, and later Epicurus were. This reference to Socrates is important because Naess [50:52] identifies that he follows Socrates to "provoke questioning until others know where they stand on basic matters of life and death. This is done by using ecological issues, and also using Ecosophy T as a foil". So to is the reference to Aristotle, as Naess advocates following Aristotle's view of "everything with (philosophical) moderation" [50:105].

Another professional philosopher with strong links to *Deep Ecology* [50], is Cooper who points to the loss of relevance of philosophy and the cultural landscapes arguably most important to contemporary Australians- the garden- in his *A Philosophy of Gardens* [8]. Cooper believes that modern philosophy no longer explores the fundamentals of the good life, particularly those that relate to everyday living. Cooper sees engagement with the garden as a key way for people to recommence investigating notions of the good life. The lack of relevance of philosophy to the everyday life that Cooper talks about is in a large part due to a lack of understanding within the broader community of what philosophy actually is. Philosophy is an abstract concept. It is hard to understand and it requires time to undertake it. Unfortunately, a lack of time and an increased lack of engagement with the outdoor environment are key characteristics of contemporary society.

The garden was fundamental to the origins of Western philosophy. In fact it could be said that philosophy was born in the city and grew in the garden. Plato's Academy and Aristotle's Lyceum, the two largest classical philosophical schools, were established in public gardens in the centre of Athens. Epicurus, the third major classical philosophical school, was also established in the garden but his was a private suburban garden on the edge of Athens. Epicureanism, the philosophy of Epicurus, is today less well known and investigated than that of Plato and Aristotle. This is unfortunate as the philosophy of how people can live sustainably in cities, particularly in low density cities where the prime form is detached houses on large plots of land, was at the centre of Epicurean philosophy. The Epicurean School, founded in 306 BCE [25] is one of the greatest and most successful schools in history, flourishing in pagan and Christian nations alike for 700 years [30]. It was not until the Renaissance that serious interest in Epicureanism was revised [2:399). Epicurus was a key influence on Spinoza. Spinoza is recognized as a key philosophical foundation for the *Enlightenment* [71] that was later the identified as a key philosophical foundation of urban development in Australia post European arrival. Spinoza was also the key environmental philosophical influence of Naess.

Garvey and Strangroom [25:126] identify that a key reason for the success of Epicurean philosophy was because Epicurus enjoined his disciples to apply it in their own households. This meant that Epicureanism was able to flourish independently of schools and tutors, allowing it to penetrate into small towns and villages where there were no places of learning, and to win coverts from social groups that would normally be unmoved by the ideas of a philosophical system [25].

The success of Epicureanism was also partly due to a reaction against the philosophies of Plato and Aristotle, whom the general public saw as prone to grand theorizing and not linked to everyday life [25]. As Bellioti (1:99) says of Epicureanism, "such imperatives may require common sense and practical wisdom to apply, but they do not demand esoteric understanding or deep intellectualism". As Harrison [30:73-74] explains, the home garden was central to the Epicurean philosophy: *…To understand how Epicurus's garden reflects and even embodies the core of his philosophy, we must keep in mind first of all that it was an actual kitchen garden tended by his disciples, who ate the fruits and vegetables they grew there … Yet the most important pedagogical lesson that the Epicurean garden imparted to those who tended it … is intrinsically mortal and that the human soul shares the fate of whatever grows and perishes on and in the earth. Thus the garden reinforced the fundamental Epicurean belief that the human soul is as amenable to moral, spiritual and intellectual cultivation as the garden is to organic cultivation.* Like Naess' *Ecosophy T,* Epicurean philosophy focused on a simple life, shared with close friends and neighbours in which vital needs were met. Both were meant to be applied at `home places'.

Similar to Callicott [5] and Naess [50], Fox [18,19] sees ethics as being concerned with the values we should live by. Ethics is referred to by philosophers as normative ethics because it is concerned with the norms, or standards, that we ought to meet, or at least strive to meet in our conduct [19:4]. Other divisions of ethics

include metaethics and applied, or practical ethics. Applied ethics is concerned with the application of normative ethical approaches in specific, practical, real-world contexts [19:2-3].

Another reason why philosophy may not be currently relevant in Australia is articulated by Muecke in *Ancient and Modern: Time, Culture and Indigenous Philosophy* [49]. Muecke [49:155] believes that only placeless philosophical thinking can move from the northern continent to the southern one (under completely different conditions) and remain a philosophy. Like Naess, Muecke advocates for a place based focus to philosophical approaches because "… place based continuity seems more sustainable in its ecological and ethical perceptions. In short, one lives more in a place than a time". Also central to Muecke's exploration of Aboriginal philosophy is in "thinking of cultures synchronically, rather than in terms of competitive historical progress". He sees this as a "means one has to consider how co-existing cultures, in the same country are related to each other and how their values are ordered". Muecke wants to set up a mode of relating that can "… go to and fro on equal terms". Further, Muecke sees that "all forms of culture are made from ancient bits and modern bits, and their vitality consists in creative hybridizations" [49:8-9].

In criticizing Western philosophy, Muecke [49] says that "whitefella knowledge of indigenous knowledge is very shallow, whereas Indigenous knowledge of country, which has been built up through 60,000 years of occupation, is extensive, rich and elaborate". Although he does not call himself a Deep Ecologist, his approaches do align with Naess.

WESTERN PHILOSOPHERS OF THE AUSTRALIAN LANDSCAPE AND PLACE
The work of landscape focused scholars both in Australian and abroad [9, 10, 11, 12, 13, 33, 56, 57, 58, 59, 60, 61] has shown that the notion of 'wilderness' described by Naess in his concept of *Deep Ecology* [50] exists today in very few parts of the Earth, and in fact these areas, like cities and towns, are cultural landscapes. Certainly the understanding of Aboriginal Australia as a cultural landscape has been discussed in Australian scholarship for decades.

The profession that focuses on the design of landscape is Landscape Architecture. The Australian Institute of Landscape Architects defines a Landscape Architect as someone who researches, plans, designs and advises on the stewardship, conservation and sustainability of development of the environment and spaces, both within and beyond the built environment.

As identified earlier, in addition to a strong Australian involvement in `professional' environmental philosophy, there has been much philosophy developed by academic practitioners in the landscape field. The first of these is Seddon, who although not a landscape architect by training, was essentially identified as the philosophical father of the landscape architectural profession in Australia. When the landscape architecture profession was establishing in the late 1960s and early 1970's, Saniga [64:221-222] identifies Seddon as the "… *person who at this time did more than anyone else in raising the theoretical arguments underpinning values related to the perception of the Australian landscape, cultural and natural*". Saniga (64:190) notes that "Seddon's writing provided the profession with the intellectualisation required to elevate landscape architecture beyond the pursuit of practical gardening, and ultimately from garden design, and he admitted this openly". Seddon wrote books such as *Sense of Place* [65] and *Landprints* [66]. As Saniga [64:222] says, in *Sense of Place*, Seddon argued that "... *the perception of landscape could be informed by a deep understanding of all the ways of knowing a place ... In his view, cultural and natural worlds were deeply interconnected, and what we made of these worlds depended on what we were told, what we learnt and where we learnt it*". Seddon's approach echoes that of Naess.

In his later years, Seddon further refined his definition of 'sense of place' and provided an ecological framework for understanding Australia in *Landprints* [66]. Seddon wrote extensively on the design and development of vernacular suburban garden, in particular as a way for understanding the Australian environment at the most local of scales. Seddon (66) identified that the "instinct to garden and the human needs met by gardens may be virtually universal", and recognized that "... *in Australia gardening was without question one of the popular arts and ... has the highest ranking of all recreational activities*". He attributed this to "... *Australia and New Zealand have the highest home ownership in the world, and 'home' means a house, often a single-storey, on its own block of land, with room for a substantial garden both in front of and behind the house, and narrower garden strips on the side*" {66}. While questioning the autoethnographical approach and lack of theoretical framework in Seddon's writings on the suburban

backyard, Trigger [67:101] places Seddon's work as significant in both academic and public intellectual life. This is because of Seddon's ability to provide a *"broad intellectual sweep through humanities and scientific bodies of knowledge that usually remain unconnected and mutually opaque as perceived by most scholars in the universities and elsewhere"* [67:101]. Further, Trigger [67:101] says that *"Seddon's work has a capacity to bridge what remains a wide gulf between the humanities and sciences. This, in my view, remains one of the great challenges of intellectual life in the coming decades."*

While not calling himself a Deep Ecologist, Flannery in *The Future Eaters* [15:24] utilizes a deep questioning approach and investigates societies that see humans on a par with animals. In fact, Seddon [66] remarks that *The Future Eaters* was the book that he wished he had written and that all Australians should read it. Flannery [15:389] identifies that *"ecologically attuned' societies are the result of many thousands of years of experiencing and learning about a particular ecosystem, that the cultures possessed by the great majority of the other "new" lands are clearly not "attuned, and that it may take a very long time for them to adjust."* Strehlow points out [1971:549] that it often takes centuries of residence in a new country before writers and poets of a transplanted community come to look upon it as their own spiritual home and attach fresh traditions to the new place [40]. Mathews [44] explored similar concepts in her paper on becoming native in a place.

Further, Flannery [15:389-390] believes that *"The problem of cultural maladaptation seems to be particularly acute in Australia ... and arises from the great gulf of culture and understanding that exists between Aborigines and other Australians"*. In addition, Flannery [15:390] says that *"As a result of these feelings, Australians have long struggled with the issue of national identity, yet they have done so without really trying to understand the nuts and bolts workings of their land. It is now clear I think, that any lasting notion of Australian nationhood must arise from an intimate understanding of Australian ecosystems."* In the words of Mathews [44], non-Aboriginal Australians have not yet become "native".

Flannery clearly identifies that the highly urbanized nature of contemporary Australia as an example of this maladaptation. He advocates the Aboriginal approach of utilizing *"an extraordinarily wide array of resources, from insects to marine resources, plants and all kinds of vertebrate animals"* [15:402] and the use of fewer resources as the way forward. Flannery [15:405] identified that contemporary Australians, like the Aboriginal and Māori before them when they first arrived, undertook land management practices that for these reasons too were highly unsustainable and resulted in mass extinctions and changes to the landscape. Flannery's views on the importance of learning from Aboriginal culture to manage the Australian environment in the future were echoed by another well-known Deep Ecologist with a particularly strong interest in non-western and indigenous worldviews, Callicott [5].

While Callicott [5] identifies that the Australian Aboriginal worldview when it comes to the management of land (and water) is the exemplary example for other Deep Ecologists to follow, he, like Flannery and others at the time and since is mostly wrong when he states that Aboriginal Australians were nomadic hunters and gatherers who regularly moved from place to place and did not have fixed settlements. A number of publications in the past decade or so refute Flannery and Callicott's claims. Particularly in south western Victoria, Aboriginal people at the point of European contact were at least semi-sedentary [26, 34, 47], actively managed their landscapes [21, 53] and not just collected food, but also produced it [36, 53]. This also includes Geelong, or Djillong in the traditional language of the Wadawurrung, the venue of this conference. William Buckley, an escaped convict known as the 'Wild White Man' lived with the Wadawurrung for 32 years before the establishment of Melbourne and Geelong, talks of visiting one such village of stone huts just to the west of current day Winchelsea. Flannery [16:xix] says that Buckley's experience was *"unique for no other European lived among Aborigines in pre-contact situation for so long, and none gained the status in Aboriginal society that Buckley eventually enjoyed. His narrative therefore reveals Aboriginal life from a perspective of extended privilege. Dealing with Aboriginal society before it was so greatly disturbed by the European invasion, it provides a precious insight into an ancient and vanished world"*. As such, Buckley provides a template for how Westerners can more sympathetically and sustainably live in this land.

While Aboriginal people did move from place to place, it was not nomadic or wandering (travelling aimlessly), as the *Oxford Dictionary* defines these terms. Aboriginal people did move but the movement was predictable, on a circuit established over tens of millennia and based on specific weather conditions.

Aboriginal movement had much in common with Knowles' [39] three basic adaptive modes to the natural world: migration, transformation and metabolism. Migration of people follows the rhythm of nature and can occur within the house or landscape. Transformation includes the design of different houses for different climatic conditions and at the most personal level, the addition or removal of clothing. Similarly, Aboriginal people were only partly nomads, as again defined by the *Oxford Dictionary*, as "*a member of a people that travel from place to place to find pasture for its animals and has no permanent home*". Aboriginal people had in most cases, permanent homes that they lived in seasonally.

The main issue here is the negative connotations for which the terms used to describe Aboriginal Australia- 'nomad', 'hunter-gatherer' and vernacular architecture and landscape- all convey in Western society. These terms suggest that Aboriginal philosophies and lifestyles are seen as `lesser' ways of being in the landscape, where in reality as Flannery [15] says, they were highly suited. Memmott and Davidson [48:52] "*share the view of Lindsay Asquith and Marcel Vellinga, who have recently called for the Western tradition to rid itself of the stigma of underdevelopment, poverty, and the past that clings to the idea of vernacular building and create a forward-looking vision for vernacular architecture in the twenty first century*". As both Rapoport [58] and Oliver (46: 52) highlight, even today more than 99% of the estimated 1 billion dwellings in the world are vernacular, that is, not designed by architects. It is the common people, those that design, manage and live in vernacular houses and landscapes that need to be engaged with for sustainable societies to exist.

COUNTRY AS A CONCEPT AND AS A GARDEN

Aboriginal people have lived on the Australian continent for at least 30,000 years, many say more than 70,000 years [38]. This is 2,800 generations. At the time of contact with Europeans, the Australian continent was an entire cultural landscape [21, 47, 58], that was collectively known as *Country*. On arriving in Australia, Aboriginal philosophies were hardly seen by Western colonisers, or if seen it was too late. While Europeans could read English, they could not read the footprints that a friend always leaves behind, what Aboriginal writer Unaipon calls "the teaching of the Aborigines", or see the absence of clear signs that warns of danger [49:60]. The Europeans did not know how to live in this land because they did not understand it and were not prepared to understand it.

Country is a difficult concept for most non Aboriginal Australians to understand. Part of the difficulty relates to its all-encompassing multidimensional nature, part is due to the multiple meanings of the term, and part is due to philosophical differences and ways of experiencing between Aboriginal and Western cultures. *Country* is the focus or basis for much Aboriginal art, music, dance, philosophy, religion, ritual and daily activity [62]. While the concept of *Country* is complex and multi-layered, it does not mean as Rose [62] has argued, that "everything is connected to everything", rather, everything is connected to something, and there are patterns of connections: healthy, torn, patchy and intricate [70]. In fact Broome [4] believes that the multiple levels of Aboriginal connections to land allowed individuals in Aboriginal society to survive perhaps four to five times longer than those of farming societies, which emerged from the Neolithic revolution in the Fertile Crescent about 10,000 BP. Likewise, such habitation occurred in North America 14,000 to 16,000 years ago and 40,000 to 50,000 years ago in Western Europe and the British Isles [3].

Reflecting the past, the present and the future, *Country* refers to everything living and non-living, including plants animals, land, air, water, seasons, fire and stories of "Dreaming". *Country* is dynamic and multilayered, forming the rules, norms and beliefs of existence between species and humans through connecting Aboriginal peoples' back to ancestral beings from the time of creation [36]. Body and *Country* are the nexus of Aboriginal philosophy [49]. *Country* is a vernacular term [3]. In most areas, *Country* is characterised by one Indigenous language [41]. A person's *Country* is related to a specific place and is where their knowledge comes from [70]. This knowledge is local, detailed and tested through time [36, 37, 62], although there was a great consistency across the continent in how Country was managed. Gammage [21] calls this consistent approach 'templates'.

In the Aboriginal explanation, *Country* was shaped by people; in the Western one, by nature [47]. Non-Indigenous people see land and environment as being separate to them. It is something that they need to control [55]. Nature, in particular wilderness, are environments that have no or minimal interaction with people. It is founded, says Rose (62) by a peculiar notion that if one cannot see traces of one's own culture in the land, then the land must be 'natural' or empty of culture. This is often referred to as *terra nullius*. Rose

[60] believes that the concept of *terra nullius* (land that was not owned) was based on the prevailing Western view that the landscapes that European settlers encountered were natural, and as such assumed that there was no ownership and property. This suggests an unconscious act. Head *et al* [31] says that Aboriginal gardens were often ignored or rendered invisible in the complex process of colonisation. Pascoe [52] believes that they were more than ignored, they were purposely erased.

Philosophically the Aboriginal and European views of land are fundamentally different [4, 37, 38, 40, 47, 49, 53, 59,62]. Muecke [49:24] articulates this difference as *"... while Aboriginal peoples were anchored by place, the Europeans were busy marking time"*. In contrast to *terra nullius*, as Rose [60] identifies, there is no place where the feet of Aboriginal humanity have not preceded those of the settler, nor is there any place where the *Country* was not once fashioned and kept productive by Aboriginal people's land management practices. As Muecke [49:51] says: *In many cases what Europeans want to classify as 'wilderness' or 'nature' may be simply neglected Aboriginal 'gardens'. While I use the term 'garden' to suggest cultivation, there is clearly no horticulture in the European senses. 'Cultured landscape' might be a better phrase than 'garden'.*

Aboriginal ownership of land is a complex phenomenon. Aboriginal people are born of the earth [53] but are owned by the land [58]. Because they are owned by the land, Aboriginal people cannot sell the land, as much as they cannot sell a relative [43]. Hence, Aboriginal people are situated within their own *Country* emotionally, psychologically and metaphysically [37, 38, 62]. Because connection to *Country* is central to Aboriginal peoples' existence, the health of *Country* is linked to the health of its people [37, 62]. Kingsley *et al* [36] believe that there is a striking similarity between western and Indigenous understandings of wellbeing. Just like there were many accounts of how fine the landscape encountered by Europeans on their arrival [21, 53], so too were reports on the health of the Aboriginal people. Hodgson and Wahlqvist [32] identify that prior to the European settlement of Australia, the quality of life and health of Aboriginal people was probably better than that of Europeans with a life expectancy at birth estimated at about 40 years and some reaching ages of 65 years or more

Looking after the health of *Country* is called 'Caring for *Country*'. Caring for *Country* is similar to Coopers [8] gardening practices. It is the form of reciprocal negotiation with the needs of that particular place [55] that is unique to Australia and such responsibility occurs through totem relationships [62]. These relationships to *Country* are about respect, mutuality and connections [70]. Self-interest and respect for the land cannot be separated, just as people and land cannot be separated [40]. The specific responsibilities that Aboriginal people have for the land are defined by totemic relationships. These totemic relationships are three way and occurred between the person or group of people and the species, but also with country [40]. Rose [62] sees totemism as a manifestation of a broader metaphysics of ecological beneficial connectivity and is similar in concept to what Western scholars now identify as ecological knowledge. This is similar to Naess' ` eco-self'. Naess [50] believes that the enlargement of the eco-self results in environmentally responsible behaviour as a form of self-interest.

A key characteristic of Aboriginal notions of *Country* is that it continually changes. Consequently many Aboriginal responses to `exotic' plants, animals and cultural forms is to embrace them [68]. Perhaps the best known example of this is the Aboriginal adoption of the dingo (*Canis lupus dingo*), which arrived from south east Asia some 3,5000 years ago [68]. The rabbit is a more recent example. The Aboriginal approach is on landscape functionality rather than what is 'natural' or 'native', and hence what belongs in an ecosystem (68). This is another type of template that Aboriginal land managers have left for 21st century Australians.

Indigenous Australians talk of '*Country*' rather than the 'environment' [55]. Land and *Country* are interchangeably used in Indigenous communities [36]. The cultural representations of Country can also be referred to as landscape (Muecke, 2004). *Country* is home [36, 62]. Country is "nourishing terrain" [62]. Now *Country* is being called 'gardens without fences' [21}. The notion of gardens without fences mirrors contemporary Western understandings of garden. As Head *et al* [31] says, *"... in a similar way to Country, garden is simultaneously an idea (the balancing point between human control on one hand and wild nature on the other), physical place (with plants, materials and objects arranged in space) and action (intimate and direct involvement)."*

Many contemporary Aboriginal Australians see Caring for *Country* as a responsibility for both Aboriginal

and non-Aboriginal Australians and that there is much to learn from the connection Aboriginal people have to *Country* [15, 16, 37, 38, 62]. The Aboriginal philosophers urge us to follow, to know someone by following literally in their footsteps of that figure, because knowing the character equals a capacity to mimic the characters gait [49:36].

The notion of garden as *Country* is important in bridging contemporary philosophical and world view differences between Aboriginal and non-Aboriginal Australian culture. Nearly 90% of contemporary Australians live on a suburban block, in a detached house that is surrounded by a garden. Over three quarters of Australians enjoy gardening and for most it is where they interact with the natural world. It is also important because despite prevailing myths that Aboriginal people live `out there' as McGaw *et al* [43:299] identify, three quarters of the Indigenous population live in cities. Cities are where practical reconciliation between non-Aboriginal Australians and both Aboriginal Australians and the land must begin.

WHAT CAN CONTEMPORARY AUSTRALIAN SUBURBIA LEARN FROM THE ABORIGINAL PHILOSOPHY TOWARDS COUNTRY AND ITS MANAGEMENT?

Gammage tells us that at the time of European settlement of Australia, that there was a template for living in and managing the entire continent, and that this management was universal and governed by policy that was forged from a deep, implicit and shared concept of *Country* [21]. Yes the people who lived here had simple lives and often moved during the year, but they were not nomadic hunter-gatherers. Movement was known, purposeful and in response to their environment.

In terms of settlement size, Aboriginal Australians were as urban as any other society at that time. The template of contemporary Australia is the suburban block. It has been since the 1790s. Fox, Rapoport and Flannery also talk about templates. Templates provide the model for others to follow. Low density suburban form is not going to go away. There is too much invested in it. It is not only preferred by Westerners, but also by numerous non-Western societies for thousands of years.

Both the Aboriginal and Western templates are vernacular landscapes, designed by the common person, not 'experts'. Less than 1 per cent of contemporary houses are designed by architects and even fewer suburban gardens are designed by professionals. Accordingly, how the managers of suburban blocks understand and engage with the broader environment is a critical question, the specifics have not been discussed in this paper.

Contemporary Australia is a mix of Aboriginal and Western philosophical approaches and world views. Current urban forms were imposed on the Australian landscape without consideration of its impacts on the environment. It cannot be easily undone. The Western is dominant and highly visible and it has a substantial impact on the very thing that underpins life- the biosphere. Aboriginal philosophy was based on the biosphere but was not visible to Westerners. The question is not so much whose footprints do we follow- we need to follow those of the original inhabitants of this land in understanding and connecting with it. The question is how do we find a balance between the two philosophies to live in an ethical manner? In this matter, Fox provides some guidance in his *Ethics for the Built Environment* [18] and his *Responsive Cohesion Theory* [20]. Muecke's [49] model of relating between Aboriginal and Western philosophies as equals, which is similar to Fox's responsive cohesion, shows how Aboriginal Australians have already been doing this for over two hundred years. Seddon and Rapoport provides the details on how cultures can implement Fox's *Ethics for the Built Environment* within the context of specific places, in this case contemporary Australia.

Part of the reason that Epicurean philosophy worked so well was that unlike other Western philosophy, it was grounded in a particular place- the private suburban garden. It was practical and had direct relevance to people's everyday lives. Epicurean philosophy was not a parlour game as Gare says of contemporary `professional' philosophy.

The Wadawurrung have lived in Geelong for more than 30,000 years. The Wadawurrung word for *County* is Tabayl, which means ground. Aboriginal philosophy has always been grounded. Grounded, in a particular place- most commonly the daily living areas.

Aboriginal Australians did design their landscape consciously. On the back of Naess [50] and others from the Deep Ecology movement, Westerners are now beginning to see the footsteps left by the Aboriginal ancestors. But, what are the lessons that Aboriginal Australians give us, and that we must incorporate into current and future Australian society, which is mostly lived in the city?

We suggest they are the following:

- That us, and everything in our environment are connected;
- If our environment is not healthy, we are not healthy;
- How ecosystems function in Australia are fundamentally different to Europe, even though the climate from where Western philosophy came from is similar to the climate for most of Australia;
- That management of Country or the environment must be based on reading the landscape- learning how to harness ecosystem functions and services to meet vital needs and only in a manner that does not reduce the functionality of ecosystem services;
- That design and management of the landscape must be subtle and as simple as it needs to be and no simpler;
- That philosophy is a way of knowing rather than as a method of inquiry;
- That philosophy must be grounded in place;
- That knowledge of environment can only be gained through knowledge of place;
- That the best way to know a place is to engage with it, and the best and easiest way for contemporary Australians to engage in place and its broader context is the suburban garden;
- While ideas can be transferred at a very high level, i.e. basic human needs, how they are applied must be informed by a deep understanding of place and how it works;
- That for a philosophy to work, it must be understood and practiced by everyone;
- That a philosophy evolves over time and involves the incorporation of new elements, i.e. dingo and rabbits

The purpose of this paper is to not only focus on the fundamental differences between Aboriginal and Western culture as it relates to living in Australia, but to also highlight the similarities between the cultures and where they meet, as Rapoport (61) calls them, the underlying constants or universals. Some of these universals in relation to environment-behaviour interactions are that all cultures undertake gardening of some kind. Another is that low-density living has been the norm in human societies, not high-density cities.

Highlighting the similarities between cultures provides a `third way' between the two extremes of Aboriginal and Western philosophy. Macdonald [42:49] believes that such an approach is how future societies will achieve an equilibrium with their environment. Such an approach lies at the heart of Spinoza's and Eastern philosophies, both central influences on Arne Naess and Deep Ecology.

Naess' *Ecosophy* [50] translates as ecological wisdom of household place. Most of the elements of *Deep Ecology* espoused by Naess still hold true: deep questioning, acceptance that both people and the broader environment have needs and rights, that people should live in voluntary simplicity with a high degree of self-reliance to meet their vital needs, that academic philosophers should be a small minority of participants and that a grassroots social movement is needed for *Deep Ecology* to take effect. The main failure of *Deep Ecology* is that as a social movement it has yet to foster connections with the residents of household places; those that dwell in single houses on individual blocks in the suburbs. For *Deep Ecology* to take hold, such approaches need to start with where people are at. For most Australians, where they are at for most of this time is at home- the suburban block.

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From Ego to Eco: Leadership and the Eco-systemic Self

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Abstract: For sustainability conversations to thrive we need to move beyond the combative debating styles of communication and governance dominating the political discourse.

A number of protagonists working in the area of Sustainability Leadership suggest that in order for sustainability to be effective in culture and organizational life there is a need for the evolution of Advanced Leadership Capacities. Chief among these are the development of a capacity to shift away from ego-based identifications to eco-systemic views of self and society.

Deep Ecology leads us toward such a dynamic view of the self. Both Naess' definition of the ecological self as "that with which you identify' and his conception of the self as a self-in-Self point us in the direction of an eco-systemic self. This paper is an active post-metaphysical inter-active conversation about the ecological self and the qualities that are needed in order to cultivate both an ecological ego and sustainability leadership.

Arne Naess, the grandfather of Deep Ecology, had a penchant for obscurity in the way in which he wrote his papers. For someone who wants clear-cut perspectives I've come to appreciate his approach was an exercise in post-metaphysics. I want to emulate his example not by reflexive obscurantism but through engaging in direct phenomenological research here and now, so this paper becomes something of a co-creative process.

As Post-metaphysics I want to interact with you in the surfacing of collective truths. The act of knowing is a dynamic process by which we engage multiple beliefs, multiple dimensions of our selves, multiple value systems and intelligences. As such, this paper/presentation is an exploration of inter-knowing.

I want to recognize that our knowing is impacted as much by the ways we engage with each other as by the content of our conversations. Consider now what energy, what quality of presence you are bringing to this field of inquiry? How are you listening? Are you focused in your mind? If you are you are prone to listen through judgment, assessing in categories of right and wrong, good and bad, true or untrue. Is it possible to relax the mind and engage with open-hearted curiosity in a shared process of truth seeking? Can we bring present a sense the large field of inter-being, a sense of being within a larger evolutionary process?

I'm interested in living Deep Ecology in the process of giving a paper on Deep Ecology. I believe this is one of the emergent necessities of this historical moment. That we 'presence' our 'knowledge', our derived truths to the field of inter-knowing in a way that allows deeper truths to surface in the moment. We open our facts to dialogue, we move from fixing 'problems' to engaging with challenges as evolutionary opportunities. Maybe we can sit with a little humility [humus-of the earth] in deep dialogue to the larger conversation culture is having with evolving nature-culture.

To engage in this process together I first have to till the ground, present a few thoughts, questions, ideas, sew a few seeds that we will then collectively fertilize.

Deep Ecology and Leadership

What is being reflected to us in the social field when it comes to Leadership? In the political arena leaders seem to be modeling old paradigm modes of thinking and behaving. Brandishing their egos like sabers they try to cut down their political foes in constant and ferocious battles for the supremacy of their ideologies. They bludgeon the masses with odious repetition, sound-bite wars that hide covert agendas. They indulge in character and career assassinations, chamber expulsion as their ego's joust for personal and political

ascendancy. It is a game of thrones that seems to belong more to the era of knights and dames than a post-modernist democracy.

In pockets of the social and eco-entrepreneurial movement a transition is occurring to a new paradigm. Scharmer characterizes this as a paradigm shift from ego to eco (1). It is a shift from the 'I' to the 'we', from the expert strategist who leads from the front to the alchemist facilitator who garners insight and inspires action from the multiverse of perspectives and potentials. Power shifts from the top of the pyramid to the base, periphery and the surroundings. Leaders engage in multilateral, collectively creative, eco-systemic conversations. In these conversations the diversity of individual perspectives is valued as players work to co-sense and co-create the future that wants to emerge from within the whole field of engagement. It is a movement from egocentric perspectivalism to something approaching Naess' core notion of the self-in-Self (2). One operates with deep self-awareness awake to how one is creating and being created in a networked field of relationships. One no longer perceives oneself as separate to others or the world, so can give up the identity structure of competitive individualism. The small self comes to see that it is, and how it is, *part of and partner to* the vast matrix that is evolutionary ecology, how it is part of an evolving web of inter-being, inter-knowing, inter-acting.

The shift from ego to eco requires a shift in consciousness and the embrace of an ecological ego. In this shift one comes to see the self as a dynamic ecology, with all these part-players of the sub-personality system working to keep things safe and in control while going about the business of getting the self what it desires. The self is a desire-defense system that knits together this host of players, or sub-personalities, in a coherent identity structure. Our persona, our unique self, is like this bunch of identifications with ways of being, ways of thinking, ways of relating, ways of valuing that we get all knotted up around. Naess clearly had this in mind in his definition of the ecological self as 'that with which you identify' (3). We are a dynamic process of identifications, an ecology, that solidifies into the 'knots' of the personality system. These 'knots' both focus and limit our perspectives and our capacity for co-creativity.

This idea of the self as a 'knot' of sub-personalities corresponds with Naess' ontology. He states that the whole exists as a "total-field" in which selves are seen to be relational conjunctions or "knots in the biospheric field of intrinsic relations" (4). We create this 'knot' of being through habitually opting for certain behaviors and values. We can get very condensed or contracted, 'knotted up' around issues, people, ideas, ideologies, values. The shift from ego to eco represents a freeing up, an unknotting, of the self so that we can be in a dynamic relationship with reality. Because we are part of and partner this 'total field', which is intrinsically relational, we need to maximize out capacities for relationship. Instead of being collapsed around the identity structure, with its "this is who I am like it or lump it", or, 'my way or the highway' attitudes, the ego becomes the conductor of the chorale of characters singing up the song of the self while activating the songlines of relationality.

The question is are you singing and dancing with life or do you get yourself all knotted up around things and so reduce your capacity to be in creative relationship with yourself, others, the world? The answer is probably both. The world likes for us to be both dynamically stable and at a growing edge. Negotiating that balance is the thing. The critical need, as I see it, is to develop an ecological ego as it enables us to live as a dynamic ecology. In this scenario the ego is choicemaker, orchestrator, conductor, CEO if you like. Taking a step further the ecological ego discerns choices of being, doing and relating, aligning the self in the field of relations, in ways that optimize flow and creativity. We have made a shift from looking AT ecology, and needing to fix the world out there, to seeing we ARE ecology. Our persona is a dynamic ecology that sits nested within other natural and social ecologies. We are continually in a dynamic exchange, continually in a conversation with life. The conversation is about maximizing our potency, our capacity to act in co-creative partnership with the evolving field of inter-being, inter-becoming. The evolution of an eco ego-system frees the self from unconscious patterns of behavior that generate conflict and difficulty while enabling us to deal creatively with conflict as an evolutionary imperative. It brings the self into a dynamic conversational relationship with reality enabling the self to partner evolution and to be partnered in our own evolution.

What is the conversation you're having with the evolutionary imperative as it is expressed in and around you? How are you in creation? How's your partnership skills?

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Theoretician of developmental psychology, Cook-Greuter (5), Kegan (6), Torbet (7) see this movement from power to partnership, from authoritarianism to co-creation, from individualism to inter-being, from expert to alchemist or ironist, as a sign of the maturation of the personality structure. Barrett-Brown, in a study of 'Conscious Leadership for Sustainability, suggests the key capacities leaders need to develop in order to advance Sustainability are: the ability to deeply connect, to follow intuition and inhabit multiple perspectives, to know oneself while always seeking to transform oneself, to adaptively manage by following the energy of systems, embracing uncertainty while allowing for the emergence of novelty (8). He suggests a need to approach Sustainability as a Spiritual practice. The practice requires nothing less than our evolutionary transformation.

Collective Inquiry

So now I've prepared the ground and sown a few intellectual seeds I'd like to inquire into our individual and collective experience of 'an ecological or eco-systemic self'. Our aim will then be to co-generate some new principles of ecological or sustainability leadership.

I am going to use a process that arises from a psycho-therapeutic practice known as Voice Dialogue, developed by Hal and Sidra Stone (9). It was first used as a collective process known as Big Mind by a Zen Buddhist Genpo Roshi (10). In this process we talk to different parts of the self or sub-personality system. We look at the role and function of each part, how parts are sometimes in conflict with each other, how they were formed in the past and may no longer serve our best interest or our collective interests. We may find our evolutionary 'hardwiring', geared as it is to safety and belonging, needs to be transcended. We will conclude with an exploration of the Aware ego as the central organizing principle of the self. We will explore how it can act in an 'enlightened' way to orchestrate our identifications, attachments and repulsions. We explore how it can function as an Ecological ego, bringing eco-systemic awareness to its inter-activity, enabling one to live as a self-in-Self in a way that serves the evolutionary flourishing of life.

I'm going to ask to speak to different parts of you in a collective process. Those who feel free to speak out into the group please do. Those of you who wish to have an inner experience should also feel free.

Each of these parts of the self embodies an energy. It may be expansive, contractive, defensive, aggressive, quiet, bold. You may feel the part stands in front or behind you. It may be very small or large energy, be a strong or a weak impulse. I want you to really feel the energy and take a position on your seat, in your body that helps you to fully feel, fully identify with the energy the part embodies.

Voice Dialogue Process

I'd first like to speak to the Controller, the part of you that Controls. Who are you? What is your task? What do you provide for the self? How do you help and limit the self? How do you help/limit others? When are you most active? How long have you been around? How do you control the self, control others? Why do you do this? What is your greatest fear? Are you prepared to let the self engage in further dialogue?

I'm then going to speak to different parts of the self. These may include the pusher, the rational mind, the judge, the pleaser, the greenie, open-hearted presence, the evolutionary. Lastly I am going to talk to the aware ego, the part of us that can see these characters at play and orchestrate their involvements.

What we are doing is creating a map of our self-system, generating awareness of the dynamic process of egoic identification. With ego-system awareness comes a greater capacity to skillfully choose our identifications and attachments, to place them at the service of the self-Self. Truly becoming an ecological self.

Conclusions

So what can we conclude from this experience? My conclusion is the Self is profoundly ecological. It is an eco-system of dynamic parts enacted in relation to a larger dynamic field of inter-being. It is ecological because it is a dynamic communion of inter-acting parts that coheres as one, the unity that is the self's identity. The different parts of the self are called into being in relationship to environmental conditions, social, cultural and natural.

Hopefully our exploration has shown us that the identity structure, the persona is simply a set of habits of relating. That it is a desire/defence system, a means of protecting and promoting individual self-interest, its right to exist and to realize its potency, i.e., its creative power and potential. The defence systems of plants and animals show up as bitter tastes, spiky protuberances, body armor, the ability to attack or retract and go to ground. Humans create bitter and spiky personalities, personality armor, aggressive or withdrawal behaviors.

Because the self is a dynamic system enacted in relation to a dynamic field the habits of the self may not serve the self's or the system's self-realisation, the self-in-Self. The field is constantly giving feedback to the self. The quality of connection, the conflicts and challenges that arise are all feedback process that enable the self and system to realize new potentials of being and relationship. Self and system either co-evolve or experience breakdown, dis-ease and, if change is not forthcoming, death.

Elsewhere I have presented a perspective on the creative and destructive dimensions of evolutionary ecology. I've explored how it is that evolution utilizes the forces of chaos and destruction, the threats of demise and death, to propel the evolution of higher orders of networked communion (11). In the human this takes place through the deepening of self-Self awareness, ego-death, and the evolution of more sophisticated means of deepening and expanding capacities to connect and operate as dynamically inter-woven unities, systems of inter-dependence.

What does an eco-systemic view of the self mean for leadership. I'd like to co-generate a response to this question. I'm going to guide you into a felt experience of the eco-systemic self and together discern some principles of Sustainability Leadership.

So I want you to close your eyes and place yourself imaginatively in the still centre of the self, in the place of the Aware ego. Imagine all the part of the self around you like organisms in an ecosystem. Controller, Pusher, Pleaser, Evolutionary, Judge, Rational Mind, Open-hearted Presence. Some parts are closer than others, some parts may still be hidden awaiting discovery, some parts may be strong and dominant. The aware ego can bring these different parts of the self to play at any time depending on the context. See the self in a work situation, what parts step forward? See the self at home, which parts are the most pronounced? Which parts come forward when you're in Nature, or with loved ones? Feel how the self is constantly changing with each situation, different parts coming forward, different parts letting go retiring.

Now feel the field of inter-being around you. Feel the trees and plankton breathing you. Feel yourself being fed and nourished by the plants and animals whose lives you depend upon, connect to the ecosystems that produced these beings. Now connect to the socio-economic systems that support your life, that provide the raw materials for your home, energy, communication, transport, water and waste systems. Feel the great matrix of social enterprise in all countries across the globe. Connect to the political systems that direct flows of money and value.

Feel yourself to be a self-within-a-larger-Self, part of the great water and climate cycles, part of social and cultural cycles, part of evolutionary time, here on this earth for a small space of time. Feel yourself as partner to the great evolutionary processes.

Feel your heart. Feel how it connects you to everything you love: places, people, environments, nature. Feel yourself expand and flow through all those connections. Feel the love that wants to flow into creative form, into the dynamic ecologies that are communions of inter-being.

Ask yourself: Who is my Self? What is it that life wants to manifest through me? What needs to die, or be let go? What qualities need to arise in me and in the field to lead the evolution of ecological, eco-social systems?

Feel your body, seated on a chair, in this room with others. Open your eyes. Share your answer with the person next to you.

So can we draw up a list of qualities that sustainability leaders are being invited into?

Here are some of mine.

1. Listen and respond to the feedback you are getting in your own life, in the eco-social communities you inhabit, or life is likely to get a lot worse, more painful, more difficult.

2. Be prepared to undergo ego death. Being prepared to engage the question of what needs to die in me so that greater life can happen, for me and for all. Evolution moves toward greater complexity in relating, greater depth in the self, greater integrity/integral functioning in the system. Too much contraction/closure, holding rigidly to beliefs and views accelerates feedback, often as conflict, which will precipitate change. The more tightly a position is held, particularly if it lacks integrity, i.e., is not functionally integrated within the networked systems that maintain it in being, the more conflict is generated, the more violent the impetus for change. One can understand ISIS as much as climate change and super-cyclones in this regard.

3. It is important for the self to both operate with a relaxed stance, to hold and advance one's position, and to be able to drop it into the pool of collective wisdom that is surfacing deeper truths and operationally integral structures.

4. There is a need to move from the dominance of the rational mind, which constitutes only one small fraction of the self-system toward a field intuition where the rational is employed as only one dimension of the sensing-interpretive system. If we primarily manage our work relationship in the rational mode we work largely within past frameworks of assembled belief, we are stuck in judgment, we operate through reactive patterns of thought-emotion that arise that are heavily condition by our past. Domasio has shown how the self continually runs a cycle between the rational mind and the emotions such that the emotions, and the habitual pathways of responding to these emotions, dominate the narratives of the mind (12). Contrary to what we believe thought follows rather than controls emotions. Emotions arise in response to thoughts/experiences which give rise to secondary thoughts, secondary feelings that lead us into habituated pathways of mind.

5. There is an equal need to develop a capacity for open-hearted presence to the larger field of life where one can sense, intuit the patterns and invitations arising in the field. This involves developing the heart center to balance and guide the activity of the mind. The HearthMath Institute (13) has done extensive research on the effectiveness of the heart to direct the mind from old pathways and reactive patterns. They show how the heart is more effective in influencing the mind than the mind is in influencing the heart. They focus on bringing coherence to mind body and emotions to bring about balance needed for intuitive insight.

6. Deepen the capacity to dialogue with nature and the symbolic imagination. Because we have arisen from an evolutionary process it is important to recognise that the capacities of being are ways of connecting with the larger field of the Self. Expanding the capacities of intuition and imagination, developing the capacity to engage in symbolic conversation and explore synchronicities are some of the modalities necessary to work in concert with the emergent field of co-creativity.

7. The very fact of ecology says that life moves toward communion, dynamic unity-in-diversity. It is therefore important to cultivate a deep sense of trust that one is held in a field that moves toward the creation of unity, eco-systemic balance, organismic communion and community. We need to rest back from the anxiety for change that often drives us, to trust in the processes of natural change. We have 300 trillion cells plus 500 trillion microorganisms working co-operatively in our bodies as a

single unity. Life knows how to create co-operative singularities. The more we co-operate, listen and respond to the invitations of the life field, including those generated by the conflicts and difficulties that necessitate ego death, the more we are aligned with the process of self-Self realization. In contrast the less we listen, the more we hold tightly to limited beliefs that run contrary to feedback from the greater field, the more likely we are to precipitate the conditions for our own destruction.

8. Cultivating affects of joy and gratitude rather than blame and judgment. This involves moving from mind-dominated states of being to heart based modalities of connection. Naess criticised the joylessness he witnessed in socially responsible people. He claimed that joy arose from engaging our power to act. He defined 3 types of joy.

> first, that resulting from the contemplation of our own power, however small, which gives us acquiescentia in se ipso, self-respect and contentedness; second, the joy resulting from increased personal, active knowledge of things greater than we are; and third, the joy resulting from active interaction which, strictly speaking, defines ourselves (as well as other objects or fragments) in the total field of reality (8).

Joy arises from dwelling with gratitude in the field of our connectivity.

9. Developing the abilities of co-sensing and co-creativity. This means that we develop an ability to sense evolutionary movements within the field of inter-being so as to be able to collaborate in eco-systemic conversations in deep listening to what wants to emerge. Scharmer advocates the need to take co-sensing journeys to stimulate whole system reflection and dialogue (1). It also means that we embrace multi-perspectivalism, understanding that a perspective is simply a view from somewhere. None of us has a 360 degree view.

10. Embrace Uncertainty. It is important to be easy with unknowing, to relax sufficiently that new insights can arise that are aligned with flow of evolutionary emergence.

Leadership for today requires our personal and collective evolution. We are being invited into conscious partnership with life itself. We are already deeply dynamically forming the life world. We are already being in-formed, given form, by our interactions and identifications with people, place, culture, eco-social systems, by our ego-systems. We may as well liberate ourselves into choice-full awareness bringing consciousness to our life partnering. Lets develop the skills to be great partners.

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Sustainability progress in monopolistic landscapes – a German water case study

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ABSTRACT

Water-supply and distribution companies (WSC) are dealing with a crucial resource. That is why the German national sustainability strategy highlights water as one of the priority fields of action. In Germany, WSC show characteristics of natural monopoly. Monopolistic landscapes change slowly and are relatively stable and often well-structured as well as organised. Evolutionary theory is appropriate to understand market behaviour in monopolistic landscapes. Companies use exploitation strategies they know. The clear separation between public institutions obtaining general, overall responsibility for water protection and management, and the private sector as well as municipal operators being responsible for practicing special functions is characteristic for the German water economy. In theory, sustainable principles and integrative concepts have to be part of a companies' strategy to generate a measurable contribution when realising sustainability. So, it is of interest how German WSC implement sustainability strategically. Facing sustainability concepts in the water industry the 12 well-established sustainability principles, are analysed and enriched by current strategic tools and concepts in order to find strategic impulses. Strategic concepts and tools facing management and sustainability (e.g. ISO 14001, Reporting, Balanced Scorecard etc.) were analysed and evaluated in the context of the German water industry. Using literature studies and web analysis the relevant data of 110 German WSC was collected. A cross-sectional design was used in order to find patterns for fostering sustainability. Although based on rather good governmental regulations the water industry needs a change towards sustainability and forward-looking strategic thinking. There is the need of strengthening sustainability management tools and the initiation of possible transformation paths of the existing water systems in order to guarantee high water quality permanently. There are mainly risk or cost strategies. Yet, WSC seem to be irritated by competitors, strategic leaders and stressing factors, like fracking, etc., and enhance their sustainability activities accordingly.

1 INTRODUCTION

Water-supply and distribution companies (WSC) are companies dealing with one of the most crucial natural resources. Thus, they have a special duty to meet sustainability criteria and CSR issues. Corporate governance [1] and ethical business leadership require explicit integration of environmental and social challenges in the core corporate activities and corporate sustainability management of water utilities. From an evolutionary perspective the special challenge can be seen in the high path dependency of the infrastructure of sanitary environmental engineering [2]. The system is built on mass throughput and consumption growth and therefore is only partly adaptable to changed conditions. The central task has to be seen in the necessary conformity to the changed facts, like a strategy for resource conservation and an efficient resource use [3]. In the last two decades, considerable innovations were developed in the fields of alternative water-supply technologies in Germany. However, they were mainly realized in some small-scale pilot projects and often not institutionalised in management principles. WSC often react with cost efficiency strategies [4]. In this context, the central research question is how WSC embed sustainability and CSR requirements in their management and operational practices. ISO 26000 defines corporate social responsibility (CSR) and how it can be implemented into the companies [5]. In order to be able to meet ISO 26000 requirements WSC should establish management systems [6]. In this study 110 representative German WSC are analysed concerning their sustainability management tools and CSR contribution. Therefore, a first analysis is made by a cross-sectional design imposing data for further research in this field. Criteria for the CSR sector are the seven core elements of ISO 26000 like organizational governance, human rights, labour practice, the environment, fair operating practices, consumer issues, community involvement and development. Active sustainability management will be evaluated by the implementation of the respective management tools like ISO, 9001, ISO 14001, ISO 50001, Corporate Citizenship, SA 8000, ILO, UN Global Compact, etc.

2 OBJECTIVES/METHODOLOGY/SCOPE

2.1 The water sector and its sustainability as well as CSR orientation

WSC show the characteristics of natural monopoly [7]. Because of the economies of scale and density as well as subadditive cost functions a company can provide the market more economically than every greater number of companies [8]. The clear separation between public institutions obtaining general, overall responsibility for water protection and management, and the private sector and municipal operators that are responsible for practicing special functions, in particular the direct services to citizens, such as drinking water supply and wastewater disposal, are characteristic for the German water economy [9].

Beyond that different structures of the companies like pure WSC and multi-utility/public services or private-law or municipal companies, mixed legal forms can be found in the water industry [10]. There have been private-law and municipal companies in the German water industry for decades [11]. For instance, in contrast to UK, where water companies are operating in the single digits, in Germany approx. 6.211 WSC are operating according to ATT et al. [11]. Most of them are small- and medium-sized enterprises (SMEs). Municipal and private-law companies have different values referring to the number of companies and the volume of water. With a view to the number of companies regarding the legal form there are 56 % municipal institutions and 44 % private-law ones. Referring to the volume of water private-law companies have 64 % interest and the municipal ones a 36 % share. The German water sector is characterised by wide, far-reaching and partly interwoven shares. In tendency, smaller companies supply a relatively small number of people in rural areas in contrast to urban ones where usually a small number of companies supply a large number of inhabitants with water. Half of the water output is provided by around 100 companies (less than 2% of the companies) [11]. Thus, the corporate structure and the structure of urban development are closely interwoven in Germany. In addition, there is still a difference between the Eastern part and the rest of Germany regarding the establishment of the appropriate conditions of supply, investments, return on investments, the structure of urban development, etc. as long-term development after the German reunification [12]. The successful infrastructure model studied of its social and distributional objectives as well as the reached environmental and hygienic standards is faced with the following central challenges:

- Decreasing population numbers and falling specific need of water of the households and businesses [13]
- Different regional water prices and investments as well as a lack in transparency [12]
- New requirements of resource regulation, especially matters of cost coverage and economic efficiency (EU Water Framework Directive)
- Regional shortage of resources and the rise in prices for energy and raw materials [6]
- Climate change with its global and regional consequences to the water economy [14-16]
- Cost of adaptation to the climate change [6]
- A changed energy policy framework because of objectives and legal developments at the Europe-an and national levels
- Facing water initiatives, like the objectives of the European initiative Right2Water: (1) right to water and sanitation for all people in Europe, (2) no liberalisation of the water sector, and (3) global access to water and basic sanitation [17].

Water, land and energy are strongly interlinked [18]. Water governance refers to the range of political, social, economic and administrative systems that are provided to ensure the responsible usage and management of water and water-related services for all ranks [19]. It is thus clear that only functioning governance is the fundament of a successful land and water management and has to be considered in all planning and management levels. Sustainable water management refers to the integrated management and governance of all artificial and natural water cycles under consideration of a long-term protection of water as a habitat or as a central element of habitats and livelihoods [20]. Corporate and institutional governance are embedded in legal, social and environmental conditions that are limited in influence by a company - either public or private [19]. According to management literature sustainability (development) is mostly integrated on different levels and can be implemented by three steps: (1) the formulation of practical and measurable objectives, (2) the development and implementation of respective measures and tools, and (3) the ongoing monitoring and revision [21, 22, 4]. The qualitative difference is given by (1) internal goals defined by the company itself like business ethics, sustainability, quality, production volume, market shares, etc., and (2) practices and tools used within the company in order to achieve these goals, like resourcing, management tools including indexing and controlling as well as internal and external dialogues. Sustainability effects can

also occur without having implemented a sustainability management system. Yet, the introduction of sustainability management systems often increases the efficiency of existing business models and reduces the damage done to social and natural capital per unit produced at the same time. According to evolutionary theory investments are irreversible and non-fungible. "Self-reinforcing forces lock the system into a trajectory that progresses in a particular direction" [23: 981]. Garud and Gehman [23: 981] argue further that given path dependencies, "novel solutions (including ones towards sustainability) can emerge only by chance as existing sociotechnical regimes will exert selection pressures against anything that disrupts ongoing operations". Realising sustainability ideas are more likely in niches and stepwise [24, 25]. "Niches influence their selection environments and thereby favourably affect the subsequent evolution of sustainable niche-derived innovations" [24: 1030]. Altogether, technological development as well as structural and institutional considerations plays an important role in moving towards more sustainability. The sustainability achievement of a company decisively depends on how ecological and social challenges are met conceptually, institutionally and instrumentally [26]. Analysing current management and sustainability literature main standards, tools, concepts and approaches in the light of sustainability management are shown in table 1 [26-30].

Table 1. Selective key sustainability management approaches

Standards/ Certifications	Tools	Concepts or Systems	Systemic approaches
Standards provide documents offering requirements, characteristics or guidelines for reaching a purpose. Certification confirms certain characteristics.	Means or instrument for reaching a specific goal.	Fundamental categories, sets of different but aligned tools to reach a set of objectives.	Concepts or systems that focus on systemic influence, dependence, impact and effects of interaction in-between and within a whole.
Eco-efficiency-analysis: ISO 14045	Benchmarking	Corporate Citizenship	Cradle-to-Cradle
Ecological footprint (ISO 14040/44)	Climate and environmental balance	CSR	IPP/LCA
EMAS (III)	Environmental/ sustainability statement/ report	(Eco-)Design	*(Multi-Agents-) Simulation*
ISO 9001	Further education/ training	EFQM	*Systemic structural constellation*
ISO 14001	GRI	Environmental information system	
ISO 26000	Idea management	Incentive system	
ISO 31000	ILO	SBSC	
ISO 50001	Mission statement	Sustainable Supply-Chain-Management	
SA 8000	Stakeholder dialogue	Sustainable Value	
	Working time models	UN Global Compact	
	Risk management	*Impact assessment*	** italic ones were not investigated*

As wide as CSR theories are as manifold CSR definitions are. All concepts have the impact of corporate initiatives on society in common. Carroll and Shabana [31] highlight that those CSR activities not valued or supported by individuals are not rewarded by the market. Okpara and Idowu [32:13] summarize four rationales for CSR: "(1) company reputation and legitimacy, (2) equal employment opportunity and cost and risk reduction, (3) competitive advantage, and (4) creating win-win situations through synergistic value creation". This goes hand in hand with Schmidpeters [33] framework 'from defensive CSR to proactive CSR as. Thus, companies always have the opportunity to develop own initiatives from compliance to sustainable entrepreneurship or innovations.

2.2   Methodology

In order to provide new findings or to realise patterns of association on sustainability in the water sector an exploratory case study design was used. It is used for investigating phenomena not having much knowledge, clearly identified research questions or applying limited preliminary research [34]. The exploration of new research fields benefits from cases making characteristic issues evident. In this case, the research context is not clearly specified as there are information missing regarding sustainability management strategies and tools used in the water economy.

When and what: From May 2012 until December 2013 selected instruments of sustainability management have been examined in 110 representative German WSC. After analysing the current state of the art

concerning sustainability management by using sustainability-related papers and books [19], [26-30] 31 management tools and all 37 elements of ISO 26000 were analysed.

How: With regard to the amount of data and the organizational structure of the German WSC, an extensive general analysis cannot be presented here. Therefore, water supply companies were systematically analysed within all 16 federal states with the help of data bases of popular German water associations like DVGW, DWA, BDEW, DBVW, ATT, VKU [35]. The selection of the companies was based on a random selection, pulled out by chance. The WSC were segmented with regard to size (turnover, service area and population density) and region (local, national, international, municipal utilities or groups) and classified into private-law, municipal and mixed-financed organizations. As the legal form does not allow any conclusions of the financing form all shares were analysed and thus categorized respectively. WSC from all 16 federal states are represented (25 south, 27 west, 32 north, 26 east) in this sample. 53 % of them are municipal companies, 29 % are private ones and 18 % are mixed financed companies. In accordance with the recommendation of the European Commission regarding the classification of the size of firms this sample shows the following distribution: With regard to the given annual income and organizational members there are 20 small companies, 20 middle sized company and 52 big companies. 18 companies cannot be classified definitely; however, they can be seen as small- and medium-sized enterprises (SME) in a broader sense.

Methods used – data and analysis: With the help of literature studies and web analysis with about 935 pdf files and over 1790 webpages as well as a secondary data analysis relevant data was collected. The data was prepared with the help of categories or headlines like climate, climate protection, environment, project, engagement, transparency, core business, social, etc., and by keywords [36, 37]. The corresponding management concepts and instruments were interpreted on the basis of quantitative content analysis and by means of contingency analysis as well as correlation [36]. In the case of quantitative content analysis three different cases were possible, 0 – no item found, 0.5 – partly available or used, 1 – fully used or implemented. According the variables the financial status, the region and the type of enterprise had to be defined as nominal. Cross-sectional designs can always be used when it cannot be inferred that one variable causes another [38]. In a nominal design chi-square and Cramer's V can be used as methods of bivariate analysis. By using Cramer's V the statistics only provide a positive value showing an indication of the strength of the relationship but not of the direction between two variables. It is often presented in combination with a chi-square test showing the confidence of a relationship between two variables in a sample. Contingency analysis was used to look for relations between the finance status, the region and the type of enterprise on the one hand and the management tools on the other hand. In addition, there was a bivariate analysis conducted between the management methods themselves and the size of a company, the number of employees, the turnover, the density of population and the annual water supply in m3. Spearman's rho (ρ) was used for examining relationships between ordinal variables [38].

Limitation and next steps: This analysis is limited to the given or represented information at the companies' websites and in the pdf files as well as certification data basis. As there might be more management tools in use (than communicated), the study will be continued with a survey containing a standardized questionnaire. Moreover, cross-sectional designs are limited to direct interpretation as there is an "ambiguity about the direction of causal influence" [38: 44]. To be able to find causal relationships specific hypotheses have to be formulated and proofed by other statistical means in a second step.

3 RESULTS

Descriptive analysis

The WSC use five different management tools in average, whereas the SME use three approaches in average and the big companies use eight tools. Within the sample of 110 WSC the Corporate Citizenship is dominant within the variety of management tools, followed by ISO 9001 (see figure 2). 68 % of all WSC describe to use Corporate Citizenship, however, Corporate Citizenship only acts on low levels of sustainability management, e.g. compared to CSR (35 %) or integrated systems like EMAS (14 %) or IPP (3 %). Just a third of the investigated WSC use CSR like supporting water projects within foreign partner companies or cities or highlighting the environmental and social responsibility by committing partnerships with land owners in order to save the water quality. Environmental and sustainability reports are provided publicly by 34 % of all WSC, interestingly 51 % of all municipal companies. 11 % of the WSC integrate sustainability

aspects in their annual reports and 14 % have a publicly supplied environmental statement. 80 % of the municipal financed WSC use an environmental statement consequently; EMAS (III) has been implemented by the same percentage of companies. 80 % of the municipal financed companies use an environmental information system, but these are just 4 companies. The ISO 9001 is also used by more than a half of the WSC in this sample. 36 % of the WSC use working time models to adapt work time and offer work-life-balance. Only 39 % of all WSC have a mission statement, meaning, there is a lack in vision and mission in general. Those companies having a mission statement mainly integrate sustainability-related aspects within their statement. Further education or training can be found at 41 % of all WSC and benchmarking at 27 % as general management tools. Only a third of those companies offering trainings explicitly educate their company members with regard to sustainability.
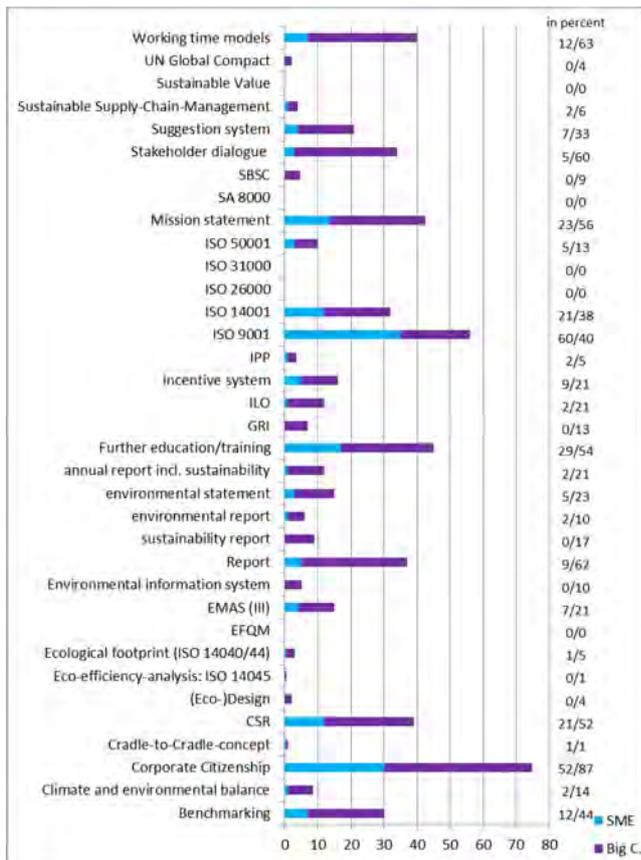
Fig. 1. Frequencies of management approaches concerning type of enterprise, N=110
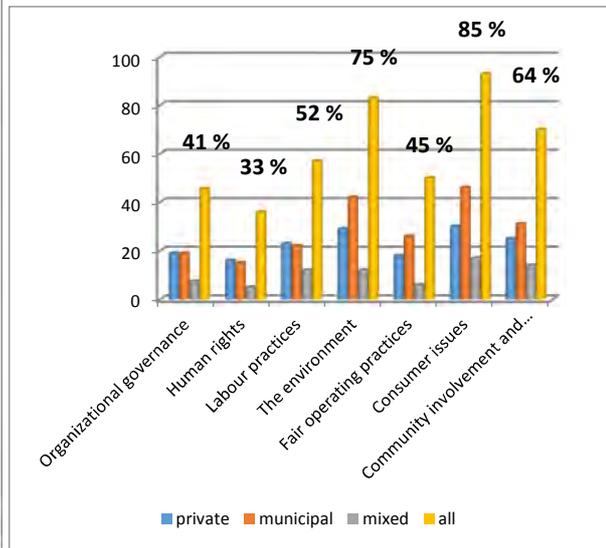
Fig. 2. Identification of ISO 26000 core elements regarding financing form, N=110

Interestingly enough, none of the WSC use or have implemented Sustainable Value, EFQM, SA 8000, ISO 26000 or ISO 31000. The Cradle-to-Cradle-Concept (within two companies), Eco-Efficiency-Analysis/ISO 14045 (within one WSC) and Sustainable Supply-Chain Management (within eight companies) are partly implemented or realised. For instance, LCA/IPP is used by one WSC and partly integrated by five WSC. Two of 110 WSC (1.8 %) use a Sustainability Balanced Scorecard as an integrated management system (both of them municipal financed and big companies); five companies use a plain BSC (all big companies, almost evenly spread concerning the financing form).

Merely 29 % of the companies have the accredited environmental management system ISO 14001. In this sample 31 % of all municipal financed companies, 19 % of mixed financed and 50 % of the private financed WSC implemented ISO 14001. Only 21 % of the SME reveal ISO 14001. EMAS III can be found in only 14 % of all examined companies; 27 % of that in the SME, and 13 % in the private ones. None of the Eastern companies has EMAS and only two in the North have it. The more economical lined up management instruments ISO 9001 can be found in 51 % of the WSC. Here, SMEs have a 63 % (60 % of all SMEs) interest and the big companies have a 37 % (40 % of all big companies) share. Large companies show a higher frequency in the use of the other management tools like mission statement, dialogues, trainings, etc.

Figure 2 shows the distribution of the categories of CSR elements of ISO 26000. It is obvious that the category of *environment* is most strongly pronounced. Moreover, organizational governance, human rights as well as consumer issues are rather underrepresented or less stressed by the companies. Two different clusters are obvious in tendency: SME operate in small-scale areas and have ISO 9001, engage in corporate citizenship as well as in the ISO 26000 core elements 4, 6 and 7, whereas large companies provide more water for a higher density of population and show some engagement in all ISO 26000 core areas, and partly have a report, corporate citizenship, further education, a mission statement and stakeholder dialogues.

The slight reference to organizational governance, human rights and fair operating practices is conspicuous. In ISO 26000 demanded aspects of the *organizational governance* are not consistently shown by the companies. The organisational structure is very often presented, but rather often single guidelines or responsibility areas are represented. Just a few companies show their formal and informal governance structure, like decisional structures, values and norms, very clearly. The management tools are unincisive, but only 39 % of all WSC have a mission statement. Approximately 60 % of all private WSC provide information to this first CSR issue.

Even less transparency can be found at the *human rights*. The issue 8 'fundamental principles and rights at work' is mentioned most frequently by the big WSC (60 %). All sub-issues are mentioned between 0 to 3 % by the SMEs. The size seems to play a role in this case, see tables 2 and 3. Only 11 to 12 % of the WSC move into position to 'due diligence' and 'avoidance of complicity'. In large parts, the description of human rights manifests itself as consideration and integration of human rights into entrepreneurial activities. The WSC say illegal activities are punished and legal norms are kept. Information regarding the establishment, the internal processes or realization is not given at all. The second CSR core subject does not find much consideration, especially in the SMEs. Those companies providing information on core issue 2 quite often present information regarding core issue 3 and 5. Beside the size and the annual water supply there is a quite high relationship between providing information on human rights and the implementation of working time models. However, the use of the respective management tools is underrepresented.

Only every third SME mentions *labour practices*, however, 73 % of the large companies do it. Issue 3 'social dialogue' is mentioned least by company types, only 44 % of the large WSCs and 7 % of the SMEs do it. Sub-issue 5 'human development and training in the workplace' has the highest representation for both, SME (29 %) and large companies (73 %). Interestingly, the municipal companies show half or less than a half of the percentages reached by the private or mixed-financed companies in all of these sub-issues. The use of further education/training as management tools is fairly good; SA 8000 is not in use at all. Although all companies provide the highest level of information on the core issue *environment*, mixed-financed companies provide less information on that in tendency. Compared to the three sub-issues climate protection, emission reduction and sustainable resource development the fourth subsection biodiversity and nature protection are not so often mentioned by the companies.

The core subject *fair operating practices* issues 5 'respect for property rights' has the highest representation for both, SME (14 %) and large companies (79 %). The issue anticorruption is mentioned by none of the SME and only ten large companies do it, meaning only 9 % of all WSC give detailed information about measures, processes and anticorruption structures in their companies. Here is a lack in use of the respective management tools. The core subject *community involvement and development* is often expressed with issues like social investment (issues 7), health (issue 6), education & culture (issue 2) as well as partly community involvement (issue 1). Technology development and access (issue 4) are important for only every third company, none of them is a SME. In addition, none of the SMEs addresses the sub-issues 3 and 5. The respective management tools for element 6 and 7 are rather good in use by the WSC.

Cross-sectional or bivariate analysis

In order to find relationships or patterns between the sustainability management tools and selected items contingency and correlation analysis was conducted with the help of SPSS. Table 2 shows the results of the contingency analysis, table 3 the results of the spearman's rho analysis. Obviously, in accordance with ATT et al. [11] and their descriptions regarding the corporate structure and the structure of urban development of German WSC there is a rather high relation between the type of enterprise and density of population as well as the annual amount of water.

Table 2. Contingency analysis, N=110

Category pairs	Phi	Cramer's V	Contingency Coefficient	Approx. Significance	Pearson Chi-Square (Value/df/Asymp. Sig. (2-sided))
Type of enterprise – Density of population	.767	.767	.609	.000	64.724/4/.000
Type of enterprise – Amount of water supply	.728	.728	.588	.000	58.265/4/.000
Type of enterprise – Reporting	.559	.559	.488	.000	34.396/1/.000
Type of enterprise – Stakeholder Dialogue	.588	.588	.507	.000	30.055/1/.000
Type of enterprise – Working Time Models	.533	.533	.471	.000	31.294/1/.000
Type of enterprise – C2	.581	.581	.503	.000	37.183/1/.000
Type of enterprise – C5	.635	.635	.536	.000	44.351/1/.000
Just values shown above .500					

In this sample, a high or medium relationship can be found between the type of enterprise and reporting, stakeholder dialogue and working time models. Having a closer look at the cross tables it becomes clear that just 9 percent of the SME, but 62 percent of the big companies have a sustainability-related report at all. Private financed WSC have significantly more engagement in Corporate Citizenship compared to the other both financing forms. There are WSC neither having ISO 14045 nor ISO 14040/44.

Table 3. Spearman's rho of sustainability management tools, N=110

Category pairs	T - Rep	T - SD	N - Rep	N - SD	N - WT	D - Rep
Spearman's rho (ρ)	.563**	.574**	.545**	.555**	.528**	.515**
Sig. (2-tailed)	.000	.000	.000	.000	.000	.000
Category pairs	EE - EF	EE - UN	E³ - Rep	GRI - SC	T – C5	N – C2
Spearman's rho (ρ)	.502**	.704**	.502**	.501**	,576**	,549**
Sig. (2-tailed)	.000	.000	.000	.000	,000	,000
Category pairs	N – C5	D – C5	A – C2	A – C5	T – C5	Rep – C5
Spearman's rho (ρ)	,645**	,645**	,507**	,537**	,576**	,587**
Sig. (2-tailed)	,000	,000	,000	,001	,000	,000
Category pairs	FE – C3	WT – C2	C2 – C3	C2 – C5	**. *Correlation is significant at the 0.01 level (2-tailed); just values shown above .500*	
Spearman's rho (ρ)	,543**	,520**	,556**	,531**		
Sig. (2-tailed)	,000	,000	,000	,000		
A = Annual water supply in m³, D = Density of population, EE = Eco-efficiency analysis, EF = Ecological Footprint, FE = Further education/training, GRI = Sustainability Reporting Guidelines, N = Number of employees, Rep = Reporting, SC = Sustainable Supply Chain Management, T = Turnover, UN = UN Global Compact, C2 = Human rights, C3 = Labour practices, C5 = Fair operating practices						

4   DISCUSSION

General implications for sustainability evolution in monopolistic landscapes

Based on the key question to what extent water companies implement sustainability in their management processes, this sample showed very clearly a lack of strategic planning or imperative [39]. In the sense of evolutionary theory just incremental steps seem to foster sustainability in a monopolistic landscape. General management tools are in the foreground compared to more sustainability-related instruments. The found tools and concepts fulfil more the management tasks of participation and targeting than others. Innovative concepts or system-oriented approaches, like SBSC, Sustainable Supply-Chain-Management, IPP and Cradle-to-Cradle approaches, are not sufficiently used and implemented into the strategic management processes by the WSC. As the average of implemented sustainability management tools is about five (of 31), meeting mostly three to four principles, there is much to do to integrate sustainability issues more widely. The results seem to strengthen the extant literature that in monopolistic landscapes mainly known strategies are followed [40-42], and just some of the companies develop new moves, e.g. towards sustainability.

It is remarkable that just nine percent of all WSC have implemented the DIN ISO 50001. Sustainability reporting has to develop broadly. Sustainability management approaches highlighting social and/or environmental issues are underrepresented at all. It is really surprising that none of the investigated WSC have EFQM in use, but half of the companies are ISO 9001 certified. Beside compliance DIN ISO norms also fulfil signalling effects that provide documents offering requirements. This might explain the higher use of ISO 9001 compared to EFQM focusing on permanent improvement and more orienting towards sustainability. According to Granly and Welo's [43] results ISO 9001 could function as an enabler for the implementation of ISO 14001. Hence, the presence of a tool that has many aspects in common with a more sustainability-related tool can serve as selection criteria for companies, as the investments are relatively low

compared to the implementation of other new tools. Inoue et al. [44] found out that the duration of ISO 14001 has a positive influence on the environmental R&D ratio; thus a vicious circle is quite obvious – the more the WSC do not use sustainability management tools the unlikelier sustainability development in this industry is. The authors also stress the importance to focus on both exogenous factors and organisational and managerial factors in order to explain voluntary corporate actions. Further research should, therefore, focus on the reasons for implementing ISO 14001 and its influence on a comprehensive sustainability strategy. As both companies, SMEs and big companies, have ISO 14001 implementation further researches should also find out about the relation between ISO 14001 and sustainable water innovation.

According to DiMaggio and Powell [45] isomorphism is a process in which units facing the same set of environmental conditions resemble other units. Both coercive isomorphism and mimetic processes can cause more sustainability-related thinking. The first approach is often based on social expectation, the second one on strategic perception. Particularly in the case of heterogeneous expectations organisations are mimicked holding a leading position and have taken promising structures or methods. Benchmarking is a good reference here, 27 % of the WSC conduct benchmarking regularly in this sample. This is another argument to implement sustainability management tools intensively; the use of tools, concepts or systems / systemic approaches can be used to identify developmental options, good practice and cost reduction. Some of the big companies have already started to develop new tools for the reduction of leakages. Some selective WSC foster voluntary cooperation and contracts with farmers in order to protect land and water conservation zones, e.g. establishing green farming or avoiding of specific pesticide. Here, financial support (by the states or EU) for the establishment of greater compensation areas or protection zones or reserves could raise competition. Mimetic processes on population level can also explain the high frequency of Corporate Citizenship. Corporate citizenship activities are mainly interwoven with marketing engagement and not explicitly aimed at being a good corporate citizen. The comprehensive integration, communication and public presentation are insufficient in the sample. Only a handful of WSC has a credible commitment to CSR. Here the visibility of social responsibility is shown by specific supply chain-related activities.

Size as a central component of variation processes in transition
According to the tables 2 and 3 the type of finance does not show strong patterns in contrast to the type of size. There are strong relationships between reporting and size (type of enterprise, turnover, and number of employees) as well as the density of population. These are often big companies, so that these companies can be forced more to represent their sustainability engagement and investigation and have to show their activities or legitimate their strategies. There are also distinct patterns between stakeholder dialogue and size (type of enterprise, turnover, and number of employees). The size of a company seems to have an influence on the use of sustainability tools, but rather on standards, systems and systemic approaches. However, it is obvious that there is a strong relationship between GRI and sustainable supply chain management (SSCM) as well as UNGC. Those WSC having UNGC and SSCM are likelier to have GRI guidelines in use at the same time. For big WSC it should be proved further whether the GRI guidelines are a kind of promoter for further sustainability activities and whether they can be used as one. The use of GRI guidelines might open doors for further sustainability activities and the use of sustainability concepts. In fact, the UNGC yearly communication on progress is closely based on GRI indicators, thus, the tool and concept are interwoven although they focus on different goals. The patterns between eco-efficiency analysis and the ecological footprint or UNGC are quite comparable. Once implemented, an eco-balance can provide data for several analyses. In order to fulfil the principles 7 to 9 of the UNGC the WSC can make use of eco-efficiency analysis and the ecological footprint.

The results indicate rather different interventions or stimuli for big companies and SME in order to foster competition, like incentives for establishing own renewable power plants or cross compliance. Maybe sustainability is currently not the key driver in this industry, and the water industry is more focused on the selection criterion of pure or origin water having high quality than diluting the product on basis of a still quite diffuse concept 'sustainability', because co-dynamics and co-evolution of several systems or structures is quite limited by the dependency on the network and infrastructure [25, 46]. Further research is necessary.

Set of theses and hypotheses

H1: The existence of ISO 9001 enhances the likelihood of an ISO 14001 implementation.

H2: The longer WSC are having ISO 14001 the likelier the engagement in sustainability innovation is.

H 3: Coercive isomorphism and mimetic processes are the key selecting processes in the water industry.

H4: The bigger the WSC the likelier sustainability reporting on a mandatory basis is.

H5: The bigger the WSC the more stakeholder dialogues are used for sustainable development.

H6: The higher the number of employees the likelier working time models due to corporate structural opportunities.

H7: The use of GRI guidelines enhances the likelihood of using more complex sustainability concepts or systems in big WSC.

H8: The use of standards or certifications opens the door to use additional and connectable sustainability tools or concepts in big WSC.

H9a: The more money a WSC has, the more intensive its CSR engagement is.

H9b: The more manpower a WSC has, the more extensive the company's CSR activities are.

H9c: International operating WSC invest more in CSR activities compared to local ones.

H9d: The smaller and more local operating the WSC is, the less CSR engagement is obvious.

H10: Providing information based on an obligatory structured manner makes the companies to represent further voluntary CSR information more likely.

H11: Private finance enhances the likelihood in CSR engagement in the water industry.

H12a: The higher the sense-making the likelier the voluntary cooperation is.

H12b: The higher the systemic understanding the likelier voluntary cross compliance is.

H13a: Coercive isomorphism and mimetic processes have more influence on CSR activities in the water industry than cost and performance-orientated approaches.

H13b: The more precise a water association addresses and honours CSR activities and the need for CSR engagement the likelier WSC voluntary engagement und activities related to their core business practice are.

H13c: The more water gains in importance in the international discussion the likelier CSR engagement of international operating WSC. Thus in turn, increases positive direct spillover effects on WSC operating in an adjacent supply area or more indirectly from the water industry associations on their WSC.

5   CONCLUSION

Henn et al. [12: 7] highlight that water is life according to different races, water is a public good according to citizen, water is a civil right according to the United Nations; however, water is policy teaches reality, water is profit knows economy, water is not a common trading good, but an inherited asset that has to be protected, defended and used appropriately as the EU Water Framework Directive manifests. This study provides the following findings:

1. Although based on rather good governmental regulations the water industry needs a change towards sustainability and forward-looking strategic planning.
2. The implemented tools are mainly focused on general management and participation as well as targeting in particular.
3. Holistic or integrative sustainability management tools and approaches are underrepresented.
4. There is a significant difference between big companies and SMEs not showing typical characteristics of corporate sustainability research findings. Big companies have more sustainability tools, norms or approaches in use compared to SMEs. Big companies use more reporting.
5. Some tools seem to open the door for other and even more complex sustainability approaches.
6. A clear first step would be the development of a mission statement containing specific and valuable CSR and sustainability elements. A second step would be a clear plan for the implementation of diverse ISO 26000 elements and the development of respective indicators. A third step is the implementation of a sustainability management system.
7. There is no industry wide understanding of CSR. Historic reasons and structures as well as a monopolistic culture have influence on the low CSR value.
8. Realising system changes towards sustainability have to be managed in an integrative way. There are some pioneer inter- and innersectoral alliances, either based in the initiative of associations or single companies; however, structured cooperation and participation are missing.
9. Coercive isomorphism and mimetic processes seem to be the core selection processes on the population level.
10. Although having the power, in monopolistic landscapes stability, path dependencies and known search routines have most influence. Thus, transformation towards sustainability is happening by chance and stepwise, fostered by single companies and growing from niches in the water industry.

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EVALUATION OF HOUSEHOLD ENERGY CONSUMPTION: IMPACTS OF RESIDENTIAL BUILDING ENERGY EFFICIENCY STANDARDS AND USER BEHAVIOUR PATTERNS IN AUSTRALIA

ABSTRACT

Residential sector in urban areas is the third largest sector of final energy use in Australia, which accounts for about 12% of the country's total final energy consumption. Reducing energy consumption is vital to achieving reductions in carbon emissions. Policy makers and researchers are working towards low carbon cities. Several factors affect energy consumption including housing characteristics and lifestyle. Greater stringency in regulations for new housing construction has been introduced via changes to the Building Code of Australia (BCA) in the past decade. The policy aim of these measures at both national and state level is to enable reductions in household total energy use and mitigate total greenhouse carbon emissions attributed to the housing sector. This paper discusses the impact of the introduction of a National House Energy Rating Scheme (NatHERS) on the provision of new housing stock with a focus on developments in South Australia. The paper presents results of an empirical study on household energy consumption carried out in two capitals cities in Australia. It captures relationships between energy consumption and housing characteristics and lifestyle. The impact of the introduction of Nationwide House Energy Rating Scheme on the provision of new housing stock is also presented. Energy rating schemes have the potential to improve the quality of housing stock. It is limited to new housing where thermal efficiency levels could be improved. A holistic approach to energy consumption would require city planning strategies to reduce the overall demand for household energy consumption. The empirical evidence presented in the paper help policy planners and housing industry professionals towards meaningful ways of mitigating carbon emissions.

Key words: Household energy consumption, House Energy Rating Scheme, National Construction Code.

1   INTRODUCTION

In recent decades governments worldwide have implemented mandatory energy performance requirements for new housing through regulation in order to reduce levels of energy consumption and lower household carbon emissions. In the UK, 27% of all carbon dioxide (CO_2) emissions are said to be related to housing [1]. The situation is similar in other countries including Australia where energy consumption attributable to housing occupancy is not only a significant expense for individual households but also a significant factor at a national level in overall greenhouse gas contribution [2]. Energy consumed in the home can be broadly categorised as energy used in maintaining a thermally comfortable environment (heating and cooling), lighting, and other energy (mainly electrical) used for other appliances covering a multitude of household devices such as TVs , security systems and computers etc.).

In Australia the regulation of housing energy performance for new homes is through the National Construction Code (NCC) which evaluates and regulates the energy efficiency of a residential building. The efficiency of the building shell determines the amount of heating and cooling needed to maintain thermal comfort in the building. In the Australian regulations this energy requirement is commonly evaluated in terms of a star rating (increments of 0.1 stars) using building thermal modelling software under the required and agreed protocols of the nationwide house energy rating scheme (NatHERS). The software simulates expected conditions based on climate zones and other known factors about the location, occupancy and dimensions and construction materials of the house. The software correlates well with other global building thermal models [3]. After determining the heating and cooling energy requirement, it converts this amount to a star rating with a higher star rating corresponding to a lower demand.

Studies of energy use in Australian housing have focussed on the use of the software tools to measure the predicted energy loads for a typical house and model changes to both design and orientation [4, 5, 6] as well as other features that affect the rating (location, adjacent shading etc.) These software tools model impacts on end energy use, based on default occupancy settings. Although the software is primarily used for design and

rating of new buildings, there has been considerable debate about the potential for using the software for evaluating the thermal performance of existing buildings, under a mandatory disclosure regime.

The term 'energy label' as applied to housing has a number of interpretations across the globe and is a relatively new aspect to housing characteristics. In the developed economies where both the sale of existing and the construction of new homes is tightly regulated the concept of energy labelling encompasses, evaluation of total energy demand under various occupancy conditions, measurement of both thermal performance of the fabric and spaces within a house and in some cases appliance energy efficiency evaluation. With the growth in domestic solar photovoltaic (PV) energy production usually by rooftop installations the labels have included such terms as zero carbon or net zero energy homes [7]. Purchasers of housing can be informed through labels of the likely energy performance of the house and governments and municipalities can understand the energy profile of the residential buildings in their domain. O' Leary [8] provides an analysis of various Australian mandatory disclosure models proposed.

2 HOUSE ENERGY RATINGS IN AUSTRALIA

The home energy rating scheme in Australia is the Nationwide Home Energy rating scheme (NatHERS). Similar to HERs in other countries, it is a method of rating the energy performance or energy-efficiency of a house by calculating (usually incorporating a computer simulation using AccuRate© software) the energy load and/or energy consumption of a dwelling for several end-uses such as heating and cooling. Inherent in all the methodologies is the assumption of 'typical' occupant-related factors such as number of people, number and use of appliances, and thermostat settings. The climate used in the calculations is also standardised for a given location. A validation of the building thermal model as used in the NatHERS software was conducted by Delsante [28] as part of the adoption of NatHERS by the Australian government. Whilst modelling using the NatHERS software provides a prediction of energy demand, its primary purpose is as a comparative tool and standards are set for each climate zone and take into account extremes in local weather patterns. Further research by Wang et al. [27] indicates a satisfactory outcome of testing of the software against international benchmarks which evaluate the ability of design and analysis tools to adequately model the envelope dynamics of buildings.

The need for heating or cooling relates to the total effect of all heat flows in and out of the building. This is the method applied by the AccuRate© software to determine the heating and cooling energy needed for a building design, from which the star rating is determined. An increase in star rating results in a lower energy demand to achieve comfort temperatures. An increase from 5 to 6 stars represents a reduction of 23% in the energy demand of the building in the Adelaide, South Australia climate zone (125 to 96 MJ/m^2).

Once the data for a house has been entered the report features of the software can be used to generate two specific reports as listed below;

- A summary report listing the project, client and rating assessor details. The heating and cooling requirements (MJ/m^2) and most fundamentally a star rating in compliance with the BCA/NatHERS protocol.
- A more detailed Building Data Report which lists data on the construction elements for individual zones, sizes, openings etc.

In Australia there are few studies which evaluate predictive models of household energy consumption. Williamson et al. [28] has focused on the lack of correlation between the predicted values from the software and data on actual energy use. In a study of 31 houses in South Australia the NatHERS energy load (MJ/m^2) predicted values are plotted against the actual average annual household energy consumption from billed data from the appropriate electricity, gas and oil retailers over at least a 3 year period for each dwelling. The authors find that no significant correlation is observed as shown in figures 2. However as stated earlier, if heating and cooling represents a minority of total household energy, other household energy appliances will affect the data, and a correlation may not occur. The researchers attempted to extract heating and cooling data from the consumption data and produced Fig. 3. This figure does show a correlation but it is very weak. However, the extraction method involved correlating bill data with heating and cooling degree days, rather than direct measurement of energy used by the heating and cooling equipment. This method does not consider the impact of solar radiation and humidity on the heating/cooling load and does not consider the

different efficiencies of the equipment between houses, as well as how the efficiency changes with temperature. Therefore the finding shown in Fig. 3 is uncertain.
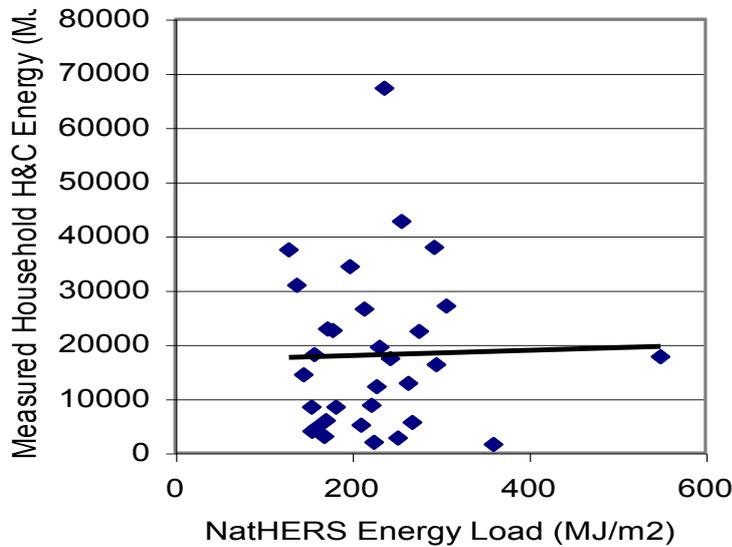
Figure 2. NatHERS (MJ/m^2) vs Total Household Consumption for Heating and Cooling (MJ).
Source: Williamson et al. (2006).
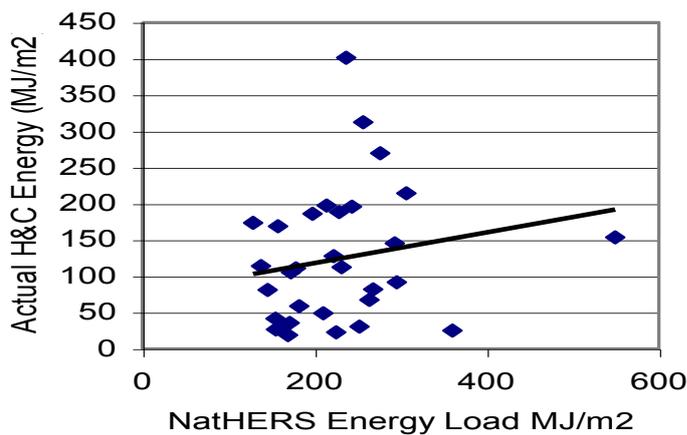
Figure 3. NatHERS (MJ/m^2) vs Total Household Heating and Cooling per Conditioned Floor Area.
Source: Williamson et al. (2006).

In a more recent study by Saman et al. [29] which addressed the performance of housing during heatwaves in Australia, data revealed that having a more energy-efficient house design measured by a higher Nathers rating generally improved the occupants' thermal comfort and reduced heating and cooling energy use. In earlier studies by Saman and Halawa [30] and Saman and Mudge [31] a group of homes with improved NatHERS star ratings were also shown to use less energy.

3   DATA ANALYSIS OF MONITORED ENERGY STUDIES OF SOUTH AUSTRALIAN HOUSES

To investigate further as to the reliability of consumption data to evaluate the energy efficiency of the building shell of a house, two separate studies have been conducted by the authors using data on household annual energy use from 2000 up to 2013. Here, the experiment was to analyse energy consumption for each

set of homes which had relatively similar profiles of occupancy, income and house type. The first data was obtained from monitoring energy consumption from almost identically constructed dwellings with low income tenants. The more recent study is of the Lochiel Park (LP) housing development in the suburbs of Adelaide, which included 33 homes over 12 months with reliable gas and electricity data for occupants with above average income and education. The Lochiel Park (LP) green village located eight kilometres from the Adelaide CBD is a world-class ecologically sustainable development. The development's planners set ambitious ecological targets to be delivered through a comprehensive set of design guidelines including high levels of thermal comfort based on Nathers ratings of at least 7.5 stars, solar water heating, photovoltaic electricity generation linked to the size of the dwelling, energy-efficient lighting and appliances, a load management system to control peak demand, energy and water use feedback monitors, rainwater water harvesting, and the recycling of stormwater for toilet flushing. For this study the impact of solar PV is excluded and all used energy by the house is analysed. Guerra-Santin and Tweed [32] discuss both the variability of techniques to monitor building energy performance and advances in monitoring techniques due to the availability of more affordable sensors and meters. The specifics of the monitoring equipment and data collection techniques used in the study are discussed by Whaley et al. [33]. The energy demand monitoring system(s) are described in figure 4 below. A smaller subset of the 9 houses had more detailed monitoring of individual circuits and indoor temperature and relative humidity etc.
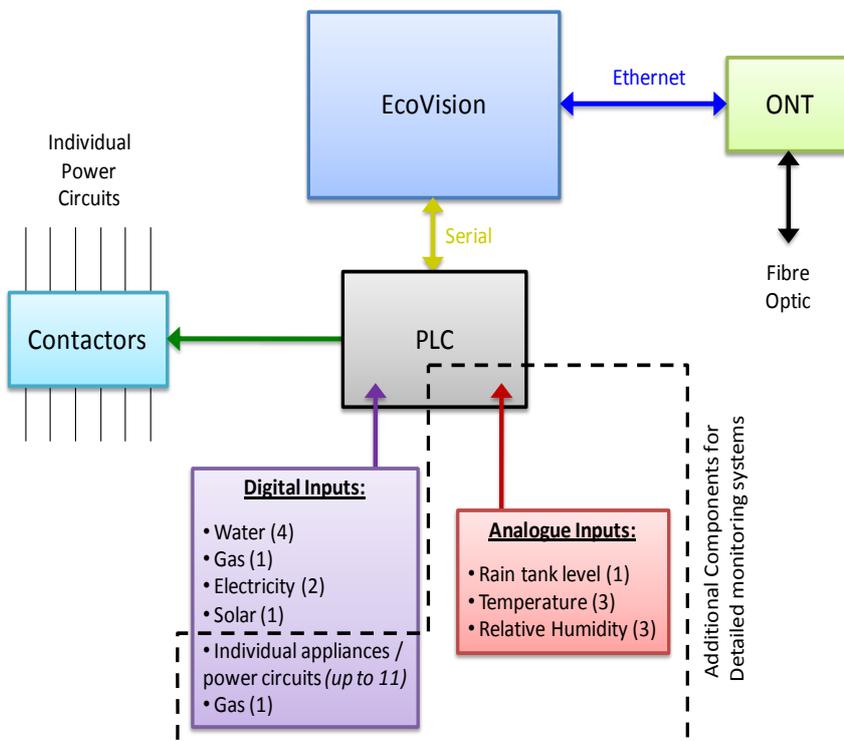
Figure 4. Overview of Lochiel Park monitoring systems.

Whilst energy use data typically exists in the form of periodic energy bills from service providers the monitoring of energy consumption from the Lochiel Park houses via an intelligent system as outlined above allowed both daily consumption figures to be recorded and adjustment for gross energy demand where solar panels provided electricity at certain times of the day. The occupants own interactions with the in–house monitoring systems was studied by Whaley et al. [33] through structured interviews and informal discussions indicating some evidence that systems with easy to read feedback displays assist households to reduce their energy use and identify energy system faults, although the quantum of energy saving is difficult to ascertain.

The second study includes data from 13 homes in the city of Mount Gambier, a regional centre some 400km south of Adelaide. The climate is cooler with a longer heating season than Adelaide. The public housing

authority of SA was implementing a policy of providing heating equipment to tenants, and the main purpose of the study was to determine the specifications of heaters to minimise household heating costs. This was achieved through direct monitoring of heating equipment in homes. However the first stage of the project was to correlate heating costs against heating system for similar households.

Gas and electricity quarterly bill data was obtained for over 200 houses from the energy utility, and it was found that the variation across similar houses was so large that no valid correlation was obtainable. The sub-set of 13 houses that are from Mount Gambier with energy consumption data represent similar houses out of a the larger set of 200.

These homes are essentially identical in design, insulation levels and heating systems, and can be considered as being of low energy efficiency. Furthermore, they are each occupied by 3 people, the makeup of which is unknown, apart from them having the same low income socio-economic status.

Table 1 provides a housing characteristics profile of the two data sets, the differentiation in rated performance, which varies between 7.5 -7.7 stars for Lochiel Park and estimated at less than3 stars for Mount Gambier which is typical of older houses built before the introduction of mandatory energy efficiency measures. Of significance the two clusters are not rated in the same climate area and as such the NatHERS star bands rating accounts for the higher energy demand of the cooler (more heating dominated) region of Mount Gambier.

Table 1. House style, location and occupancy attribute for studied houses Lochiel Park and Mount Gambier.

	Lochiel Park (LP)	Mount Gambier (MG)
House style	2 storey townhouse (modern)	Single storey, 2 bed unit
Age of Construction	Less than 8 years old	50-60 years old
Av floor area	197m^2	135m^2 (all similar)
Climate Zone (Building Code)	5	6
NatHERS star rating (thermal load, MJ/m^2)	$7.5 - 7.7$ $(58 - 53)$	estimated at less than 3 stars
Occupancy profile (avg.)	$2 - 5$ (2.7) persons	3 persons
Major Appliances	Gas-boosted solar water heaters and Mainly electric (ducted and Split system) a/c s	Electric off-peak storage heaters, gas wall furnaces

To compare households, the primary energy of the bill data was determined, to enable a direct comparison of household energy. The calculation of primary energy demand from the bill data for gas and electricity was determined as below:

$$PE = G/ + E/\eta e$$

Where
PE = primary energy in Mega joules (MJ)
G = gas usage in MJ
E = electricity usage in MJ
He = 35%

Figures 5 and 6 report the annual primary energy loads for the houses in the study showing wide variation in energy per household.
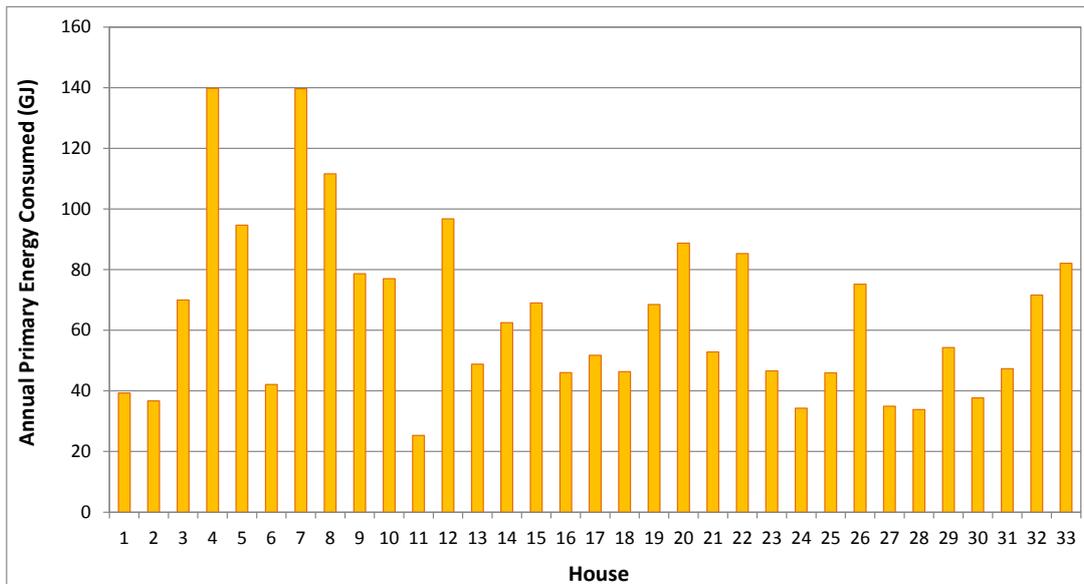
Figure 5. Annual primary energy use for sample Lochiel Park houses, 2012- 2013.

Annual primary energy demand for the sub-set of 13 Mount Gambier homes is greater in total but exhibits less variability than the Lochiel Park homes. Figures for both Lochiel Park and Mount Gambier annual primary energy demand can be compared against data from the South Australian Energy Services Commission [34] which show on average households in the state using some 84 GJ per annum in 2010. The higher rated Lochiel Park houses are performing on average below this figure whereas the older, lower star rated and more heating dominated homes of the Mount Gambier cluster are significantly above state averages.

The average annual primary energy for Lochiel Park is 184 MJ/day whereas for Mount Gambier it is 488 MJ/day. In annual terms which can be compared with state averages the average household primary energy us is 65 Giga joules and for Mount Gambier it is 179 Giga Joules.

Figure 7 compares the spread of energy consumption for the two groups in both absolute and normalised primary energy consumption (GJ/Yr), showing that there is greater variation in the Lochiel Park homes with a standard deviation of 45 % compared with that of the Mt Gambier houses which has a standard deviation of 24 %. Figure 8 shows this again for Lochiel Park normalised by various metrics, including habitable floor area (square metre), number of persons, floor area and person. This shows that regardless of which metric is used, there is a significant spread of primary energy consumption with a greater spread for Lochiel Park.

To account for the climate variation, a 7.5 star rated home (Lochiel Park) versus a 3 star rated home (Mount Gambier), requires under the software predication a heating and cooling load of 86 and 341 MJ/m^2, respectively. This is a 75% reduction, and is similar to the actual difference in primary energy consumption of 63%. Therefore whilst the rating is an assessment of energy for heating and cooling only, it is another example of how a higher star rated home can outperform a lower star rated home.
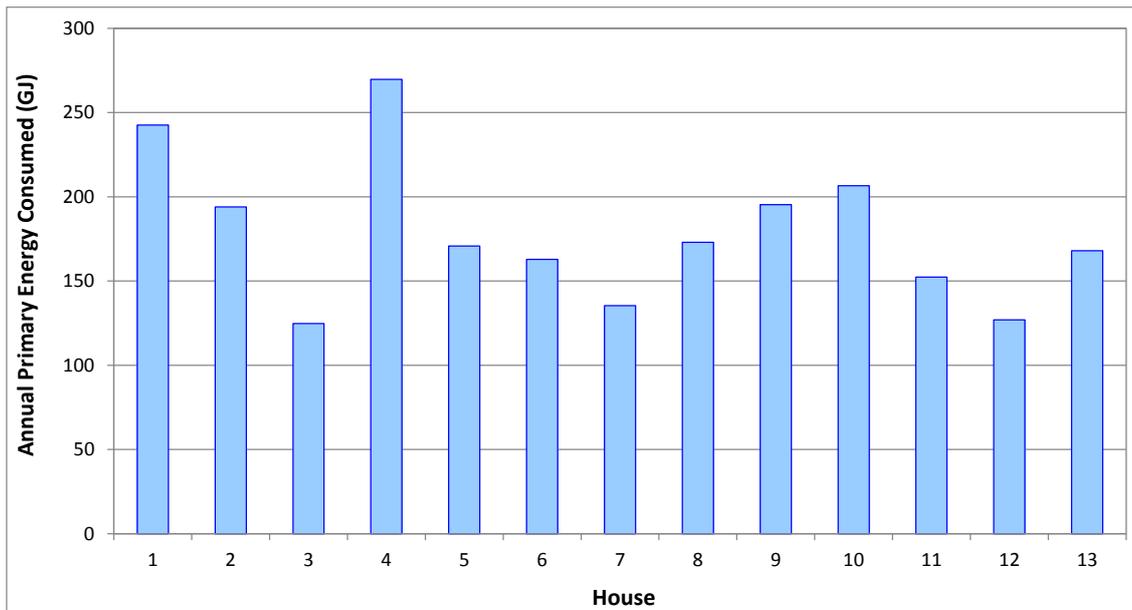
Figure 6. Annual Primary Energy use for sample Mount Gambier houses (2001 -2002).

Figure 7 shows that there is even a crossover of primary energy use, where some Lochiel Park homes use the same energy as some Mount Gambier homes. In this case, had energy bills been used it is possible that some of the Mount Gambier homes could be viewed as delivering a lower energy consumption than some of the Lochiel Park homes. It should also be noted that there are some significant differences between houses that were monitored in Lochiel Park than in Mount Gambier, and awareness of these differences will help to place the comparisons into a more appropriate context. The Mount Gambier data was collected approximately twelve years before monitoring at Lochiel Park, when there were significant differences in the availability and market penetration of certain technologies, such as plasma and LCD televisions and energy efficient lighting.
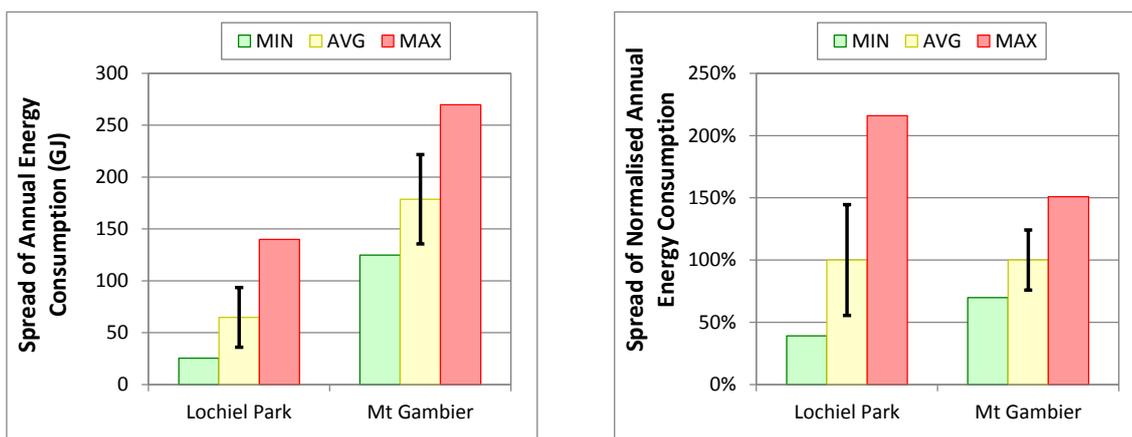
Figure 7. Spread of Mount Gambier and Lochiel Park primary energy consumption (left) in GJ/yr, and (right) normalised relative to the average for each data set. Each chart shows the minimum, maximum and average, together with error bars that represent the standard deviation.

It could also be argued that the resident's energy use patterns and their level of awareness of environmental sustainability issues also make a direct comparison difficult. Never the less, a comparison was considered useful to demonstrate that differences in energy use across both clusters.
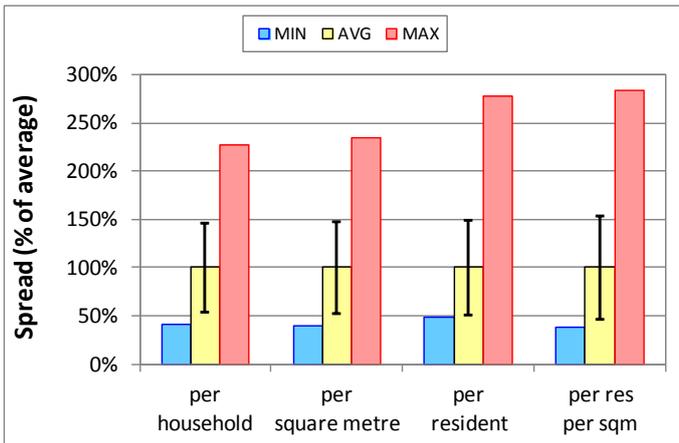
Figure 8. Summary of the Lochiel Park house spread of normalised primary energy consumption data, showing the minimum, average, maximum and standard deviation using various metrics.

Finally figure 9 shows the monthly variation in Lochiel Park primary energy usage, together with the minimum, maximum, average and standard deviation (shown as error bars). The graph shows that during winter and summer months where significant heating and cooling is conducted, there is significant variation in the primary energy use. This variation highlights the significant impact of behaviour when it comes to heating and cooling use.
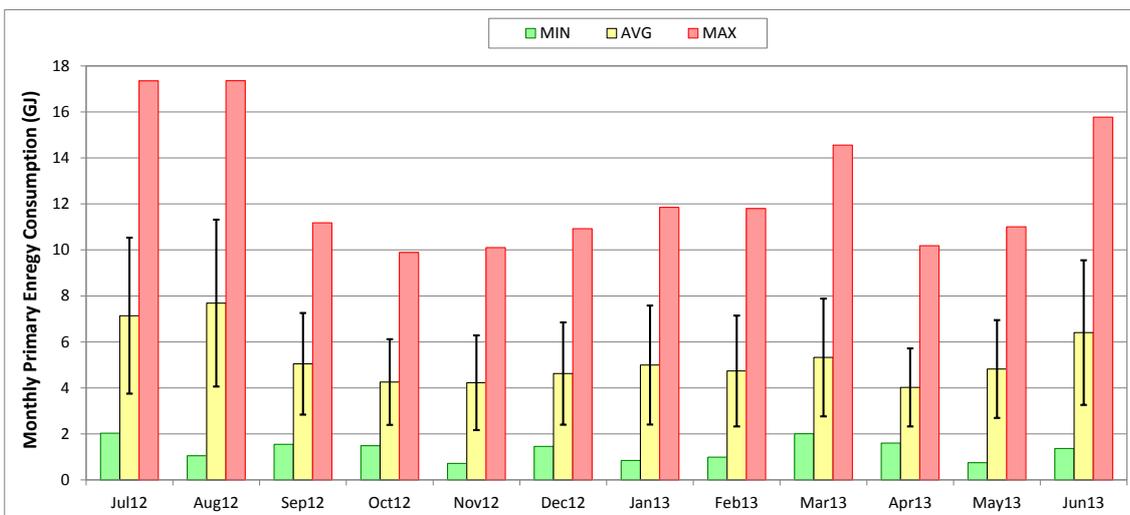
Figure 9. Summary of monthly minimum, average and maximum primary energy consumption per Lochiel Park household. The error bars correspond to one standard deviation, centred on the average (mean).

4   CONCLUSION

These findings have implications for housing and city planning policies. Currently there is a tendency to evaluate energy efficiency in terms of energy rating of new housing without necessarily addressing the issue of the size of housing. The literature has shown that adoption of energy efficient appliances and solar panels have some influence in reducing energy consumption. Average floor area of new housing in Australia is among the highest in the world and there is no indication of it declining in the near future. Larger housing has been the tradition for several decades in Australia and a drastic reduction in size of housing is unlikely in the short to medium term.

At the heart of consideration of energy performance in housing is the relationship between built form and occupant behaviour and the self-evident truth that buildings do not in themselves use energy rather it is people that do so. For evaluations of occupancy and built form what can be observed by studies is the variation in household energy use patterns and this is again borne out in the study in South Australia using clusters of homes in Lochiel Park and Mount Gambier.

The houses within each of the two separate clusters Lochiel Park and Mount Gambier are relatively similar and have similar star ratings under the current Australian nationwide house energy rating scheme (NatHERS). What is then evident is the wide variation in energy use irrespective of rating and that occupancy dictates end energy use. The homes in the study have a significant comparative improvement in thermal performance brought on by changes in housing regulation from the older and lower 3 star equivalent of Mount Gambier, to the 7.5 – 7.7 star homes of Lochiel Park.

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NAVIGATING IN THE AMBIGIOUS SUSTAINABILTY LANDSCAPE: A conceptual discussion of corporate sustainability in the context of organizational decision making

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ABSTRACT

The purpose of this paper is to unveil conceptual insights on how firms manage *corporate sustainability*, e.g. how companies integrate social and environmental issues in their business decisions. It is argued that fundamental mechanisms in organizational decision-making processes as described by the *Behavioral theory of the firm* are imperative in order to understand and manage change processes for sustainability. A special emphasis is put on the role of top managers, and empirical findings from the *Accenture and UN Global Compact CEO study on sustainability* from 2013 are utilized in the discussion.

The empirical data indicate that engagement, dialogue and partnerships with stakeholders are key features of successful companies. On a conceptual level, this can be related to processes of organizational learning and how firms deal with uncertainty when making decisions. More specifically, the ability to reduce uncertainty linked to actions of external stakeholders seems to differentiate firms in terms of both business and sustainability performance.

Companies that outperform their peers have CEOs that emphasize investor dialogue in order to quantify and communicate the business value of sustainability. Thus, the role of investors in organizational change processes for sustainability is an interesting research topic. More generally, a promising research area is how and why stakeholder interactions differ between companies and especially how dialogue with external actors can enable the firm to tackle uncertainty and ambiguity inherent in corporate sustainability.

1   INTRODUCTION

How do firms manage ambiguous demands from their stakeholders? To what extent do organizations incorporate social and environmental concerns in their decision-making processes? Such questions reflect a debated issue among scholars, and the topic is often referred to as *corporate sustainability* [1]. Furthermore, contemporary literature in the area identifies organizational mechanisms by which sustainability issues get integrated as a promising research area. More specifically, how firms make choices among a range of available sustainability policies is identified as a research gap[2]. Thus, this paper advocates organizational decision making as theoretical grounding. The overall aim is to deepen understanding of underlying organizational dynamics inherent in the concept of corporate sustainability and to discuss theoretical and practical implications.

2   OBJECTIVES AND SCOPE

Sustainability is a term widely used, and the reader must note the difference between corporate sustainability at micro level and the concept of sustainable development macro level. The concept of sustainable development is anchored in normative requirements and ethical values on how ensure the needs of future generations while ensuring social standards and safeguarding the natural environment. This is exemplified by the new Sustainable Development Goals under development by the United Nations[3].

Corporate sustainability reflects organizations that incorporate sustainable development, e.g. social and environmental concerns, in their business strategies[4]. The scope in this paper is micro-level analysis by combining the normative sustainability perspectives anchored in ethical values with a descriptive behavioral perspective from organizational science. This is done by applying the classical work of Cyert and March in organizational decision making, *"A behavioral theory of the firm"*[5].

Another highly influential scholar in this context is Herbert A. Simon. His classical work discusses the concept of organizational goals and emphasizes how sets of constraints influence decision-making processes. Further, he states that constraints and search criteria linked to executive roles in the organization are especially important when discussing goals and prioritization of resources[6]. Therefore, this paper focuses on the role of CEOs by analyzing their behavior through theoretical lenses.

3   A BEHAVIORAL THEORY OF THE FIRM

Cyert and March grounds their theory in a set of exhaustive variable categories along with a set of relational concepts. The categorization is shown in Table 1 and Table 2, and the following sections explain the theoretical concepts.

Table 1 Exhaustive variable categories in the behavioral theory of the firm

Variable categories		
Goals	Expectations	Choice

Table 2 Relational concepts in the behavioral theory of the firm

Relational concepts			
Quasi-resolution of conflict	Uncertainty avoidance	Problemistic search	Organizational learning

3.1   Variable categories

Organizational goals are evoked by problems and this influences what is regarded as important in the organization. In addition, responses to short-term pressures and the operational goals of subunits making decisions affect the overall organizational goals. Another important set of variables affecting the goals are those concerning aspiration levels. Essentially, three variables are identified, namely the organization's past goal, the organization's past performance, and the past performance of other comparable organizations.

Organizational expectations are seen as the result of drawing inferences from available information. Important variables are those that affect either the process of drawing inferences or the process by which information is made available. Regarding the process a special emphasis is put in variables affecting search activity within the firm. Past experience on success rate and the amount of organization slack in the firm is closely linked to intensity and success of search. Search direction is determined by the nature of problem at hand along with location in the organization where search is focused.

Organizational choice takes place in response to a problem, uses standard operating rules, and involves identifying an alternative that is acceptable. Important variables are those that influence the definition of a problem within the organization, those that influence the standard decision rules, and those that affect the order of consideration of alternatives. Generally, past experience and past record of organizational slack will affect the variables.

3.2   Relational concepts

Quasi-resolution of conflict reflects that conflict is never fully resolved within in an organization. This is linked to the process of which goals are formed. Goals can be seen as a series of more-or-less independent constraints imposed on the organization through a process of bargaining among coalitions of people. Coalitions continuously change people leave or join the organization. In addition, decentralization of decision making and sequential attention to goals permit the firm to make decision with inconstant goals under most conditions.

Uncertainty avoidance captures the mechanism that organizations avoid uncertainty by solving short-term problems instead of long-term strategies. Decisions are based on day-to-day feedback, and firms only engage in plans that can be made self-confirming through control devises and negotiating with the external environment. This means that the firm seeks to make external conditions endogenous and controllable in order to minimize uncertainty. In short, firms achieve a reasonable manageable

decision situation by avoiding planning where plans depends on predictions of uncertain future events.

Problemistic search conveys that search is motivated by a problem and is directed towards finding a solution to that problem. Furthermore, search us simple-minded and is based on a simple model of causality until driven to a more complex one. Finally, search is biased because of unresolved conflicts within the organization. This means that bias reflects variations in training, experience, and goals of participants in the organization. In general search activities have a goal and are interested understanding only insofar as such understanding contributes to control, e.g. problemistic search is engineering rather than pure science.

Organizational learning reflects adaptive behavior over time and especially with respect to three different phases, namely goals, attention rules and search rules. Adaption of goals concerns aspiration levels, and is a function of past period goals, experience related to those past goals and experience of comparable organizations. Adaption in attention rules happens generally in two ways. First, when firms change criteria over time to which they are measuring performance. Second, this happens when firms change parts of its comparative environment to which it pay attention. The final phase regards search rules, and this reflects that firms adapt rules according to success or failure with alternatives.

4 EMPIRICAL BASIS

The empirical findings are drawn from the publicly available report from the CEO study done by the consulting company Accenture in collaboration with UN Global Compact[7]. In the following, a summary of general trends will be given. Furthermore, a special emphasis will be put on a group of companies outperforming competitors both on traditional business metrics and sustainability aspects.

4.1 General findings and trends

All of the CEOs in the study represent members companies of UN Global Compact which is a sustainability initiative comprising of ten principles within human rights, labor issues, environmental aspects and anti-corruption. Details regarding methods are given in Table 3 and Table 4.

Table 3 Study details

In-debth interviews	Survey population
107	1000

Table 4 Origin of survey respondents

Europe	Americas	Asia pacific and Australasia	Middle East and Africa
526	201	187	86

The main trend in the period of 2010 – 2013 is that CEOs seem to have adopted a more cautious approach towards sustainability reflecting a sense of frustration. This is a named the *plateau effect* and illustrates companies not being able to scale their business efforts towards sustainability. Many are stuck with incremental achievements. Furthermore, business leaders are signaling that they cannot progress without radical changes in market structures and systems. In addition there seems to be a refocus on short-term issues, and sustainability may be slipping down the agenda of top managers. Even though many leaders are growing skeptical there are some that are intensifying their commitment. These are named *transformational leaders* in the study.

4.2 Transformational leaders

By analyzing the business and sustainability performance of 77 companies it was possible to classify CEOs in different groups. Accenture assessed business performance by using their "High Performance Business Methodology". Sustainability performance was evaluated on the basis of the following rating systems: RobecoSAM, the Carbon Disclosure Project Leadership Index, the FTSE4 Good Index Series and the Global 100 Most Sustainable Corporations.

21 companies were regarded as able to combine sustainability leadership with market outperformance in their industry. These companies seem to have found ways to turn sustainability in to competitive advantage by linking environmental and social issues to quantifiable business cases.

According to Accenture leaders of transformational companies are more likely to

- Measure and reward sustainability in employee performance assessments and remuneration
- Regard environmental and social issues as important to the success of their business
- Believe in the transformational potential of partnerships with NGOs and others
- Reject traditional perceptions of sustainability as philanthropy
- Engage investors on sustainability

Furthermore, the quantitative analysis highlights areas where there was a significantly difference between the CEO groups. Transformational leaders were compared to a global average, and out of

seven areas, "Partnership & Collaboration" and "Engagement & Dialogue" were the ones to have more than twenty percentage points in difference. Thus, these are included in this paper. Table 5 shows the comparison through percentage of respondents that answered "Strongly agree" and "Agree" on the statements.

Table 5 Comparison of transformational leaders with global average

Area	Example actions	Statement from the study	Transformational leaders	Global average
Partnership & Collaboration	Cooperate with industry peers to develop voluntary standards. Partner with NGOs and other groups to maximize on-the-ground impact.	*"Cross-sector partnerships will be instrumental in enabling in delivering positive social and environmental outcomes over the next five years"*	100%	78%
Engagement & dialogue	Work with investors to quantify and communicate the business value of sustainability.	*"Investor interest is currently an incentive to invest in sustainability"*	76%	52%

5 CONCEPTUAL ANALYSIS AND DISCUSSION

The general trend in the CEO study is an increasing frustration when it comes to concrete results and business relevance of sustainability issues. This can be connected to *organizational choice* and *problemistic search*. Selecting alternatives and solutions will be characterized by satisfying behavior based on known problem-solving practices. Thus, frustration will emerge when standards procedures do not work. Furthermore, there seems also to be tendency for favoring short-term actions. This is typical behavior reflected by *uncertainty avoidance* and that firm steers away from long-term planning.

A crucial aspect is how firms adapt to past experience through trial and error. This will determine whether or not the firm learns how to overcome shortcomings in search and attention rules. An explanation for the "plateau effect" could therefore be that *organizational learning* is lacking, and that the firm is not able to develop functioning routines and problem solving mechanisms. Such dynamics are closely connected to *organizational expectations* because past experience will influence how firms frame sustainability issues in decision-making processes. Organizational barriers could emerge if past experiences have proved limited success. In the study this was illustrated by the frustration among CEOs. The notion that sustainability issues cannot be managed without radical changes in market structures and systems can also be seen as an example in this regard.

By analyzing transformational leaders the Accenture study conveys that firms are on different levels when it comes to linking sustainability with business practice and traditional decision making. The empirical data indicate that engagement, dialogue and partnerships with stakeholders are key features of successful companies compared to global average. Interestingly, by trying to control expectations from external actors the firms negotiate and set the agenda which is behavior predicted by the theory as *uncertainty avoidance.* A tolerable uncertainty level can also be seen as prerequisite for internalizing and thus managing environmental and social issues in the organizational decision-making processes. In other words, if a company lacks ability to reduce uncertainty linked to expectations of stakeholders, it will most probably perform below average on sustainability issues in its industry.

6   CONCLUDING REFLECTIONS

One of the core insights from applying the behavioral theory of the firm is that organizations have a natural tendency to avoid uncertainty and to favor known routines and practices. The empirical study revealed that companies employ different strategies in this regard.

One possible strategy in the context of sustainability is to avoid stakeholders such as NGOs, investors and governmental agencies as long as possible. However, well-performing companies with effective routines and procedures seem to reduce uncertainty through dialogue and partnerships. Such an analytical observation is in line with recent empirical research on corporate sustainability because stakeholder engagement is identified as a key factor for performance both in terms of societal and financial value creation [2].

An inference to be drawn from the conceptual analysis is that competency building as a result of learning processes over time is needed to manage environmental and social issues. The reasoning being the organizational maturity within corporate sustainability enables the firm to engage in constructive partnerships and dialogue with external stakeholders. This probably results in positive feedback which again frames future organizational expectations.

An interesting area for further research is how and why stakeholder interactions differ between companies and especially how dialogue with external actors can enable the firm to tackle uncertainty and ambiguity inherent in sustainability issues. More specifically, the role of investors in organizational change processes for sustainability seems to be a promising research topic.

7   ACKNOWLEDGEMENTS

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THE VALUE OF ETHNOECOLOGICAL KNOWLEDGE OF THE MINAHASANS: REPOSITIONING TRADITIONAL BIOCULTURAL KNOWLEDGE IN INDONESIAN ENVIRONMENTAL PLANNING

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ABSTRACT

Indonesian strategic and statutory environmental regimes have drawn directly from conventional Western models of environmental planning and natural resource management. These models are often at odds with, do not connect with, nor appreciate generational traditional biocultural knowledge and information from regionally-specific Indigenous communities in Indonesia. This knowledge, and the voice of the custodians of this knowledge, has been overlooked and circumvented in the name of broadscale nationalistic co-ordinated strategic planning. The problem is that nationalist planning, in a multicultural archipelago full of a diverse set of communities often with their own languages, dialects, cultural relationships to landscape, and mixed connectivity to different cohorts of colonial (European and Asian) and religious affiliations means that a deep understanding of environmental information at local and regional level is negated and denied legitimacy. This paper offers a platform to discuss this issue, the difficulty of nationalistic planning and its failings at the Minahasan regional level in Indonesia, and the wealth of cultural and environmental answers the Minahasan culture can bring to the table to better management its landscape sustainably and culturally. This paper's purpose is to question conventional and generic environmental planning systems in Indonesia and charts an alternate culturally-attuned agenda that can offer to inform and better manage landscapes sustainably and culturally. The tipping points are deep questions about how to regionally manage landscapes sustainably and culturally in deference to a nationalistic agenda before the latter dooms the former producing a 'one-fits all' or generic Indonesian biogeographical landscape devoid of cultural nuances.

Key words: Sustainable development, landscape planning, ethnoecology, Indigenous biocultural knowledge.

1. INTRODUCTION

Sustainable development, a dominant paradigm of the past 20 years, is commonly described as being the balance between economy, environment and society. The Indonesian government in their policy context has articulated and reasserted sustainable development through the Indonesian Agenda 21 as comprising the need to maintain quality levels of economic growth and employment; social progress that recognises people needs; and, the effective protection of the environment together with the prudent use of natural resources [14].

This paper presents an ethnographic analysis of the knowledge and value of ethnoecology of *Minahasan* people, an ethnic community who inhabit the Minahasa Region landscape, in the North Sulawesi province of Indonesia [37]. The analysis seeks to interrogate the Minahasan ethnic community's understanding of its bio-culture as sustainable development that conserves their traditional living practices. It focuses on the ethnoecological aspects of *Minahasan* people and their culture as important traditional Indigenous traditional biocultural knowledge, and thereupon it's potential for re-application in contemporary environmental planning and design for North Sulawesi [38]. An ethnoecological approach has been applied in multi-disciplinary areas, such as in improving livelihood of local peoples, conservation of medicinal plants in community-based management projects, to understand a culture, how people associate themselves with environment and how knowledge needs to be incorporated into any development that concerns people.

The ethnoecological approach applied in this research seeks to obtain a better understanding of how Indigenous people perceive their environment and how they organise these perceptions. Ethnoecology is defined as Indigenous perceptions of "natural" divisions in the biological world and plant-animal-human relationships within each division [9]. Ethnoecology is contained in all studies that characterize interactions between local people and their natural environment [18, 19, 24]. Martin describes ethnoecology as knowledge of the way people understand the interplay between humans, animals, plants and physical elements in the

environment [18]. Henfrey [9] and Martin [18] both emphasize the interactions and the way local people conceive nature.

In recent years, documenting traditional ecological knowledge has become a growing concern. Thus, in an ethnoecology study the relationship between humans and their environment is a central concept and this research offers a contribution to this intellectual environment, such as in rural development, health care and conservation [18]. Research on ethnoecology can help to understand the dynamic relations between biodiversity and social and cultural systems as it considers traditional biocultural knowledge [11]. Studley [32] describes environmental knowledge in relation to the ecological dimension and traditional systems of knowledge, which mostly allude to medicinal, technical, and ritual uses of plants, animals, and rocks. Studley [2] concludes that inhabitants bestow names and occupancy of territory, the spiritual, cosmological, and relational aspects to the various presences in an environment. Ethnoecology according to Hardesty [8:291] is a study of systems of knowledge developed by a given culture to classify objects, activities, and events in its universe. Ethnoecological knowledge is therefore linked to a specific place, culture and society, because it is dynamic in nature and it belongs to groups of people who live in close contacts with natural systems. It demonstrates contrast with "modern" or "Western formal scientific" knowledge [35]. Contemporary use of traditional biocultural knowledge is considered relevant in traditional resource management and land use planning in Indonesia.

2. OBJECTIVES / METHODOLOGY / SCOPE

In this paper the value of ethnoecological knowledge of the Minahasans is examined to reposition their ethno-science in Indonesian environmental planning schemes, by viewing ancient cultures and social, economic, environmental and spiritual systems as interdependent. This approach thereupon can make a valuable contribution to better understanding landscapes as to their incorporation into regional development.

This research was conducted in Indonesia in the Minahasa Region, North Sulawesi Province. Minahasa is a region on the north-eastern peninsula of the Sulawesi Island (formerly called Celebes Island). It's inhabitants are called 'Suku Minahasa' or the Minahasa Ethnic group [7, 36, 37]. The Minahasa has a significant cultural inheritance being currently researched for scientific and educational purposes. However, little research on the Minahasan cultural landscape, ecological landscapes or either Indigenous architecture.

Bibliographic survey and field research were primarily done relevant to socio-economic and cultural aspects of Minahasa region inhabitants.

This research was qualitative study-based, and involved observing and collecting data and exploring the bodies of knowledge relevant to local traditions and wisdoms on the management of the Minahasan landscapes. Multi-methods were used against the framing of cultural landscape dimensions, and included participant phenomenon observation, in-depth interviews, group discussions and survey strategies. An ethnographic approach was used to analyze and compare local knowledge and land-relationships developed by Minahasan people to curate their unique characteristics as well as ensuring adoption their cultural, social and economic values. This study relied on survey research methods, key informant field interviews, and examination of environmental variables such as varieties of crops and plants. Primary data collection has been taken during the 3 months fieldwork in April-June 2011 and 3 weeks in July 2012. Data collection methods included interview, and participant phenomenon observation of which the latter was based upon observing human-land interactions, such as planting or home-gardening management. The researcher was involved as a participant observer. Other collection method that has been used is ethnoecological inventory or field interview, which consists of walking in the field or in the landscape with an informant, listens, asking the activities and taking notes [37].

Data was collected in 16 different places located in the greater Minahasa region. The site selection-criteria was based upon bio-cultural characteristic. To seek variability between people and nature, the researcher invited participant individuals living in settlements located in three landscape types (adjacent to mountainsides and forests, adjacent to catchment area, and adjacent to the lake) that offer a diversity of features. Qualitative data was obtained during the first fieldwork sessions. An in-depth interview and group discussions was applied to 265 respondents, that were selected using purposive sampling and snowball techniques [34]. Interviews were divided into different classifications of elderly (142 respondents), head of

village (13 respondents), cultural subjects (22 respondents) and youth (7 respondents). Consistent interview questions were applied to all respondents and key informants to gain local knowledge, perceptions, connections and interactions with the landscapes and places. In examining ethnoecological information, interview questions were also applied to 133 farmers. During the interviews, the researcher used semi-structured and unstructured interviews as well as open-ended questions to allow respondents to express responses and answers [31]. Four factors that are considered important in establishing the trustworthiness of findings are credibility, transferability, dependability, and confirmability [5]. In contrast to phenomenology, grounded theory, ethnographic, or narrative studies that are based upon specific methodological frameworks can emerge from distinctive disciplinary traditions [5].

In transferring data into research results, various methods are attained to make it understandable. The processes of the analysis started with the transcription, description and inscription documentary data, interview and field notes. This paper profounds the ethnoecological knowledge values of Minahasans from four aspects: (1) traditional Biocultural knowledge, (2) Ethnobotanical knowledge, (3) Ecology and sustainability, and (4) Water resources: water holes or spring waters.
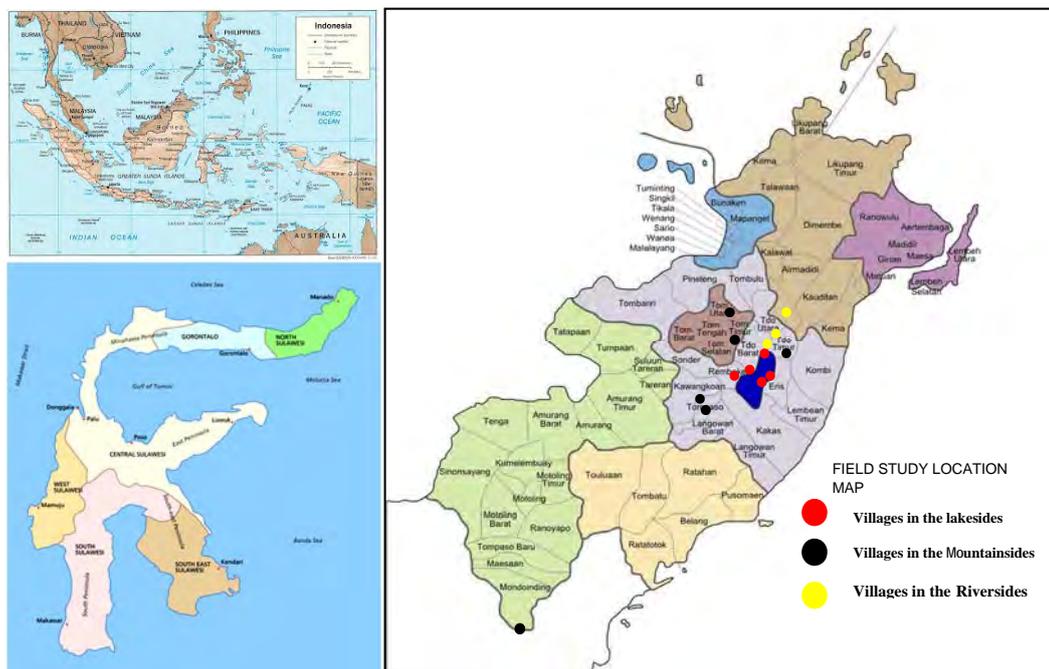
Figure .1 The field study locations and the selected villages: Central Minahasa Regency, North Minahasa Regency; South Minahasa Regency and Tomohon Municipalilty. (Source: www.minahasa.net ; Author modification)

3   RESULTS
The Context of Minahasa: People and Their Environment
The Minahasa regency, and its associated cities of Manado, Tomohon and Bitung, is distinguished by two lowland areas encompassing the northwest to the southeast side of the Sulawesi Island peninsula. These lowlands divide Minahasa into four parts (Figure 1), with the Central Minahasa as its historical heartland. The region presents an interesting case study to this current discussion. The region has a patchy landscape and environment consisting of mountainous and hilly terrain, dominated by an agricultural landscape and a lake ecosystem in the heartland [2, 36, 37]. Specifically, the local ethnic groups, who have inhabited the region for generations, represent one of the oldest regional ethnic groups in Indonesia whom were originally identified during the Portuguese and Dutch colonization and missionaries periods [3, 22, 33].

Historically, the *Minahasa* ethnic groups have been progressively integrated or assimilated into the greater Indonesian population, and after European colonization experienced an extensive Westernization of their socio-cultural systems. Some studies argue that the Minahasans are now a completely Westernized society that is divested of its traditional items [3]. Other studies, about Indonesian culture, claim that the Minahasans

have become less traditional compared to other Indonesian ethnic community groups, resulting in a major adoption of Christianity and the loss of Indigenous cultures in contemporary Minahasa [4, 15, 28, 29].

In a contemporary context, the Minahasan people are today re-engaging with their cultural traditions, with their traditions of life and meaning. Cultural values that links their past with their present and give insights into what their ancestors undertook in the past are rekindling the remaining tangible and intangible Minahasan cultural heritage including their occupation sites or places, where Minahasans continue to live and use the natural resources, and sites that represent substantial natural landscapes (for example, Lake Tondano, rivers and spring water sites, remain burial grounds and sites, and cultural artefacts).

Discussions and debates with the Minahasa community about land involve environmental, socio-cultural, economic, and their history in being able to comprehend the historical and contemporary interplay between their people and their environment [33]. Landscapes studies in the Minahasa region thus can involve multi-diverse local wisdoms, and traditions and this is because while the Minahasan people's worldview has changed overtime their use of their landscape retains their ultimate expression as established in the earliest pre-histories before European colonialization. Over the last few years a massive development has occurred across much of this landscape, aided by Indonesian policy, resulting in many Minahasan people parcelling up their farmland and selling it for development.

The value of Minahasa landscape is accordingly possess now more economic values that cultural and emotional values. This shift prompts many to ask about balance; how can the historic and cultural values of Minahasans be conserved while at the same time allowing the community evolve into the future.

Studies about Indigenous knowledge, both in developed and developing countries, have recently been encouraged peoples to assert the need for the implementation of development plans that yield higher effectiveness and gains towards Indigenous people's acceptance and participation. Such were denied in the past, resulting in the fact that the cultural dimensions of the Minahasa were not integrated into the regional development strategies. There are some records of development failures that were due to ignorance of the cultural potentials and barriers. Such ignorance led to the implementation of development projects which often distorted cultural knowledge and also created an attitude of rejection towards further development planning.

Traditional Biocultural Knowledge
In managing the Minahasan's land and environment, local traditional knowledge is seen as a link to their Indigenous thoughts that converts knowledge of their spiritual insights into sustainable living concepts. The word 'knowledge' is applied to Minahasan Indigenous understandings of nature, interpretation of natural processes, knowledge of resources and so forth. In the following analysis, evidence of the substantive properties of this Indigenous knowledge are applied to Minahasan resource management, in particular agricultural or farming practices, hunting and gathering, and ethnobotanical plant usage.

Evidence of Biocultural knowledge of villages in the three different land environments (lakeside, catchment area and adjacent mountains) show that the Minahasans are continuing to exploit their natural resources according to their cultural rules. Through biological adaptation and adoption of local knowledge derived from their ancestors, the Minahasans continue to use the landscape and the forest in sustainable ways. What is considered as spirit of the land is reflected through the lessons learned from Minahasan's traditional agricultural practices, thoughts, and from their mediation of different cultures (traditional and modern) based upon self-experience. The knowledge of the Minahasans has been gained through in-depth interviews with farmers and elders in the case study area are presented in this paper as examples.

Villages adjacent to the Lake, for examples in Pelelo'an, traditional farmers apply the 'plant and hire system'. In managing land cultivation, based upon their local knowledge, include; (1) *Reka*-clean and plough the soil, to make *'lare'* or bed lines for planting seeds; (2) *Kumakas*-first ploughing after seedling in two to three weeks and applying fertilizers; (3) *Lumu*-adding some soil to the plants; (4) *Kumarua*- second fertilizing after one month and a week; (5) *Panen*-harvesting the crops. Farmers continue to use this method despite the fact that modern agriculture may offer different and more innovative methods [37].

The majority of the Pulutan community rely on exploiting "land" that contains clay at upper layer structure (5-10 m) that can be found around the village environment to make ceramics or other types of objects. The Pulutan community believe that the clay will be recycled naturally in 10-12 years (they consider that the soil is "growing" or continually available). The soil is then called *Ka'anak.* The Pulutan community manage their production in traditional and semi-traditional ways. The respondents inherited the tradition of ceramic making from their families, and also have their own knowledge and experience, ranging from 10 to 45 years. The traditional knowledge and the general steps of practice are described in Figure 3a and 3b [37].

First • the clay is taken from certain plantation areas or *kobong* in the hills. The soil clay is dug around 2 X 2 m for each site to make about 100 lumps of clay or *"me'me".*

Second • the grinding process: the lump of clay will be ground to make it smooth.

Third • the manufacturing process: the main resource is soil clay and the community use straw and resin torch as adhesive materials. In production, one lump of clay will produce articles or objects based upon personal creativity.

Fourth • the draining process: the articles are placed under the sun for 2-3 days (depending on the weather).

Fifth • the combustion process: placing the articles in a combustion construction called *"Porno".*

Sixth • the brushing process: adding adhesive material, such as resin torch or *damar,* when the articles still hot after the combustion process.

Seventh • the finishing processes: painting, ornamentation and engraving the surface.

(1) Lump of clay or *Me'me*

Grinding and smoothing the clay

(3)Traditional tools called *Wuwuwu, Kukure, Sesepe, Lalanei, To'toto* and *Loto* to produce ceramics such as *kana, kure, porno*/kitchen appliance and flower pot.

(4) Production process using traditional skill and tools

(5) Production process using Semi-traditional tool called *putaran*

(6)Examples of ceramic production using traditional tools

(7) Draining the ceramics under the sun

(8) Combustion process using *"Porno"*

(9) Finishing process

(10) Examples of final ceramic product with different creative expressions

Figure 3a and 3b: The Process of Using Natural Resource - Clay in Pulutan Village
(Observations made on 27th May and 28th May 2011)

Traditional environmental knowledge was identified in the three villages that have riverside settings, which indicates that this has been derived by hereditary means, as detailed in the summation below:

In Lininga'an and Kembuan Villages, research on traditional environmental knowledge amongst the community was obtained from farmers who have sustained their production for over 10 years. Farmers possess private land but also work on other owners' lands, which is called the *Tumoyo* system. In the 1960s the *Tumoyo* system was equally divided between both the farmers and land owners until the agreement was changed in the 1990s, whereby ⅓ of the harvest is for land owner and ⅔ for the farmer. Traditional farmers apply the "*Sawah Tadah Hujan*" which is almost totally reliant on water. Beside the main task of farming, the community also works in *ladang,* or dry lands, planting subsistence crops. Based upon these farmers' traditional methods, agriculture lands are sustainably conserved by their Indigenous traditions, while at the same time continuing the plant production chain in the area. Previously, in the 1960s the farming system utilised human labour to work cooperatively and mutually through the *mapalus* and *mawenangan* traditions. In *mapalus*, a group consisting of 30 to 40 people had a manager to lead them, whilst in the *mawenangan* tradition the group consisted of 9 to 10 people without a manager.

All people involved in *mapalus* or *mawenangan* had an obligation to contribute to the efficacy of collective agriculture by working on the land [37]. Thus, farmers in Lininga'an have maintained their traditional methods in order to continue agricultural production. Land management of Lininga'an farmers and their experiences in managing crops demonstrates that their agricultural tradition has been kept coherent over a long period of time. Farmers interviewed identified changing weather, technology, and Tondano City development encroachment as factors that have heavily affected their land cultivation activities.

On another issue, Lininga'an is being slowly converted to an urban area and the community is continuously impacted upon by development plans, particularly land conversion. Conversion of vacant or abandoned agricultural lands into housing areas is a threat to these farmers and to agricultural sustainability overall. Hence, it is important to ponder the role of Minahasan agricultural lands, in which the continuation of traditional ecological knowledge of the community is maintained, and also the potential loss of both land and tradition to comparatively unproductive uses [37].

Farmers in Tanggari villages applied intercropping system, mainly planting paddy coinciding with corn, pepper and red spring onion. Farmers of Tanggari do not use modern tools due to the landscape condition – one example of these planting practices was gained from respondents experience as farmer. The planting processes in the Tanggari nomenclature are as follows: (1) *Tumanem* -the beginning of planting period, (2) *Iwuri* -clearing the land and adding more soil to the plant, (3) *Iwuri kedua*-after one week planting to avoid weedy grasses, (4) *Kumoat* -remove grasses after two months, (5) waiting period/monitoring, (6) *Tumudu or Mengupu* – harvest period. In *Tumudu* or *Mangupu* period, farmers have a technique in picking plants or paddy called *Rantal*. However, if the crops are in great quantities farmers will practice *Tumudu* (5 to 6 people are working together) or *Mapalus* (more than 10 people in a group). Farmers also apply traditional land treatments in planting corn. After land clearance and the making of terraces, farmers start planting the seeds in holes ranging from 25 to 30 cm. In 2 weeks, in *Kumalipo'po* period when the leaves start to grow, they perform *Kumiskis*, and after another 2 weeks or 1 month in the *Keweruan* period when the plants start to flower, they perform *Kumedua*. This treatment regime aims to loosen the soil (using a hoe). Some farmers do not use fertilizers as the soil is abundantly fertile, which means that plants can easily grow. However, other farmers use fertilizers to stimulate plant growth. Farmers who undertake land cultivation over 5 hectares have alternatives to developing their land by planting other trees. This method continues to be practiced amongst Indigenous farmers [37].

In comparison, the evidence of farming traditional practices of the villages in the mountainside settings have been documented in six villages. Rurukan, Makalonsouw, Tumaratas, Kinilow, Village community undertake traditional land management in dryland cultivation areas, with mainly seasonal plants. Rurukan farmers apply traditional land management including an intercropping system and planting rhythms; for example, within one year farmers harvest the crop twice and with the third opportunity they plant another type of plant using traditional farming processes involving land clearance, terracing and making plant beds, planting seeds, *kumerker* period to remove weedy plants or grasses, *rumo'ro* period to re-adjust the distance between the plants and remove the excess plants and weeds, cleaning the space between plant beds, fertilizing (depending on the fertile), and a waiting period to harvest in 2-3.5 months. Rurukan farmers have a tradition of managing agricultural production, particularly in hiring labourers known as *Marawis*. *Marawis* is similar to the *Mapalus* tradition in the aspect of cooperation work, however, it is done only by women and they get paid. In *Marawis*, the women workers remove the weedy grasses and clean the *bedeng* (planting beds), and this farming period is called *Kumerker*. Those original farmers in the community who work on their own land also work with other land owners, particularly in the period of waiting for the harvest to sustain life. Rurukan traditional farmers use the moon calendar in managing their crop [37].

The community in Pinabéténgan Village applies horticultural plants that thrive in this environment, mainly for subsistence farming, but also for production purposes. They also use an intercropping system. Some farmers apply their own land cultivation regimes comprising both *sawah* (wetlands) and *kobong* (drylands). Others merely work with another land owner (*tumoyo or toyo* system) or hire and manage land cultivation. Pinabéténgan traditional farmers in the majority measure their land with *tek-tek* and *waleleng*, while some others use the hectare measurement. The majority of farmers work on land sizes ranging between ½-3 *tek-tek* (about 1,750 m²-10,500 m²). All *paddy* farmers start the farming process with *koloko* or seeding. Following three weeks of the *koloko* process, farmers continue with the *tempang* process, or cultivating the land before planting the seeds. After conducting the *tempang* process, farmers plant seeds, with a preference towards the local *paddy*. Commonly, farmers add more fertilizers around 2-3 times over 2-3 weeks and the next process, called *Abut,* involves removing weedy plants. Farmers also use liquid pesticides to combat plant diseases while waiting for the harvest period. In the farming process, the wisdom and tradition from the Elders using the moon cycle phenomenon in determining the planting period and treatment or nursery are applied [37].

Ethnobotanical Knowledge
Traditional ethnobotanical knowledge in the Minahasan community has long been used to sustain life since pre-colonial times in this region. Plants are not only used for food, but also in medicinal, house construction, ritual and other cultural uses [20]. Plants in Minahasa have been researched and written about in reports and books by researchers from outside the region and by locals. In order to conserve the role of plants in the Minahasan living practices and to maintain their use in cultural and historical practices, a re-identification of plants connected to the community's extant traditional knowledge is needed [37].

The categories employed in this research were as follows: Medicinal curative plants; Rites and Ceremonies – specific plants for cultural events; Technology – plants for making tools or utensils; Firewood – dead woods to burn for specific purposes; Edible – including cultivated vegetables and fruits; and Miscellaneous – other functions in any of the above. Minahasan's botanical knowledge that involves the use of plants for traditional healing purposes is still being practiced today. In Minahasan culture, the ability to heal people is called "*se mangelot*" [6], and this knowledge has been inherited from their ancestors. Minahasan's belief system and myths are connected to the need to treat illnesses and to provide therapy, as they believe in the God *Empung* and the myths of "*Opo-Opo*" (the spirit of ancestors), the belief of *bad spirits or force spirits* and the belief of the existence of human spirit souls [21].

Information was gathered from respondents who have knowledge of curative plants. Interviews and field observations were undertaken in the community. Respondents with backgrounds as traditional healers or *dukun* (also called *tona'as, tonaas wadian*"), *biang*, and Elders select plants for therapy or healing based upon the causes: (1) Common illness (i.e. fever, flu, injury), (2) Bad vapour or bad wind of the earth, (3) Improper care of one's-self, (4) Black magic, and (5) Human execution by witchcraft or "*Opo-Opo*" (*guna-guna*). Some plant materials presented in this research have well-identified plant taxonomy but several do not. Thus, it is anticipated that further taxonomic research in this area is necessary.

Rites and procedures of Minahasans in traditional healing and therapy can be compared with other Indigenous communities in other regions, but can also be used as a cultural reference for tracing interactions between people and their environment. Evidence of some significant ethnobotanical knowledge and traditions in the case study areas, which have the potential to be maintained, are the use of local plants for medicinal purposes, which was obtained from 144 respondents in 16 urban-rural areas in the highlands of Minahasa. The medical ethnobotanical survey data represents plant species which are purported to have some medicinal value. The varied distribution of these species reflects the great ecological diversity of the inland area of the region. Many plants occur as restricted endemics, while other plant species are more widespread not only in their geographic distribution but also in their patterns of use in traditional healing. This study indicates that the Minahasan's are known to treat particular health conditions. Almost all medicinal plant species used by the Minahasan's are employed to treat several health conditions using alternative treatments. These findings led the researcher to wonder if those species with high usage might also demonstrate lexical similarities or variations in nomenclature across the Minahasan community in general.

The Minahasan people also use plants for ceremonial purposes. Minahasans recognize several local plants that are associated with their cultural practices, particularly in conducting monthly and annual ceremonials at Pinabéténgan Village. Long before colonization, plants played an important role in particular rites to *Opo Empung* [27, 29]. Pre-colonial Minahasan people practiced sedentary agrarian culture. Research about ethnobotany for cultural materials in the case study areas evidenced several significant plants that Minahasans use in several ceremonies and rites: (1) *Mangalei* of a group or individual (plea for blessings from *Opo Wailan wangko* (God Almighty) and plea for a *sombar* or heirlooms for self-protection and healing, such as medicinal plant materials, which are given through a medium or a trance); (2) Ceremonial events, such as annual cultural celeberations; (3) Rite of thanksgiving, which mostly occurs at the *Watu Pinawetengan* (a historical division stone) place. Figures below list the plant materials used in these rites and ceremonies.Each Minahasan sub-ethnic group possesses similar plant materials for their rituals. However, their use depends upon availability in the area. Commonly, in preparing plant materials, the Minahasans (mainly ethnic leader called *tona'as* and healers) use odd numbers of 1, 3 or 9 portions of each material.

Tawa'ang Keles (*Coryline terminales* Kunth) and bamboo *(Bambusa* sp.*)* for: (1) ceremonial and (2) rite
(Photographs taken at *Watu Pinawetengan* on 17th June 2011 and 7 July 2013 (Source: the Author)

Tawa'ang and *karimenga rundang/rangdang* are the most popular plants in all rituals. Andriani and Kruijt [1-II:35, 1-III:162] mentioned *tawa'ang* as a magic plants "*par excellence*" in Sulawesi and described it in a healing ritual context. Palm [23:222] wrote about this particular plant being common in East Asia and Oceania, which was associated with blood, vitality and a rejection of demonic spirits, and is also used in other Indigenous communities in Indonesia because of its symbolic meanings and purposes – for example in Mentawai it is called *sago* (calling) and in Batak Karo it is called *simbera bayak,* or wealth prospect [26:145].

The Minahasans also use plants taken from the forests around their living place. The Minahasans collect part of plants such as the logs, bark, wood or timber to build houses. Plants, such as *tawa'ang,* have a significant role in a rite that precedes colonization. Minahasans have a particular nomenclature of plants involved in house construction. Data on plants was recorded from interview respondents in the case study areas, for example *Wasian -Michelia celebica, Walantakan-Diospyrus ebenum, Nantu - Sapotacede* sp. *Celebensis, Ares - Dipeo carpaceae,* Sea *-Morinda bracteata, Akel* or *Seho - Arenga sacchrariferum,* and so forth. The Minahasan people have used trees for other purposes, such as using the *damar* (*Agathis dammara*), *saketa* (*Jatropha curcas*) and *wiouw* (*Aleurites moluccana*) for emergency lighting. *Tawa'ang* is also a particular plant associated with customary law or related to land division matters. A private land allotment in a family is called *tana pasini* and each family member of family has a right, known as *hak lilikur,* to own a piece of land; this is an unwritten law that is acknowledged by local and regional governments today. Mostly, *tana pasini* is cultivated land and may also be known as *kobong* and/or a heritage land (*kintal*) where a family clan lives. *Tawa'ang* (mostly *tawa'ang keles*) is used to divide the land boundary or *sipat* (*sipat* means border). Through a ritual *adat, tawa'ang* is planted by the village leader and Elders. In some cases, in other villages, the two parties who own the parcel of land will plant the *tawa'ang*. Plants such as *Saketa* and *Bori/Wori* wood (*Ormocacarpum glabrum*) are used alternatively by the community in marking private land borders or parcels.

Ecology and Sustainability
In the Minahasan Indigenous way of life, biodiversity is a substantial influencer for all resource use that supports the existence of their life as well as the sustainability of the ecology of the region. Biodiversity is identified through the presence of totemic species and their habitats, fruit and flowers having regard to the seasonal calendar and weather. Minahasan ancestors before colonization understood comprehensively the everyday weather phenomenon and annual weather patterns. Undoubtedly, these ancestors (*Opo-Opo*) linked up or correlated these natural phenomena to their rites and activities. For example, in the past the Minahasan ancestors had a precolonization narrative connected with agriculture that was interpreted, manifested and re-communicated in the traditional dance *maengket* [22].

In determining weather and climate Minahasans use a seasonal calendar. In the past, the Minahasans used the seasonal calendar to guide and inform agricultural practices, particularly planting, cultivation or harvest seasons. When weather was constant it could be predicted by learning the cycle of these seasons. The Minahasans, in particular farmers, used the seasonal calendar to manage their crops and production. Climate and weather are significantly changing and are currently unpredictable in the region. The pattern of weather (including wind direction) in the past was used in land division-making in a village. The Minahasans divided the land into Timu = north, Amian = east, Talikuran = south and Sendangan = west. The Minahasans base their responses and judgements on ecological thought. Contemporary climate change has changed the way Minahasans manage their natural resources. The locals are concerned about conserving the land, water and

forest, and in particular the sustainability of the Lake. They recognize that the surrounds of the Lake possess many springs that are significant to maintaining the ecology of the Lake and its environment. Thus, Minahasans exploit the Lake wisely. This can be witnessed when people fish in the Lake using traditional ways and never use any harmful tools like explosive materials for larger benefit. In this way, they believe they are acting in a responsible manner for future generations.

Water holes or spring waters are deemed have a significant role in ecology and sustainability in the Minahasa region. The Minahasa region is rich in water holes because its patchy landscape mosaic of dense forest trees store abundant ground waters and water flows. As a significant component in the landscape, water holes or spring waters have a link to the Minahasans both spiritually and physically. In general, Minahasans use spring waters for their daily living. Spring waters also engage with the community in their belief systems. Some Minahasans believe certain spring waters can bring healing, such as water holes *Rano Kasuruan* (*Air Allah*) at Pinabéténgan, *Rano ni Empung* at Mt Empung and *Teneman* in Makalonsow; the community claim these to be "holy water". The Minahasans use these water holes for health benefits and healing purposes. This study sought to comprehend the role of water holes in Minahasan life and their perceptions of the places that contain this valuable resource through the interviews and observations in 16 villages as case studies.

Overall analysis of this ethnoecology study demonstrates that the Minahasan people make extensive use of the biodiversity of both forests and other natural resources for subsistence purposes. There is evidence of conscious application of ethnoecological knowledge. There is also evidence of utilitarian factors that are encoded in the Minahasan biological lexicon, in which the treatment of several categories of non-cultivated plants and animals is atypical. This overall subsistence application is dominated by agriculture; however, the employment of ethnoecological knowledge in these fields of activity was not extended further in this study. The possibility that agriculture (to complement hunting) is having impacts upon the forest ecosystem, the emergent properties of an agroforestry ecosystem and regime, and the regulation of human exploitation of natural resources as a result of symbolically-encoded restrictions on subsistence activities are interesting to be discussed.

4 DISCUSSION AND CONCLUSION
The Challenge for Indonesian Environmental Planning System
The discussion gives an overview on how ethnoecological knowledge can be sounded in environmental planning system, as there have been a lot of recent debate and research about issues pertinent to an ethnic community in Indonesia, including *Minahasan* people. While this is not the first research inquiry about this people, the majority of this research to date has been concentrated on socio-cultural and environmental issues. In this kind of research, ideas, beliefs and theories about the social world as what social sciences are based upon are applied into practical realities of human environment in cultural landscape realm. Therefore, communities' ethnology should be utilized in any planning and development that concerns their living environment in order to conserve their living culture and natural resources.

The discussion summarizes and provides description and understanding on past cultural attributes to the present and the positive roles of local knowledge of Minahasans and the important of ethnoecological information in informing environmental planning and management. This research finding recommends and assists Minahasans to continue their traditional knowledge and build their positive roles, subject to their strong connection to the Minahasa land as their "home land", as for recognition to self-identity and in maintaining the local traditions and its values. Moreover, the value of traditional biocultural knowledge of the Minahasans reflects their relationship to the current environment characteristics. The ethnoecological knowledge is more attuned to the Minahasan's living quality than Western or Indonesian generic concepts.

From a holistic perspective, ethnoecological knowledge benefits the locals and could be recommended for integration into local/state (and potentially national) place and environmental planning initiatives both in schemes and plans (rural or urban). The challenge is, increased population and development through modern and global influences in the Minahasa region will continue and will occupy more landscape spaces around and within Minahasan living places. These influences lead to landscape change and threaten to bring about the disappearance of local traditions amongst the community. Therefore, conserving the Minahasan landscape and their traditional ethnoecological knowledge are crucial for the Minahasans to sustain their land and environment.

This research recommends Indonesian government in terms of reaching sustainable Natural Resource Development, which the opportunity of ethnoecological knowledge may help to achieve a sustainable development in which many species have been cultivated and used in a sustainable way for thousands of years. The skills and techniques of these indigenous and local communities provide valuable information to the global community and can be a useful model for environmental policies. The international community has recognized this close and traditional dependence of the indigenous and local communities on biological resources in the preamble, and more concretely. There is a growing international awareness of the links between cultural diversity and natural diversity, and the vulnerability of both outside processes.

5 ACKNOWLEDGEMENTS

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THE ROLE OF TRADITIONAL REGULATION IN THE INDIGENOUS VILLAGES FOR CONSERVATION OF VILLAGE PATTERN

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ABSTRACT

Balinese traditional architecture is a significant treasure which has been inherited to the Balinese descendants. Scholars over the last 50 years have identified this statement, pointing to the unique and distinctiveness of Balinese culture and its associated architecture. Their research documents Balinese architecture and culture of the past and how Balinese architecture has been affected by development pressures in Bali, and in the Indonesian nation as a whole. This knowledge can understood through their research that documents how the Balinese people interact with their society, to their spiritual realm and with their environment, and to their God which is integral to their philosophy of *Tri Hita Karana* which is their universal discourse. This historical relationship has ensured that Bali Island has become a major tourism destination and is considered one the most beautiful places on Earth, both of which result in increasing pressures upon Bali that directly affect the nature and quality of Balinese life.

Bali does under threat by globalization and digital technology dissemination. These agencies of change are spreading over the world and do have a direct affect upon people‟s living whether positive or negative. In order to conserve the heritage of the Balinese vernacular landscape given this context, this paper considers the role of traditional Balinese regulations in seeking to keep green the integrity of village‟s pattern in Balinese Indigenous villages. Through observations, interviews and mappings, the research has sought to explore how the Balinese Indigenous community could maintain and conserve their vernacular landscapes through the implementation of the *Tri Hita Karana* concept in their daily and religious activities. Fieldwork in the Indigenous villages found that many traditional rules have been important in preserving their cultural landscape. The research project recommendations offer strategies for the Bali government to better maintain and conserve this important component of Balinese heritage, as well as strategies forward to guide decision processes to ensure the conservation of this traditional architecture.

Key Words: *Tri Hita Karana* Concept, indigenous villages, village pattern, traditional regulation

1. INTRODUCTION

Bali is well recognized as an island that has kept its native landscapes and its unique culture. Geographically, Bali is one of several islands in Indonesia and is located between Java Island in the west and Lombok Island in the east. The mainland of Bali is surrounded by 5 smaller islands including Nusa Dua, Nusa Ceningan, Nusa Lembongan, Serangan and Menjangan islands. Bali covers an area of 5,636.66 km². Bali consists of 9 administrative regions (8 regencies and 1 municipality), 51 districts, 579 villages, and 3,945 traditional *banjar* (hamlets) and these are populated by 3,522,375 inhabitants with a population density of 625 inhabitants per km² in 2010[1].

The Balinese landscape is characterized by its well- known vernacular landscape and its historical *subak* irrigation system – „Cultural Landscape of Bali Province: the *Subak* System as a Manifestation of the *Tri Hita Karana* Philosophy‟ - which was inscribed by UNESCO on its World Heritage list in 2010[2]. This cultural landscape of Bali consists of five rice terraces and their water temples that cover 19,500 ha. The temples are the focus of a co-operative water management system of canals and weirs, known as *subak*

that dates back to the 9th Century. Most Indigenous villages historically adopted the *subak* system in their agriculture as a manifestation of the *Tri Hita Karana* philosophy.

The philosophy implies how Balinese society keeps balance and harmony to their Gods, human beings, and the natural environment. Indigenous Balinese village still possess their original culture which was not affected by the influence of the Majapahit Kingdom. Most Balinese Indigenous villages are scattered in the north, the east and in the middle of Bali island. When the Majapahit Period occurred, the original Balinese people called *Bali Aga* or *Bali Mula* or *Bali Kuna* shifted to live in the isolated and secluded mountains areas and hill areas of Bali Island [3]. These Indigenous Balinese people still conserve their traditional rules and customs including maintaining vernacular landscapes. This research focuses upon the question about how do *Bali Aga* village efforts and practices in daily life maintain and conserve the vernacular landscape that surrounds the village. This research offers strategies for Balinese local government to better conserve the Balinese landscape and to encourage the Balinese people to continue to implement the values implicit in the Balinese cultural landscape that helps to conserve its traditional architecture.

2.   OBJECTIVES, METHODOLOGY AND SCOPE
This paper summarises an investigation of the traditional regulations applied in the landscape through its Indigenous villages and to consider the opportunities these traditions and patterns might offer to improve the quality of village pattern. Further, it will discuss some of the Indigenous villages in Bali Province that have been involved in the efforts to increase the village pattern. These villages include Tenganan Village, Penglipuran Village and Jatiluwih Village that are representative of this greener heritage. Nevertheless the Indigenous villages in Bali Province commonly have specific and unique regulations for the maintenance of their customary villages and environment.

An extensive literature review was undertaken to understand the existence of Indigenous villages and to obtain a robust understanding the Balinese cultural principles and practices, imbued by Hindu religion, that have been incorporated into Balinese traditions and architecture. The observational field work was undertaken in 24 Indigenous villages in Bali Province. Data collection included both tangible and intangible including the socio-culture, traditions, norms and the physical environment of the villages related to architecture. Interviews were also conducted to obtain foundational information regarding village conditions and traditions which contribute to the village"s collective and individual architecture. The interviews sought to ascertain the consciousness of village for the regulation in conserving and maintaining traditional architecture and how this relates to village spatial layout patterns.

3.   RESULTS
Balinese Philosophy of the *Tri Hita Karana*
The philosophy of the *Tri Hita Karana* of Balinese culture development has been re-formulated by the Local Government of Bali (1994:17-19). The Balinese philosophy of *Tri Hita Karana* is now internationally known as the concept that determines all Balinese people"s lives. The concept involves a relationship between people to their Gods, human beings and their environment. The Balinese envisage three causes of prosperity; wealth, safety and happiness. These rotate around *Ida Sang Hyang Widhi Wasa*/God as a creator, preserver, and destroyer. So wherever they go, whatever they do, God is always placed. The relationship of people to human beings can be seen through the Balinese communal organisation (*desa pakraman*.), that embodies the togetherness principle of *Tatwam Asi* (you are me) and the *sepi ing pamrih* concept (dedication without reward) as an implementation of Hindu beliefs. The relationship between people to environment explains that place or region, where they were born and live plays an important role in this society including the village borders, and walls surrounding their houses. Briefly, the *Tri Hita Karana* concept is one archetype in understanding why Balinese society has a safety feeling. In this case *Tri Hita Karana* is included in *Parahyangan*/God, in *Pawongan*/activities, and in *Palemahan*/ areas or regions of the environment [4]. The concept results in a balancing of the life of people

that determines how the Balinese interact not only to their fellow creatures but their trust to their God and ancestry, as well as how to keep and maintain their surroundings in sympathy with nature. This relationship was implemented in most of villages in Bali through their customary regulations in each village. Further, the concept also preserves traditions used by people; recently businesses and the tourism industry have sought to be involved in the promotion and adoption of the concept in their activities to keep the balance with environment.

The Implementation of the *Tri Hita Karana* in Balinese Villages

The *Tri Hita Karana* concept involves the microcosms up to the macrocosms. Architecturally, the Balinese people still use traditional measurements of the body of the household leader to measure the dimensions of traditional buildings to live in. This means that the housing or buildings inform the identity of the inhabitant. At the micro-scale, housing divisions comprise three levels of zones that reflect the division of the people"s body such as, head, body and leg which is called the *Tri Angga* Concept. In terms of housing patterns, the head zone has sacred value are is reserved for the family temple; body is the middle zone and is reflected in buildings, and the leg is reflected is the impure zone where places like the kitchen and livestock reside. The next scale is the village. The village is divided into three zones or *mandala*. There is the *utama mandala* (sacred zone) for the village"s temples, the *madya mandala* (middle zone) for settlement and public facility, and the *nista mandala* (impure zone) for cemetery. Finally the regional landscape also comprises three zones. There are mountains (sacred zone), plain area (middle zone) and beach/sea as disposal (impure zone). This concept embodies Balinese beliefs in their traditional life that cannot be separated from the Hindu religion that binding their heritage.

There are around sixty Indigenous villages that have been identified based on previous research (Table 1) which still embrace their traditional customs which is called *awig-awig*. This includes the *ulu apad* system of village governance, and the burial system for deceased cremation. These numbers are calculated based upon a Bali Province inventory in 1988/1989, Muller"s fieldwork in the 1980s and the Bali Regulation No 16/2009. Bali Province documented about 35 Indigenous villages in 7 regencies in Bali [5]. In addition, Muller (2011) observed and photographed approximately 25 of the Indigenous villages which she identified in three locations; there are central mountains, north-east coast, central south and east Bali which mostly lies in the Bangli Regency, the Buleleng Regency, and the Karangasem Regency [6].

Table 1 Numbers of the Indigenous Villages (*Bali Aga*) in Bali Province

No	The Indigenous Villages (*Bali Aga*) in Each Regency in Bali Province								Tot
	Karangasem	Buleleng	Bangli		Gianyar	Klungkung	Badung	Tabanan	
1	Bungaya	Sidetapa	Bayung Gede	Sekardadi	Taro	Tihingan	Sulangai	Tengkudak	
2	Asak	Tigawasa	Pengotan	Puakan	Sebatu	Nyalian	Pelaga	Wongaya Gede	
3	Timbrah	Tua Pedawa	Kayubihi	Catur	Camenggawon, Celuk			Jatiluwih	
4	Tenganan	Tua Cempaga	Penglipuran	Belantih					
5	Bugbug	Gobleg	Kedisan	Blandingan					
6	Ngis	Julah	Songan A	Abangbatudinding					
7	Kesimpar	Sembiran	Songan B	Pinggan					
8	Sibetan	Sudaji	Satra	Batur Utara					
9	Ababi	Les	Pengiangan	Batur Selatan					
10	Seraya	Penuktukan	Yangapi	Batur Tengah					
11	Perasi	Sambirenteng	Sukawana	Kintamani					
12	Padang Kerta	Pacung 1 and Pacung 2	Trunyan	Suter					
13		Bulian	Buahan						
14		Banyuseri	Palaktiying, Landih						
Tot	12	14	26		3	2	2	3	62

Sources: Dinas Pekerjaan Umum Propinsi Bali (1988/1989); Muller (2011).

Historically, each Indigenous village of *Bali Aga* has their own unique history which is mostly written about in the inscription of Serai A II and in inscription in Blanjong, Sanur Village. Most the *Bali Aga* villages were established during the year 882 before the Majapahit Kingdom commenced in Bali. These villages already existed on the plateau areas and along the shores of Lake Batur which is surrounded by protected forest, flanked by hills, rivers, and it has fertile land. Some of the *Bali Aga* villages have dry land such as Seraya Village in the east of Bali. The *subak* irrigation system was mostly adopted in villages such as Wongaya Gede and Jatiluwih villages. *Bali Aga* village inhabitants involve 200 to 2,300 householders whom mostly embrace the Hindu religion. However, in some villages can also be found other religions, i.e. Moslem, Buddha and Christian (Sibetan, Kintamani, Taro, Wongaya Gede and Jatiluwih villages). The villager"s maintain their lifestyle dependency upon agriculture as farmers, and few are fishermen who live on the coast. *Bali Aga* villages has the *ulu apad* system of governance which is headed by Jero Kabayan who use duty is to make the village"s decisions having regard to tradition rules. Administratively *Bali Aga* villages are led by one village leader called *perbekel*[7].

Each village has their own uniqueness of customs and cultures. All villages celebrate the annually ceremony of *Ngusaba Desa* which occurs during the full moon day. The *Ngusaba Desa* involves the worshiping of divinities and ancestors and during the celebration of the *Ngusa Desa* the performance of sacred dances, traditional music, and traditional war theatre will occur as a dedication of their prosperity. The *Ngusaba Desa* is usually held in the *Bale Agung* or village"s temple. Interestingly, another unique cultural tradition that occurs in Pengotan Village involves the tradition of mass wedding. During this event approximately 40 couples" are married. There are also specific rules about the holding of mass weddings through traditional ceremonies. In addition, most villages celebrate two types of *Nyepi* (silent day) that occurs annually in the Balinese traditional calendar called *Sasih Kesanga* (the 9th month). There are *Nyepi Agama* which is required by the Balinese Government and *Nyepi Adat* that is required by the village"s customs.

Other activities which relate to the forms of village traditional landscapes include the funeral system. *Bali Aga* does not use the cremation system of burning corpses as what Balinese people in the south parts of Bali practice. Their cremation is commemorated by a burial system called *biye tanam*. The Trunyan Village is the only village that has a unique cremation system well-known as a „primitive" sky-burial system [8]. Some villages have adopted mass cremations such as Sidetapa, Buahan, Kedisan, Sekardadi, Wongaya Gede, and Jatiluwih villages. *Bali Aga* villages have mostly three to four grave yards for different interments such as for infants, adults, and for inappropriately death people.

Bali Aga villages lie on a linear axis pattern aligned to mountain as the sacred zone to the impure zone of the sea or water bodies like a lake. This directionality is *kaja*/the north faces to the mountain and *kelod*/the south faces to the sea. Penglipuran Village in Bangli Regency has a strong linear pattern called *rurung gede* which is aligned to the north and south [9]. *Bali Aga* villages still preserve their traditional housing which is formed in row of small pavilions in addition to a compound traditional building that creates an open space in the centre called *natah*. Linear pavilions do not have open space as compounds but rather serve as a circulation area. Traditionally, housing contains one unit pavilion owned by one householder. The housing pattern comprises of several rooms in the one unit building; i.e. shrine or holy room, one or two bedrooms, kitchen, and terrace. The building materials are usually brick, wood, tile roofs, and bamboo.

The Element of Balinese Traditional Landscape
The vernacular landscape of Bali spreads from mountain areas down to the hills, and then to the lake, and includes rice terraces of paddy in most villages, a traditional housing pattern, extended downstream to the shores. These type of landscapes can be divided into several types" of traditional open spaces including *natah*, *telajakan*, *lebuh*, temple boundary, *melasti* precinct, *alun-alun* and cemetery or *setra*.

Natah is an indoor open space in a yard with a central orientation, which is formed by compound buildings or shrines and temples. *Telajakan* is an outdoor open space pattern; which is located between traditional fences (*penyengker*) and drainage lines (*jelinjingan*). Usually it is planted traditionally for spiritual and economic functions. *Lebuh* is an outdoor open space that is located in front of traditional main entrances. The traditional temple boundary is an open space surrounding temples to keep the holiness of temples. The *Melasti* precinct is a sacred area along the coast which is used for the *melasti* ceremony (deities' sanctity ceremony) on the day before celebrating the Balinese New Year which called *Nyepi*. This ceremony occurs at *pempatan agung* (traditional cross-road pattern) that are open spaces or *alun-alun* in the main cross roads of village which are used for socio-religious activities, including the *Tawur Kesanga* ceremony. The cemetery or *setra* is the village's burial area and a place for the cremation ceremony (*ngaben*) that takes place in the impure zone of the villages.

The Balinese traditional open space through the *Catuspatha* concept, or *pempatan agung*, can be divided into several types; *karang tuang*, *karang embang* and *karang bengang*[10]. Traditionally, the open space of *karang tuang* is placed in each corner of the cross-road, while *karang embang* are places in the *banjar adat* or hamlet, and *karang bengang* is a wide open space of the city's green belt. However these types of traditional open space in the *Catuspatha* concept are difficult to be found in Denpasar City due to the city's growth that require spaces to fulfil living demands.

4. DISCUSSION

The Indigenous villages have their own traditional regulations that obligate all villagers to *awig-awig*. The *awig-awig* is written commonly to arrange the social culture of village including ceremonies, rights and obligations of villagers. To explore the traditional rules of the Indigenous villages, it has been observed that several villagers enforce the rule's implementation of the *Tri Hita Karana* concept in each village. Indigenous village observed included Penglipuran Village, Jatiluwih Village and Tenganan village which are the most acknowledged village that maintain their village landscape through the implementation of traditional rules in the village and the village society obeys these rules.

Penglipuran Village is located in Bangli Regency. It has a total area of 4.42 km² and is inhabited by 3,632 people. Most of the land use pattern in Penglipuran village comprises dry land (216 ha), plantations (140 ha), settlement (45 ha), cemetery (2 ha), and other functions (39 ha). The village embraces the Hindu Religion and most people are involved in agriculture, trade, industry, services, cattle raising and other jobs [11]. Geographically, Penglipuran village occupies sloping areas (3%) to the south, is located 785 m above the sea level and it has an average 22° C temperature[7]. Jatiluwih Village is located in Tabanan Regency with an area of 22.33 km². It has approximately 2,487 inhabitants and the village embraces the Hindu religion. Most of the villager's work in agriculture, cattle raising, plantations, trade, industry, service, etc. Jatiluwih has sloping topography and edges Batukaru Mountain. Jatiluwih is one of several villages in Bali that implements the *subak* irrigation system and also implements the *Tri Hita Karana* Concept. Tenganan Village is located in east Bali Province, in the Karangasem Regency. It occupies a total area of 9.52 km² and is inhabited by 4,018 people. Geographically, Tenganan Village is located 70 m above sea level with an average temperature of about 28° C. It has rather sloping area of settlement and is surrounded by hills, and the village is located by a ravine and a river [7].

The following discussion considers the implementation of traditional regulations that underpin village efforts and practices about village place conservation. The regulations have significance in keeping and sustaining the Balinese landscape. There are three core rules that apply in Balinese Indigenous villages consisting of the implementation of *natah* and *telajakan* in the housing, preserving the *subak* irrigation system, and maintaining tropical rain forest.

Traditional Open Space of *Natah* and *Telajakan* Preservation
In the Balinese traditional architecture, traditional housing is called *umah* and is comprised of several building that are surrounded by traditional fencing creating one space in the centre called *natah* or plaza. Philosophically, *natah* is developed through Balinese traditional architecture and is imbued by the *Tri Hita Karana* concept; relationships between humans to the God/*Parahyangan*; relationships between humans to wellbeing/*pawongan*; and relationships between humans to environment/palemahan. *Natah*'s position is based upon a religion axis (north-south). *Natah* has its functions centrally orientated in buildings, determines the circulation for all buildings, determines guest space(s) with temporary roof during ceremonies, and also for drying crops such as rice. The *natah* in Balinese traditional housing is formed by decision processes for building layout [12] which is based upon traditional measurements of the household head. Philosophically, *natah* has significant meaning in terms of a companionship connection between *akasa* (sky) which has *purusa* (male character) and *pertiwi* (earth) which has *pradana* (female character).

The *telajakan* is placed along the road between housing fences and drainage lines. The *telajakan* area is provided by householders so that they will be responsible to the maintenance of *telajakan*. This will bring greater value for the settlement planning especially in the city which land is now getting more expensive in price. Traditionally, the dimensions of *telajakan* involve the width of a chicken cage and foot's width. It is approximately 1m or can be called traditionally 1 *depa agung* (an arm span of householder). The width of *telajakan* can be measured by a bundle of rice, and it is about 2.20m. The existence of *telajakan* is appointed in Bali Regulation No. 10/1999; it is also implicated in the Spatial Planning of Denpasar City. The width of *telajakan* can be determined by the minimum of road width "its 0.5m in pathway (6m) to 2.0m in main road" (18m).

The maintenance of traditional open space is a basic rule of traditional Balinese architecture. It can be seen in the Penglipuran Village with its strong linear axis pattern which is decorated by *telajakan* in outdoor open spaces, and the *lebuh* in front of the main entrance. Inside the housing yards, villagers in Penglipuran Village still provide the *natah* as an open space of orientation of buildings. Penglipuran Village is strongly preserves their traditional elements of landscape. Penglipuran Village as one of several tourism destinations in Bangli Regency and is well known for its linear axis village pattern. The axis is the main core of the village through which can be seen natural and green scenery that keeps the connectivity to the traditional landscape. It looks uniform along the main road, on both sides with both offering views to plantations to the observer enabling the passage of fresh air in the village. The *natah* of indoor green open space also is well maintained in each house and in the orientation of all buildings in the traditional housing.

Figure 1: *Natah* as an orientation of buildings in the housing unit of Penglipuran Village.
Source: Author, 2012.

Figure 2: the existence of *telajakan* in the Penglipuran Village.
Source: Author, 2012.

Preserving of the *Subak* Irrigation System
The village landscape can be divided into three zones involving the sacred zone, the middle zone and the impure zone. This configuration underpins the establishment of the irrigation system of *subak*, which involve a managerial and technical system of water distribution by *subak* organization, crops, and traditionally farming started and finished throughout traditional ceremonies from planting seeds till harvest. The *karang bengang* as green belt of the village is represented by rice terraces in the *subak* irrigation system. The Jatiluwih village is one of Indigenous village in Tabanan Regency that has ensured that the traditional rule is still preserved. The Jatiluwih, with its highly-photographed rice field terraces, is included in the „Cultural Landscape of Bali Province" world heritage listing because of its adherence to the *Tri Hita Karana* concept.

Figure 3 and 4: The rice terrace in the Jatiluwih Village as an implementation of *Tri Hita Karana* Concept. Source: Author, 2012 and 2013.

The *subak* irrigation system is a manifestation of the *Tri Hita Karana* concept and has been extensively discussed by Jusna (2012) where he concludes that complex ceremonies enclose every phase of the rice plant growth [13]. Activities begin with a meeting of the *subak* members, and then continue with the cultivation until the harvesting all followed by ritual ceremonies which pay respect to the *Dewi Sri* as the goddess of fecundity.

The *subak* system shows how villagers work and manage to co-operate between others in order to water their rice fields with water that comes from the mountains and then flows to their agricultural activities through dams, channels and tunnels that are organised by the *subak* system. Villagers commemorate ceremonies from cultivation to crop harvesting to demonstrate their respect and thanks to their God that offers them the sustenance of life. This relationship is embodied in the existence of *subak* temples in the fenceless centre of the rice fields or in secret nooks under trees [14].

Maintaining of the Tropical Rain Forest
The Tenganan Village is surrounded by tropical rain forest upon which most villager‛s depend for their livelihood derived from plantations and farming. Tenganan Village manages customary land which includes lands, forests, crops that belong to the village. Krause (1988) states the villages manage their lands based upon the villager‛s demands of life. The villages believe that land does not belong to them but is God‛s possession. The villager is convinced that "the earth belongs to the Gods". The villager believes in the "*Wong desa angertanin gumin Ida Betara*" belief that they can only manage the land, and that the land belongs to the divinities. A farmer can continue to plant and harvest the land which has been planted. If he cannot do planting anymore, he has to turn in it over to the village. During planting, the farmer has

to offer respect through some of his harvest as his "*upeti*" or lease to the God's which is paid to the village treasury.

Tenganan Village has a unique regulation that is obeyed by villagers to maintain the village's forest or hills. To maintain the tropical rain forest and environment conservation, each village has different rules to arrange their forest, hills, farms, plantations, etc. Tenganan Village has a rule that no one can cut down trees. Under this rule, a tree's life belongs to the village. The village delegates three people to examine whether trees are alive or died. The rule is that if the tree assessed is 80% dying, then the tree can be cut down. Villagers will be fined two times the tree's value if they cut down trees randomly without the village's permission and trees will be confiscated by the village.

However, an exception is for new couples that can ask for free wood to be sourced from village's forest only to build a traditional building (*Bale Tengah/Bale Buga*). Tenganan Village has a rule that enables new couples, after they get married, that three months after their marriage they have to move and live in empty land provided by the village, and can build of this empty land. This policy is in accordance with conservation of the green belt of tropical rain forest surrounding the village that could be damaged if there is no strict regulation including the planning whole area of the village. Another unique rule in Tenganan Village is that the statuses of durian trees belong to the village. Anyone can have a durian fruit when it falls from a tree when durians are ripe and ready to eat. Usually the villager will wait for the durian under the tree. No one can seize if people are already waiting under the tree and they should find another tree. People benefit from the durian fruit approximately IDR 500,000.00 until IDR 1,000,000.00 as additional income.

Figures 5 and 6: The tropical Rain Forest surrounds Tenganan Village and the *Bale Buga* on construction.
Source: Author, 2012.

5. CONCLUSION

Most Indigenous villages are located in the remote areas of Bali such as highlands, along the lake and on hills. The villages are surrounded by protected rain forest or plantations. There are conscious efforts implemented by villages to conserve their natural realm and their traditional concept of *Tri Hita Karana*. There are important traditional rules that underpin traditional architecture and Balinese life adopted from and implemented through the *Tri Hita Karana* concept. This discussion demonstrates how significant has been the influence of traditional regulations upon maintaining the traditional Balinese landscape. The traditional open green space of *natah* and *telajakan* have commonly been adopted in most traditional villages in Bali although some other elements of traditional space such as *teba* or back yard, *karang embang*, *karang tuang* (green open space in the corner of crossing-road) are more difficult to locate because increases in development. It is important to conserve traditional open space whether in the Indigenous villages or in the City to respect the natural environment. In fact *natah* and *telajakan* can directly characterise the identity of the Balinese landscape that forms the housing patterns. *Natah* and

telajakan can expand relational views of houses and roads. Research into *natah* has demonstrated that the more extensive the *natah* and the more luxuriant its plants the greater the reduction of wind speed and humidity modification in traditional housing [15]. Thus, where *natah* occurs as open space it will attract sunshine and fresh air to enter into housing or settlements. This means that *natah* directly influences a better quality of living in traditional housing.

Fortunately, the *subak* irrigation system is still conserved in some villages as their „heritage" irrigation system. The *subak* system of agricultural technique used in Bali has existed since the pre-history period (from BC to 9th C) during which people were dependent upon nature and environment conditions for their living [16]. As an example, Jatiluwih Village in Tabanan Regency is one village that still conserves the *subak* system with rice terraces demonstrating an integration of people to its agricultural system as a primary source of living; it is known that Tabanan Regency as one of regency epithet of the "rice granary"[1]. The subak system is a unique system that is not only a technical system of agriculture, but also it implements a tradition rule that relates to religion that is reinforced through the implementation of the ceremonies during every stage of the rice plant. This is why the *subak* system, as selected by UNESCO for cultural landscape conservation, is believed to be a cultural system that integrates technology, people empowerment and intangible activities. Lastly, the Tenganan Village also has a unique regulation that maintains the tropical forest through selectivity of tree management. Only the specific age of a tree determined when it can be cut down for certain purposes of people livelihoods. This rule has been inherited through generations of villagers in Tenganan Village and these people still obey this regulation and another rule that can advantage villagers as well.

These rules, of traditional regulation, cause significant impact and contribution to people"s lives controlling how they keep and encourage a quality of life, how to conserve the environment and how to avoid ecological destruction caused by ribbon development. Accordingly, local governments and stakeholders should take into account these traditional regulations as the main concepts in the conservation of the Balinese cultural landscape to prevent Bali Island from destruction of its natural values and assets.

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MAKING SENSE OF HERITAGE MINING LANDSCAPE CONSERVATION IN MALAYSIA: POTENTIAL AND CHALLENGES

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ABSTRACT

Landscape is interpreted as the creation of a cultural expression through human ideology and representing a living heritage. Since landscapes are continually evolving, it arouses challenges for sustainability in preserving significant cultural landscape which rested in evolving and transitional world. Kinta Valley former mining landscape can be described as 'relic landscape' and this landscape type is one of the sub category under organically evolved cultural landscape (or vernacular landscape) as incorporated in UNESCO *Operational Guidelines* [18:8]. The main contribution of this paper lies within the gap of knowledge and practise of cultural landscape conservation in Malaysia emphasizing on the cultural values embedded within the heritage mining landscape of Kinta Valley of Perak State, Malaysia. Concerning to the significance heritage values that lies within the Kinta Valley former mining landscape through the lens of cultural landscape theory and practice, this paper highlights on the potential and challenges faced by the Perak state government in establishing mining cultural landscape conservation which can be incorporated within the state and districts planning gazetted documents. Palang & Fry [15] remark that the interface between culture and landscape is very important to understand as it will lead to interpretations of future and current issues of past landscape developments and interventions. United Nations [17] emphasize that sustainable cultural landscape composing of 'socially, economically and environmentally durable' and therefore preserving the heritage mining landscape will unravel and unveil the valley sustainability. In addition, qualifying the cultural landscape significance crafted by past tin mining activities in Kinta Valley has resulted in the establishment of heritage values of state and national significance. Therefore potential and challenges of preserving this heritage landscape will be disclose and thereupon embellish the Malaysian culture heritage in general especially in enduring Perak State culture heritage and sustainability.

Keywords: Culture landscape; vernacular landscape; sustainability; tin mining landscape; Kinta Valley; Malaysia.

1.0   INTRODUCTION
1.1   The concept of Cultural Landscape

Sauer states that "the cultural landscape is fashioned out of the natural landscape by a culture group. Culture is the agent, the natural area is the medium, the cultural landscape is the result" [12:15]. Humans and nature holds a long history of interrelationship and dependencies. Lennon [11] highlights that this connection has generated mosaic in the landscape and therefore landscape memory, symbolism and manifestation including remnants of the past lie within the landscape layers. The term 'cultural landscape' was first proposed in the early 20th century within the academia sphere and adopted by Professor Carl O. Sauer, a American geographer of the Berkeley School in 1920s, in his *Morphology of Landscape* [6, 8, 12, 16]. Fowler adds that this concept has been internationally embraced in conservation practise in the 1980s and 1990s before the concept of 'cultural landscape' was incorporated into the World Heritage Convention in 1992. Lennon observes that the World Heritage Convention became "the first international legal instrument to recognize and protect cultural landscape" [20:47]. With that recognition, the Tongariro National Park in New Zealand was inscribed as the first site to be nominated as World Heritage List under the 'cultural landscape category' in December 1993 and followed by the Uluṟu-Kata Tjuṯa National Park in Australia in December 1994. Blair and Truscott [20] argue that landscape is perceived as a cultural artefact which comprises tangible remains that have been left by present and earlier cultures; hence it

offers various layers in the landscape. Further, Antrop [1] observes that landscape is valued for its natural, cultural inheritance and aesthetic attributes [21, 22] and Antrop describes landscape as a reflection of our changing society and their attitude towards the environment thus "full of past memories" [1:21].

1.2 The evolving mining landscape

Particularly Australia ICOMOS [2] described evolving landscapes as 'system' that extend either in 'relic' or 'continuing' that portray through its features, land use and patterns. Prior to this meaning, former mining landscapes were entitled as evolving landscape thus embraces the transformation of lands as consequences of extraction mining industry and possesses the tangible and intangible values which Jones [8:14] described them as "socially treasure" translating the "expressions of change in our human ideals, philosophies and human and natural actions". Interestingly, this landscape category able to demonstrate how mining activities may influence and physically transformed the landscape hence depicts human and nature dependencies. Furthermore in order to support mining operations, infrastructure and facilities were built to accommodate this activity and thereupon impact the overall land use and spatial patterns of these places. Further, UNESCO acknowledges historic mining landscapes as being part of their cultural landscape definition because this landscape category demonstrates the imprints of past interactions between humans and their environment. Correspondingly with embedded outstanding universal values, recognition of this landscape type was previously granted to the Blaenavon Industrial Landscape, UK (2000); the Cornwall and West Devon Mining Landscape, UK (2006); the Iwami Ginzan Silver Mine and its Cultural Landscape, Japan (2007); and the Nord-Pas de Calais Mining Basin (2012).

Therefore, through the lens of cultural landscape theory and practice and having regards to the heritage merit portrayed by the Kinta Valley, this paper tends to concentrate in finding answer to question: "What is the current conservation practice in Malaysia and specifically in the Perak State?". In addition, the highlighted question will enable the analysis of the current management plan as well as the conservation plan as imposed by the Perak State Government to be reviewed in conjunction to the establishment of appropriate actions that able to protect and retained the integrity and authenticity of Kinta Valley industrial mining landscape as heritage for Malaysia.

2.0 SCOPE/OBJECTIVES/METHODOLOGY
2.1 Scope and Objectives

The main aim of this paper is to assess the Perak State management constrains and opportunities within the selected management plans and documents that pertain to cultural landscape conservation in Malaysia. In order to provoke discussion on the potential and challenges of mining cultural landscape as heritage in Malaysia, the Kinta Valley former tin mining landscape has been selected as the main case study.

2.1 Methodology

This study imposed a single case study design and thereupon a mixed methods research approach has been adopted. Yin [19] highlights that there are 2 reasons of embracing a mixed methods approach for case study design; (1) case studies that focus upon the evaluation of a phenomena as the end result, and (2) associated data that form a part of the component of analysis of a wider case study. Using the mixed methods research approach enabled an ability to investigate, discover and identify and map the values of the Kinta Valley vernacular landscape that has evolved as a consequence of extensive tin mining activities dating back to the 19th century. In describing or testing the reliability of this case study, mixed methods research have been undertaken involving documentary research (including historical research, archival records, gazette government documents and geospatial data), focus group (workshop with the experts), site observations and questionnaires that specifically designed for the Kinta Valley residents. Although this study adopted a mixed methods research, the central strand of the study remains qualitative and therefore in attaining the main objective of this paper, qualitative-content analysis has been conducted

involving selected government gazetted documents of both state and federal level that act as legislative tools governing the Valley at present.

3.0 RESULTS

3.1 Justifying Cultural Landscape Significance

The significance of mining cultural landscape portrayed by Kinta Valley, Malaysia is undeniable. Tangible evidence that is spread through this valley is remarkably visible and extant especially within the outskirts of Ipoh City. Notably, Ipoh emerged from a small village known as Kampung Paloh and later transformed into an important hub for the Kinta District in 1890s and thereupon in 1920s Ipoh has been designated as the capital city of Perak State. According to Osman and Ishak (2012), Kinta Valley hosts the highest hectarage of ex-mining land with 47,614 ha (58.2% of total state land), much of this former tin mining lands were notably established within the southern and western part of this valley. Different from Cornwall and West Devon mining landscape[1], UK, the existence of tin deposits within Kinta Valley was geologically identified as stanniferous alluvium hence it portrays a different mining technique used in order for tin extraction. Succeeding the Taiping tin production boom in 1889, from 1890 Kinta Valley held the record of being the main producer of tin for Malaysia until this industry collapsed in 1980s due to the fall of the international tin market in 1985 resulting in the often immediate abandonment of mining sites. Subsequently, the extensive tin production that occurred over more than a century has directly influenced the Valley land uses thus crafted a significant spatial pattern that extant until the present days. These activities included a transportation network predominantly by a road and railway system that were established in the 1880s to enable the transportation of tin ore from the important mining places to tin smelter located in Penang (refer to Figure 3.2). Therefore, the transportation clusters and networks that were established in Kinta Valley also depict the result of immense tin mining exploration in this valley. In addition, important mining elements that are today extant within the envelope of this Valley include hydro-electric power plants[2] (Malim Nawar power station and Chenderoh power station), mining dams and pipelines that were located within the foothills of the Main Range (involving Mt. Bujang Melaka, Mt. Chante, Mt. Chabang and Mt. Juang) thus signifying the *in-situ* hydraulic mining activities that were once introduced by the European mining companies dominated mainly within the Gopeng areas. In order to improve the irrigation system due to the sedimentation of extensive mining exploration, Kinta River was canalized in the 1950s (refer to Figure 3.1) and this huge project involved the straightening of 61 kilometres of the river between Lahat and Kuala Chenderiang [7, 10]. Hence, with all this extant evidence and patterns in the landscape, can one conclude that Kinta Valley is one of the best examples of a mining cultural landscape in Malaysia.
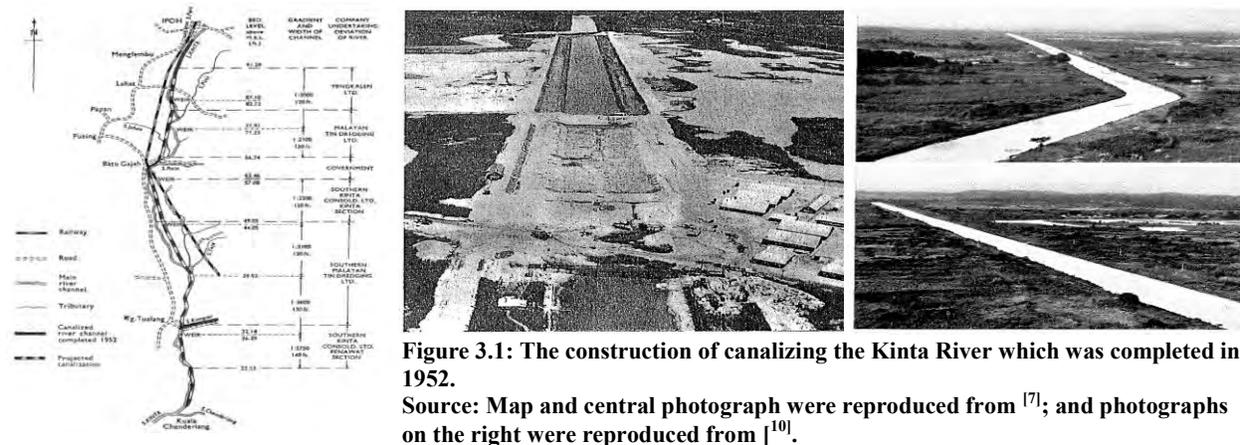
Figure 3.1: The construction of canalizing the Kinta River which was completed in 1952.
Source: Map and central photograph were reproduced from [7]; and photographs on the right were reproduced from [10].

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[1] Cornwall and West Devon mining landscape, UK has been inscribed as the UNESCO World Heritage Site in 2006. This place portrayed a dramatic extraction industrial landscape as consequences of deep mining activities (hard rock mining) that mainly concentrated for copper, tin and arsenic deposits.

[2] Both power stations were operated by the Perak River Hydro-Electric Power Ltd. (PRHEP) and were both established in the middle of 1920s to support electricity demand from tin mining industry in the Kinta Valley.
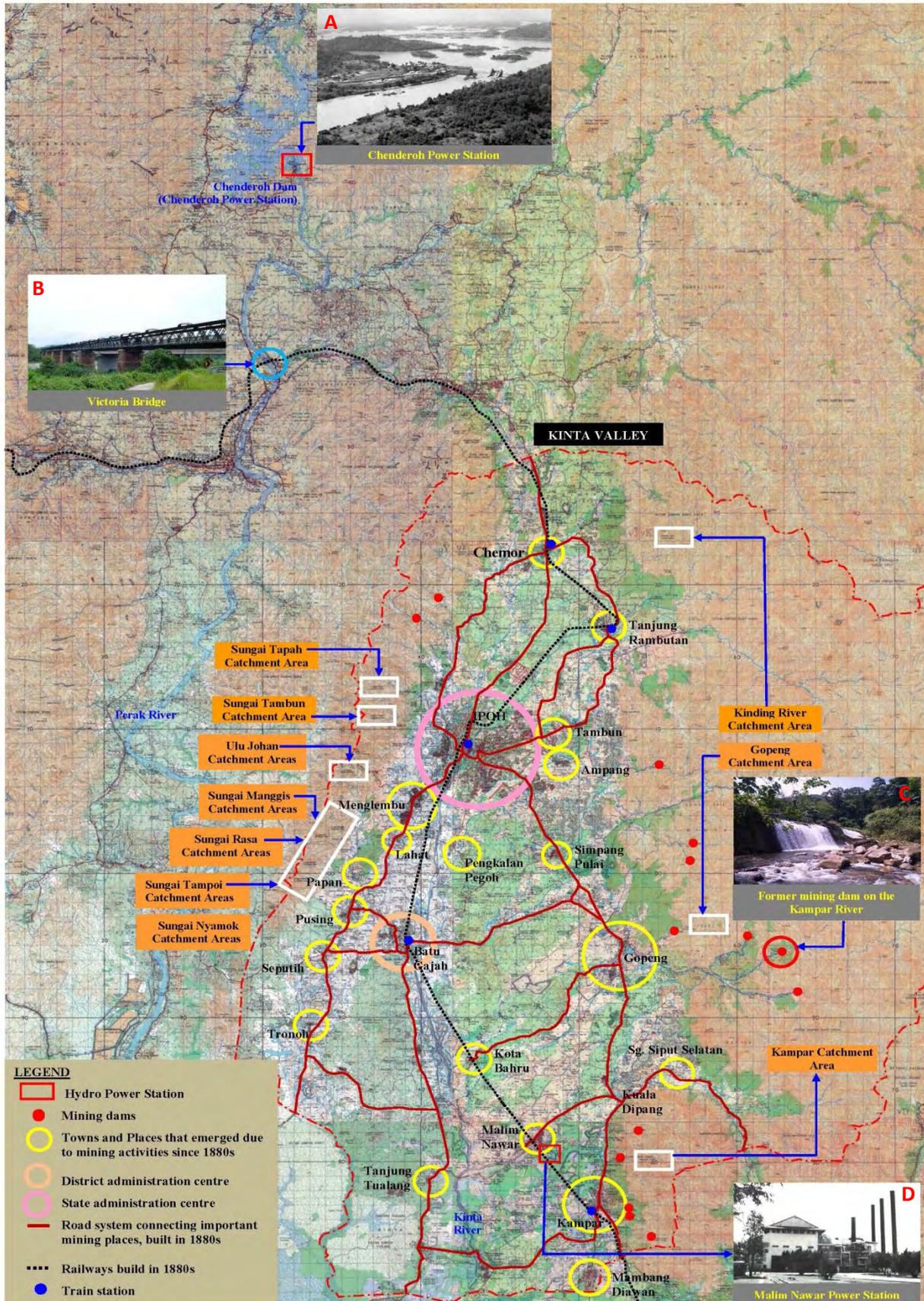
Figure 3.2: Geographical map of Kinta Valley indicating the extant evidences and spatial patterns that exist due to extensive tin mining activities in the Valley commencing for more than a century (from 1880s to 1980s). Source: Reproduced Image A & B from Google Images; Image C was photograph by author in 2013; and reproduced image D from Khoo [10:126].

3.2 Statement of Culture Heritage Significance

As discussed in the *Burra Charter*, the major values that contribute to the cultural significance of a place consist of aesthetic, historic, scientific, social and spiritual values. Historically, the development of an industrialized mining in Kinta Valley significantly witnessed and paralleled the migration of Chinese miners to colonial Malaya as well as the interference of the British colonial administration in Perak especially in Kinta Valley. Chinese brought with them their culture as well as a regime of economic expertise for mining production which was difference from the Perak Malays whom had a greater affinity for and expertise in padi plantation activities. Tin mining in Kinta Valley therefore demonstrates the social formation of this place through various cultural and religious backgrounds that continue to the present. The remarkable physical transformation of Kinta Valley portrays strong connections and interdependencies of human and nature variables whereby the present landscape is a cultural construct that hosts a richness of heritage values. Through comprehending the existence of tangible physical remains (landscape fabric), the Kinta Valley post-industrial landscape holds a tangible and intangible record of history, scientific, social, aesthetic and spirituality demarcating its strong identity as the major tin producer venue for Malaysia.

3.3 Assessment of Management Constrains and Opportunities

Kinta Valley is very unique compared to the other districts in Perak State. This valley was once a district its own but since 2009, Kinta District has been administratively split into two, given the economic rise of its southern part (from Gopeng to Kampar) enabling the creation of a new district that still maintains the integrity of the former district boundary. Since the state administration area is also under the boundary of Kinta Valley, the management of this valley is now administered by 3 different local authorities including the Ipoh City Council (administering North Kinta), the Batu Gajah local authority (administering Western Kinta) and the Kampar local authority (administering the South Kinta / Kampar District). In administering this valley, gazetted management plans have been prepared in accordance with the Perak State Structure Plan 2020 and these management plans address the detailed and content of district local plans (refer to Figure 3.3).
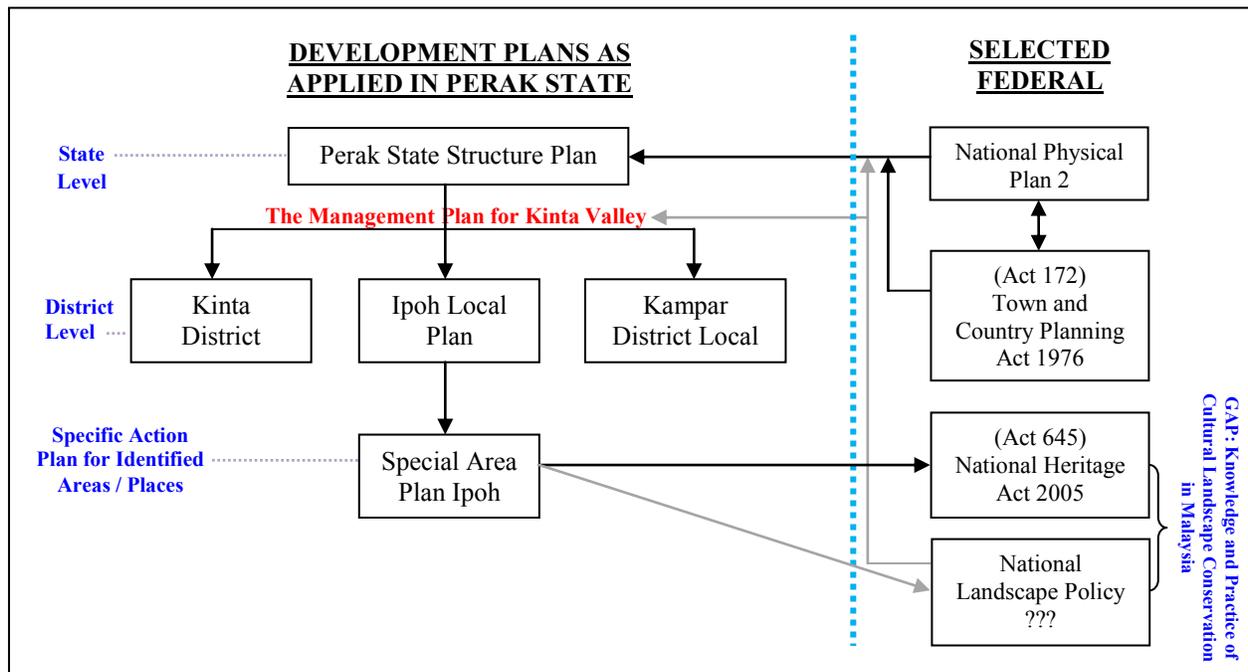

Figure 3.3: The Management Plans for Kinta Valley
Source: author

Within the context of this study, 5 selected management plan of state and district level as well as 2 legislations at federal level have been selected for evaluation, all of which have a direct connection to the case study area. Therefore a content analysis of these documents has been undertaken whereby the management constraints and opportunities were identified as below:

(i) Management Opportunity

The post-industrial landscape of Kinta Valley (discovered by the Perak state stake holders upon its heritage values) is full of evidence of imprints of past human activities that were lured to the place by the prospect of making a fortune from tin mining. The influx of Chinese, Indians, Singh, Western communities together with Sumatran Malays to this Valley contributed to a rich social interaction as well as hosting diversified cultures and religions whom settled and worked in Kinta Valley. This historical development (refer to Figure 3.4) is the major asset to Perak state that has yet to be realized and which is integral and reflective of a cultural landscape. Because of the importance of Ipoh old town area as being part of this tin heritage legacy, the state government has translated this awareness into a *Draft Special Area Plan for Ipoh Town 2020*. Although the focus of conservation within the context of this document is concentrated upon buildings and monuments (refer to Figure 3.5), recognition exists in the document to heritage items as being embedded within the content of this document demonstrating the state government's seriousness in making sure that these identified items are given due recognition and protection. In addition, a Special Area Plan, as enabled in the Malaysian *Act 645 National Heritage Act 2005*, offers yet to be Enactment (legislation of state level) for the protection of heritage items extant in Perak.

Figure 3.4: Tin mining industry has dramatically changed the physical outlook of Kinta Valley thus having regards to extant fabrics and spatial patterns, this post-industrial landscape able to translate and demonstrating the history, aesthetic, scientific, social and spiritual values of past mining legacy.
**Source: Courtesy photograph by Tan Sri Hew See Tong**
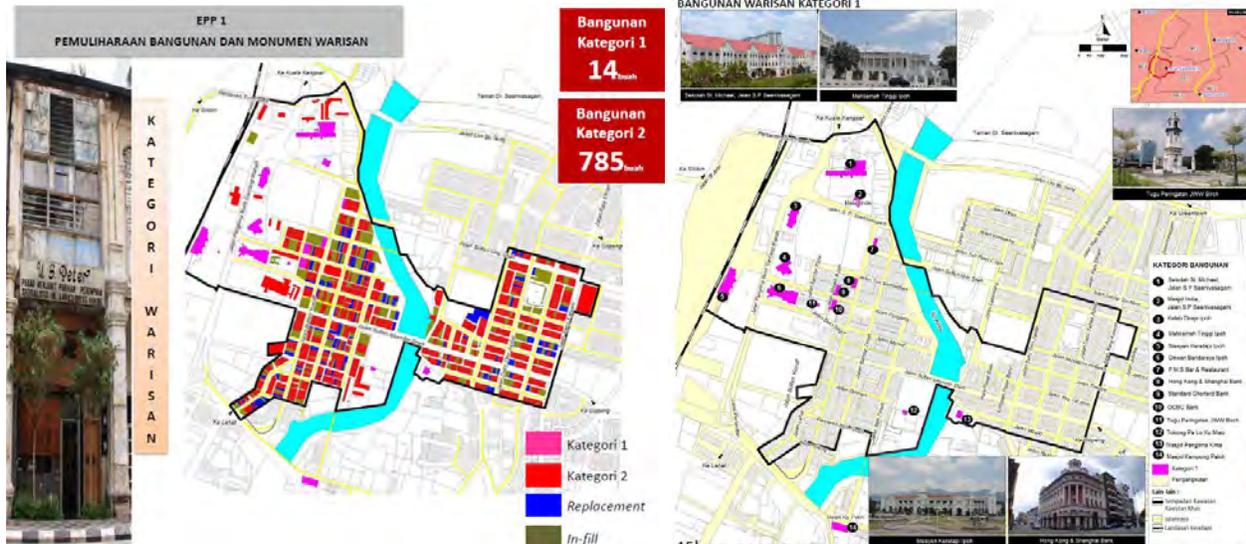
Figure 3.5: Conservation of heritage buildings and monuments within Ipoh old town centre.
Source: Reproduced from *Draft Special Area Plan for Ipoh Town 2020 [Draf Rancangan Kawasan Khas Pekan Ipoh 2020],* p. 13 and 15.

In addition, within the content of *Perak Structure Plan 2020 (2008, p. 140)*, a strategy outlines the need to recognise the Chenderong Tin Mining Village [PSN28-*Desa Perlombongan Bijih Timah Chenderong*] located between Batu Gajah and Tanjung Tualang and together with TT5 dredge (the last tin dredge in Malaysia) as comprising a tourism 'product' for Perak. The textual strategy in this document portrays an awareness amongst stakeholders about the heritage values of this areas to be promoted for conservation although much of this strategy focuses upon tourism activities.

(ii) Management Constraints

Lack of knowledge of the cultural landscape concept is the major intellectual gap that represents a barrier for understanding the heritage values embedded within Kinta Valley's former tin mining landscape especially as to its potential as fulfilling ICOMOS' cultural landscape criterion. Internationally, industrial landscapes are increasingly receiving attention for their heritage values. This is demonstrated with the World Heritage recognition of the Blaenavon Industrial Landscape in the United Kingdom in 2000, later followed by the Cornwall and West Devon mining landscape in the United Kingdom in 2006 both of which evidenced a changing paradigm within the international heritage community towards acknowledging the values embedded within this landscape type and their overall outstanding universal values having regard to the World Heritage List criterion.

Notably, a gap exists within Malaysian federal legislation whereby within the Malaysian *National Heritage Act 2005* there is no cultural landscape category although the Malaysian *National Landscape Policy* does acknowledge cultural landscape as forming part of Malaysia's heritage. In addition, much of the strategy for the protection of cultural landscape outlined in the Malaysian *National Landscape Policy* is concentrated upon the agricultural landscape type [13:28] - Strategy 4.2: Identify and Develop Landscape of High Value in Visual and Cultural) with no recognition of the mining cultural landscape type as being one of a wider spectrum of the cultural landscape types that need to be acknowledged and conserved.

Further, a gap also exists between Malaysian federal and state documents, as demonstrated in differences between the Malaysian *National Landscape Policy* at the federal level and the *Perak Structure Plan 2020* at the state level. The Malaysian *National Landscape Policy* provides a national-level view of cultural landscapes, and was authored by the Malaysian National Landscape Department whereas Perak state

gazetted documents (or plans) have a different interpretation and policy agenda. Because of this lack of understanding on 'cultural landscape' concept within the Perak state planning and management documents, this lack of comprehension negates a coherent understanding as to what are the heritage values embedded within the Kinta Valley former mining landscape. As a consequence, much of the former tin mining sites has been, at a land use planning level, strategized to be converted and developed into housing, commercial and industrial development in order to support population growth in Kinta Valley allied to the expansion development of Ipoh, the capital city of Perak State [4].

4.0 DISCUSSION AND CONCLUSION

The intention in conserving cultural landscapes is to safeguard them, not just as historical evidence, but as living systems and possible future templates for cultural development. Working landscapes should continue to be economically viable within the framework of authenticity [5:22].

The main barrier, that places challenges upon recognizing cultural landscapes, and in particular mining cultural landscapes, as part of the overall Malaysia heritage lies with poor stakeholder, governance and community understanding about this concept.

Although the Kinta Valley former mining landscape is able to demonstrate its heritage significance at a national Malaysian level, without legislative support and protection, as well as enhanced stakeholders knowledge, the values of this landscape will be lost resulting in an impact upon the landscape authenticity of the place. Loss of authenticity, due to minimal community knowledge, lack of legislation, insufficient fund and incentives are pointed out by Engelhardt and Rogers (2005) through *Hoi An Protocols for best conservation practice in Asia* as being key constraints towards heritage conservation in Asia. Hence, without a proper acknowledgement and recognition, much of the landscape fabrics are concern to be dilapidating which result to loss of sense of place and thereupon impact on the integrity of the Kinta Valley post-industrial landscape.

Therefore, the result highlighted in this paper will better assist the stakeholders in formulating strategies that will broaden the scope of cultural heritage conservation (knowledge and practice) thus leading to the survival of Kinta Valley post-industrial landscape. Henceforth, there is an urgency to review the Malaysian *National Heritage Act 2005* to align it to international conservation practice and charters including addressing the paradigm shift from monument and building conservation (through the spirit of *Venice Charter*) to recognizing the heritage values embedded within places and landscapes (as expressed in ICOMOS' *Burra Charter* and *Florence Charter*). Other than the Malaysian *National Heritage Act 2005*, the Malaysian *National Landscape Policy* should also extend the scope of cultural landscape conservation from simply agricultural landscapes to embrace mining cultural landscapes as amplified in the Kinta Valley post-industrial landscape. Further, the professional institute representing the profession of landscape architecture in Malaysia, the Institute of Landscape Architect Malaysia (ILAM), together with the National Landscape Department of Malaysia (JLN) and academics/experts from various institutions in Malaysia should collaborate in order to enhance understanding and advance knowledge of cultural landscape heritage to stakeholders (of public and private sectors), communities and heritage custodians. Thus, conserving the Kinta Valley mining cultural landscape will ensure the retention of its authenticity and subsequently contributing to the Perak State's sustainability.

5.0 ACKNOWLEDGEMENTS

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THE CHALLENGES OF ADDRESSING AN ABORIGINAL RESPONSIBILITY FOR *COUNTRY* IN LAND-USE AND NATIONAL PARK PLANNING: A SOUTH EAST QUEENSLAND CASE STUDY

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ABSTRACT

This paper presents research insights on the challenges that Australian Aboriginal communities living within the South East Queensland (SEQ) metropolitan region face in seeking to exercise their contemporary responsibilities to care for *Country* in land-use and national park planning. A case study design was adopted to analyse the incorporation of two Aboriginal communities connections to *Country* in state-based planning systems, and to explore the responsibilities Aboriginal communities ethically seek to adhere to in maintaining *Country* from their own understandings.

Country, from an Aboriginal understanding, involves a deep ecological, cultural, economic and social comprehension of 'law' guided by a responsibility for *Country*. Otherwise known as customary law and custom, *Country* is that which both Aboriginals and their communities are intrinsically connected to. *Country* is the moral value that guides Aboriginal obligation to care and this obligation could well conflict with mainstream contemporary Western management policy and legislation.

This research draws on insights from Quandamooka *Country* (North Stradbroke Island) and Jagera *Country* (Brisbane City and Ipswich), located within the Brisbane metropolitan region in South East Queensland of Australia. During this research, it was concluded that, in both Quandamooka *Country* and Jagera *Country*, the respective Owners are operating within a sphere of increasingly complex challenges that impact upon their ability to conserve and have recognized the values of their obligations to *Country* care in planning. Common themes occurring on *Country* identified in this research included issues relating to a neglect of care to maintain *Country* by planners and government officials, and interactions that prevent Traditional Owners from having their obligation of caring for *Country* on their terms expressed through land-use planning legislation. Political agendas of the Queensland State that influences the interactions of planners and government with Traditional Owners were also concluded to be detrimental, and to damaging trust, ongoing discussions and understandings. These insights indicate that Aboriginal communities are facing an increasing conflicting range of perceptions and comprehensions that are hindering the expression and execution of their moral responsibility embodied in their deep ecological law to care for *Country* in Western planning legislative obligations. It illustrates that the responsibilities given to practicing planners and government officials to care for *Country* under Western law are commonly not adhered to It concludes with the suggestion that for some progress to recognize an Aboriginal responsibility to *Country* in planning, state-Traditional Owner relations and collaboration is now needed to help transcend the legislative challenges underpinning Western planning law.

TERMINOLOGY

Aboriginal and Torres Strait Islander People. According to s51 (25) of the High Court of Australia (1983):

> *'An Aboriginal or Torres Strait Islander person, is a person of Aboriginal or Torres Strait Islander descent who identifies as an Aboriginal or Torres Strait Islander and is accepted as such by the community in which he or she lives.'*

Queensland Health [1] 'Guidelines for Aboriginal and Torres Strait Terminology' has expressed a preference that the word 'Aboriginal', within the context of Australia, is always capitalised. Within this research, the use of 'Aboriginal' and 'First People' predominately refers to 'Aboriginal and Torres Strait Islander People'

Country means far more than just the physical landscape. Rather it:

> *'…incorporates people, animals, plants, water and land. But Country is more than just people and things; it is also what connects them to each other and the multiple spiritual and symbolic realms. It relates to laws, custom, movement, song, knowledges…histories, presents and futures…Country can be talked to, it can be known, it can itself communicate, feel and take action' [2 p.54]*

Indigenous refers to an Indigenous person from any part of the world, and does not necessarily refer to an Aboriginal Australian

Traditional Owner is understood using Queensland's Health *Guidelines* [1] as:

> '*an Aboriginal and Torres Strait Islander person or group of Aboriginal and Torres Strait Islander people directly descended from the original Aboriginal and Torres Strait Islander inhabitants of a culturally defined area of land or Country, and has a cultural association with this Country that derives from the traditions, observances, customs, beliefs or history of the original Aboriginal and Torres Strait Islander inhabitants of the area'.*

INTRODUCTION.

Over 70% of Australia's Aboriginal peoples now live within urban and regional centres, with 28.3% of the total Australian Aboriginal population living within the Queensland State [3]. Approximately 29% of Aboriginal people in Queensland live within the Greater Brisbane region (or South Eastern Queensland (SEQ)), which has seen the third-fastest growth rate of all metropolitan regions across Australia in the last decade. The State Government's most recent population projection indicates the region is expected to grow to approximately 5.5 million people by 2041 [4]. Rapid change, growth and loss of land means that Traditional Custodial groups, are willing to engage with planning policy and practice to accommodate their needs and obligations in the planning and management of the Brisbane metropolitan landscape.

Since 1799, when the first known European exploration of the Moreton Bay region was recorded by Matthews Flinders, the settlement narrative of the Brisbane colony and surrounding area tells a dark reality of contact and conflict with the original Aboriginal inhabitants. Based on a European perception that Aboriginal society was destined for elimination [5] a number of Aboriginal and Torres Strait Islander mission stations were established by religious organizations for Aboriginal peoples (some later to become gazetted reserves for the use of Aboriginal peoples under the *Aboriginal Protection and Restriction of the State Opium Act 1897).* While over 7000 Aboriginal people were removed from their ancestral lands to 64 missions and reserves established across the Queensland state between 1898 and 1939, the majority of the Aboriginal peoples within the Brisbane region were relocated to Bribie Island and the Myora Mission on North Stradbroke Island. It is important to understand that both the Quandamooka and Jagera Traditional Owners in the SEQ region are seeking to re-establish their ancestral connections to *Country* within the backdrop of this narrative.

Today Aboriginal communities are regaining access and in some instances, control of their ancestral lands across Australia. Native Title and Indigenous land rights together cover 20 percent of mainland Australia, and encompass lands that have high biodiversity significance and conservation [6 p.14]. This is highly significant for land-use planning as Traditional Owner values are not only locally based, but they are important for the co-ordination of environmental issues that span nationally and regionally [6].

LAND-USE AND NATIONAL PARK PLANNING.

Land-use planning
Arising from the *Integrated Planning Act 1997* the *South East Queensland Regional Plan 2005-2026* (SEQRP, 2005-2026) established the first statutory regional priorities to engage with Aboriginal and Torres Strait Islander Peoples' requiring a need to maintain and protect their cultural landscape values in the practice of SEQ regional land-use planning. A SEQ Traditional Owner decision-making body, made-up of a number of Traditional Owner groups, was established in 2005 known as the South East Queensland Traditional Owner Land and Sea Management Association (SEQTOLSMA). This body soon became recognized as the peak Traditional Owners engagement body for regional cultural and natural resource management by the state and local government. Combining Aboriginal and non-Aboriginal environmental philosophies in Western environmental management regimes was a new and emerging planning issue for SEQ regional planning, and specific Indigenous landscape values for the region had never been previously incorporated in statutory planning policy [7].

The second iteration of the *SEQ Regional Plan* (SEQRP) explicitly recognized Aboriginal cultural heritage, in Desired Regional Outcome (DRO) 3: Regional Landscape. A sub-element of the DRO; 3.6 Landscape Heritage included the policy (3.6.2) which stated "Through the planning process, identify, recognize and respect Aboriginal peoples' cultural connections to the regional landscape" [8 p.64]. In DRO 7 Engaging Aboriginal and Torres Strait Islander Peoples, policy 7.4.1 stated, "Protect and maintain traditional Aboriginal cultural landscapes and culturally significant places in land-use, planning and management arrangements in partnership with the traditional owners of those landscapes and places, and maintain or improve traditional owners' access to cultural resources" [8 p.89]. SEQTOLSMA (later renamed to South East Queensland Traditional Owner Association, SEQTOA) developed a *Regional Cultural Resource Management Plan and Investment Strategy* to "unite and address the issues of the degradation of our traditional countries and the continuing erosion of the values of our cultural heritage sites and landscapes" [9 p.iv]. The SEQTOLSMA *Plan and Strategy* aimed to feed into the *SEQ Natural Resource Management Plan* (SEQNRM), a non-statutory plan that established a collaborative framework to integrate regional natural resource management planning, as well as investment and activities to help achieve a range of targets. Importantly the 2009 SEQNRM articulates measurable targets for the management of the environment and natural resources aligned to the desired regional outcomes in the statutory 2009 SEQRP. However, despite the good intentions expressed in these DRO's and the collaborative frameworks that had developed, there was little progress to identify, map and describe Aboriginal landscape heritage, largely because it was still unknown how these values could inform regional planning outcomes [7]. Aboriginal cultural heritage is thus primarily protected and given recognition under the *Aboriginal Cultural Heritage 2003 (Qld)* (ACH *Act*) of which Section 23 of the *ACH Act* requires that all peoples who are undertaking land-use activities, to exercise a duty of care by taking all reasonable and practical measures to ensure the activity does not harm cultural heritage

National park and land-use planning for Aboriginal Cultural Heritage
Other regulative planning instruments that need to take into account the *ACH Act* are embodied under institutional arrangements such as the *National Conservation Act 1992 (Qld)* and the *Native Title Act 1993 (Cwlth)*, Compliance with Aboriginal cultural heritage legislation resides outside the *Sustainable Planning and Other Legislation Amendment Act 2012* (SPOLA Act) and the *Nature Conservation Act 1992* (NCA Act) Queensland's current Acts for land use planning and protected areas. The linking of cultural heritage legislative requirements under the ACH *Act*, is so that adequate protection in addition to land-use planning and protected area management under the SPOLA Act and NCA Act can be secured for Aboriginal cultural heritage. Planning for Traditional Owner cultural heritage is thus incorporated across a number of regulatory instruments. This paper conceptualizes planning as a legislative responsibility given to both land-use planners and park planners to engage with Aboriginal cultural heritage under the ACH *Act*.

Published literature indicates that studies on the engagement and interactions of Traditional Owners in Australian rural/remote land management has received the most attention [10; 11] and that specific research on the complexities faced by Traditional Owners in making decisions in an already well-established planning regime in Australia's peri-urban and urban landscapes is lacking. Barry and Porter [12] have theorized the concept of a 'contact zone' between state planning systems and Aboriginal environment relationships, while Rose [13] has provided perhaps the only insight into an Aboriginal ethic of connection whilst contributing to an environmental justice debate discourse. More recently, Low Choy *et al.* [14 p.186] questioned if Aboriginal landscape values can be adequately identified and incorporated into strategic regional planning concluding that it was possible but the impact of urbanization (such as land development, conflicting boundaries and displacement off *Country*) added additional layers or overlays to landscape elements that were integral to Indigenous regional landscape values [15 p.183-186]. While there is an extensive body of literature that suggests how to better engage with Aboriginal peoples in decision-making for local and state planning [16; 17] and literature that suggests ethical dimensions to these engagement protocols [18; 19] specific research relating to the impact of making decisions upon Traditional Owners in seeking to protect their *Country* in Western planning regimes, has not been explored.

Geographically, this research focused on the Jagera peoples (including also the clans of the Yugera and Yugerapul peoples) and the Quandamooka Peoples (including the clans of the Nughi, Nunukul and Gorenpul peoples). All these communities are located within the SEQ region of Australia. The Jagera Peoples' ancestral lands or *Country* encompass the urban areas of Brisbane central business district and includes

Brisbane's residential south-eastern suburbs and northern suburbs, Ipswich City, as well as state forest land, bays and waterbodies, coastal channels and the mountains of the Great Dividing Range. The land area of Jagera *Country* extends across a total of 9 local government council administrative areas. Quandamooka's ancestral lands or *Country* include Moorgumpin (Moreton Island) and North Minjerribah/North Stradbroke Island, as well as the surrounding waters and islands of central and southern Moreton Bay) and water channels and streams between Brisbane to Logan.

RESEARCH APPROACH.

A qualitative methodology with Traditional Owners participants was applied to this study. This enabled the formulation of a common and shared understanding based upon an awareness of the researcher's position as a non-Aboriginal researcher and a centreing of Indigenous values and beliefs throughout the research process [20]. Therefore, for this study, informative and insightful data was drawn from an ongoing *inclusionary* process that sought to empower the marginalized [21]. This process included methods of continuous interactions and communication with individuals, long stays on *Country*, listening and partaking in informal discussions, as well as undertaking semi-structured interviews and an analysis of the SEQ institutional planning regime as it relates to this topic. Further, the adoption of a qualitative methodology allowed the researcher to immerse in the local context and happenings that is so crucial for quality observational Indigenous research. In exploring the ethical complexity faced by Traditional Owners to protect *Country*, consideration of place and *Country* was crucial before, during and after data collection because the value of *Country* plays a key role that underpins the 'ethics of care' [22, p.10].

Relationships with Traditional Owners in SEQ, developed by a prior project linked to this research study (led by Low Choy), assisted this research in building upon community relationships with Aboriginal representatives who were able to endorse and enable access into their communities and representative organizations. During the initial research development and approvals process, it was decided that it was inappropriate for the researcher to directly contact participants and that the control of the research process was better placed in the hands of the communities and their representatives. The community representatives distributed an information leaflet to the communities detailing what the research was about as well as what their rights were as participants of the research. Respecting cultural protocols about who to contact and how, is knowledge known only from being within the internal network of the communities, and respecting these protocols was fundamental for ensuring quality ethical considerations and cultural respect in this research. Because of the fluidity of the human environment in which this research was set, as well as the methods of the research, the researcher stayed on *Country* for a number of days enabling potential participants to directly meet the researcher and discuss the project in detail about the project or say that they were interested in participating. Interviews were either conducted immediately or an informal chat enabled an arrangement of a conversational interview at an agreed date, time and venue. Fifteen recorded interviews were conducted with Traditional Owners together with observational notes if the participant asked to physically show the researcher *Country* and to informally chat in the field outside of the more formal interview environment.

ABORIGINAL RESPONSIBILITY FOR COUNTRY.

Literature relating to Traditional Owner responsibilities to *Country*, and the significance of this responsibility to care for *Country* in environmental planning and management is discussed by several authors [6; 23; 24; 25]. However, what is less evident is research that explores the challenges experienced by Traditional Owners to exercise this responsibility to care for *Country* within the context of Western land use planning beliefs of management.

An Australian Aboriginal responsibility to their ancestral *Country* is created by *Country* for *Country* which "consists of people, animals, plants, Dreamings; underground, earth, soils, minerals and waters, surface water, and air" [26 p.8]. No justification is required to explain a position or an action because caring is the exercise of a responsibility that has been born to Aboriginal peoples, organized by totemic principles [27 p.130]. Totems commonly involve *Country* and a "… relationship that invariably requires that people take responsibilities for their relationship with another species, and learn that their own well-being is inextricably linked with the well-being of their totemic species" (26 p.28). An Aboriginal responsibility explains what

action is not acceptable because the survival of totems and their balance is the mandatory ethic of life [28 p.9-11]. An Aboriginal obligation for *Country* is thus a morality of life, and the conduct of this responsibility the philosophy. It is a philosophy that Aboriginal peoples need to abide by, listen to and exercise, and be engaged with, as part of happiness and health, for *Country* and for people [24]. As a result there is little flexibility of choice because there is no other purpose other than to keep everything healthy and balanced. This responsibility of care is thus not influenced by human value alone. It is an ecological-informed code that defines the identity of Aboriginal individuals and the collective, and influences the Aboriginal human value. The value of *Country* in an Aboriginal person develops in the context of the specific law of *Country* in which he/she is bound to [26; 29]. Thus, there are very often no options to making choices to care for *Country*. Equally there should be no conflicting moralities because everything, human and non-human, is embedded in this philosophical ethic.

The challenges facing Traditional Owners interacting with decision-making in planning thus involves making choices between knowing what is right, and having to negotiate with what might not be right or is wrong with regard to that value. Thus the main issue Aboriginal individuals and communities face is holding the knowledge of what action is required to adequately care for the needs of *Country*, but having to constantly negotiate on this action. A recent example is demonstrated by the Traditional Owners outright rejection of an Indigenous Land-Use Agreement (ILUA) between the Wangan and Jagalingou Peoples and the Adani Mining Company proposing to build one of the biggest coalmines in the world in Central Queensland. It is a dilemma for policy makers because the ILUA process, that seeks to aid the engagement and empowerment of Traditional Owners to negotiate land-use decisions on their ancestral lands, is only just that; a negotiation process. There was never a right to veto, which is exactly what the Wangan and Jagalingou Peoples exercised. They have exercised this because their ethic of care has told them that this development is wrong and the reality is that it will destroy the health and balance of *Country*, no matter what compensation is provided; as one Elder said: "If they [Queensland Government] approve Carmichael, they will be responsible for the death of our land, and our connection to it going back to time immemorial" [30]. Other research has demonstrated that a responsibility to care for *Country* cannot only take into account the human value, as this is not the sole adjudicator for management decisions. *Country* is also a judge and can be "talked to, can be known, it can itself communicate, feel and take action" [22 p.14]. How to make and act on decisions is therefore more than simply a facet of geography and *Country* kinship but one where *Country* is also responsible for its people. In this manner, *Country* thus listens and acts on its own responsibilities to care.

A number of scholars emphasize the significance of the care implicit in an Aboriginal responsibility to *Country* for health and protection. Gammage asserts that the knowledge of how to care shapes the success of the activity of care [27 p.133]. Rose, from her exploration of Aboriginal worldviews, argues that the interdependence of both the human and non-human elements affects the health and vitality of all [26]. More specific examples include dangerous places that you should avoid and not go near, and places that are gender specific [31]. Munn also demonstrates how this is a shifting spatial field that is always with the Aboriginal, regardless of whether on *Country* or not [31 p.451].

Rose [13] draws from a number of ecological ethic theories to illustrate how each could relate to the dimensions of an Aboriginal ethic of connection. One such theory is the 'ecological self' [32] that explains decisions and outcomes which are at 'one' with nature and which deliver outcomes that offer benefits for all selves- human and non-human. An Aboriginal, consciously or otherwise, makes decisions informed by an ethic of care for all. The purpose of life is a universal moral to prevent risk and harm [27 p.137], not to review and negotiate options when the already known, is known to be right. Literature has yet to discuss and research the challenges that Traditional Owners face when making decisions to care for *Country* in a Western-dominated utilitarian planning ethic which is all about working towards what should (or could) be right.

Rose also advocates a "dialogic ethic of situated availability", which "when the aspirations of settlers come into conflict with the aspirations of Indigenous People" the principle to apply is that "… from the perspective of the settler … the other must always come first" [13 p.184]. This principle could help Aboriginal people not to be forced to justify their initial positions, because rather, the law of *Country* explains why [27 p.131]. However in a peri-urban and urban context rapid growth and change is occurring. The difficult/controversial question of whether Aboriginal concepts of caring for *Country* might have to be applied along with other

forms of contemporary knowledge to manage the extreme challenges of unprecedented growth that are occurring within their landscapes, might have to be asked.

The emerging complexity of conflicting interests that exist in the management of *Country* is a new and emerging issue for contemporary Traditional Owners because their ancestral responsibility of care embodies a belief structure whereby all things are within the law and obligation to *Country*. Self-empowerment of Aboriginal peoples by improving access to training and education to give Aboriginal people skills to equally compete in the modern economy (for example, the neoliberal agenda advocated by/associated with Aboriginal activist and lawyer Noel Pearson) is suggested as one way to create a system that can allow for Aboriginal culturally-informed outcomes in the management and care for *Country*. Other suggestions include collaborative approaches, focusing on a process of working towards meeting/developing a shared understanding as the most important part of caring for *Country*. While both groups differ in their orientation, the central purpose to care for *Country* and it's people is their guiding morality.

FINDINGS.

As a primary observance, *Country* and their values for *Country*, was considered intrinsically important to all Traditional Owners interviewed. Traditional Owners made reference to the fact that being a good person is achieved by being integral to your responsibilities given by *Country*. For Traditional Owners the governing value of an ancestral *Country* is a morality to be respected. Performance and determinants of success of individuals and communities, is always linked back to the ethic of *Country*. It is always on display; it is *Country*. All Traditional Owners know and hear what is being done on *Country*. Everyone knows what everyone is doing.

The theme of caring for *Country* was paramount in most Traditional Owner opinions, particularly those working in organizations set-up to manage and care for the lands of the communities they represent. Participants described the challenges of exercising their responsibilities as Traditional Owners to care for *Country* under the obligations of Western management law, along with the 'assumed position of care' of land use and park management planners, government officials and even industry and developers. That is, they believed that those who profess and hold the perceived Western authority to adequately protect *Country* and landscapes, do not know how to adequately protect *Country* under Western management law and instruments. A notable example of this was the supposed protection of Cultural Heritage sites, when in fact sites are being continually destroyed. One Traditional Owner, a Cultural Heritage Officer for a State National Parks department, witnessed how in one incident that the States' lack of maintaining drainage and road networks resulted in the damage of a significant cultural heritage site. However the relevant State government department failed to notify the Quandamooka community about this loss, and when confronted, denied there was any cultural heritage because "they'd checked the register" and there is "nothing on the database". As explained by one Traditional Owner

> '...they would just do business as they've always done. If they want to go and put a track in they'll go and dig a track. If they want to dig a hole they dig a hole. They don't really care where it is.' (TC1)*

*Each participant have been allocated a number which is used to reference quotes along with the participant identity (TC= Traditional Owner)

Similar responses were recalled by some Traditional Owners who were frustrated by State government land-use policy officers who were unwilling to genuinely engage with their obligation to *Country*. One participant encapsulated this as

> '…always trying to give us their interpretation of what the Cultural Heritage Act is, telling us telling Aboriginal people… they're telling Aboriginal people what our Aboriginal culture heritage is'. (TC2)

Another common challenge recalled by some Traditional Owners was about the management and diplomacy required when making contact to engage or collaborate with State government land use planners and policy

officers. All participants mentioned their own obligations to *Country*, particularly with regard to respecting Elders and those with the knowledge of *Country* and stories of *Country*, to set the beginnings or 'terms of reference' of negotiation and meeting:

> *'Elders need to be consulted and make the final decisions for Country. Planners need to realize that for us to make decisions, it goes beyond those representative or sitting in a meeting. We have our own obligations to meet too'* (TC3)

The broader agenda and political values and priorities set by the State government to then influence the individual planners who are to consult with Traditional Owners, was cited by Traditional Owners as being particularly complex to exercise their responsibility for Country. An example was cited of developing a good relationship with some state government national park planners who were interested in listening to what the Traditional Owners had to stay. However, when returning to their department with solutions and proposals to meet the needs and interests of the communities, it was clear that the state government planners were met with the possibility of undermining their professional careers, potentially even losing their job:

> *'Yeah we've had a couple of good people that have come and they've worked with us, and they've had these long outstanding careers with the Department, and they've come over here and they've tried to work with us and make it work. And they have- the project sand proposal they've put forward back to senior management as non-indigenous park employees work and based here, met with resistance from mainland management, so then it's undermined their personal careers, and they've lost their jobs here. They have totally destroyed their careers because they are here working with the Indigenous to try to make this work'* (TC4)

Other examples involved the responsibility for *Country* being potentially compromised by planners consulting with one or two of the community members and then applying the thinking that the community has been consulted with. One method to manage this common challenge was establishing a decision-making framework within the communities, which made decisions for *Country* relating to land-management much more aligned to those who have the right to make decisions. One participant believed that this made the Aboriginal communities to decide, in a contemporary context, how decisions were to be made and decreased some tensions and resistance that was being met within the communities when decisions were taken without taking into account these structures.

DISCUSSION AND CONCLUSION.

This article has examined some of the challenges Traditional Owner's face in exercising their responsibilities to care for *Country*. It was found, however in a case study of South East Queensland, that *Country* in Western planning legislation is not being maintained or protected. Thus the challenges for Traditional Owners to exercise their own understandings of *Country* are not yet faced. Their interactions with government officials and planners show that state planner's own obligations to care for *Country* through existing Western planning law are not being adhered to. It is clear from the comments on these challenges, all Traditional Owners follow the belief that everyone is ruled by a policy of knowledge [26 p7-12; 27 p.13-14]. The findings from the interview data revealed that this belief in conduct of care was indeed applied to all, regardless if from a Western or Aboriginal perspective of care. Importantly, for Traditional Owners protecting *Country* in Western land-use planning, despite its challenges, was seen as an outlet for them to care for *Country*. Thus, the main challenges for Traditional Owners came from primarily state government planners not adhering to their legislative obligations. Negative sentiments towards state government land-use planner's attempts to utilize legal authority and knowledge to tell Traditional Owner what their responsibilities of caring for Country are, and how negotiation should begin, reflect the tensions and difficulties Traditional Owners face. The challenges are perhaps worsened by the fact that certain state departments are more likely to serve the political agendas of the state at the expense of legislative obligations. For example, national park planner's career improvement (and sometimes even career) might be at risk because adhering to their responsibilities is considered to be in conflict with the larger political agenda of that state government.

Regarding the SEQ case study, the question may be asked whether the challenges that Traditional Owners face in exercising their obligation to *Country* lead to these tensions existing between the State and Traditional Owners. If so, the pertinent question Traditional Owners might ask is: "is *Country*, the Aboriginal landscape and history, worth including in State-based planning?" In answering this question, Traditional Owners, drawing from the SEQ case study, must be prepared to accept that where land use planning legislative obligations are orientated by the values of the political administration in office in the State, there are ethical obligations for land-use planners to build and engage in collaborative relations. In land-use planning practice this aims to help towards 'constructing a civic culture' [33 p.361]. However accepting this view could be more difficult in state departments such as National park departments, which may not have land-use planning ethical obligations to collaborate when conflicts of interest arise.

Under the 'law' of an Aboriginal responsibility for *Country*, those Traditional Owners who are pushing for care for *Country*, it is increasingly recognized by Aboriginals that it is not an easy task and that disappointments and hostility will be met within this contact space, as was documented in this South East Queensland case study. State government planners who do not take into regard their obligations under planning law, limits their ability to be legitimate and responsible in their work practice to care for the perspective(s) and values of Traditional Owners. However, the exercise of ethical values to meet the interests of Traditional Owners, could perhaps serve to transcend some of the legislative complexities Traditional Owners are currently facing. One of the fundamental principles underpinning the moral code of care in Aboriginal *Country* is that Aboriginal peoples use the responsibility to realize themselves. Gammage, for example observes: "Since people could neither deny nor deflect reaction, they depended on understanding it as fully as possible- the more they knew the better they could manage their lives and their Country. They strove to know what lay beyond" [27 p.148]. The need for collaborative planning to build relationships and understanding is particularly relevant in the South East Queensland region where state planners and government are not taking into account legislative responsibilities to care, let alone respecting the law and customary obligations Traditional Owners have for *Country*.

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GREEN TAX REFORM, TIPPING POINT FOR ENERGY USE: THE PORTUGUESE CASE

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ABSTRACT

The need for a lower energy profile has been repeatedly called for, with little progress: we have lacked the collective will and the economic tools to "walk the talk". Tax reform has long been recognised as a powerful mean to change behaviour of economic agents; it has been on the political agenda for decades, since the 1993 Delors Report on Growth and Employment, but has seen limited application.

The paper reports research on the potential of tax reform to change the energy system, with significant socio-economic and environmental gains, focusing on the Portuguese case study.

The theoretical concept explored is the "environmental tax reform". The idea was first proposed by Pigou in 1920, defending the transfer of tax burden from labour to natural resources with a "double dividend": gains in both resources management and employment. Later research indicates that a careful design of the fiscal tools is key to positive or negative economic outcomes. Our research couples macroeconomic concepts and policy goals with energy efficiency potential and economics at company level, collating abundant but dispersed information from scientific, official and business sources.

The Portuguese energy and transportation system suffers from 4 000 million Euros per year of market distortions: 2% of Portuguese GDP and 20 times the amount of a tentative "green tax reform" recently initiated. Elimination of distortions could finance savings in energy use and GHG emissions up to 20%. Improvements involve more equitable taxation, tax incentives for energy efficiency and public transportation, and elimination of harmful subsidies.

Tax reform is a change of paradigm and a powerful tool to change the behaviour of economic agents. In the present economic and budgetary crisis, it may be the best tool to improve energy efficiency of the economy. The concept may be extended to other domains such as water, land use and resource management.

Key words: environmental fiscal reform, energy efficiency, transparency, consumer choice

1   INTRODUCTION

Energy is both an essential part and a constraint to any development strategy. It was identified early on as one of the key limits to growth [1]. Since the 1987 Brundtland Report [2], and with greater emphasis since the 1997 Kyoto Protocol [3], the need for a lower world energy profile — based on efficiency rather than growth — has been repeatedly called for, with little progress: we have lacked the collective will and the economic tools to "walk the talk". Sustainability indicators, world wide and in Europe, show that, despite growing knowledge, practical progress has been limited, and long term trends are worrying at best [4].

Tax reform and particularly environmental tax reform has long been recognised as a powerful means to change behaviour of economic agents towards the common good. The concept was first proposed in 1920 [5] and has been extensively debated in the scientific community. It has also been on the European political agenda since the 1993 Delors Report [6]. However, it has seen relatively limited application in practice: environmental taxation revenues in the EU fell from 2.7% to 2.4% of GDP between 1995 and 2012 [4].

Environmental tax reform serves a double purpose: (i) to ease the tax burden on the "good side" of the economy, namely labour; and (ii) to shift the burden to the "bad side" of the economy, i.e. pollution, waste and intensive resource use. Abundant literature on the subject shows a number of other benefits and

difficulties. On the positive side, environmental taxation promotes innovation and economic efficiency and hence economic growth, and is also beneficial for the public budget — the so-called 3[rd] and 4[th] dividends. On the negative side, it may create added risks for vulnerable segments of the population. A careful design of the tax reform is essential to achieve the purported goals without negative social impacts.

2 OBJECTIVES/METHODOLOGY/SCOPE

The goal of this paper is to explore the potential of the environmental tax reform concept to guarantee an effective paradigm shift in the energy sector. Portugal is used as a case study.

Our research starts from policy goals and explores how they may be achieved with energy efficiency potential and economics at company level, collating abundant but dispersed information from scientific, official and business sources. The research methodology comprehended the following steps:

1. Review of energy policy in the EU and Portugal;
2. Evolution of the Portuguese energy sector and identification of drivers for change in energy consumption patterns;
3. Identification of energy market distortions, including the elimination of harmful subsidies and enhanced eco-taxation;
4. Review of existing information on the potential for energy savings in housing, service buildings, industry and transportation, and identification of impediments to its implementation;
5. Discussion of opportunities to improve simultaneously the equity of the fiscal system and the support of energy efficiency measure.

3 RESULTS

3.1 Energy policy in the EU and Portugal

The European Union energy strategy [7] focuses on five priorities: 1) Achieving an energy efficient Europe; 2) Building a truly pan-European integrated energy market; 3) Empowering consumers and achieving the highest level of safety and security; 4) Extending Europe's leadership in energy technology and innovation; 5) Strengthening the external dimension of the EU energy market.

The revised goals for the Portuguese energy strategy [8] are the following: a) Fulfilling all commitments assumed by Portugal in a rational manner; b) Reducing greenhouse gas (GHG) emissions; c) Diversifying primary energy sources and supply security; d) Improving energy efficiency of the economy, decreasing public expense and using resources efficiently; e) Improving competitiveness of the economy by lowering energy-related costs.

Although priorities differ, the overall Portuguese goals are in line with the European strategy. The major short-term targets, European and national, are a 20% improvement to energy efficiency (related to a business as usual scenario) and 20% energy from renewable sources by 2020. The new "Energy-Climate Package", agreed by European leaders in 2014, calls for a 40% reduction in greenhouse gases (relative to 1990 levels), 27% renewable share, 27% improvement in efficiency, and 15% grid international linkage, by 2030.

In 2014 the Portuguese Government initiated a green tax reform, led by the Ministry for Environment and Energy with support from the Ministry for Finance. A voluntary committee of experts, the Committee for Green Tax Reform (CRFV), performed the bulk of the work. The process was concluded with the publication by Parliament of Lei nº 82-D/2014 of 31 December, which includes a number of provisions on energy, including a modest carbon tax. The scope of this reform is rather narrow: it represents a shift of a mere 200 M€/year, while identified market distortions in the energy and transportation markets amounts to 4 300 M€/year; contrary to recommendations of the Committee, no "tax income recycling" was applied to improving resource efficiency. Nevertheless, it may serve as a first (small) step in the development of an environmental tax reform.

3.2   Evolution of the Portuguese energy system

Historically, the Portuguese energy system has been characterized by poor efficiency indicators. Observing the evolution of greenhouse gas emissions, energy consumption and energy intensity, three periods can be distinguished in the past 25 years [9, 10].

From 1990 to 2005 consumption and pollution rose and the energy intensity grew steadily worse, up to 178 toe/M€ 2005; this evolution was driven by low energy prices and the absence of energy and climate policies. From 2005 to 2012 energy consumption and related emissions began to decrease, and energy intensity improved, due to a combination of technical modernization, modest investments in energy efficiency related to European regulations, and increasing energy prices; for most of this period Portugal had positive economic growth rates, supported by European funds and, until 2011, heavy borrowing. Since 2011, the economic crisis and the international intervention to relieve the debt crisis caused a reduction in GDP, investment, energy consumption and emissions, with the stagnation of the energy intensity indicator.

At its best, in 2012, the Portuguese energy intensity was 147 toe/M€ 2005, higher than the EU-28 average of 143 toe/M€ 2005; a grossly excessive figure since Portugal has a mild climate and relatively little industry.

An analysis sector by sector allows better understanding of the underlying reasons for this evolution. In the industry, modest improvements in efficiency from 2006 to 2010 (about 1% per year) are in line with mandatory requests for energy planning. In the service sector, the inversion of the consumption and energy intensity happens earlier, in 2004, probably related to better energy management practices. In the domestic sector the inversion is related to saturation in household equipment plus technological modernization, years before the onset of the economic crisis.

In the transportation sector, the greatest energy consumer, technological modernization and resulting decrease in energy consumption and pollution were motivated by advanced car taxation based on environmental criteria since 2007 (the one success story of environmental taxation in Portugal to date). On the other hand, mobility indicators have been hindered by weak and inadequate transportation and planning policies. The share of passenger inland transport by car in Portugal is 88% (EU average 82%); the share of freight inland transport by road in Portugal is 93% (EU average is 72% and going down) [12]. Over 35% of the Portuguese motorways do not have traffic to justify their existence [13]. The use of public transportation has been going down steadily; by 2013, there were 3008 (three thousand eight) different kinds of public transport tickets in the metropolitan area of Lisbon, and the share of public transportation in commuter trips had fallen from 50% (20 years earlier) to 25% [14].

Despite the fact that energy efficiency has been on the agenda for decades, and has been a (modest) reality in Portugal for a decade, existing national policies do not support energy efficiency. Between 2007 and 2011, only 5% of state-sponsored investments in the energy sector were dedicated to efficiency improvement; the remainder 95% was awarded to the gas and electricity utilities, to subsidize new production plants and transport lines [15]. The Government ignored the recommendation of the Committee for Green Tax Reform, who in 2014 called for a substantial increase of incentives to energy efficiency.

For many years, official energy consumption forecasts totally ignored the underlying technological, behaviour and statistical trends which indicating an inversion of consumption patterns. By 2013 — eight years after energy demand began to fall — official documents still "predicted" an exponential increase in energy consumption. In the electric sector, demand increases of over 1% per year were still "predicted" by 2013 [16]. This partly explains the huge amount of useless investments in excessive capacity, particularly in the electricity production system and in the motorway network.

The new paradigms of a resource-efficient economy, the consumer-producer "prosumer", and the game-changers of the modern photovoltaic and household electricity storage, now reaching the market, have yet to be understood by policy makers and translated into actual policy instruments.

3.3   Energy market distortions

The Portuguese energy market shows very significant distortions. An evaluation by the European Environmental Agency [17] identified 3 000 M€/year of potential for improvement in environmental taxation, of which 2000 M€/year are energy or transport related. Further studies that encompassed more aspects of the energy system [18, 19] elevated this figure to 4 300 M€/year. Most of these market distortions are subsidies to energy production and consumption and to favour private cars, in practice promoting resource waste, poor management practices, and investments in over-capacity. The resulting impacts include unnecessary consumption and costs, GHG, acid gases and other pollutant emissions, land and biodiversity degradation. Those distortions are harmful to consumers (both families and companies), in favour of the large energy and construction corporations, road concession holders, automotive industry and banking.

Table 1 – Quantification of market distortions and creation of eco-taxes [17, 18, 19]

Sector	Measure	Value (M€/year)	Criteria/references
Electricity	Reduce installed capacity subsidies	400	Peak coverage 1.1
	Eliminate PRE to cogeneration and dedicated biomass	430	Average 2010-2012
	Reduce renewable PRE	290	Reduce by half
	Avoid future costs with new dams (*)	215	Future burden
	Power generation water use tax	116	EEA 2013
	End tariff debt (*)	322	Commercial interest rate
	Subtotal	**1 773**	
Energy taxes	Apply ISP to rail and waterways	27	EEA 2013
	Align ISP and IVA in agriculture	108	EEA 2013
	Level ISP across industry	45	EEA 2013
	Level IVA of heavy fuels	27	EEA 2013
	Adjust motor fuel tax rates with inflation	137	EEA 2013: inflation
	Align taxation of electricity	166	EEA 2013: Spain & Greece
	Align taxation of natural gas	60	EEA 2013: Spain
	Introduce carbon tax	279	EEA 2013: 15-20 €/t
	Subtotal	**849**	
Transport	End benefits for company cars	483	EEA 2013
	Air travel tax	98	EEA 2013
	HGV vignette scheme	170	EEA 2013
	Adjust road tax for diesel vehicles	594	EEA 2013
	Tax ex-SCUT concession holders	350	50% State Budget transfers
	Subtotal	**1 695**	
Total quantified distortions		**4 317**	
Total immediate possible revenue (except *)		**3 780**	

We should emphasize the following:

-   *Power guaranty subsidies.* Electricity consumption has a downward trend since 2007; photovoltaic is increasing rapidly and getting less expensive; the coverage index of electric power (whose optimum is 1,1 for security) is now 1,3 and growing [16], due to continuing investments in excess capacity, especially in hydropower. "Power guaranty" subsidies have been a bane on the Portuguese State Budget for many years. In the period 2010-2012, harmful subsidies to electricity production, mostly thermal power plants, amounted to at least 1 000 M€/year;

-   *Fossil fuel subsidies.* The special production regime for electricity production (PRE), originally created to promote investment in emerging and renewable energy technologies, was distorted to include fossil fuel cogeneration and other harmful subsidies [20];

- *National large dam program*. Electric utilities supported by the Portuguese Government are pursuing the construction of new hydropower dams. They cause huge environmental and social impacts, although they represent merely 0,5% of gross energy consumption (3,5% of electricity) at a cost double the market average; they are useless in a scenario of decreasing consumption. Future costs will cause an increase of 8% in the electricity bill, including a direct subsidy of at least 300 M€ (probably much more if the demands by the electricity companies are accepted) [21]

- *Tariff debt*. Due to past political reduction of electric tariffs, consumers now owe the electric utilities about 5 000 M€, a mounting debt;

- *Fuel taxes and fees*. There are many exemptions in energy related taxes and fees, including the tax on energy products (ISP) and value added tax (IVA) [22];

- *Vehicles*. Company car benefits should be eliminated; the circulation tax (IUC) for diesel vehicles should compensate differences in gasoline and diesel prices; air traffic and international road transport taxes should be introduced;

- *Motorway concessions*. Motorway concession holders are heavily subsidized, especially in those motorways that have little traffic to speak of [23]. Most of them were originally designed as toll-free or "SCUT", but now are subject to tolls. Such concession holders should be taxed.

3.4   Savings potential

The potential for energy efficiency improvement and respective costs can be derived from existing studies. Industry and housing are the more commonly analysed sectors (see tables 2 and 3).

Table 2 — Scenarios of energy savings in housing, national scale [24, 25, 19]

Energy savings potential in housing				Investment scenario (G€)			Payback (years)	
Type of measure	(Mtoe/y)	(%base)	(G€/y)	BAU	Priv.ETR	Publ.ETR	Sce.BAU	Sce.ETR
Change of habits	0,06	2%	0,4	0	0	0	0	0
Equipment substitution	0,60	23%	2,0	6,4	4,5	1,9	3,2	2,2
Thermal solar	0,41	15%	0,8	8,0	5,6	2,4	10	7
Construction improve.	0,27	10%	2,0	54	38	16	27	19
All measures	**1,34**	**50%**	**5,2**	**68**	**48**	**20**	**13**	**9**
Op.1: PNAEE 2013	0,35	13%	1,2	3,7	2,6	1,1	3,2	2,2
Op.2: base-20%	0,54	20%	1,8	5,7	4,0	1,7	3,2	2,2
Present consumption	**2,68**	**100%**	ETR scenario: 30% tax rebate on investment					

BAU = business as usual; ETR = environmental tax reform; Priv. = private investment; Publ. = public aid

Table 3 — Scenarios of energy savings in industry, national scale [15, 19]

Energy savings potential in the industry				Investment scenario (G€)			Payback (years)	
Measure scenarios	(Mtoe/y)	(%base)	(G€/y)	BAU	Priv.ETR	Publ.ETR	Sce.BAU	Sce.ETR
Option 1: PNAEE 2013	0,3	5,4%	0,12	0,53	0,37	0,16	4,3	3,0
Option 2: base-20%	1,1	20%	0,45	1,95	1,36	0,58	4,3	3,0
Average consumption 2001-2005	**5,4**	**100%**	ETR scenario: 30% tax rebate on investment					

BAU = business as usual; ETR = environmental tax reform; Priv. = private investment; Publ. = public aid

Generally, the best investments, with lower overall costs and smaller payback periods, can achieve consumption savings of around 10%. Further investments, reaching 10 to 20 % additional savings, are still economically interesting, especially when compared to energy production costs, but their application is dependent upon low interest rates on loans or the existence of moderate incentives. There is still significant savings potential above this level, but it requires higher investment costs with longer payback periods.

Existing research [15] shows that the major constraints to investment in energy efficiency are availability of funds (especially difficult in Portugal in a period of deep economic crisis) and the payback periods of some investments. Availability of information used to be a constraint in the past, but is growing insignificant

thanks to the Internet; more important is the awareness of entrepreneurs, especially in small and medium companies.

Positions by different stakeholders as reported to the Committee for Green Tax Reform show that an important obstacle to more adequate fuel taxation is international competition: it is hard for a business to compete when taxation impedes a level playing field [26]. This means that energy taxation has to some extent to be harmonized and international level.

Energy savings potentials for transportation and service sectors are harder to estimate; there is less information organized, but general trends are well known.

Buildings in the services sector have shown a large potential for energy savings, but its management is complex, both technically and institutionally [27]. Investments are significant, budgetary constraints are many especially in public institutions, often the operator is not the owner of the building it has been shown that, because of such constraints, regulations on the energy behaviour of buildings have had little effect on energy savings, especially on public institutions [28].

In the transport sector there are two major issues:

a) Commuting traffic in the metropolitan areas. Half the population of Portugal lives in the metropolitan areas of Lisbon and Oporto. Nowadays 75% of those commuters travel by car with an average occupation of 1.4 persons per vehicle. Transferring even a fraction of those car-bound commuters to the public transportation system with generate very significant energy savings. The effect of suburban dispersion alone accounts for at least 15% of energy consumption in transportation [29];

b) There is a vast potential for rail use in long distance transportation, both passengers and freight. Portugal needs a modern rail infrastructure, but national commitments under ERTMS (the European Rail Traffic Management System) are yet to be fulfilled [30].

Both these issues require integrated policies, multi-sector and multi-stakeholders, and also significant investments. Technology is the easy part, and there are European financing sources for such projects. Some of the financing can be obtained through the fiscal system, e.g. the carbon tax. The debate about the green tax reform showed that people are much more inclined to accept a fiscal burden if they understand it will be beneficial for them.

4   DISCUSSION

The problems of the energy sector have been identified for a long time. The first priority to deal with energy should be energy efficiency, because it is at once the solution with the best environmental results and the best cost-effectiveness.

Efforts to promote efficiency by regulation have had a very limited success. In Portugal, a significant number of regulations regarding energy management in industry and buildings resulted in a paltry improvement in industry efficiency (less than 5% between 2006 and 2011) and almost none in buildings.

On the other hand, the few instances of fiscal and other economic incentives have produced very significant results. Families, business and even public institutions react swiftly to well designed market signals, which they interpret, correctly, as both a threat and an opportunity. A few examples in Portugal:

-   The success of the car taxation reform, based on pollutant emissions, which promoted the renovation of the car fleet in favour of more efficient models;

-   The effect of increase in energy price, modest since 2005 and more significant since 2010, that was the driving force behind most efficiency improvements in the industry and services. In business, when an investment (in energy efficiency) has a payback time lower than 3 years, the likelihood of its adoption rises dramatically. Well chosen measures such as fiscal benefits can have a powerful effect in promoting private investment;

- The offer of feed-in tariffs for renewable electricity production generated a whole new market, especially in the wind power subsector, that nowadays accounts for about 25% of all electricity generated in Portugal;

- Much of the discussion around the recent green tax reform revolved around the recycling of new taxation to (i) help solve the pollution problem by creating incentives for more efficient cars, and (ii) allow the people who pay for the tax to have a clear benefit from it. In fact, the CRFV showed that the best distribution of carbon tax revenues, for economic benefits, would be a split between co-financing energy efficiency and reducing the income tax [26]. Unfortunately so far it was not done this way, hindering the potential positive economic effects of the tax reform [31].

To achieve the targets of the National Plan for Energy Efficiency 2013-2016, in the industry and housing sectors, a total investment of about 4 200 M€ would be needed (cf. Tables 2 and 3). Economic incentives of 1 400 M€ (e.g. in the form of tax deductions) could promote the remaining private investment, because that would decrease payback time to below three years. To achieve a more ambitious target of 20% savings on baseline, a total investment of 7 700 M€ would be needed, requiring about 2 300 M€ of incentives.

As referred above, the energy-related market distortions identified in Portugal (including harmful subsidies and potential for new eco-taxes) amount to 4 300 M€/year, every year, so it is perfectly viable to simultaneously finance energy efficiency (or energy substitution) measures, to reduce the tax burden on labour and to have collateral economic and budgetary benefits.

The present budgetary and economic crisis in Portugal has already been a tipping point in a number of ways. State spending in Portugal had been boosted for years by means of heavy borrowing. The international recession initiated by the 2008 financial scandals made clear that such borrowing was not sustainable. Failure to secure loans in the open market by the Portuguese State in 2011 led to an international intervention by the "troika" IMF/ECB/EC, which was successfully concluded in 2014. However, the measures imposed to balance the budgetary deficit took a heavy toll on the "real economy", resulting in a recession harder than in most countries. Portugal learned the hard way that we cannot live forever on borrowed money — a lesson that has yet to be learned about the excessive use of natural resources.

The economic crisis had some healthy effects, including the elimination of some superfluous State spending, and progress towards more transparent energy pricing. This has made investments in energy efficiency profitable, in theory; unfortunately, because of the recession, most Portuguese companies and families do not have at present the financial means to follow through on those investments in energy efficiency. Eliminating or reducing market distortions and diverting that money towards incentives for resource efficiency may be the best way to finance a desperately needed change in the paradigm of energy use — perhaps the only way in a context of economic crisis. Moreover, as the Portuguese 2014 green tax reform has shown, a fiscal reform calls much media attention to a problem that is not often discussed by the general public. Awareness about the unsustainable paths of our society is something we must pay much closer attention to.

Further contribution to this point was made in an IMF report [32] that exposes worldwide harmful subsidies to fossil fuels of 5,3 trillion US dollars per year — 6,5% of global GDP. According to IMF researchers, eliminating such subsidies would cut global GHG emissions by 20%.

In a nutshell, a serious environmental fiscal reform would go a long way in promoting environmental improvements but also energy efficiency, social equity and budgetary balance.

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THE LEGAL TRANSITION TOWARDS SUSTAINABLE MATERIALS MANAGEMENT IN EU ENVIRONMENTAL LAW – IS THE EU ON THE RIGHT TRACK?

ABSTRACT

The European Union (EU) is experiencing a transition towards the Sustainable Material Management. Changes are necessary to break down strong path-dependencies and lock-ins. Policy and legislation play important roles in this. A variety of constructive policies has been launched in the past fifteen years that form the basis for legislative action. Despite numerous fruitful attempts to adjust particular laws, legislation is still lagging behind policy. Nonetheless, several developments in law-making and legislation can be identified that enhance the legal transition: a strategic approach is being adopted, the better law-making programme is intended to create coherence and simplicity, and the entire life-cycle of a material is increasingly emphasized. Especially the latter development needs to be advanced to get the transition going. In this regard, opportunities lie in the alienation of legislation, the integration of policies, the broadening of scope of laws and the introduction of novel concepts into the legal framework. All things considered, the EU has just started its legal transition.

1   INTRODUCTION

Some believe we live in the so-called Anthropocene [1]. Human-caused pressures on the earth's system are widespread. In this new geological epoch (i.e. from the Holocene to the Anthropocene), materials underpin the quality of human life and are driving forces of the economies. We all use smart phones, drive cars, wear clothes and trade money for products on a daily basis. The other side of the same coin is that pressures on natural resources, the environment and human health and safety have increased severely by the use of materials over the last decades and will continue to rise if our existing routines endure. On top of that, due to the desire in developing countries to attain the same welfare as in developed countries and because of the expected dramatic growth of the world population in the coming decades (from 7 billion now to over 9 billion people in 2050 [2]), we demand more and more from the environment and human health. Hence, a change in many of our current manufacturing, production, consumption, usage, waste treatment and trade patterns is required. Despite the awareness of the need to radically change these processes and behaviours when drafting and amending European Union (EU) policy and legislation, many shortcomings remain in place. In fact, the EU is facing a transition towards the sustainable management of materials.

2   OBJECTIVE AND SCOPE

Although there are various approaches on how to characterize a transition, all of which highlight different dynamics, it can generally be assumed that 'sustainability transitions' take place in interconnected and interdependent socio-technical systems, such as in the fields of energy, water, food and materials. Generally, such a transition takes at least fifty years. Fundamental and structural changes are necessary to transform the socio-technical systems. The challenges identified are commonly linked with and stimulated by the strong path-dependencies and lock-ins in established sectors that show unsustainable symptoms. In the context of materials these are – amongst many others – resource scarcity concerns, short life-cycle products, increasing material use and chemical contamination. Existing policy, legislation and institutional structures are just three possible causes of these challenges. [3] [4]

Even though transition literature acknowledges that legislation could also play an important role in guiding the direction of transitions for the better, legislation is generally only briefly touched upon. A difficulty would probably be that no sustainability approach, nor Sustainable Materials Management (SMM), comes with a blueprint; the legal potentials for SMM are endless and the final result is far from clear. After all, sustainability comes in all shapes and sizes. Moreover, legislation as such is a continuous process of determining norms that are deemed right in a certain period of time and in a certain society. Therefore, legislation is 'just' another tool and is always 'under construction'.

Since it is impossible to pinpoint the exact stage of transition towards SMM, the aim of this study is to get an impression of where the EU stands at the moment and of where it is heading to. This might at least indicate where the Union could improve its legislation. As a matter of fact, EU legislation is somewhat lagging behind policy when it comes down to SMM, leaving a patchwork of measures in place that do not necessarily correspond or connected with one another.

This study briefly explains the framework of Sustainable Materials Management in EU law (section 3.1). Subsequently, it sheds light on some important developments in EU law-making and law for the SMM transition (section 3.2), whereupon significant and related flaws are put forward (section 3.3), which are illustrated by some examples [5].

3   SUSTAINABLE MATERIALS MANAGEMENT, DEVELOPMENTS AND FLAWS

3.1   Sustainable Materials Management and EU Law

In 2010, the Environment Council defined Sustainable Materials Management as '*an integrated approach that seeks to reduce environmental impacts of materials use and conserve natural resources throughout the life-cycle, a prerequisite for a more resource-efficient Europe*' [6]. SMM has in the first place been developed by the OECD (since 2004) and has been fleshed out by two major reports in 2005 and 2012. The Environment Council definition has thus largely been inspired by the OECD's working definition, according to which SMM is '*an* [policy] *approach to promote sustainable materials use, integrating actions targeted at reducing negative environmental impacts and preserving natural capital throughout the life-cycle of materials, taking into account economic efficiency and social equity*' . The 2012 report further clarifies that 'materials' include all the extracted or derived from natural resources at all points throughout their life-cycles, and that 'life-cycle of materials' includes all the activities related to materials (e.g. extraction, transportation, production, consumption and waste treatment). In addition, it highlights the multitude of actors and (governmental) levels involved. [7] In general, Sustainable Materials Management addresses the transition towards the sustainable use of materials, as the approach not only tries to preserves resources; it also intends to reduce waste and to minimize the environmental impacts of the materials we use. It is further based on the idea to not merely shift the burdens to another stage of the material's life-cycle or across geographical and political borders.

These explanations eminently reflect the broad framework in which legislators need to operate when dealing with materials. Achieving SMM is further challenged by the strong connection with other socio-technical systems, most of which also undergo sustainability transitions. A particular change in one system may cause great effects other systems. Despite the OECD's work on practical guidance for policy makers to put in place SMM policies, it has not been able to fully address these legislative challenges. It only briefly touched upon this issue by formulating a principle that encourages policy makers to apply the full diversity of policy instruments (including regulation) to stimulate and reinforce sustainable economic, environmental and social outcomes (Principle 3) [8]. According to the OECD, combining and integrating these mechanisms must therefore be stimulated. In doing so, it could indeed decrease the inflexibility of law. In the light of increasing stakeholder engagement and sharing of responsibility, governments can also consider shifting from command-and-control models of regulation toward more policy governance by setting long-term goals [9]. In addition, the 2012 report specified additional principles and subprinciples that can be carried out *through* law, such as economic incentives, increase of reuse and recycling, life-cycle perspective, detoxification, eco-innovation, trade stimulation, the gathering and sharing of information, and many more. Overall, the OECD carries out the message that an effective SMM framework must embrace a life-cycle perspective and a high level of co-ordination between economic actors and different policy areas. Therefore, the OECD advices governments – amongst other things – to develop innovative frameworks and processes to co-ordinate policies between a larger number of ministries. [10]

It is not the purpose of this study to elaborate upon all the legislation applicable to materials separately, but it may be useful to explain the relationship between SMM and EU primary law. After all, it is best when the legal transition towards Sustainable Materials Management establishes a legal basis in a broader framework that is not so much subject to external pressures, such as political or financial uncertainties.

As from Lisbon, Article 3(3) Treaty on European Union (TEU) has been one of the primary provisions when it comes to Sustainable Materials Management, for it aims at sustainable development [11], and a high level of protection and the improvement of the quality of the environment. The provision further highlights the need for stimulating scientific and technological progress and the establishment of an internal market in the EU. As a general rule, measures concerning the internal market are based on Article 114 Treaty on the Function of the European Union (TFEU) and measures reflecting the environmental objectives in Article 191 on Article 192 TFEU. Hence, most environmental measures are based on Article 192, for example when it concerns waste. Article 191(1) TFEU prescribes that EU environmental policy shall contribute to pursuit of the following objectives: *preserving, protecting and improving the quality of the environment; protecting human health; prudent and rational utilisation of natural resources;* and *promoting measures at international level to deal with regional or worldwide environmental problems, and in particular combating climate change*. These objectives clearly underline important aspects of Sustainable Materials Management. Because Articles 191 and 192 TFEU do not contain any precise prohibitions or obligations, nor do they lead to other concrete requirements for legislative action, the objectives need be operationalized in secondary legislation. Likewise, Article 191(2) TFEU contains several environmental legal principles (i.e. the precautionary and preventive principles, the source principle and the polluter pays principle) that merely function as guidance for further policy and legislation [12], despite the fact that the 7th Environment Action Programme (EAP) adheres the principles by enumerating the principles once more, which is important because EAPs are nowadays adopted under Article 192(3) TFEU (as a Decision) and are thus legally binding and official sources of EU law. This possibly puts more weight on the principles than before.

On the whole, the rather flexible and open nature of EU primary law makes it arguably easy to embed Sustainable Materials Management into the environmental legal framework. By the same token, it does not give much practical guidance either. Therefore, this study continues by looking at several developments in law-making and secondary laws.

3.2 Developments in law-making and law

To avoid repetition of things which have already been explained extensively in textbooks on EU environmental law, this study refrains from merely enumerating all the landmark dates for Sustainable Materials Management in environmental policy and law. Instead, it sets out three developments that facilitate the transition towards SMM. It also shows the relatively short period in which SMM has emerged and the background of the Circular Economy Package, which in itself is a fine example of the current state of the art.

3.2.1 Horizons, better law-making and the life-cycle perspective

Since the 70s, environmental concerns have been gaining ground in environmental policy and legislation, both on State and European level. The first legal measures were a reaction to large-scale accidents with great impacts on the environment. Over the last forty years, environmental policy-making and law-making have changed from taking an ad-hoc approach to a more strategic approach. This evolution is very much reflected in the communications of the Commission, particularly the ones drafted in the past fifteen to ten years. The Commission – the engine of SMM policy-making and law-making in the EU – launches green papers, action plans, strategies and general communications (legally speaking they are all communications) and roadmaps on a regular basis, which increasingly

include 'horizon targets'. These horizons have moreover been shifting from no date at all (e.g. Green paper on the Integrated Product Policy, 2001), to ten years (e.g. Europe 2020 Strategy, 2010) and even to thirty five years (e.g. Roadmap to a Resource Efficient Europe, 2011) [13]. Consistent with the latter horizon, the EU institutions as a whole engaged itself to a so-called circular economy '*where nothing is wasted and where natural resources are managed sustainably*' in 2050 in the 7[th] EAP, which was adopted by the appropriate name of '*Living well, within the limits of our planet*' in 2013 [14]. Although legislators have also increased the use of targets over time, they have not been following the same pattern as regards the expanding periods. Evidently, that would have been counterproductive: while policy may be adapted quite easily, it is more difficult to change law. It should therefore not include horizons in a faraway future. Several waste laws fixed incremental deadlines up to fifteen years, for example up to 2020 in the 2008 Waste Framework Directive (WFD) and up to 2015 in the 2001 End-of life Vehicles Directive [15]. All things considered, the increasing use of horizons in policy and law perfectly fits into the notion of a sustainability transition.

The second development that is arguably in the interest of Sustainable Materials Management is the growing engagement of non-state actors in law-making and the assessment of legislation at every stage (from planning to implementation and revision). Under the guise of better law-making, the Commission – assigned by the current and the previous two regimes (Juncker Commission, Barroso Commission and Prodi Commission, respectively) – introduced various initiatives in the past fifteen years: e.g. Better Regulation, Smart Regulation and REFIT (Regulatory Fitness and Performance programme) [16]. Altogether, these initiatives promote the use of roadmaps that describe the initiatives planned and the examination of potential economic, social and environmental consequences before the Union takes any action. The first element ties in with the observation on the increasing use of horizons, whereas the latter element puts emphasis on sustainability and the Integration Principle (see 3.3.2). Furthermore, once the EU has adopted secondary legislation, the Commission evaluates the legislation's implementation and executes a so-called 'fitness-check' to identify opportunities for simplification and regulatory burdens reduction. An initial but significant step would be to improve the overall coherence of the legal framework by aligning definitions, deleting overlaps and filling gaps. Also, the Commission asks industries, citizens, administrations, research bodies and organisations at various stages of this process to express their views and to lower costs of information collection. Not least to gain public support for the particular measure. In general, it seems that this development also corresponds to the transitional approach. It is as if the inherently inflexibility of law is slightly decreased by the fitness-checks and public consultation, because the Commission can spot the (potentially) flaws of a legal measure right at the beginning, in the course of its drafting or after its implementation, whereupon it could start off a legislative procedures to adapt the draft/measure. In addition, according to the Commission, better law-making also entails the greater use of different (legal) policy tools; this has also been advocated by the OECD in the context of SMM.

A third development concerns the growing use of a life-cycle approach. In accordance with the work of the OECD, the EU laid strong emphasis on the waste treatments in the past. In recent years, however, there have been calls not only to focus on the waste stage, but to broaden the scope and change the direction of European waste legislation more towards the management of *materials* in general, regardless of the material's status or particular application. For example, the 2008 Waste Framework Directive contains an expanded five-stage waste hierarchy (Article 4(1) WFD). In order to deliver the best overall environmental outcome, Member States may customize the hierarchy where this is justified by 'life-cycle thinking' on the overall impacts of the generation and management of such waste (Article 4(2) WFD). As a rule, the prevention of waste is the first to tick off on the priority list and takes place entirely outside the scope of the waste stage. Additionally, EU waste policy and legislation stresses the importance of re-use and recycling, which follow the prevention of waste in the hierarchy and places former waste back into user stage (reuse) or adds an entire new life-cycle to the previous one (recycling). Recycling is really at the heart of current EU waste policy. Explicit legally binding engagements thereof can be found in Recitals (28), (29) and (41), and Article 11(2)

WFD. Furthermore, the introduction of the Extended Producer Responsibility concept and the Polluter Pays Principle in the framework directive further highlights the significance of the design, production and user stages of a material's life-cycle. The life-cycle perspective has also been incorporated in other waste legislation targeting specific waste streams, e.g. in the WEEE Directive, which contains a provision on the design and production of electrical and electronic equipment [17].

3.2.2 The Circular Economy Package

As all Commission regimes tried to improve EU waste legislation in accordance with the views and technologies that were accepted and available at the time of application, the previous Commission regime (Barroso, 2004-2014) dedicated much effort to the overall coherence of EU waste legislation. An example, which has been mentioned before in different contexts, is the Waste Framework Directive of 2008: the directive annexed the Hazardous Waste Directive 91/689 and the Waste Oils Directive 75/439, and it was 'officially' called a *framework* directive, whereas its predecessors were not (legally speaking, however, there is no difference between directives and framework directives). Despite this initiative, the legal waste framework was still fragmented. Evidently, this can be explained by its historic ad-hoc approach. Nevertheless, it did not stop the second college of Barroso from launching a new and comprehensive policy package mid-2014 in order to install a *'common and coherent EU framework for promoting the circular economy'*, also known as the Circular Economy Package [18]. The programme was really meant to be the apotheosis of a whole range of policy initiatives (some of which are touched upon above) and fleshes out the notion of 'circular economy', which had initially been introduced in EU policy and legislation by the 7th EAP and can be understood as the European interpretation (or equivalent?) of SMM [19].

The Circular Economy Package consisted of a communication and a legislative proposal [20], which amends six waste directives, amongst which the Waste Framework Directive and the Landfill Directive [21]. Importantly, it was the result of a long period of drafting roadmaps, performing assessments, doing research (e.g. the Targets Review Project), carrying out public consultations … *et cetera* so as to enhance simplicity, clarity and predictability, and to reduce costs and efforts. Indeed, the Circular Economy Package is a prime example of the better law-making initiative. One of the outcomes of the procedures was the need to align definitions in EU waste law. The definitions of recycling used in waste laws regulating specific waste streams are for instance slightly different than the WFD recycling definition, which causes confusion and contradictory calculation methods for the recycling targets throughout the EU. To build upon the issue of targets, the legislative proposal gradually increased the majority of the reuse and recycling targets. Generally, the targets ultimately aimed at 2030. In addition, it aimed for the phasing-out of landfilling by 2025 of recyclable wastes in non-hazardous landfills. The Circular Economy Package clearly endorsed a transitional approach by adopting a long-term vision.

Not before long, however, there were clouds on the horizon. The newly appointed European Commission officially killed the Circular Economy Package in December 2014 after just having been in office for less than two months. The Package's withdrawal clearly shows the political vulnerability of the legal transition towards Sustainable Materials Management in the EU. While the Package had been proposed in times of economic crisis, which could had restrained the proposal's drafting in the first place due to prevailing economic considerations, it was eventually withdrawn due to a wind of change that blew through EU politics. No provisions in primary law can stop that. Of course, this state of affairs is not new: a new President of the European Commission usually announces withdrawals of legislative proposals in his Work Programme at the start of his mandate. This practice is assumed to be in compliance with EU law. Yet, this time there was a broad-based engagement for the Circular Economy Package by the Member States, the European Parliament and industries alike, for they already invested quite some time, effort and money in 'greening' their policies and activities over the past few years. Moreover, the proposal had in fact been the result of the better law-making

programme. Ironically, the preparation and announcement of the withdrawal were done by Timmermans, who currently serves as the First Vice-president of the Commission and as the Commissioner for Better Regulation.

Despite all this, the Commission assured to come up with a 'more ambitious' proposal before the end of 2015. It should nonetheless be stressed that such a statement is by no means legally binding, which leaves a lot of wiggle room for the Commission in terms of time, content and type of legal measure. It could well be that the proposal will be more economic-driven or more comprehensive in the sense that it covers more than just adjustments to 'only' six waste laws. All in all, the sustainable use of materials is a much debated and important issue in the Union's quest to enhance its ecological resilience and to transform into a sustainable society.

3.3. Flaws and opportunities in the application of the life-cycle perspective

The Circular Economy Package neatly illustrates the difference between policy and law on EU level. Efforts have been made to consolidate policies into one coherent policy on SMM. The policy-makers took into account a long-term vision and the public's opinion, and the communication really tried to promote a *circular* line of reasoning instead of a linear. Whereas waste had been the centre of gravity for EU policy for many years (this has indeed proven its success), the importance of design of production processes, products and services also shone through in the policy's aspiration.

Although the Package's legislative proposal had been the result of the better law-making programme (which can arguably also be understood as a challenge, as discussed below) and contained several upgraded and new targets, it did not broaden the scope of the legislation addressed nor did it incorporate legislation regulating other life-cycle stages. In other words, it was only intended to amend waste legislation by means of familiar and overall effective legal tools. As a consequence, if the proposal had been adopted, there would still be a patchwork of legislation in place governing materials. Indeed, the Package's title is therefore somewhat misleading.

Below, four interconnected flaws are put forward that should be addressed in the future (in the new Circular Economy Package?) and all relate to the crucial role life-cycle perspective plays in the legal transition towards Sustainable Materials Management.

3.3.1 Align legislation – The Waste Framework Directive and REACH

As stated before, the measures in place not necessarily correspond or connected with one another. Aligning secondary legislation would therefore be a golden opportunity for the transition towards SMM in the EU. Let us take the Waste Framework Directive and the Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as an example, since both measures regulate the recycling process of wastes containing chemical substances and thus play significant roles in the SMM transition. After all, chemical recycling preserves virgin resources from being used, either in the manufacturing and production processes (e.g. for energy) or in the products themselves.

It is worth repeating that EU waste policy and legislation stresses the importance of recycling. REACH, on the other hand, stimulates above all a clean and safe material cycle, meaning that as little as possible impurities and hazardous substances are contained in the substances and products containing chemicals. Both objectives can be defended in the context of SMM. However, current practices show that chemical recycling is excessively hindered by some obligations under REACH.

As for the purity of the chemical cycle and the safety for humans and the environment, REACH contains several mechanisms relating to the registration, authorisation and restriction of substances, which is generally in the form of information assessment and supply. In this context, it could be observed that there are some exceptions to the registration obligation, one of which is most important for recyclers and is expressed in Art. 2(7)(d) REACH. It is however almost impossible for recyclers to

fulfil the requirements when they receive post-consumer waste (e.g. household waste), because the waste is generally being delivered without any information on the substances' composition. Consequently, recyclers have to do their own (laboratory) analysis of the constituents, requiring an in-depth research that is time-consuming and costly. In addition, the registration fees are quite high. In fact, the same problems occur with regard to the determination of the hazard profile of the recycled substances (i.e. for the restriction and authorisation requirements). Admittedly, regulatory compliance rarely is free of challenges and of the need to devote financial resources to it. On the other hand, it should not stop the recycling industry from pursuing their activities. The question that arises is why taking the innovation path, which enquires so many efforts, if there is an easy way that equally takes you to success? In other words, why recycle when the use of new chemicals may lead to a similar or financially even better reward? [22] It looks like if REACH has not been made to stimulate recycling.

The Commission already responded to this flaw through the better law-making programme: it reduced the registration fees for smaller enterprises. In addition, the Commission is working on Union-wide End-of-Waste (EoW) criteria for plastics, which might improve the overall coherence between REACH and the Waste Framework Directive. The incorporation of existing definitions of hazard profiles and lists of hazardous substances, such as the ones in REACH, in the criteria could be a binding factor between waste legislation and product legislation. The question is whether these changes do the trick in this specific case.

3.3.2 Integrate policies – The Integration Principle

The integration of policies is a fundamental aspect in the life-cycle approach, because the sustainable use of material is a complex and comprehensive issue, involving many actors throughout the life-cycle, and which requires a shared responsibility throughout the Union. Basically, this boils down to yet another touchstone for SMM in EU primary law: the Integration Principle. According to Article 11 TFEU environmental protection requirements should be integrated into other policy fields, in particular in view of promoting sustainable development. The provision recognizes that the environment is always affected by other policies, the obvious examples being policies addressing other socio-technical systems than the material system, such as transportation, trade, energy and industry. Indeed, the Integration Principle captures very well the 'sustainability transition' approach and the OECD's support for policy cohesion. Because EU policies are in principle equally important and the Union is obliged to try to achieve them all (Article 7 TFEU), the Union is not obliged to give priority to environmental protection requirements. Instead, the EU institutions have broad political discretion in putting the principle into practice [23].

Generally speaking, within the Commission the departmental integration cannot be considered successful, as the administrations typically work vertically, without many institutional or regulatory interdepartmental meetings [24]. The SMM transition will most likely require new partnerships and communication channels between the departments. In fact, this is precisely the reason why DG Environment allied with different departments for the launch of the Circular Economy Package, e.g. DG Employment (which also presented a new initiative in mid-2014, the Green Employment Initiative) and the DG Internal Market & Industry (DG GROW). In addition to the aim of policy integration, working together with other DGs was politically speaking also the best option, because DG Environment alone would probably not had been able to get enough support for the package.

Another issue relating to the integration of policies concerns the assessments made in view of the better law-making programme. As it happens, these assessments are generally made in economic terms, while environmental impacts can often not be expressed in terms of money. For this reason, possibly more weight will be given to trade and industrial considerations instead of environmental considerations, although not necessarily intended. The assessments can thus lead to less environmental protection caused by the watering down of proposals [25]. Notably, the activity of other EU institution is to a large extent dependent on these proposals. These institutions and the

Commission in particular must therefore make sure that the better-law making programme is not misused in a way to disconnect policies. Moreover, better law-making and deregulation should not be mixed up, especially in cases when it concerns environmental protection as the environment does not have a voice.

3.3.3   Broaden the scope – The Ecodesign Directive

A difference between waste legislation and product legislation is the transitional stage in which they are situated. Although significant steps have been made in REACH (there are several obligations in place to pass on information through the chemical cycle, which *ideally* also includes the waste stage), not all laws are that progressive to date. In general, there is an lack of environmentally orientated product legislation, despite the good intentions of the Action Plan on Sustainable Consumption and Production (DG Environment) [26].

The Ecodesign Directive 2009/125 [27] is primarily aimed at the energy efficiency of energy-related products, such as kitchen equipment, air conditioning products and washing machines. However, since the importance of resource efficiency increases in the Union, the Commission launched a study on material-efficiency for the 'Ecodesign Methodology', which was finalised in December 2013 [28]. The report suggested that – amongst other things – the following parameters should be added to the Ecodesign Directive: recyclability benefit rates and recycled content. These conclusions clearly show the willingness of the (at least the previous) Commission to expand the scope of the Directive, e.g. by considering to include more material-related considerations to the valuation. As a matter of fact, the Directive's Annexes I and II already specify several parameters that can be used in this respect, but which have been neglected so far. Yet another step forward would be to expand the Directive's scope in the context of products, meaning that the eco-design requirements would not 'only' apply to all energy-related products but also to non-energy related products. This would probably cause a tremendous transformational change, especially because the Ecodesign Directive is a horizontally based directive and can thus be the perfect platform to encourage the use of the life-cycle approach (comparable to the Waste Framework Directive).

These potential changes should however be nuanced and seen in the light of the integration of policies. In point of fact, the Directive is – like most product-related laws – adopted on the basis of Article 114 TFEU. The Article on the internal market is most relevant in the case of product-related (environmental) measures, because products usually require uniform rules. For that reason, these measures are generally not in the Environment Commissioner's portfolio. Instead, DG Grow pursues this matter, which is also the case for the Ecodesign Directive. While DG Environment puts more and more emphasis on the life-cycle stages apart from the waste stage in waste legislation, DG Grow has just started experimenting in cross-border policies in product legislation.

3.3.4   Introduce new concepts – Enhanced Landfill Mining

The Circular Economy Package continued to cling to well-known and well-working legal tools, such as setting new targets. Disappointingly, it did not introduce any innovative ideas to improve the life-cycle perspective, for example with regard to landfilling. Landfills have long been a final 'solution' for waste; due to a whole host of environmental and social problems, the EU now carries out a policy that severely restrains this type of disposal. Nonetheless, there are still numerous closed and/or operational landfills in place on the Union's territory and many problems continue. The idea of mining landfills has been developed to address these issues and can be defined as *'a process for extracting minerals or other solid natural resources from waste materials that previously have been disposed of by burying them in the ground'*[29]. The Flemish Enhanced Landfill Mining (ELFM) Research Consortium – which is now endorsed by a European consortium – developed a concept that builds upon this idea by integrating in an integrated and systematic resource recovery practice.

ELFM can be understood as the safe conditioning, excavation and integrated valorization of landfilled waste streams as both materials and energy, using innovative technologies and respecting the most stringent social and ecological criteria [30]. Phrased differently, the collected and treated non-recyclable waste (in line with the waste hierarchy: landfilling is the final option, after recycling and energy recovery respectively) is temporary stored, during which gasses are being valorized. When it is technological and economically viable to recycle or recover the waste, the materials are excavated, dried, washed, further processed … *et cetera*, whereupon the actual recycling or energy recovery takes place. The overall aim is to maximize the valorization of the waste in all possible ways.

It appears, however, that the concept of ELFM does not sit well with the current Waste Framework Directive and Landfill Directive, mainly due to certain terminology constrains [31]. An example thereof is the absence of 'temporary storage status' in waste law, because after more than three years storage pending recovery, the storage changes its status from a normal waste treatment (Article 3(14) WFD) to the specific treatment of disposal (i.e. landfilling, Article 2(g) LFD). This change would result in the application of the Landfill Directive, which is without doubt not the aim of ELFM: that is recovery. For his reason, legislators may want to consider abolishing the three-year limit that triggers the application of the Landfill Directive. What is most important is that if this is actually done, ELFM could cause a real revolution in current waste management practices, because landfilling would not be a 'final solution'. In fact, landfilling as such will not even exist anymore. After all, ELFM adds a new life-cycle to *all* waste materials and/or valorizes the wastes as energy. No precious materials will get lost in the treatment processes, which makes ELFM an excellent example of the application of the life-cycle approach. It seems that the incorporation of transformational initiatives like ELFM would not only pave the way for SMM in EU legislation, it may also contribute to the integration of policies and to other sustainability transitions, because ELFM also addresses energy considerations.

4   CONCLUSION

The EU is experiencing a transition towards the sustainable use of materials. Fundamental changes are necessary to break down strong path-dependencies and lock-ins in established sectors. Secondary environmental laws play an important role in this: they could either keep those unsustainable practices in place or they could promote sustainable practices instead. A variety of constructive policies has been installed in the past fifteen years that form – together with several provisions in the primary legislation – the basis for legislative action in the field of Sustainable Materials Management. Despite the numerous often fruitful attempts to adjust particular Regulations, Directives and Decisions to SMM, legislation is generally still lagging behind policy. This, of course, characterizes law in general, since policy generally serves as the kick off for legislative proposals.

Several developments in secondary law and law-making can however be identified that (potentially) enhances the transition to SMM. First, following the same development in policy, waste legislation too includes an increasing amount of targets, which directs the Member States towards continuing goals. Moreover, the period of many of these targets has also been increased in the past fifteen years, however not to the same extent as in policy. The latest pit stop in the transition was the launch and withdrawal of the Circular Economy Package, which included a legislative proposal to adjust several waste laws. This proposal also contained quite a few target upgrades and targets for new waste streams. The use of horizons is seen as a characteristic of sustainability transitions. Second, the better law-making programme is becoming more important in EU law-making than before. The Commission provides full assessments before and after legislation becomes into force. Public consultation and so-called fitness-checks are part of the programme and the use of them indicates that law-makers are aware of the necessity to respond faster to flaws in legal measures. The programme's downside is that it could be used to merely deregulate, which may turn out to be all wrong in case of environmental legislation. In addition, the assessments are generally made in economic terms, which may exclude environmental consideration to be taken into account. Moreover, the withdrawal of the Circular

Economy Package illustrates that the use of the better-law making programme is rather arbitrarily. Last, the EU institutions have been taken account of the life-cycle perspective for some time now. Ambitious words were particularly uttered in policy, some of which have already been turned into deeds: the 2008 Waste Framework Directive, for example, includes an enhanced waste hierarchy and the directive also aims at life-cycle stages other than the waste stage. Another example is the REACH Regulation, as it contains various obligations to pass on information throughout the chemical chain, including the waste stage.

Nevertheless, still lots of opportunities regarding the life cycle approach exist that were not seized by the previous Commission in the Circular Economy proposal. Key is that SMM requires greater integration of policies. Achieving this requires cooperation across different Commission departments. The appreciation and implementation of the Integration Principle should thus be strengthened. Furthermore, it is important to align the different stages of a material life-cycle. Challenges lie for instance in the consistency between REACH and the Waste Framework Directive. Additionally, the scope of the Ecodesign Directive should be broadened in the sense that it should be applicable to all products and that it includes more material-related parameters, covering all life-cycle stages. Another reflection is that the Commission should not back away from the introduction of new concepts. Enhanced Landfill Mining, for example, maximizes the material and energy valorisation of wastes. Its incorporation in waste legislation, however, needs significant changes to current practices and law. In the meantime, we should not see SMM as a stand-alone transition. The introduction of new concepts such as Enhanced Landfill Mining could build a bridge to other socio-technical systems (energy). As these examples show, the opportunities for an improved incorporation of the life-cycle approach in legislation are interrelated and they overlap with one another. Additionally, they make the vital links to other policies and systems in transition.

All things considered, the question of whether the EU is on the right track as regards the legal transition towards Sustainable Materials Management is difficult to tell. On the on hand, the withdrawal of the Circular Economy Package could be seen as a hurdle, because the legislative proposal contained solutions to several problems identified. On the other hand, the proposal had only been marginally inspired by a life-cycle viewpoint. Although there is indeed a genuine chance that a reanimated proposal hangs on to this course, it may be equally quite the reverse.

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ECONOMIC VULNERABILITY FACTOR ON SUSTAINABLE LIVELIHOOD OF URBAN FARMER IN KOTA BHARU KELANTAN, Malaysia

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ABSTRACT

Brutland Commission Report 1987 emphasized the livelihood sustainability as one of the agenda towards sustainable development. Moreover, sustainable livelihood also has become one of the agenda to achieve the objective of Malaysia Vision 2020 by improving the public living standards and low-income communities. However, in a part of a community, there a many vulnerability factors that led to the deterioration in livelihood and social sustainability. This study was conducted to analyze four factor of economic vulnerability that affect the sustainability of urban farmers' livelihood and in Kota Bharu Kelantan, Malaysia. The method of this study is based on a quantitative approach involving data collection and data analysis by Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structured Equation Modelling (SEM). There are four latent constructs factor of vulnerability that is ineffective marketing channel factor, burdensome production costs factor, lack of loan facility factor and low production yield factor as exogenous variables. While the latent constructs of livelihood outcome is endogenous variables that develop the structured model of the study. The structured model of the study showed an excellent compatibility and all indices reached the target. As a result, fitness indices for the model are as follows: $\chi2 = 174.767$; CMIN/df=1.398, all of Goodness of Fit Index (GFI), Normed Fit Indices (NFI), Tuckers-Lewis Index (TLI) and Comparative Fit Index (CFI) were higher than 0.9, and RMSEA<0.08. This study found that the ineffective of marketing channel aspect of urban agricultural production is the main factor of vulnerability that affects the respondent's sustainability of livelihoods.

Keywords: urban agriculture, sustainable livelihood, vulnerable factor, structural equation model

1. INTRODUCTION

Since 1991, Malaysia has set the target to achieve a developed nation by the year 2020 through Vision 2020 agenda [1]. These goals were presented by Tun Dr Mahathir Mohamad through a paper entitled "*Malaysia: The Way Forward*" in Malaysian Business Council in 1991. In line with these goals, the government has improved the public living standards and low-income communities as one of the agenda in six *National Key Result Areas* (NKRAs) [2]. One of the important aspects that are emphasized is managing the polarity between the rich and poor society in terms of the economy by improving the living standards of low-income households [2]. In addition, the 1Malaysia Concept also emphasizes the principle of social justice and sustainability by defending the interests of each community and ensuring that no groups will be marginalized from the mainstream of development [3]. The successful efforts are visible when the incidence of poverty has declined significantly from 49.3 percent in 1970 to just 3.8 percent in 2009, while extreme poverty is almost disappeared by incident at only 0.7 percent in 2009 [4]. The government has also decided that extreme poverty can be eradicated by the end of 2010 and reduce the level of poverty between 2010 and 2012 [2].

Nevertheless, there are some poverty still exists in certain areas and communities in society [4]. They still face many difficulties to get out of the vulnerability zone and achieve sustainability in livelihood. There are many studies show that urban farmer face a variety factor of vulnerability that affects agricultural production and their livelihood [5]. In order to fulfil this agenda the sustainable livelihood is a very important concept

that forms part of the welfare goals of life and achieve the social sustainability objective. Livelihood sustainability concept emphasizes consistency and the ability of the community to build more sustainable and peaceful life [6]. Therefore, this paper examines four economic vulnerability factors that are identified to affect the sustainability of urban farmers' livelihoods, which are lack of loan facility [7][12], burdensome production costs [13][15], ineffective marketing channels [9][16][17] and low productivity yield.

1.1 Urban Agriculture

Urban agricultural is the development, food processing and distribution, food and non-food cultivation, and farming activities carried out specifically for urban markets either in the suburbs or in the middle of the city [18]. In addition, urban and suburban agriculture also referred to as intra (within) and peri (on the fringe) of cities agriculture [5]. [19] also pointed out that urban agriculture is a food production activity that are conducted in a small area in the city including vacant plots, gardens, curbs, balconies and plant plot in the city to develop agriculture and livestock activities on a small scale, whether for personal use or for sale in the neighbourhood. Urban agricultural activities are carried out through various approaches. Among them are ground-level farming, rooftop farming, hydroponics, and green houses [20]. Types of areas used for urban agricultural activities also includes home surroundings, community spaces, extra spaces or public and private storage, industrial and similar areas, rivers and floodplains, water bodies and wetlands, and slopes [9]. Meanwhile in Chicago, United States, there are three approaches to urban agriculture that are mainly used depending on the location, size, type of management and commercialization level, namely home gardens, community-based gardens, and commercial gardens and small farms [21]. In the meantime, [22] also explained that many urban agriculture activities carried out in continental countries of Africa such as Madagascar, South Africa, Nigeria, Zambia, Zimbabwe and Tanzania. While in Asia, urban agricultural activities are also conducted in countries such as Indonesia [23], Korea [24], Vietnam [25], Taiwan [26] and Philippines [27]. In addition, in 1996, the United Nation of Development Programme (UNDP) estimates that there are approximately 800 million people worldwide have been involved in urban agriculture activities since early 1990 [28].

Thus, urban agriculture is not a foreign activity among urban communities [9]. In East Africa, on average, it is estimated that one-third of the urban population is engaged in agricultural activities [29]. In Kampala, 34.8 percent of urban households are identified to be involved in agricultural activities, particularly farming [30]. In Nairobi, farming activities can be seen running in the suburbs mostly small company operations [31]. It is also estimated that 90 percent of leafy vegetables and 60 percent of the milk sold in the city of Dar es Salaam, Tanzania are produced through agricultural activities in urban and suburban city [29]. On the other hand, in the city of Addis Ababa, Ethiopia, milk production from agricultural activities in urban centres has become a very important production [29].

In the city of Paris, France, there are about 580,000 hectares of land for urban agricultural activities involving 5,300 farms. Most of these farms operate on the industrial scale, the production of cereals for domestic and international markets [32]. In addition, in 1996, the American Community Gardening Association (ACGA) estimates that there are more than 6,000 community gardens in 38 major cities in the United States including Boston, Newark, New York, Pittsburgh, Philadelphia and San Francisco. It is also estimated that 30 percent of it which is about 1,800 community gardens have been running since 1991, as a response to the growing interest on agricultural activities [21]. While in China, the largest supply of vegetables by agricultural activities in urban and suburban areas represents 76 percent of total supply in Shanghai and 85 percent of the total supply in Beijing. Producing vegetables and fruits intensively is a broad life selection for the population in Beijing, where 31 percent of the urban population and 64 percent of suburban residents are involved in urban and suburban agricultural activities [29]. In addition, the development of urban agriculture in Jakarta, Indonesia, was started after the economic crisis faced Indonesia in 1998 and has opened job opportunities to the local community. Research on urban agricultural activities by [33] in South and North Jakarta showed that 100 percent of the respondents were migrants from rural areas of Indramayu, Subang and Bogor. They consist of rural farmers who migrated to the city to get a better job, but due to the lack of employment opportunities, they carry out agricultural activities around the suburbs for their survival.

According to The Urban Agriculture Network, it is estimated that 20 percent of the total demand on food in Jakarta are met through own production [34]. Research by [23] indicates food production in urban

agriculture activities are able to meet 1.2 percent demand for rice, 0.5 percent demand for vegetables and 19.6 percent demand for fruits. The response to urban agricultural production is very high where farmers are estimated to be earning up to Rp 1,079,000 in West Jakarta and Rp 923,000 for farmers in North Jakarta [33]. According to DKI Jakarta Agriculture Department in 2012, about 17 percent or 11,240 hectares of the total area of Jakarta city is used for agricultural purposes [34]. In Malaysia, urban agricultural activities were also carried out in some areas. Among them is Kinta district of Perak. Research by [35] shows that there are approximately 1,418.6 hectares of land in the area is used for three types of agricultural activities which are cultivation of vegetables and fruits, fishery and swallows activities. Furthermore, urban agriculture activities are also carried out by people in the Klang Valley. However, research conducted by [36] shows that the level of development of urban agriculture in the region is still low. Most of them farm illegally on a small scale on roads of reserved land, delineation zone and land reserves for the construction of utilities, particularly the Tenaga Nasional Berhad (TNB) reserves. Urban agricultural activities began to face various constraints and obstacles, especially the availability of land for planting in urban areas [37].

Along with the rapid economical growth, there are many development projects, particularly in urban areas for the construction of buildings for commercial purposes, including the construction of residential houses, supermarkets, highways, etc. Moreover, an increasing number of urban populations also led to changes in the status of land use from agricultural to commercial purposes. In Peninsular Malaysia, the residential population in urban areas covered 67 per cent of the total population, with urban area growth of 2.1 percent compared to rural growth rate of 1.4 percent for the period of 2000 to 2009. Other than that, it is also estimated that 75 percent of the population would inhabit urban areas by 2020 [4]. Therefore, the achievement of sustainability of livelihoods among the urban community is seen more challenging especially regarding the farmers who undertake agricultural activities in urban areas.

1.2 The Concept of Sustainable Livelihood

Livelihood sustainability emphasizes the ability of individuals or households to cope with and recover from stress, shock and any changes that occur as well as maintain or enhance their assets today and in the future in a way that does not affect environmental resources [6]. The definition emphasizes the capacity, asset ownership and activities that are required by individuals or households for their livelihood sustainability. Ownership of livelihood asset is very important as it provides capabilities to households when faced with stress and shocks as well as maintain and enhance the ability of other assets. Other than that, emphasis on livelihood assets is also aimed to increase opportunities for more sustainable livelihoods for generations to come. To provide a clearer understanding on concept of livelihood sustainability, Department for International Development (DFID) has developed a conceptual framework, linking elements that play an important role in influencing the achievement of household livelihood sustainability. Figure 1 indicates the conceptual framework used to evaluate the effectiveness of existing efforts towards enhancing the sustainability of household livelihoods. There are five main elements involved namely context vulnerability, livelihood assets, changes in the structure and process, livelihood strategies and livelihood outcomes. Livelihood sustainability framework clarifies that livelihood sustainability of individuals or households will be achieved when they reached their livelihood outcome. The livelihood outcomes achieved plays an important role in providing the ability to a household in increasing their assets for their livelihood. There are various livelihood outcomes to be achieved by the household, including more revenue, improved food security, increased well-being and reduced vulnerability in their livelihood. According to [38] again, an individual or household is vulnerable to a variety of factors that may lead to their present vulnerability situation and preventing from achieving sustainability in their livelihood. If this vulnerability factor is not managed well, individuals or households will be unable to achieve sustainability in their livelihood.

1.3 Vulnerability Factor

Vulnerability describes the unstable situation in the external environment that may affect the livelihood. According to [39] vulnerability is an unsafe condition of an individual, household or community as a result of changes occurring in their environment whether it is ecological, economic, social or political changes. Increase of vulnerability level may cause the people to be exposed to a negative external environment that may affect their family and their own survivability [40]. It is related to changes in the external environment that may cause continuing effects towards poverty and influencing livelihood sustainability. Vulnerability factors can also have a direct impact on the livelihood asset ownership status into achieving better

livelihoods. Assessment on a certain vulnerability is depending on the case study approach involving the differences of place, time, society and a certain scale to understand the composition of environmental risks and characteristics of an effective response towards them [41]. Therefore, a specific thorough understanding on vulnerability is important to understand any action to be taken into achieving a certain community and environmental sustainability.

H: Human; N: Natural; F: Finance; P: Physical; S: Social
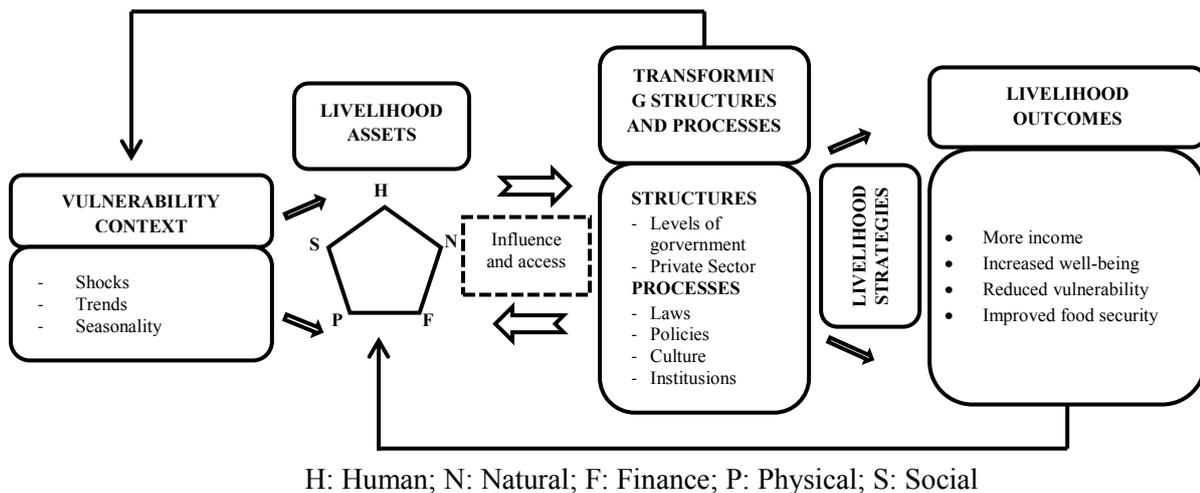
Figure 1 DFID Sustainable Livelihoods Framework [38]

Based on [38], vulnerability is discussed in the form of a shock such as sudden death, drought, natural disasters, wars and conflict, accidents, price hikes and currency declination. In addition, vulnerability is also discussed in the trend context including the output declination, price of production decrement, population change, diseases and costs of production increment. Vulnerability is also discussed in the form of seasonal price hikes, production, health and job opportunities. Discussions regarding the definition of vulnerability has been expanded to the meaning: easy and tend to be injured, threatened well-being, cramping life, feeling hard and painful due to frustration because of hope destruction, getting more isolated from the livelihood mainstream, threatened health as well as public safety [41]. According to the theory, the increase in vulnerability level of economic activity and people's livelihood may affect the next generation and their livelihood sustainability in the facing the life in future [42][43]. This study emphasize four economic vulnerability factors that are identified to affect the livelihood sustainability of urban farmers, which are lack of loan facility, the burdening production costs, ineffective marketing channels and low production yield.

1.4 Livelihood Outcomes

Livelihood outcome refers to the successful livelihood strategy and feedback from vulnerability factors that they managed to overcome [44]. Livelihood outcome is also the productivity achieved by asset availability of livelihood that they possess or are in their reach. Livelihood outcome includes revenue, increased well-being, reduced vulnerability, better food security, ability to meet basic needs and sustainable use of natural resources [45]. Livelihood outcome is very important as it is the aim and objective wanting to be achieved by household in living.

In livelihood sustainability context, the livelihood outcome takes into account a variety of indicators as a determinant in interpreting the results achieved in well-being either by quantitative or qualitative approach [46]. [47] clarifies that besides revenue and its uses, food security, health status, reducing vulnerability context, identity building, participation in social activities and environmental quality are also given emphasis by the community. However, not all the livelihood outcome desired by a household can be achieved. This constraint is caused by the existence of obstruction factors faced by households and it differs depending on the time, place and circumstances of the household. Moreover, this constraint is also caused by the desire to achieve the livelihood outcome clashing with the desires of other groups with stronger livelihood [38], making the weak unable meet the desired livelihood outcome. In the livelihood outcome context, this study highlights three elements that are defined as indicators for livelihood outcomes of urban farmers in Kota Bharu, Kelantan, which is income adequacy [38][46], high production yield and food adequacy [45].

2.   RESEARCH METHOD

This study uses a quantitative approach in which questionnaires were used for data collection from respondents. To analyse the data, this research using Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM).

2.1   Sampling

This study was conducted in the area of Kota Bharu Municipal Council (MPKB) in Kelantan. Selection of study site is based on two important principles, namely the urbanization development that has been taking place in Kota Bharu city and that there are still many urban farmers depending on agriculture for their living. This study used a stratified random sampling method and was carried out in two stages. In the first stage, the study population is divided according to the areas of Local Authority (LA). There are two local authorities in Kota Bharu District, namely Kota Bharu Municipal Council (MPKB) and Ketereh District Council (MDK). This study focuses on the area under the MPKB administration where there are five main areas, which are the areas of Badang, Kemumin, Kubang Kerian, Pendek and Peringat. In the second stage, the research samplings were made according to categories of plants they worked on. There are five plant categories, namely vegetable plants, fruits, paddy, short-termed cash crops and industrial crops. This study focuses on farmers based on three crops-planting categories, which are vegetable plants, fruits and paddy. Based on the data results from the Agriculture Department of Kota Bharu District in Kelantan Malaysia, there were 200 urban farmers whom are actively engaged in farming around the MPKB area while the research was conducted. Researchers have selected all the 200 farmers as respondents. Table 1 shows the number breakdown of respondents according to the areas and plants category. Based on research results towards the questionnaires obtained, all 200 forms were returned.

Table 1 Population breakdown and research samples

Area	Crops Category			Total
	Vegetables	Fruits	Paddy	
Badang	6	29	-	35
Kemumin	36	-	34	70
Kubang Kerian	39	22	-	61
Pendek	1	11	-	12
Peringat	22	-	-	22
Total	**104**	**62**	**34**	**200**
Percentage	**52%**	**31%**	**17%**	**100%**

Source: Research data analysis 2014

Based on the literature review, studies found that there are four key elements that became the vulnerability factor in economic aspects towards the urban farmers in Kota Bharu Kelantan. These elements include the lack of loan facilities, burdensome production costs, low productivity yield and ineffective marketing channel. In particular, this study contains 18 items from the four constructs. The constructs and number of study items are shown in Table 2 below. All items in the questionnaires were constructed based on data intervals, which is the urban farmers' perceptions via the four points likert scale ranging from 4 - strongly agree to a scale of 1 - strongly disagree. Rational of the construction item scale is based on statistical interval scale which aimed to analyze the data using structural equation modelling test [48].

3.   RESULT

3.1   Reliability and Validity

To test the validity and consistency of the questionnaire, researchers have identified the Cronbach's Alpha value, which is the good value and that can be adopted, that is value exceeding 0.7. Cronbach's Alpha range of values for all study constructs is between 0.863 to 0.939 as shown in Table 2 below:

Table 2 Reliablity and Construct Validity of Research

Latent Construct	Number of Items	Cronbach's Alpha
Lack of loan facility factor	PI1, PI2, PI3	0.939
Burdensome production factor	KP1, KP2, KP3, KP5	0.896
Low production yield factor	HP2, HP3, HP4, HP5	0.928
Ineffective marketing channel factor	PE1, PE2, PE3, PE4	0.884
Livelihood outcome	Income adequacy [HK1] High production [HK2] Food adequacy [HK3]	0.863

Source: Research Data Analysis 2014

Before conducting the factor analysis test for authentication / confirmation, factor analysis tests have been conducted using Statistical Package for Social Sciences (SPSS) version 21 software for accurate sampling. The results from exploratory analysis of all the items, Kaiser Meyer Olkin (KMO) test obtained the value of 0.789. Meanwhile, the Bartlett's Test of Sphericity, the value for Approx. Chi-Square is 2790.456, df value is 153 and is significant at 0.000. Based on the analysis of Total Variance Explained, total items contributed to measure the research constructs is 80.8 percent, which is higher from the minimum value of 60 percent. On the other hand, based on the Scree Plot analysis, the system has provided construct number recommendations of five constructs, which is as the proposed number from the researchers.

The value of loading factor, on the other hand, showed a very good value and higher than the minimum value of 0.6 for all items. The range of item values for low production yield factor construct [HP] is between 0.765 to 0.957, ineffective marketing channel factor constructs [PE] is between 0.825 to 0.868, burdensome production cost factor construct [KP] is between 0.835 to 0.892, lack of loan facility factor construct [PI] is between 0.883 to 0.960 and livelihood outcome construct [HK] is between 0.851 to 0.890. The outcome from exploratory factor analysis test proved that all the items have been qualified to perform authentication factor analysis based on structured model construction methods [49][50]. After exploratory analysis shows all items are matched and suitable according to their respective constructs, MPB analysis can be carried out. This research conducts Structural Equation Modelling (SEM) analysis by using the Analysis of Moment Structure (AMOS) version 20 software. In general, SEM technique consists of two components which is also known as (1) the measurement modelling and (2) structural modelling [51]. The results of the measurement model are as Table 3.

Based on Table 3 derived above, the analysis of the measurement model shows all correspondence index proposed by [51][53] has been obtained. They suggested that the relative fit index for each model must exceed 0.90 while the Cmin/df value is between 1.0 to 3.0 and the RMSEA value, on the other hand, cannot exceed the value of 0.08. In addition, the correlation values between the constructs were below the maximum value of 0.85 [54] which is between -0.283 to 0.223. Meanwhile, the Squared Multiple Correlations value exceeded the minimum of 0.40 [54] which ranging from 0.449 to 0.980. However, one item for lack of loan facility construct, which is PI4 had to be dropped because the load factor value is low and does not meet the relative fit requirements model. The analysis result from the measurement model shows that, the proposed research model has a very good level of relative fit and can be used for the purpose of research model structure analysis.

Table 3 Relative Fit Index Model Research Measurements

Measurements	Research Measurements Model	Suggested Relative Fit Index
X^2	174.767	> 5
P	0.002	Sig.
Cmin/df	1.398	1.0 − 3.0
RMSEA	0.046	< 0.08
NFI	0.940	> 0.90
TLI	0.978	> 0.90
GFI	0.911	> 0.90

Source: Research Data Analysis 2014

4. DISCUSSION

To obtain the final results and answering the study objectives which is to study the economic vulnerability factors that affect livelihood sustainability of respondents, research model structure is formed and analysis is conducted. Based on the structure model analysis as in Figure 2, all relative fit indexes are obtained as what has been proposed. Details of data are shown in Table 4 below:

Table 4 Relative Fit Index Research Structure Model

Measurements	Research Structure Model	Suggested Relative Fit Index
X^2	174.767	> 5
P	0.002	Significant
Cmin/df	1.398	1.0 – 3.0
RMSEA	0.046	< 0.08
NFI	0.940	> 0.90
TLI	0.978	> 0.90
GFI	0.911	> 0.90
CFI	0.982	> 0.90

Source: Research Data Analysis 2014

Structural equation modelling that was presented does not perform modification process because it has met few conditions, which are the RMSEA value of not more than 0.08, the relative fit index model value that exceeds 0.90. Based on structural equation modelling that was developed, there are five constructs formed. Vulnerability economic factors that comprise lack of loan facility factors, burdensome production costs, low production yield and ineffective marketing channel, while livelihood outcome construct is composed from adequate income, high production yield and food adequate.
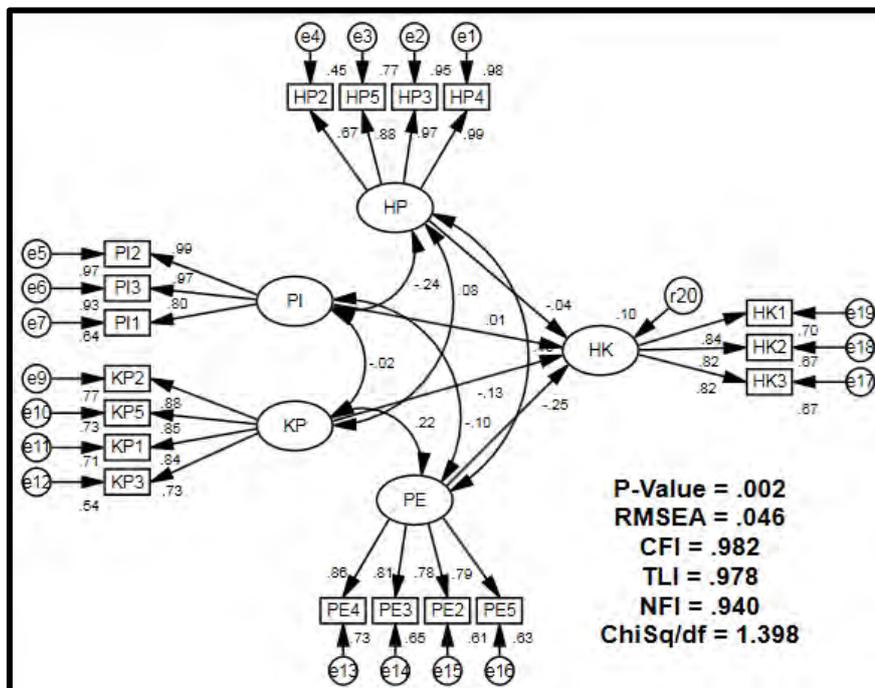

Figure 2 Research Structure Model

Table 5 shows research structure model analysis. In this Table 5, the livelihood outcome is affected by four vulnerability factors. Consequently, the well-being of the respondents' lives is affected and their livelihood sustainability declines. Research findings show that lack of loan facility factors contributes 0.006, low

production output factor contributing -0.050, ineffective marketing channel factor contributes -0.253 and burdansome production costs factor contributing -0.172 to the vulnerability situation from respondents' livelihood outcomes. Based on these values, it is inferred that marketing aspects contribute the lowest value compared to three other aspects. It shows that the marketing aspect is the main element that became a factor towards the vulnerability situation among urban farmers in Kota Bharu Kelantan, Malaysia.

Table 5 A result the impact of exogenus latent contruct on endogenus latent construct

Regression Correlation			Estimate	S.E.	C.R.	P	Result
HK	←	HP	-0.050	0.101	-0.497	0.619	Not Significant
HK	←	PI	0.006	0.078	0.080	0.936	Not Significant
HK	←	KP	-0.172	0.110	-1.558	0.119	Not Significant
HK	←	PE	-0.253	0.086	-2.931	0.003	Significant

Source: Research Data Analysis 2014

5. CONCLUSION

Well-beings and sustainability of people's livelihoods is an important thrust towards achieving the goals of Vision 2020. This goal is also emphasized in Brutland Commission Report 1987 as one of the agenda towards sustainable development. Therefore, the efforts on well-being livelihood, social sustainability and living quality level of the people should be improved. One of the important elements highlighted by [6] in achieving livelihood sustainability is the good management in vulnerability factors. The presence of these numerous vulnerability factors can affect individual or household development towards achieving livelihood sustainability. The results of analysis showed that marketing factor is the main factor that influences respondents' income. These factors are caused the development of urban farmers' sustainability social and livelihood affected. It is caused by wholesalers or middlemen's attitude who not only took a part of production yield, but also at very low prices. This situation certainly does not benefit the farmers.

In fact, issues relating to wholesalers or middlemen indeed have been a concern in the national level. The government, through the Ministry of Agriculture and Agro-based Industry (MOA), has launched a campaign "*Jihad Memerangi Orang Tengah* (Jihad against the Middlemen)" to ensure that farmers will fully benefit on their products. Among the initiatives introduced are: (i) creating 276 Farm Collection Centers operated by the Regional Farmers Organization (PPK) throughout the country; (ii) providing agrobazaar.com portal as foundation for business matching; (iii) provide a guaranteed market for producers who sells to FAMA with support of the floor price; (iv) mobilizing 792 transporting lorries from various departments and agencies to facilitate the marketing of seasonal fruits throughout the country; and (v) providing 1,000 sales tents/canopies to manufacturers of seasonal fruits. In addition, marketing factors are also affected by volatile market prices to the extent of having a bad impact on the income of respondents. Among those that are identified is the heap of production in the market which led to discouragement of sales including imported outside goods.

6.   ACKNOWLEDGEMENT

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TAKING WOMEN'S BODILY FUNCTIONS INTO ACCOUNT IN URBAN PLANNING AND SUSTAINABILITY: SANITATION, TOILETS, MENSTRUATION

ABSTRACT

This paper discusses global sanitation issues, in relation to girls and women with reference to toilet provision, menstruation and urbanization. Whilst over 2 billion people lack adequate toilet provision, water supply, sanitation and for that matter electricity, women are particularly badly affected. 50% of school girls in Africa leave school when menstruation starts because of lack of school toilets. Most women and men without toilets continue to defecate outdoors but women are particularly vulnerable. Over 50% of the world's population is urbanized and of those, over 50% of urban dwellers live in shanty towns and unregulated settlements, most of which are with any sanitation provision. Comparisons are made with the public toilet situation in Western countries, Women who have fewer facilities to start with, but more toileting needs, are especially badly affected. But public toilets are the missing link in creating sustainable, accessible and equitable cities. Lack of toilets has implications for health, hygiene, the needs of the elderly, disabled and children, as well as tourism, business and retail turnover. Many countries and large cities lack any toilet provision for women in the workplace, and no facilities are available for those travelling by public transport or foot. So better provision will increase women's access to the city, and result in their right to the city being fulfilled. Investment in toilets is not money down the drain. Likewise in the developing World provision of toilets, basic hygiene and water supply, reduces disease and improves health. Toilet provision is one of the last frontiers of gender inequality and this very basic issue needs to be integrated into urban planning policy, urban design and development priorities as part of gender mainstreaming programmes

Key words gender, menstruation, sanitation, toilets, cities

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INTRODUCTION: WHAT IS THE PROBLEM?

Addressing the issues of sanitation and drainage –especially the lack of clean water supply – is a key component of the developing world agenda, along with sustainability policy and world health. But, much of the policy output is surprising non-specific, set at too high a level, and concerned with generic issues, related to generalised images of the world's population. There is little disaggregation from a gender perspective, as to the specific needs of, and implications for women, as against men. Furthermore international initiatives, policy statements and research about sanitation tend to major on 'water', and even when discussing water-borne disease, appear extraordinarily coy and too embarrassed to get into the specifics of human bodily excretion and its effect on water courses. Whilst faecal and urinary matters may sometimes be discussed within the context of human waste, menstruation barely seems to exist as an issue. Yet women comprise over half the world's population and at any one time, around a quarter of women of childbearing age will be menstruating. So there are several levels of neglect nested within the field of sanitation, namely an overall lack of recognition of the importance of toilet provision for women as well as men, but within that context, a failure to consider of the specific needs of women, and in particular a complete lacuna regarding all matters menstrual. But this is not 'just' a developing world issue, we need to look at overarching international attitudes to toilet provision and design.   In particular the prevailing influence of developed countries, especially Western Europe from colonial times, casts its patriarchal shadow over the rest of the world. This still shapes attitudes towards the levels of toilet provision for women and men, the design of toilet facilities and the overall cultural awkwardness about addressing women's intimate toilet needs which so infects the sanitation, engineering and development professions.

RESEARCH BACKGROUND AND TOILET DEFINITIONS

I came to doing research on toilet provision as a result of my long-standing interest in addressing 'women and planning' (geography and gender) issues (Greed, 1994). Undertaking research on the social aspects of planning policy, I soon found that 'ordinary people', especially women, in the UK were concerned about the

increasing lack of public toilet provision. As time went on I became very absorbed in creating a new field 'toiletology' bringing together both technical and sociological dimensions of the subject (Greed, 2004), which I still do to this day within the context of planning for accessible, equal and sustainable cities (Greed,2011, 2012, 2014). To clarify public toilets in the UK (indeed much of the West) may be defined as comprising both traditional 'on-street', local authority public toilets and 'off-street' toilets to which the public has right of access, for example in restaurants or department stores, which, together, are better defined as 'away from home' toilets (BTA,2001). Historically women have always had less toilet provision than men, whereas many other groups suffer toilet discrimination, including the elderly, those with small children, and people with disabilities. In fact I soon found all the dimensions of human life are components of the toilet agenda including gender, sexuality, ethnicity, class inter alia. Toilet policy is also central (although often unrecognised) across a wide range of high level policy areas, including health, development policy, social inclusion, religion and culture, environment, sustainability and so forth. Research by the Association of Town Centre Managers has found from studies of comparable sized towns, that those towns which have good public toilet provision actually attract more customers, tourists and visitors than those who do not (Lockwood, 2001). So far from being money down the drain, in addition to all the health, environmental and equality arguments, there is a strong business case for providing more public toilets, enabling tourists, shoppers and visitors comfortably to stay longer in a particular locality and spend more.

I have long argued that the importance of public toilet provision must be recognised within British town planning, whereas at present it is usually dealt with by technical departments such as 'waste management' or 'street cleaning' whose members have little understanding of social issues, let alone gender! If the government wants people to leave their cars at home and travel by public transport, cycle or walk, then the provision of public toilets is essential, especially at transport termini. Public transport passengers, pedestrians, and cyclists - unlike car drivers - cannot speed to the nearest motorway service station to use the toilet when they find the local public toilets have been closed. It should not be assumed that only a minority will need on-street public toilets, because alternative off-street toilet options are readily available. But still the overall image of the rail passenger, cyclist and even the pedestrian remains resolutely male and young, especially in environmental sustainability literature (Greed,2012), and many so-called professional 'experts' seem to take this image with them when they win contracts to undertake work in the developing world too.

In many developing countries not only are there very few public toilets in the western sense, most households have no private toilets either, and so there are entire countries that are 'under-toileted' where open defecation and urination is the normal practice, with major implications for health and wellbeing. In discussing global toilet issues with WTO colleagues and comparing the situation in different members' countries, both developed and developing, I have concluded that the two situations are inextricably linked and we can't deal with one without the other. In this paper, first I provide some historical perspective on reasons for toilet under-provision for women. Then I look at the implications for the global toilet situation, and explain how lack of recognition of the importance of toilet provision affects the chances of successful implementation of the Millennium Development Goals (MDGs). The particular problems women encounter are highlighted including the neglect of menstruation issues and a disregard for the levels of female provision, and specific toilet design: all of which are likely to undermine the chances of achieving the MDGs and other global economic, social and environmental policies. Whilst the problem is dire for women in the West it is much worse for those in the developing world, and the arguments are even stronger for provision. For example from the business case perspective, providing toilets for women in developing countries may enable them to go to work or stay at school all day, or travel long distances to sell their wares at market, and thus increase the gross national product.

THE HISTORICAL ROOTS OF UNDERPROVISION

The problem of unequal provision for women goes back a very long time and is still widespread in western countries too. For example, in England official government toilet regulations have historically, by law, given more provision to men than women, as stipulated originally under the 1875 Public Health Act. Industrial growth and prosperity had led to the building of our great towns and cities, brimming with a sense of civic pride, furnished with a range of public works and philanthropic amenities, including schools, hospitals, libraries, sewage and drainage works, and splendid public toilets. The only trouble was that most of the

engineers, architects and decision-makers were men, and they had very little concern with women's needs. The needs of women who comprise a major component of toilet users were never heard or understood.

But women need public toilets more than men (Penner,2013). Women are the ones who are more likely to be out and about in the day time, travelling on public transport more than men, and often accompanied by children or by elderly and disabled relatives (Cavanagh and Ware,1991; Gershenson and Penner,2009; Molotch and Noren,2010). It is well established from research that women take twice as long to use the toilet than men, because of biological considerations, and also because of the need to go into a cubicle and to deal with more clothing than men (Kira,1975). Nevertheless, typically women were provided with less than half the provision for men. Even if equal floor space is provided for the women's and men's side of a public toilet block, men are likely to have twice the number of 'places to pee' because a whole row of urinals can be provided in the same space where only a few cubicles can be fitted in. The under provision of toilets for women led to the toilet queue, and this was to have international consequences. As Michelle Barkley (toilet expert, architect and colleague) says, **'we exported gender inequality and toilet queues to the rest of the world',** as the British Empire and colonisation grew apace. Even today Commonwealth countries have until relatively recently had the same building regulations, toilet standards and codes as Britain broadly based on BS6465 (BSI,2006). The Commonwealth is still influential as it covers 2 billion people and 20% of the world's land surface. For example, Malaysia (previously Malaya) has had to update their toilet standards and increase equality for women, in order to try and overcome these problems. Of course in some countries there are also pre-existing cultural and religious attitudes that have resulted in toilet discrimination against women, but patriarchal colonial toilet standards and regulations often made the situation worse.

In recent years in the UK we have sought to change the male-bias in the British toilet standards. We have created a completely new British Standard specifically on public toilet Provision entitled <u>BS6465 Part 4: Sanitary Installations – Public Toilets</u> (BSI,2010). This was also an opportunity to ensure the standard embodied changes in toilet technology and design, and to accommodate the needs of a wider range of user needs. Even in this day and age, many Commonwealth countries still take the lead from Britain when formulating their own building regulations and legal requirements, so our new toilet standard is proving influential beyond our shores. Gendered toilet change is occurring in other influential Western countries too. Nowadays because so many more women are educated and aware of that inequality is man-made, they are working and fighting for their rights, across the world. But there are still relatively few women in engineering, sanitation and design, who are knowledge about technical toilet standards. Nevertheless, in North America around 20 states of the USA now have 'potty parity' and attempts are being made to make this a federal-level requirement (Anthony and Dufresne, 2007). Likewise in Europe, in France, the government is taking toilet equality more seriously, influenced, in part, by the resurgence in popularity of the ideas of the philosopher Lefebvre regarding 'la droit à la ville' which means 'the right to the city', which should be equal for women and men. (Lefebvre,1968; Damon,2009). The right for women to have as much entitlement as men to access the city, to work, travel and walk around has been a major issue within the 'women and urban planning' movement for many years but progress has been very slow (Greed,2005). So it is to be welcomed that France declared in 2012 that all public toilets in France are to be free and more equal for everyone, residents, tourists, public transport users. However, equal provision in terms of facilities will take a while, and many French cities do not have much provision to start with. But the lesson is that in order to get better public toilets for everyone one must seek to achieve change at the highest political and attitudinal level within government, rather than fighting with local municipalities and providers who may not have the power, resources or inclination to make changes.

THE INTERNATIONAL DEVELOPMENT CONTEXT

<u>The Millennium Development Goals</u>

The toilet problems of the developed countries pale into insignificance compared with the situation in many developing countries which lack even the most basic toilet facilities. Over two 2 billion people (a third of the world's population) lack adequate toilet provision (George, 2008). Women are particularly badly affected and this may be seen in part as the result of the colonial inheritance. Yet, the toilet issue is strangely disconnected from the mainstream development agenda. Research has demonstrated that public toilet

provision constitutes the vital, missing link that would enable the creation of sustainable, accessible, equitable and inclusive cities (Bichard et al, 2003; Hanson et al, 2007). The original definition of sustainability included environmental sustainability, but also social equality, health, well-being and economic viability (UN,1992) that is Place, People and Prosperity and toilet provision incorporates all these issues. The Millennium Development Goals, developed by the United Nations are eight in number and most have sanitation implications, especially number 7:

1. Eradicate extreme poverty and hunger

2. Achieve universal primary education

3. Promote gender equality and empower women

4. Reduce child mortality

5. Improve maternal health

6. Combat HIV/AIDS, malaria and other diseases

7. Ensure environmental sustainability *

8. Develop global partnerships for development

View them at http://www.un.org/millenniumgoals/

*7c says, 'halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.

The provision of adequate toilets, especially for women, is fundamental to the achievement of the Millennium Development Goals, especially Goal 3: Promote gender equality and empower women, and Goal 7: Ensure environmental sustainability and especially Goal 7c as shown above. Many development agencies do not believe these have been adequately achieved and that many years of additional effort are needed. Since the MDG goals have fallen behind schedule, a new set of Sustainable Development Goals (SDGs) is being introduced which are more about the processes and methods of achieving the MDGs and so do not mention sanitation *per se* and so they are likely to fail too! Of the approaching 7 billion people in the world, around 2 billion lack not only toilets but accessible water supply, and electricity too, and in many developing countries such sanitation as exists is very basic. But it is argued that toilet provision is not a modern luxury but an absolute necessary in achieving world health and development (Black and Fawcett,2008). Over 50% of the world's population is now urbanised, but a third of that number live in slums, shanty towns and unofficial settlements lacking the basics in terms of water and sanitation (Burdett and Sudjic, 2012).   More people in the world have mobile phones than toilets, but toilets are not glamorous consumer items like phones or designer handbags! In high density mega-cities of South America, it is not necessarily lack of water supply or mains drainage that prevents everyone from having toilet provision and running water in their homes. Rather it is a matter of being able to afford to be connected to the system, not how close one is to the pipes, as in many countries you have to pay for privatised 'public' services (Mara,2006; Water Aid,2012).

The Public Health Argument for Toilets

Why bother to do anything? Why care? Everyone, not just the poor, is affected by toilet inequality. In highly urbanised situations, as in the South American mega-cities, rich and poor often live in close proximity, luxury apartments across the road from shanty down development (Burdett and Sudjic, 2012). Flies and other vectors are no respecters of class or income and so rich people could be 'eating other people's shit' as the flies fly over from the cess pits of the shanty towns and land on the food plates of the rich.   Equally, all sorts of classic killer diseases, rampant in the developing world are water-borne diseases. They are transmitted by faecal contamination of water sources, exacerbated by poor drainage, standing water and simply locating the toilet in the wrong place upstream from the main drinking water source. In Africa 80%

defecate in the open, whilst world-wide over 1 billion do so (IIED, 2012). 60% of Africans do not have access to a toilet, and many will find other solutions such as 'flying toilets' (that is wrapping excreta in plastic bags and throwing it away). 80% of the children have worms and intestinal bugs and 1.5 billion people worldwide have round worms alone (Roma and Pugh,2012). In India 90% of surface water is contaminated by shit and this is as much an urban as rural problem. Therefore Jack Sim, founder of the World Toilet Organisation (WTO), has launched a campaign entitled, 'I care a shit'. Since sanitation is such a major issue, especially toilet provision, it is projected that one billion toilets are needed world-wide. But, it is not just a matter of building more western toilets, particularly in locations where there is no sewerage system or water supply to service the toilets. Dry toilets, ecological pit toilets, and low tech toilets are the way forward, especially since poorly-maintained water-based systems actually spread disease. Provision of basic toilets, hygiene and water supply would of itself reduce disease and increase health, arguably far more than expensive western technologies, medicines and drugs. Washing your hands after using the toilet is such a basic, cheap, public health measure but this cannot be done if there is no water supply. There should be international support for such measures, but in reality it is often NGOs, local communities and voluntary self-help groups that are working for change, and the topic is simply not 'sexy' or prestigious (Black and Fawcett,2008). Politicians and advisor prefer to drone on and on about the importance of sustainability, health and economic development, but seldom link these factors to the harsh and dirty realities of everyday shit-shifting, overall excreta disposal, menstruation and basic toilet provision.

WOMEN'S SPECIFIC TOILET NEEDS

Menstruation, Menstruation, Menstruation

To paraphrase a past British Prime Minister who argued that 'education, education, education' was the most important thing for the progress of the state of Britain, menstruation is an equally important issue that must accompany educational policy in the developing world. All the above generic toilet factors are very important for the entire population of the world. But we still need to give greater attention to the specific needs of women. Girls in many developing countries have to stay away from school every month when they are menstruating because of lack of school toilets. **50% of girls in Africa do not continue with school because of lack of toilets.** Around a quarter of all women of child-bearing age will be menstruating at any one time, and every month up to 5 days will be lost in terms of school attendance. Locally-made, menstrual bracelets are being given out to school girls in Durban to raise consciousness, each bracelet has 28 beads, 5 of which were red for the menstrual period**.** So provision is fundamental to achieving all the other equality and developmental objectives. Significantly, in spite of this specifically gendered problem arising at secondary school level, as shown above the MDGs only refer to increasing gender equality at primary school level (Goal 2) and ignore menstruation completely.

The lack of toilet facilities and adequate washing and disposal facilities, during their menstrual period, along with lack of privacy results in girls leaving school. Additional problems are the unequal level of provision of toilets for school girls, and the lack of privacy, indeed often there are no separate toilets for girls and women. Men can go anywhere whereas women are always vulnerable to potential attack, humiliation, loss of reputation, wild animals, snakes, and so forth if they go in the bush. It may be too far to go home, and if they so set off they may give up and not return to school the same day. This was all explained to us by school girls themselves from the Eqinisweni Primary School, Durban, at the WTO conference in South Africa. A group of school children, mainly girls, came on the stage. They gave their heart-rending personal toilet testimonies, explaining how school toilets improved their educational prospects. We were shown some truly grim, primitive power points photos of terrible toilets, just a hole in the ground surrounded by corrugated broken sheeting, with no hand washing or privacy. 80% of schools in South Africa only have pit toilets and many lack adequate facilities for female pupils and teachers. This helped change the atmosphere and culture and enabled such matters to be discussed. **Indeed menstruation became one of the one key topics throughout the conference, breaking yet another taboo.** It was said that 'menstruation' is now at the point of recognition that toilets were in 2001 when the World Toilet Organisation started.

The open discussion of menstruation at toilet conferences is a real breakthrough in the toilet wars! Amanda Marlin, a health expert working on sanitation in Africa, made the very interesting point that women are disadvantaged if their needs and existence are never recognised, that is if there is no empirical evidence

collected on women. Indeed lack of data is itself a sign of discrimination. Women are just plain invisible. There are parallels with the British and American public toilet situation in that women's needs are so often ignored as there is no gender differentiated data on their needs, or the male is taken as the 'norm' and women are just an irritating addition, best ignored, or seen as an extra expense. From this male-mind-set flows all sorts of problems such as women being charged for toilets and men not, queues for women's toilets, and in the developing world a disregard for women's modesty, privacy, fear of attack, and lack of consideration of menstruation issues.

Whilst it is very important that menstruation is recognised as of key significance in achieving gender equality and MDG goals, we cannot assume that the solution to all the problems is a western-style one. Are western disposable sanitary pads and tampons appropriate? Saskia Casteltain who has been working with the UN on menstrual hygiene, argues that if every woman used western sanitary pads and tampons it would create such a pile of waste for disposal that it would be far higher than the disposable nappy mountain. Washable pads that can be recycled are essential, especially since many girls and women simply cannot afford western products, and the sewerage system cannot cope with them either. But one must also be wary of other ostensibly more environmental solutions. The Moon cup, which is inserted to collect the menses blood inside the woman, has been heralded as the ultimate green sustainable solution. But in many cultures inserting tampons is forbidden because of virginity and purity laws. Many millions of women who have experienced Female Genital Mutilation (FGM) are unable to do so in any case. It would seem that home-made, washable cloth napkins and towels are a better solution, but even then some girls and women are too poor even to use this solution. But the big multi-national sanitary wear and paper-products companies see the developing world as a massive new market for all sorts of disposable items including tampons, pads, wipes and of course toilet paper and are even willing to give away free samples to get people hooked on these productions. So the solution is never that simple and the most important thing is to talk to the local girls and women and find out what they want, what they can afford and what they cope with themselves.

Women's Heath and Toilet Cleaning

In an ideal world not only would there be toilets for girls and women, but they would be clean, well maintained and well designed. Dirty, unsanitary toilets, are a worldwide problem, albeit to a lesser degree in many developed countries too. One of the main means of transmission of many classic diseases and many urinary, vaginal and anal infections is from human faeces; therefore it is extremely important to provide adequate, hygienic public toilets (Greed,2006). In public toilets, complete strangers mix and use the same sanitary facilities, with all the related risks of bodily fluid exchange, contamination and organism transmission. Desylpere (2004) has demonstrated that the chances of pathogen transmission are very high even in toilets that may appear to look clean, as every door handle (especially the last one out to the street), tap, lever, flush, lock, bar of soap, toilet roll holder, turnstile, is a potential 'germ' carrier. (The generic term 'germ' is used to include virus, bacterium, pathogen, microbe, parasite, fungus and so forth.) Ostensibly, hygienic equipment, such as electric hand-driers (often imagined to be safer than towels) may blow germs back into the atmosphere. Their use can contribute to the spread of Legionnaire's disease, which is transmitted through contaminated air (Rothburn and Dunnigan,2004,p 65-6). Flushing the toilet can also result in mini-droplets of contaminated air passing into the respiratory system (Deslypere, 2004). But because of women's more 'open' anatomical design all these issues are magnified compared with men, especially when women in many parts of the world will sit or squat and touch the toilet, whereas men can just stand back and urinate.

Many of these issues can be improved by better cleaning regimes and basic hygiene. One must go back one step more and to consider the role of design and ergonomics in preventing contamination. For example the installation of touch-free, flushing sensors and door-opening mechanisms, along with automatic washing, soap dispensing and drying systems (such as air blade hand dryers) reduce chances of contamination, but at the same time require higher levels of maintenance and surveillance to avoid vandalism and mechanical breakdowns. So it is not just a matter of providing new shiny toilets furnished with the latest high-tech equipment and then leaving them to care for themselves. Basic cleaning and hygiene is also absolutely necessary. It is a major mistake to introduce high-tech modern western toilet equipment and then not to maintain it and no readily-available replacement parts. Maintenance and health-wise a hole in the ground type toilet is more sustainable than some fancy western 'sit down' version. It is essential the local people can

have a sense of ownership of the toilet facilities and that they are willing and able to maintain, clean and manage them. There are so many examples of well-intentioned organisations donating western toilets to developing countries that end up un-used because they break down, they offend local taboos and make women feel vulnerable, or indeed they are seen as unhygienic by the local people used to going outside.

Poor Toilet Design

More deadly but less 'obvious', and heavily gendered, are the effects of poor toilet provision and design. Research has shown that referrals for urinary tract infections, problems of distended bladders, and a range of other uro-gynaecological problems have increased proportionately to toilet closure. The chances of streptococcal toxic shock syndrome from sanitary protection is increased if there are no toilets available to change tampons during menstruation (Armstrong and Scott,1992; Rothburn and Dunnigan,2004,p 79). Changing facilities are also needed by men and women suffering urinary and anal/faecal incontinence. Absolutely hygienic conditions are needed for changing colostomy bags (for faecal waste) along with good lighting, shelves to put equipment on, and hot water supply (Hanson et al, 2007). Public toilets may also offer baby changing facilities, another activity requiring cleanliness both for the baby and mother, requiring adequate washing facilities and disposal bins to ensure that subsequent users are not confronted with unsanitary conditions.

But good design is not a universal absolute, much depends upon local customs and what people's muscles, bladders and bowels are used to. Women need to sit down to use the toilet (at least in the West) but have difficulty doing so because of narrow cubicle design, whilst the positioning of the sanitary disposal bin or jumbo-sized, toilet roll holder may restrict sitting space even more. **The low priority given to menstruation, by the inclusion of a plastic disposal bin as an afterthought, speaks volumes about the lack of recognition of the importance of menstruation in the West, let alone the problems in the developing world.** Women are also concerned about 'catching germs from the toilet seat' (Salley,1996). Both men and women views toilets as sites of crime, dirt, disease, sex and disorder (Cockfield,2001). Studies have long shown that around 80% of women 'hover' over the seat to urinate when in public toilets, whereas they prefer to sit when using their toilet at home. Hovering contributes to residual urine retention, as the bladder cannot empty properly and thus to the development of continence problems (Kursch and McGuire (ed) 1998; Parazzini et al,2003). Research has found that crouching over the bowl reduces urine flow by 21% and increases by 150% the chances of residual urine remaining in the bladder. So again it is a matter of design as well as hygiene that together create healthy public toilets.

There is much debate about the best position, for women, to urinate, and but generally a simple squatting position (as in Eastern toilets) is probably the most natural and effective. *'But why can't a woman be more like a man?'* There have been various attempts to design a female urinal, or urinette, such as the Lady Pee. They have proved unpopular with women and are problematic in an ageing society. Gender remains a major determinant of toilet design (Gershenson and Penner (eds) 2009). Of course most of the world's population squat to use the toilet, and this is actually a more ergonomic solution, but international sanitary ware manufactures have convinced the world that it is backward to squat and modern and educated to sit! The sit/squat debate is always a major issue at world toilet conferences, but it is often forgotten than women have to sit (or squat) to urinate, whereas men usually stand to urinate. Likewise most of the world's population use water not toilet paper to clean themselves after defecating, and most of the world's population cannot afford such luxuries as paper.

As people get older their toilet habits may change, with increased frequency of urination, along with various mobility issues, all of which present new design challenges. Narrow cubicles and inward opening doors restrict access, and it could only be front-facing urinators (men) that could design such small cubicles! Women have to get into the cubicle, close the door and then do a three point turn to sit on (or over) the toilet seat. But given the gendered nature of toilet provision there is usually not enough space. This is a common scenario in the many western discussions of toilet provision and design. But it should be remembered that in many developing countries, the majority of the population are under the age of 30, and the ageing problem has not yet reached them. In fact in many countries the majority of the population comprises, children, teenagers and women, but one would not think so from the media. Disability is another major issue in toilet

design in the West, especially for elderly disabled women. But in many developing countries survival rates are lower, and the main cause of disability (and male deaths) is actually war, resulting in greater numbers of younger male disabled people, another challenge for toilet designers.

The issue of racial discrimination adds another dimension on top of gender, in terms of toilet availability and levels of provision. Race has long been a major factor in toilet provision in countries where there has been a history of apartheid and segregation. For example, Barbara Penner (Penner,2013) has highlighted the racial aspect in the USA, as follows. In 1961 in Jackson, Mississippi, a black woman, Gwendolyn Jenkins, was arrested for her attempts to desegregate public toilets, by trying to use the white women's toilets. We never hear of her, but she was the toilet equivalent of Rosa Parks who sat in the whites-only section of the bus and is credited with igniting the black movement in America. This all may seem distant history now but having visited post-apartheid South Africa there are still many lessons to be learned, and less obvious manifestations of inequality to be tackled, especially for women. But nowadays the situation is more subtle with divisions based not only on colour but also on class, income, location, professional status and of course gender. Toilets for ex-pat white people are generally very different from those for the local black people, whereas those in tourist hotels are often comparable to standard Western toilets. So again toilet providers and designers, need to take these qualitative issues into account, as well as quantitatively increasing the numbers of toilets overall.

THE WAY FORWARD

As a basic principle, it is essential to deal with the issue of lack of toilet provision at the highest level of government possible and to mainstream (integrate) toilet policy into higher-level urban planning and policy making, rather than leaving it to technical and operational departments. But, equally, gender must also itself be mainstreamed into all toilet decision making, standards setting, design decisions and levels of provision. But gender must not be treated as an abstract disembodied concept, it must be related to the realities of the differences in bodily functions between men and women, including an acknowledgment of the huge differences (from men) in respect of menstruation, pregnancy, breast feeding, incontinence, inter alia. Rather than looking to the West, the East might provide better guidance and examples on toilet provision in the developing world. There has been a restroom revolution in many of the emerging Tiger Economies of the Far East, many going from a 'hole in the ground' society, to a high-tech toilet society in one generation. But most toilets within these countries are still squat toilets rather than sit toilets, albeit linked to advanced environmentally sustainable waste disposal systems, and well maintained, frequently cleaned and respected by the local population. The World Toilet Organisation and its sister organisations, including the Japan Toilet Association and Taiwan Toilet Association, and similar organisations in China, Malaysia, Singapore and Malaysia have all taken toilet provision very seriously, and their governments have invested strongly in toilet provision and new infrastructure (Miyanashi 1996). In many of these countries female to male ratios of toilet provision in public toilets are on the basis of 2:1 in favour of women, even 3:1 in some tourist areas in Japan. They see toilet provision as a sign of progress, modernity and science, (like computers) as well as embodying civic pride and civilised principles.

There are parallels with Victorian England when huge investment in public facilities such as schools, hospitals, museums and public toilets were seen as an essential manifestation of civic pride, and a reformed society. In the West nowadays, as a result of the financial crises and government cut backs this inherited infrastructure is crumbling and the value of 'social goods' such as toilets and other local facilities is no longer understood in terms of creating a socially, environmentally and economically sustainable society. But this toilet provision needs to be adequate and appropriate to the local situation and not a copy of our peculiar approach to toilet design and our outdated solutions to human waste disposal. It is very strange to throw away some of the most valuable resources on the planet, urine and faeces, which for centuries were greatly valued as fertiliser, building materials, fuel and the source of all sorts of useful chemicals. But this is changing, for example at Bristol, there is a project underway to generate electricity from urine, using simple technologies, which might be used in African villages, yielding electricity for lighting and clean water (Ieropoulos, 2011) . For the future there are so many possibilities once society gets over its traditional negative attitudes towards toilets, human waste, especially menstruation, and, for that matter, women.

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INDIGENOUS SUSTAINABLE LAND MANAGEMENT PRACTICES: PERSPECTIVES FROM WADAWURRUNG / WATHAURONG *COUNTRY*

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ABSTRACT

This paper discusses the role and potential of ethnobotany in Australian Aboriginal plant knowledge in supporting and enabling sustainable land management practices for land use developments. In particular, it draws upon the Wadawurrung / Wathaurong *Country* knowledge for the greater Geelong region of Australia, summarises recent investigations and research, offers a deeper insight into the risks of indigenous vegetation deterioration and opportunities relating to plant usage, and highlights the importance of this plant knowledge in sustainable land management practice. The focus of this investigation is upon the Wathaurong *Country* around the City of Greater Geelong, host city for the ISDRS conference, of which there is little published material and oral distillation.

The purpose of this paper is to demonstrate how the Wadawurrung / Wathaurong people survived for over 60,000 years through sustainable land management techniques, caring & healing themselves by holding deep knowledge of the plants available in this region. Ethnoecology is the governing theoretical framework, with ethnobotany being a subset of this and the primary focus of this paper.

Conclusions arising from this research include: there is limited knowledge as a modern colonised nation; what little knowledge there is left is ageing and will disappear; and, there is an urgent need to better understand what still grows in the region prior to further urban applications and this is also compounded by the driving forces of climate change. Accordingly this paper demonstrates the need to urgently undertake this research. The implications for 'Tipping Points' is that we are increasingly at the point of no return is when we forget about the indigenous knowledge base and watch the death of the knowledge holders, and their wisdom and its benefits have not been transposed into contemporary society.

Key words: Indigenous plants, Ethnoecology, Ethnobotany, Wadawurrung, Wathaurong, *Country*

INTRODUCTION: WADAWURRUNG / WATHAURONG *COUNTRY*

The purpose of this paper is to outline the fields of research and knowledge in the area of Australian Aboriginal ethnobotany in order to contextualise Wadawurrung / Wathaurong ethnobotany. The Wathaurong people are the Indigenous people who live in the greater Geelong region and beyond as far as Beaufort, Cressy, Aireys Inlet and Queenscliff (refer map below). Wadawurrung *Country* is located in south-eastern Australia, to the south-southwest of Melbourne, and includes the provincial cities of Geelong and Ballarat (see Figures 1 and 2).
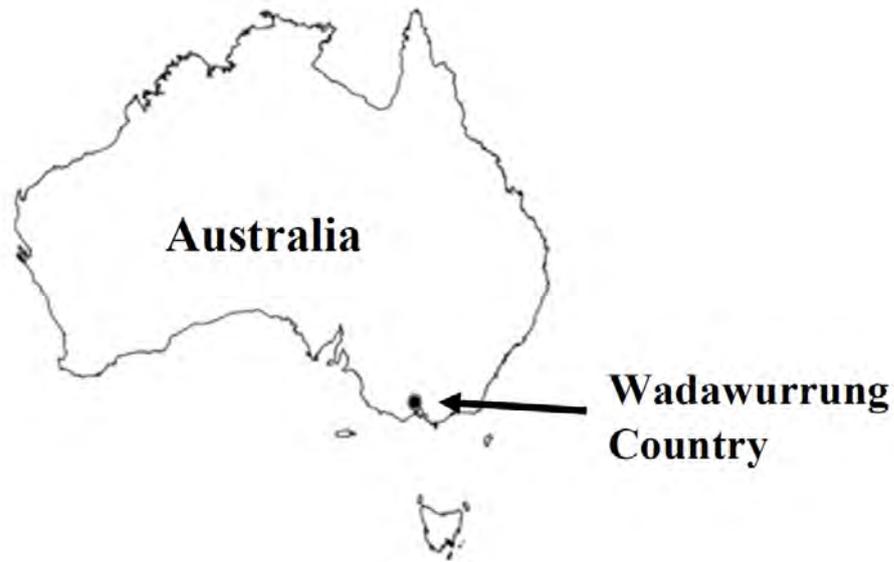
**Figure 1. Australia and the Wadawurrung / Wathaurong *Country***
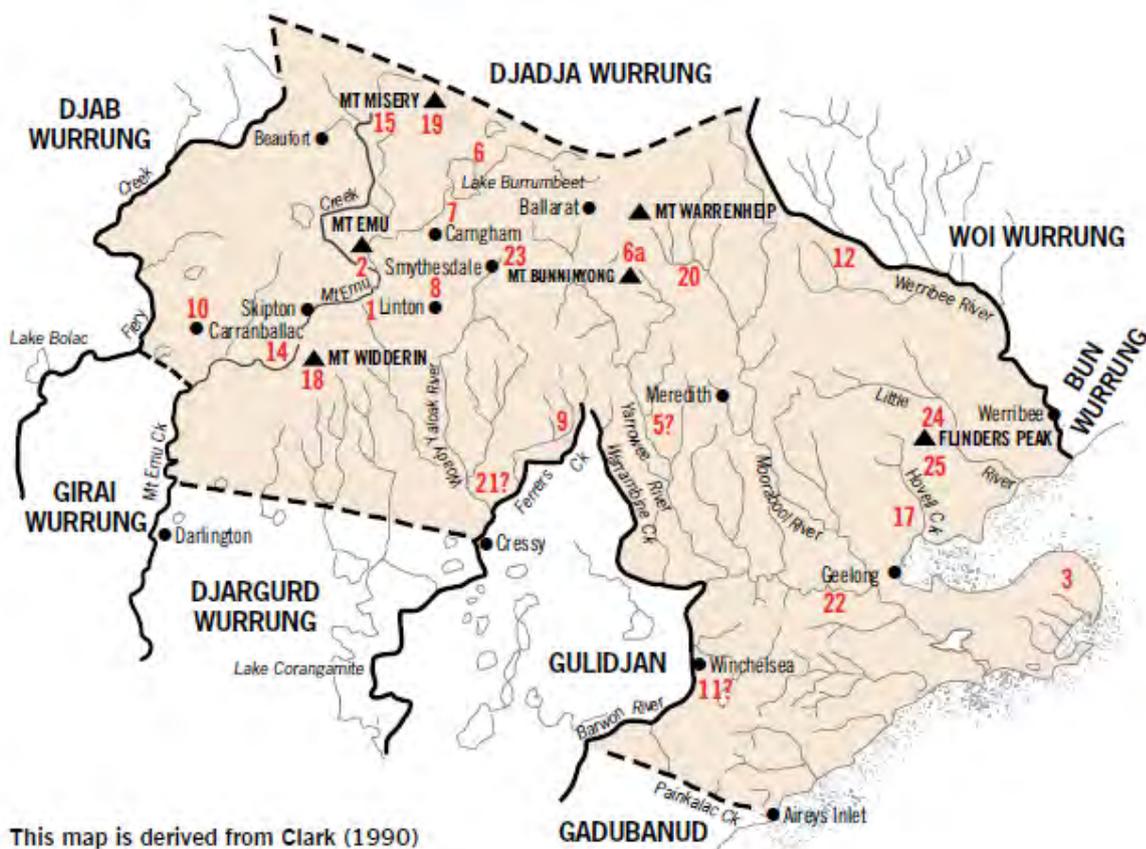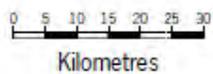
**Figure 2: Wadawurrung / Wathaurong Language Map, derived from Clark (1990) contained in CoGG (2014: 9).
Reproduced with the permission of the CoGG.**

Members of Wadawurrung have continued to live on *Country* and have an ongoing relationship with their *Country*. Many Wadawurrung are descended from a Wadawurrung woman, Queen Mary, and her son John Robinson (also 'Robertson', *b*. 1846) (Clark 1990: 274-335; VAHC 2009).

Overall, the Wadawurrung (being the *Country* nomenclature), is the word used today by the Victorian Aboriginal Heritage Council under the *Aboriginal Heritage Act* 2006, are people of the Kulin nation, whose *Country* conceptually surrounds Port Phillip Bay to the west of Port Phillip Bay (VAHC 2009). The Wathaurung Aboriginal Corporation, based in Ballarat, is the 'Responsible Aboriginal Party' under this *Act* and the legal spokesperson for the Wadawurrung *Country* whom speak the Wathaurung / Wathaurong language(s), and should not be confused with the Wathaurong Aboriginal Co-Operative based in North Geelong. Because of the Corporation's recently acquired statutory role, it is today the recognised and legal spokesperson for the Wadawurrung community.

In contrast the Co-Operative is a community-based organisation with a long-standing presence serving both Wathaurong and Aboriginal community members in the Geelong–Barwon–Colac region with the primary goal of providing all Indigenous people within the City of Greater Geelong and bordering local government areas access to a range of culturally appropriate holistic services, particularly in health, housing, education, employment and heritage (WAC 2012). The Co-Operative services an Indigenous community numbering between 4,000-5,000 people that includes a large proportion of transient Aboriginal and Torres Strait Islander people who travel to Wadawurrung *Country* from all over Australia. The Co-Operative did pre-2014, and continues to provide an instrumental role in contributing to the improvement of cultural well-being and the capacity building for Indigenous people in the region as it strives to control its own affairs and achieve self-determination as a spokesperson for Wadawurrung and Indigenous peoples resident in this region; a spokesperson function and activity that the Corporation is legally empowered to service. Pre-2014 Co-Operative applied the role of speaking for the custodians of Wadawurrung *Country*, and both the City of Greater Geelong Council and Deakin University recognise the Co-Operative's role in this capacity and invited their representatives to perform 'Welcome to *Country'* proceedings, and other cultural services, and according to Corporation staff availability continue this relationship.

For ease and consistency of referencing, both Wadawurrung and Wathaurong are used in the paper title and abstract. However, culturally, the subject area is Wadawurrung *Country* with a focus upon the Wathaurong language group that resides in the Geelong-Barwon catchment region.

2. CONTEMPORARY AUSTRALIAN ETHNOBOTANY
Ethnobotany involves the science of documenting the historical and often contemporary Indigenous practice of engagement and relationships with plants. The inquiry lies at the juncture of botanical science and anthropology, but may also venture into land management and archaeology as to strategies and pre-contact investigations. The origins of ethnobotany in Australia were driven by agricultural and horticultural agendas during the 19[th] Century. During the 20th century alternative medicinal practices and natural healing remedies, bush tucker and survival skills were in focus.
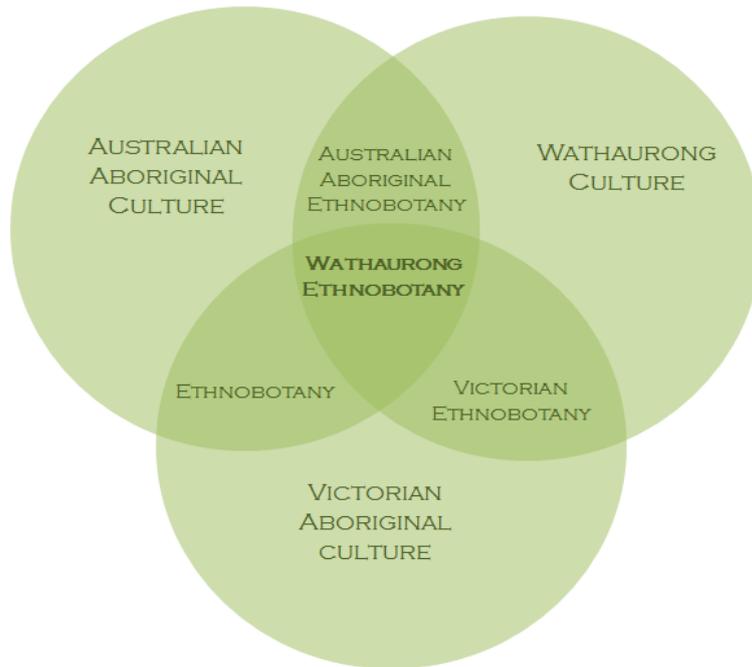
Figure 3: Ethnobotany and the Wathaurong culture
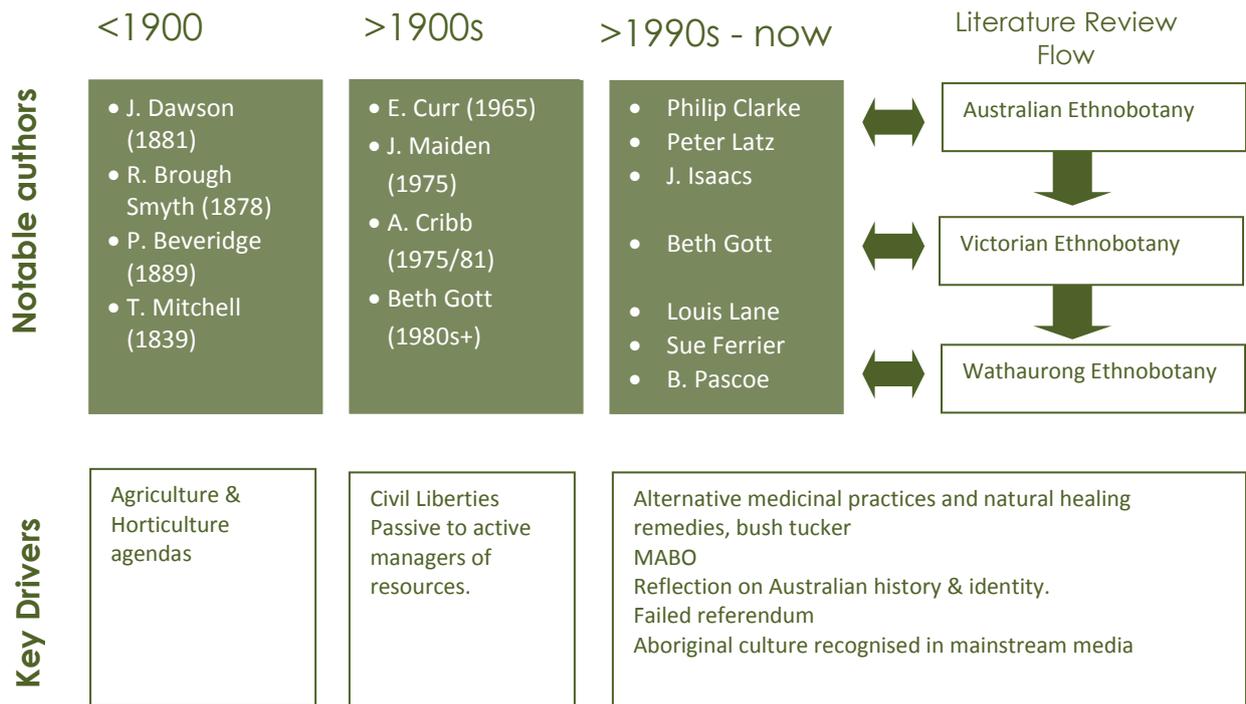
Figure 4: A graphic translation of Ethnobotany in Australia

Leading up to the new millennium saw the rise in a growing identity crisis in Australia that lead to an unsuccessful referendum aimed at releasing the apron strings from the United Kingdom in order to become a republic. This discourse indicated a widespread reflection of what it means to be Australian. Along with this historical reflection was a confrontation with the hidden atrocities that transpired over two centuries upon the Indigenous people of Australia and attempts to broaden community awareness into the mainstream with literature and movies such as 'Rabbit Proof Fence' amongst others. This growing consciousness, of how the Australian Aboriginal people have been wronged, underpins much research including this paper as an aid to

further promote an awareness of a culture that had existed successfully for 60,000 years prior to European settlement.

To understand how the Aboriginal people succeeded as a collection of nations for over 60,000 years, there needs to be an understanding of the relationships Aboriginal people had with plants. Recognising the historical evolution of ethnobotany in Australia draws from key contributors of the late 20th and early 21st centuries of earlier ethnobotanical studies including Dawson (1881) and Brough Smyth (1878) whom evolved their thinking according to the changes in Australian thinking and awareness towards Australian Aboriginals.

Clarke is a leading contemporary Australian ethnobotanist, whose early work focusses upon Aboriginal use of plants. His writings have expanded into Indigenous perceptions and use of the land embodied in a PhD on the Ngarrindjeri cultural geography of the Lower Murray in South Australia. In more recent years his work has been focused on exploring Aboriginal links to land in central and northern Australia. All of his works are extensively indexed in *Where the Ancestors Walked* (2003) which enables Clarke to give the reader a detailed yet broad overview of ethnobotany in Australia.

Clarke claims that "The Australian flora contains more than 20,000 terrestrial plant species, many of which are economically and culturally significant to Aboriginal people" (2007: 8). Thus, "plants had economic and social importance ... that went beyond subsistence, as well as being traded, they were planned for, as Aboriginal hunters and gathers negotiated the landscape in order to make the most of the surplus food when it came into season ... the seasonal abundance of food sources allowed for the surplus to be traded and provided opportunities for visitors to share in feasts" (Clarke 2003, 58). In *Australian Plants as Aboriginal Tools* (2010: 10) he has explained that their survival was underpinned by understanding "the diversity, seasonality and spatial distribution of plants and animals within their foraging territories." Clarke presents an argument against the earlier model of Aboriginal foragers being passive managers of their resources and recognises that they "actively manipulated their environment for particular intended outcomes" (Clarke 2007: 9). His (2007: 6) argument is in direct opposition to, what he explains as "recent as 60 years ago, anthropologists were still considering the Aboriginal people of Australia as nomadics, seeking food from the God like ravens" that he addressed in *Where the Ancestors Walked* (2003: 56) wherein "Aboriginal hunters and gathers limited their short-term impact upon the landscape through dispersing themselves thinly and by constantly moving according to season".

Latz spent the first 17 years of his life growing up amongst the Arrernte people at Hermannsberg Mission (Northern Territory). Consequently he is focussed on Central Australian Aboriginal cultures and he provides an explanation of the environment, plants and uses, seasons and firestick farming. Latz has spent a lifetime compiling his research which has enabled the most comprehensive regional collection of plant uses than any other literature researched thus far. He has also explored the nutritional value of the plants and provides extensive summary tables of all useful plants including availability and a rating of importance. Latz also cross references these plants with those used in other parts of Australia and the world although no specific tribes are mentioned. Plants are organised alphabetically by botanical name. His depth of numerous miscellaneous plant use in *Bushfires and Bush Tucker* (1995: 72) including "mats on the ground, platforms in tree forks to store objects, brooms to sweep the ground, foliage for mattresses, sticky plants used to sieve impurities from drinking water. Certain seed attachments provide a type of soap to wash one's hair, where as other can be made into a brush. Pollen from *Duboisia* spp is reputed to been used as a deadly poison for one's enemy. Bloodwood tree provides a tanning agent. Spinifex leaves are used to shore the sides of wells. Bark from river red gum is used to cool water.".

Gott (1998: 255-256) reviewed Latz (1995) and concluded that "the most interesting aspects is the listing of names for the plants in up to 7 of the languages of Central Australia. Linguistically, this is almost unique; and only a person of Latz's qualifications and experience could have done it." Latz also jumped on the Bushtucker band wagon allied to trends in the latter part of the 20th Century towards bushtucker and survival skills. Latz's *Pocket Bush Tucker* (1999) is a useful guide as plants are ordered by plant type, e.g grasses and sedges. The botanic name, common name and various tribal names are listed with the habitat in which the plant is grown and an explanation of its use. Each plant is illustrated to help the reader easily identity each plant. Although Latz's work is limited to Central Australia, the knowledge from this region appears to be deeper than that has been captured from the East Coast for reasons previously explained. Latz points out that

there are over 2,000 plant species in Central Australia, however he focuses on the most common plants and the more widely available. He also notes that 140 species are still edible today.

The depth of Latz's and Clarke's plant listing and associated uses are useful in comparing to the findings of Louis Lane in the Geelong region discussed below.

Whilst most of Australian ethnobotanists have delved into Central Australian ethnobotany – which is probably in part due to the available knowledge -- others have focussed purely on the plant preparation for food and are riding the wave of the 'Bushtucker trend'. Authors such as Isaacs is very focussed upon how the food is cooked both traditionally by Australian Aboriginals but also suggests modern ways of cooking the indigenous plants. In *Bush Food* (2002) Isaacs lists an extensive table of edible Aboriginal plant food on pages 217-226, and on pages 231-240 she lists a table of herbal medicines. Unlike her other books, this book contains several references to key ethnobotanists.

3. CONTEMPORARY VICTORIAN ETHNOBOTANY: WATHAURONG KNOWLEDGE

It is important to review Wathaurong ethnobotany in context of understanding their culture to provide meaning and context. However there is very little information in the public domain about the Wathaurong culture. Of this information the most useful books available have been written by Pascoe (1997, 2003, 2007).

Pertinent to Victorian ethnobotany, the most significant contributor is Dr Beth Gott who has been on staff at Monash University since 1980 after lecturing in botany at the University Melbourne as well as in London and Hong Kong. Following these experiences Gott later worked with an anthropologist studying American Indians in the USA. Gott's significance to ethnobotany in Australia has been her deep focus and investigations into Victorian ethnobotany – an area of research that is more difficult to access as it relies mostly on historical research although she also is well networked with various Elders on the southeast coast of Victoria. Gott has published a number of papers, but her notable books include *Koorie Plants Koorie People* (1992) with Zola which focuses on traditional Aboriginal food, fibre and healing plants of Victoria. Gott's methodology for accumulating knowledge includes primary source data derived from conversations with a number of Elders from various tribes who were consulted with the findings. This book describes (with photos) 50 of the 900 plants from Gott's database used by the Victorian tribes up to the 1830s. It is organised by geographical feature e.g. coastal, dry country, mountain forests, plains & open forest, river/water plants etc. The book also describes gathering & cooking processes, medicines and fibre. Gott's introduction refers to the richness of protein and vitamins in these foods given they have been uncultivated and not genetically modified and usually harvested at the appropriate seasonal times. Gott not only attributes the health inputs of the food to the success of the Aboriginal nation (pre-colonisation), but the way in which the plants were cooked, ensuring minimal loss of nutrients, as being a contributing factor.

Gott's focus is also forward thinking and not just an historic documenter of ethnobotanical information. Not only has she created the Aboriginal garden at Monash University, but she lists gardens for viewing aboriginal plants around the state in order to encourage the adoption of indigenous plants. Gott mentions in her various books that she has created a database that contains at least 900 plants that were used by Victorian Koories, despite her books only focussing on 50 or so of the more useful plants.

This shift of emphasis reinvigorated interest in Aboriginal ethnobotany including writings by Ferrier in *Wathaurong Medicines* (*c*1982) whom sought to identify and recommend the conservation of places within the Bellarine Peninsula that possess a significant quantity of ethnobotanical medicinal substances to be placed on the former National Estate Register. The National Estate provided funding for this research which was initiated by a paper outlining the possibilities and advantages of developing an Australian Aboriginal Pharmacopeia. As a subset of ethnobotany, medicines for the Wathaurong has been covered in some detail by Ferrier in *Wathaurong Medicines* (*c*1992) in a report that was commissioned by the National Estate to identify potential areas of indigenous medicinal flora of the Bellarine Peninsula that could be included into the National Estate Register. This book is the only dedicated data in the public domain relating (although only in part) to Wathaurong ethnobotany. Ferrier completed extensive research and her methods included consultations with Koories from around the district where she obtained oral history relevant to the environment of the Bellarine Peninsula as it was before European settlement. She also had various consultations with the Victorian Archaeological Survey who provided information about archaeological

evidence for the Bellarine Peninsula (which was possibly sourced from Louis Lane given her deep association with the Victorian Archaeological Survey.) A vegetation survey of Bellarine Peninsular roadsides and various surveys of the vegetation of reserves were additionally used to determine the presence of medicinal plants.

Ferrier (*c*1992:21) draws heavily upon Rhoads' (1986) *Bellarine Peninsula: Archaeological site Assessment and management study* that classifies and identifies various types of vegetation along the Bellarine Peninsula, including: "open eucalypt forest, a swamp forest, woodland and grassland, mangrove woodland, salt marsh, coastal scrub and coastal dune communities - they worked out what vegetation would have existed prior to clearing the land by looking at the soil type and climate.". While an abstract map by Ferrier (1992:22, 23) reveals the 'Possible Pre-clearing Distribution of Vegetation Associations,' she also unsuccessfully undertook to validate Rhoads' findings failing to find evidence of four of Rhoads's vegetation associations. Ferrier (1992:21) also provided a historical vegetation analysis drawing upon the written reports of Wedge (1835) who described the Barrabool hills area as having 'very few trees being predominately casuarinas and grasses, the Buckley's Falls area as having scattered red gums and casuarinas and Indented Heads area as having scattered manna gums & casuarinas and the Bellarine Hills as being almost treeless."

One key source of knowledge for the Geelong region not known about and pertinent to Wathaurong ethnobotany is the research activities of amateur anthropologist Louis Lane. Born in 1919, Lane worked as a librarian in the Newcastle and Port Kembla regions of NSW, a work environment that informed her subsequent methodical approach to anthropological and archaeological research in the Geelong region when she retired back to her place of birth. Reputedly Lane became a leading expert in researching and documenting the Wathaurong culture, actively participating as a volunteer to the Victoria Archaeological Survey (VAS) for over 20 years, becoming an Honorary Warden under the Victorian *Archaeological and Aboriginal Relics Preservation Act* in the early 1970s, and she carried out many surveys in the Geelong region herself and led survey teams with the regular VAS summer schools. The *VAS Records* often include activities reports where Lane is mentioned extensively. Lane regularly published articles published in the VAS Records series and generated prolific typescripts of her findings that are largely unpublished. She prepared over 200 unpublished typescripts containing over 8,000 pages of text covering many topics from Aboriginal protocols; to compiling a language dictionary; to investigating how Indigenous plants were used in their everyday lives. In 2015 she passed away in a Queensland nursing home.

Lane's (2001, 2013) contribution and expertise gatherers only a passing reference in Pascoe's *Convincing Ground – Learning to Fall in love with your country* (2007) that discusses the 'history of the Wathaurong, what it is like living off the land recalling firsthand the foraging and gathering techniques. This text contains a sample and map of Wathaurong, place names of the Geelong-Ballarat region and the Jillong (Geelong) timeline, but unfortunately very little plant/flora information.

Figure 6. Louis Lane. Source: John Boetje.

4. SUSTAINABILITY AND WATHAURONG CULTURE

Aboriginal people have lived on the Australian continent for at least 60,000 years (Muller, 2012; Rasmussen *et al*., 2011 in Kingsley *et al*, 2013). This is 2,800 generations. At the time of contact with Europeans, the Australian continent was an entire cultural landscape (Rapoport 1975; Memmott and Long 2002; Gammage 2012) that was collectively known as *Country*. *Country* is a difficult concept for most non-Aboriginal Australians to understand. Part of the difficulty relates to its all-encompassing multi-dimensional nature, part is due to the multiple meanings of the term, and part is due to philosophical differences and ways of experiencing between Aboriginal and Western cultures. While the concept of *Country* is complex and multi-layered, it does not mean as prominent anthropologist Debra Bird Rose has argued, that "everything is connected to everything", rather, everything is connected to something, and there are patterns of connections: healthy, torn, patchy and intricate (Weir 2010). Broome (2011) believes that the multiple levels of Aboriginal connections to land allowed individuals in Aboriginal society to survive perhaps four to five times longer than those of non-Australian Aboriginal farming societies that emerged from the Neolithic revolution in the Fertile Crescent about 10,000 BP. Likewise, such habitation occurred in North America 14,000 to 16,000 years ago and 40,000 to 50,000 years ago in Western Europe and the British Isles (Bragg & Reser 2012).

Rose (1986: 7) suggests that

> *In Aboriginal English, the word 'Country' is both a common noun and a proper noun. People talk about Country in the same way that they would talk about a person: they speak to Country, sing to Country, visit Country, worry about Country, grieve for Country and long for Country. People say that Country knows, hears, smells, takes notice, takes care, and feels sorry or happy. Country is a living entity with a yesterday, a today and tomorrow, with consciousness, action, and a will toward life. Because of this richness of meaning, Country is home and peace: nourishment for body, mind and spirit; and heart's ease.*

Flannery (1994:389) argues that "ecologically attuned" societies are the result of many thousands of years of experiencing and learning about a particular ecosystem, that 'new' cultures possessed by the great majority of the other 'new' cultures are clearly not attuned, and that it may take a very long time for them to adjust. Strehlow concludes (1971:549) that it often takes centuries of residence in a new country before writers and poets of a transplanted community come to look upon it as their own spiritual home and attach fresh traditions to the new place (Laudine 2009; Mathews 1999). Flannery (1994:389-390) believes that the problem of cultural maladaptation seems to be particularly acute in Australia "… and arises from the great gulf of culture and understanding that exists between Aborigines and other Australians" wherein "Australians have long struggled with the issue of national identity, yet they have done so without really trying to understand the nuts and bolts workings of their land. It is now clear I think, that any lasting notion of Australian nationhood must arise from an intimate understanding of Australian ecosystems". Flannery (1994:402) also advocates the Aboriginal approach of utilizing "an extraordinarily wide array of resources, from insects to marine resources, plants and all kinds of vertebrate animals" and the use of fewer resources as the way forward.

The myth of the Australian Aboriginal as a 'nomadic hunter-gatherer' was established early despite many European settlers in *Australia Felix*, or the Western District of Victoria, recording permanent Aboriginal villages and the park-like or manicured environment of the Western District landscape. Stone house settlement at Mount Eccles/Lake Condah/*Taerak* aquaculture area in south-west Victoria, known as *Budj Bim* to the *Gunditjmara*, established more than 8,000 years ago and estimated to have been able to accommodate about 10,000 people (Bulith, 2002) were a larger concentration of houses and villages across south-eastern Australia (Gerritsen 2011; Memmott & Long 2002). While Aboriginal people did move from place to place, it was not nomadic or wandering (travelling aimlessly), as the *Oxford Dictionary* defines these terms. Rather, Aboriginal people did move but the movement was predictable, on a circuit established over tens of millennia and based on specific weather conditions. Aboriginal movement had much in common with Knowles' (2006) three basic adaptive modes to the natural world: migration, transformation and metabolism. Migration of people follows the rhythm of nature and can occur within the house or landscape. Transformation includes the design of different houses for different climatic conditions and at the most personal level, the addition or removal of clothing. Similarly, Aboriginal people were only partly nomads, as

again defined by the *Oxford Dictionary*, as "a member of a people that travel from place to place to find pasture for its animals and has no permanent home". Aboriginal people had in most cases, permanent homes that they lived in seasonally. They were in fact quite sustainable in their occupation of the landscape and had mastered 'landscape planning' and food cultivation to a level that successfully supplied communities and generations, informed by their curatorship of the environment in accordance with a set of well-established oral traditions or environmental management rules and guidelines.

Into this context can be brought the contemporary term 'sustainability'. Sustainability theory and discourse draws its precedence from the 1987 Report of the Brundtland Commission entitled *Our Common Future* that defined sustainable development as "meeting the needs of the present generation without compromising the ability of future generations to meet their own needs."

Interestingly the core value of Aboriginal culture is that they are the transient occupiers of this landscape, undertaking various orally prescribed activities and actions to keep the landscape in a healthy condition, in anticipation of the return of their ancestors who will eventually return.

Thus Uncle Bryon Powell (2015: 16) of the Wadawurrung expresses this 'law', how the Wadawurrung people came to be, highlighting the link that Aboriginal people maintain with the land, sentient and non-sentient beings, and the cosmos as:

> [In the beginning]… *Bunjil (Wedge-tailed Eagle) summoned six men to assist him in the creation of the land, the people and all living things and to pass on his teachings and knowledge to all men and women. The six men were: Djurt Djurt, the Nankeen Kestrel Thara, the Black-Shouldered Kite Dantun, the Blue Mountain Parrot Tadjeri, the Brush-tailed Phascogale; Turnun, the Feather-tailed Glider and, Yukope, the Great Parakeet. All were capable of mighty deeds in the name of Bunjil. After Bunjil made the country and all the living things in it, he taught the people how to use their tools and the rules of social behaviour.*

The key point is the divestment of teachings for "people [about] how to use their tools and the rules of social behaviour", and thus look after the landscape that they were, are and continue to be custodians for.

5. THE TIPPING POINT

Although the range of information about Australian ethnobotany is limited, what work has been done is a relatively deep assessment of how Australian Aboriginals used plants with Clarke and Latz being contemporary authorities on the topic but with a central and South Australian focus. Gott's work is clearly the authority on Victorian Aboriginal ethnobotany with Ferrier focussing on a subset of Victoria and the only dedicated published source of material pertinent to Wathaurong ethnobotany. This plant knowledge and their uses will be invaluable for comparing and supplementing the findings that will be revealed from an investigation into the Louis Lane literature to ultimately derive a rounded view of Wathaurong ethnobotany.

Accordingly, a key tipping point linked to the Wathaurong and the Geelong landscape is the necessity to better understand, document and comprehend the ethnobotanical resources and legacy of this region so that it can be better integrated into our contemporary land management strategies and designs. To witness its further deterioration and loss is to cast aside 60,000 years of a tried and practiced environmental management regime, and a deeper finer grain of knowledge about the ethnobotanical properties of plants relevant to this region and *Country*.

To comprehend the depth of knowledge that maybe lost is to understand the many uses of the various parts of plants and think beyond a plant as having a singular use. The table below shows the common uses of plant parts often derived from one specimen.

Plant Parts

fruits	seeds	stems	rhizomes
nuts	foliage	gums	roots
tubers	fungi	sap	galls

nectar	fibres	bark	Sporocarps (seed-like growths from ferns

The preparation of these plant parts for use in everyday life goes beyond the regularly thought practice of food and medicinal applications. The table below illustrates the many ways in which plants were very much a part of everyday existence of the Wathaurong people.

Plant Use

Food	Ceremonial objects/ Mythological	Weapons	Adornment/ ornament /decoration	Tools	Firewood & torches
Medicinal	Totems	In Song and Artwork	Fishing	Glues/adhesives	Insect repellent
Narcotics	Clothing	Implements	Poisonous/ harmful	Water	Fibres for weaving baskets
Stimulants/ tobacco	Shelter/ Shade/ wind breaks	Calendar plants	Water transportation	Plants used in capturing game	Children's play & learning aids

This paper does not suggest that these uses would be practical in the application of modern day living such as making a canoe for transportation, but maybe there is demand for natural insect repellent or the use of calendar plants in agriculture to pre-empt unseasonal fluctuations to avoid crops spoiling. Re-introducing native plants into the diet has been slowly gathering steam in different forums for the last 30 years as has natural healing remedies, but beyond this maybe there is no modern application for this knowledge. However should this then determine that this knowledge is not worth preserving? Maybe this knowledge only serves as a symbol of a former lifestyle that should be upheld as an exemplar of successful existence that can be sustained over thousands of generations.

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EXPLOITATION OF NATURAL RESOURCES AND PROTECTION OF BIODIVERSITY; CONTRARY BUT MANDATORY: A CASE STUDY OF THE NIGER DELTA, NIGERIA.

Abstract

Nigeria boasts of large deposit of crude oil which is the main stay of its economy. The bulk of Nigeria"s crude oil deposit can be found in the Niger Delta area of the country. The processing of crude oil into generally acceptable consumable products is fraught with pollution of various sorts. Incidentally the Niger Delta equally houses rare species of plants, animals and habitats. The herbal, nutritional and aesthetical potential of many of these plants, animals and habitats are yet to be tapped. Pollution of land, air and the sea, the origin of which is from exploitation and processing of crude oil had severely affected plants, animals and habitats which constitute the larger percentage of the environment of the Niger Delta area. The fact that man depends exclusively on the environment and indeed on the ecosystem for his survival and sustenance and that diversity in nature adds value to his life has never been disproved .However appreciation of plants and animals among others have been secondary to other things. Development was not seen to include protection of plants, animals and habitats. The various agitations in the Niger Delta had been basically for improved condition of living and a bigger share of the petroleum fund, none of the agitation had been specific on preservation of plants, animals and habitats in the pollution prone area of the Niger Delta. This paper assesses oil and gas industry and other related legislations in Nigeria and their adequacy in the protection of plants, animals and habitats in the pollution prone area of the Niger Delta and makes a case for better protection of plants , animals and habitats in the Niger Delta area of Nigeria.

Key Words; Biodiversity, Environment, Pollution.

Introduction

Over the years, data, accounts, happenings and experience have corroborated the fact that every man is the measure of his environment, which is a major determinant of his frame of mind, his nutrition, his level of intellect, the soundness of his health and his general well being. Several attempts had been made by researchers, environmentalists, scientists, scholars, law makers and environment conscious individuals to define the term environment. One of such attempt is the definition of the environment as the totality of physical, economic, cultural, aesthetic and social circumstances and factors which surround and affect the desirability and value of property and which also affect the quality of peoples" lives. (The Black s Law Dictionary 6[th] edition) while Section 38 of the Federal Environmental Protection Agency Act defines environment to include water , air, land, all plants and human beings or animals living therein and the inter- relationships which exists amongst or any of them . Going by the available definitions, the meeting point however is the fact that man cannot exist without or outside the environment. As the creation story goes, the Almighty Creator created every other thing to supply man"s needs before He created man to whom He gave dominion over every other creature. However, the decades of use, misuse and abuse by man has begin to take its toll on the environment calling our attention to the fact that the environment is susceptible to wear and tear. Man"s activities of exploring and exploiting the environment for his survival has been continuously of negative implication to the environment generally. As the activities continue, the continued existence of the earth and consequently that of man continues to hang in balance as pollution of the air, the sea and the land on an unprecedented level becomes a recurring affair resulting in such calamities as the ozone layer depletion problem, biodiversity loss, erratic climatic changes, land degradation and the like.(Johnson Odusanya, 2014).The European Community (EC) called attention to the fact that " wild flora and fauna are part of mankind ,,s common heritage and that the steady decline in the number of

wild species is not only in itself an impoverishment of our national heritage, but it lessens the diversity of non – renewable genetic resources whilst at the same time affecting ecological balance with various degrees of severity" .This paper briefly assesses the Federal Environmental Protection Agency Act , the Petroleum Act, and the Associated Gas Re- Injection Act and their adequacy in the protection of plants, animals and habitats from crude oil related pollution, it equally considers why environmental laws in the oil and gas industry in Nigeria are mere cosmetic and argues that as long as there is no enforceable constitutional duty on the government of Nigeria to ensure a healthy environment which would in turn compel it to enforce environmental laws, the government of Nigeria will continue to be passive on environmental issues as part of it"s policy to encourage foreign investment while the multinational oil companies pollute and deplete the environment .

The Nigerian Petroleum Industry.

Every state has the sovereign right to exploit its own resources pursuant to its own environmental policies (Principle 21 of Stockholm Conference, 1972, the United Nations Charter and the Principle of International Law). Nigeria is blessed with many natural resources, the chief of which is petroleum. Presently in Nigeria, crude oil is exploited only in the Niger Delta area, and the resource accounts for more than 25% of Nigeria"s Gross Domestic Profit Nigeria (GDP); about 90% of Nigeria"s total export, about 80% of government annual income and 70% of budgetary expenditure. (Emejuru and Okpara , 2007). In Nigeria, the position of the law by virtue of Section 1 (1) (2) (3) of the Petroleum Act Cap 10 Laws of the Federation of Nigeria 2004 and Section 44 (3) of the 1999 Constitution is that the entire property in and control of all minerals, mineral oils and natural gas in under or upon any land in Nigeria or in, under or upon the territorial waters and the Exclusive Economic Zone of Nigeria shall vest in the Government of the Federation. Petroleum as a source of energy is very in high demand and oil is usually found deep in the ground and under considerable pressure and requires to pass through some stages to become commercially acceptable for consumption. (Omorogbe, 2001). The first petroleum company in Nigeria was the German Bitumen Company in 1908 which was followed by the Shell D"Arcy Petroleum Development Company; in the tow were Mobil Gulf (which later became Chevron), Agip, Safrap (Elf), Teneco, Amoseas (Texaco). Others as recounted by Gidado includes Occidental, Ashland and some others. (Gidado 1999) The general consensus and the available data which is backed by facts and evidence establish the fact that pollution from petroleum occasioned by accidental spills of petroleum, oil tanker accidents, pipeline leakages, routine clean –ups or discharge leakages at drilling rigs, dumping of waste oil, ruptures or blow outs of offshore oil wells, activities of saboteurs, etc have had negative impact on the environment.(U.D. Ikoni, 2010). The effects of pollution from the petroleum industry are multi dimensional and affect every area of life as a result of the generally unhealthy environment. Principle 1 of Stockholm Conference 1972 states that man has the fundamental right to freedom, equality and adequate conditions of life, in an environment of a quality that permits a life of dignity and well being , and he bears a solemn responsibility to protect and improve the environment for present and future generations. This forms the philosophical undertone for the concept of sustainable development as popularized by the report of the World Commission on Environment and Developmnet , in other words whatever qualifies to be termed development today must not cause a setback in other areas or at other times, Atsegbua, et al attempting a holistic definition of sustainable development projects that it may be seen as the facilitator for balancing the conservation of nature"s resource with the needs for development . (Atsegbua, et al 2004) Nations like Spain in Article 45 (1) of the 1978 Constitution, Peru in Article 123 of the 1979 Constitution, Poland in Article 71 of the Constitution, Portugal in Article 10 of the Constitution and America state of Florida, Illinois, Michigan, New York, Pennsylvania, Rhode Island and Virginia guaranteed the rights of their citizens to healthy environment, likewise Article 24 of the African Charter on Human and Peoples right guarantee environmental rights. The position in Nigeria is however skeptical, it is to be noted that while some nations in their constitutions placed specific enforceable duties on the government to

ensure healthy environment, section 20 of 1999 Nigerian constitution merely states that the state shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria. On the same note, the National Policy on the environment lamely „ promises" to secure for all Nigerians a quality of environment adequate for their health and well being , with no liability placed on the government for failure to ensure the said quality of environment which is adequate for health and well being. Howbeit, the petroleum industry in Nigeria is regulated by many legislations, some of which are aimed at addressing the pollutant effect of the oil industry in Nigeria. Some of the laws are the Petroleum Ordinance of 1889, The Mineral Regulation (Oil) Ordinance of 1907, The Petroleum Act of 1969,Petroleum (Drilling and Production) Regulations, The Oil Pipeline Act of 1956, Petroleum Profit Tax Act of 1959,Associated Gas Re injection Act, Oil Terminal Dues Act, Oil in Navigable Waters Act, The Marginal Fields Decree of 1996, the Deep Off Shore and Inland, Basin Production Sharing Decree of 1999, The Federal Environmental Protection Agency Decree of 1988, Environmental Impact Assessment Decree of 1992, National Environmental Protection (Effluent Limitation) Regulations of 1991 National Oil Spill Detection and Response Agency of 2006 the National Policy On The Environment, 1989, and a host of other related laws . Azinge submitted that the oil and gas industry in Nigeria is cramped with over 38 legislations, the resultant effect being interplaying, overlaps, conflicts, and waste (Epiphany Azinge 2010) The observation however is that since the Nigerian government is a major player both as a participant and at the same time a regulator in the oil industry through the Nigerian National Petroleum Corporation, many of these laws are not being effectively implemented. The Nigerian government has over the years demonstrated that it is more interested in the oil revenue while paying lip service to environmental issues, this has sparked off agitation among the people of Niger Delta as a means of calling the attention of the world to the deteriorating state of the Niger Delta environment but all along the said agitations had placed much emphasis on the entitlement of the Niger Delta people to larger share of the petroleum income , corporate social responsibility of the oil companies, compensation for loss of farmland and fish ponds due to pollution while the issues concerning gradual extinction of plants, animals and habitats are not made the focus for concern.

Biodiversity.

According to Usman , the term biodiversity is an abbreviation of biological diversity ,which in its simple and common meaning, stands for the variety of living creatures, be they animals, birds or plants. It is also the natural variability within the animal and plant kingdoms; the variety of species in any area. (Usman 2012). Nigeria is one of the signatories to the 1992 Convention on Biological Diversity which defined biological diversity in Article 2 as the variability among living organism from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems. In other words biodiversity encompasses all that nature has to offer to nurture and sustain the human race on planet earth. It is physical demonstration of nature"s versatility. Writing on the importance of biodiversity. Embaye views it from the angle of the fact that the entire food range we eat , our cloths and shelters , the multitude of products we produce at various scales and complexities to satisfy our ever growing and changing needs and healthy human environment entirely depends on biodiversity, he concludes that biodiversity is a cure for our ills. (Embaye , 2011) Altogether, biodiversity has been aptly described as the benefits and functions of nature and natural biological resources (Zabbey, Nenibarini , 2004)**.**Among the many problems affecting biodiversity like over population ,over hunting , over harvesting ,deforestation ,destruction of habitats ,introduction of non native species, pollution has proved to be the most formidable .The Federal Environmental Protection Agency Decree, 1988 defines „"pollution""" as „"man-made or man-aided alteration of chemical, physical or biological quality of the environment to the extent that is detrimental to that environment or beyond acceptable limits. In the glossary of terms under the Proposed

National Water Quality Standards (FEPA) 1991, another view of pollution reads: "Generally, the presence of matter or energy whose nature, location or quality produces undesired environmental effects".

Apart from being the major source of revenue, the other important issue as far as exploration and exploitation of petroleum in Nigeria goes is the magnitude of its polluting effects on the environment and in this case the Niger Delta environment. Oil exploration has continued unhindered so also has pollution continued unabated in any meaningful dimension .

The Nigerian government has plethora of laws in place supposedly for combating the fall out of petroleum industry but the situation has refused to improve for instance section 25 of the Petroleum (Drilling and Production) Regulations provides that the licensee or lessee shall adopt all practicable precautions, including the provision of up-to-date equipment approved by the director of petroleum resources, to prevent the pollution of inland waters, rivers, watercourses, the territorial waters of Nigeria or the high seas by oil, mud or other fluids or substances which might contaminate the water, banks or shoreline or which might cause harm or destruction to fresh water or marine life, and where any such pollution occurs or has occurred, shall take prompt steps to control and, if possible, end it.

Amokaye (2004) quoting world resources 1996 – 1997 (2004) observes that the earth is full of various plants , animals, and other micro organisms currently estimated at about 1.7 million. The Niger Delta has been described as the largest wetland in the world and comprises four ecological zones with many unique plants, animal species and diverse and delicate ecosystems . (de Linde,2003).The four ecological zones are the coastal inland zone, the freshwater zone, the lowland rainforest zone and the mangrove swamp zone (Adati, 2002 quoting FME, et al., 2006; ANEEJ,(2004). The Niger delta biodiversity deserves international attention this is due to the fact that the nature of flora and fauna found in the Niger Delta area cannot be found in any other area in Nigeria (Ugochukwu & Ertel, 2008) . Ebeku (2008) puts it more precisely that the Niger Delta region alone holds 60-80% of all Nigerian plants and animal species and the greatest number of the 205 endemic species to be found in Nigeria. Of equal importance also is the fact that Nigeria as a nation is made up of 36 states and a federal capital territory. Out of the 36 states Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers states form the Niger Delta area of Nigeria , analysis shows that the Niger Delta extends over about 70,000 km2 thus making up 7.5 % of Nigeria land's mass. (Eze, 2008 quoting Njobuenwu and Abowei, 2008) . Whereas ecosystem whether aquatic or biomes as self -sustaining collection of living organisms and their environment have the following functions traceable to them, moderation of the weather , recycling of vital chemicals needed by plants and animals for their survival in their environment, disposal of wastes, control of more than 95 percent of all potential crop pests and causes of human disease and maintenance of gigantic genetic pool, which is used to develop new crop strains and medicines . (U.D. Ikoni , 2010).
According to Dibie & Bourke (2011), ecological modernization as a discourse contends that environmental protection and economic property should go hand in hand. They submitted that without the vital raw materials provided by the environment and without the capacity of the environment to absorb waste pollution, there is no economy and that the ecosystems and natural resources found in the United States provide the context for the country's economy. Atsegbua et all(2004) noted that the control and regulation of the use of the environment by all nations is essential in view of the great and sometimes irreparable damage being done to the environment in the name of industrialization and economic advancement. Three of such laws by the Nigerian government to regulate the oil and gas industry polluting effect on the environment shall be appraised.

The Federal Environmental Protection Agency Act

The Federal Environmental Protection Agency in Nigeria as set up by the Federal Environmental Protection Agency Act is an integral part of the Presidency . Under section 5 of the Act, the Agency is tasked with the responsibility for the protection and the development of the environment and biodiversity conservation and sustainable development of Nigeria's natural resources in general and environmental technology , including initiation of policy in relation to environmental research and technology . The Agency is further saddled with the duty of preparing comprehensive national policy for the protection of the environment and conservation of natural resources, procedure for environmental impact assessment for all developmental projects, periodic master plans   for the development of environmental science and technology in accordance with the National Policy on the Environment and to advise the federal government on the implementation of the periodic master plans   for the development of environmental science and technology , on national environmental policies and priorities, the conservation of natural resources, sustainable development, scientific and technological activities affecting the environment and natural resources and to further advise the president on the utilization of the one percent Ecological Fund for the protection of the environment. The Agency is equally to promote co –operation in environmental science and conservation technology with similar bodies in other countries and with international bodies connected with the protection of the environment and with the conservation of natural resources and with Federal and State Ministries, local governments, statutory bodies and research agencies on matters and facilities relating to the protection of the environment and the conservation of natural resources. Lastly the Agency is to carry out such other activities as are necessary or expedient for the full discharge of its functions. Specifically the Act prohibits the discharge of harmful quantities of any hazardous substance into the air or upon the land and the waters of Nigeria or at the adjoining shorelines except in cases where such discharge is permitted or authorized by any law in force in Nigeria. In relation to oil pollution, the Agency is under section 24 of the Act to co- operate with the Ministry of Petroleum Resources of the department of Petroleum Resources for the removal of oil related pollutants discharged into the Nigerian environment and play such supportive role as the Ministry of Petroleum Resources may from time to time require from the Agency.

The Agency,'s enforcement mechanism includes power to inspect, power to search, seize and arrest. To this end authorized FEPA officers are empowered without a warrant to require the production examination and to take copies of any license, permit, certificate or other documents required under the law or any regulations made there under and may demand the production and examination of any appliance, devise or other item used in relation to environmental protection. Under this   provision FEPA officials are empowered to carry out proper inspection of project sites and to demand compliance with environmental laws. The Act also provides sanctions for contravention of its provisions.

The Petroleum Act. Chapter 10 Laws of Federation of Nigeria. 2004.

The Petroleum Act is an act to provide for the exploration of petroleum from territorial waters and the continental shelf of Nigeria and to vest ownership of, and all on – shore and off- shore revenue from petroleum resources derivable there from in the Federal Government and for all other matters incidental thereto.

 Among the powers of the minister under the Act as pertains to the issue under discussion, is the power of the exercise of general supervision over all operations carried on under licenses and leases granted under the Act which includes inspection of operations carried on in areas covered by oil exploration license, oil prospecting licenses, oil mining lease , refineries and installations and enforcement of the provisions of the Act , any regulation made under the Act and the conditions of any licenses or leases granted under the Act or under any corresponding law for the time being in force in Nigeria. This includes giving directions that operations under a

lease or a license granted under the Act be suspended because such operation are not being conducted in accordance with good oil field practice, until necessary arrangement have been made to prevent danger to life and property or where such operation is being carried out in contravention of the provision of the Act or any regulation made under the Act or such contravention has been, may have been, or is likely to be committed. The minister is equally vested with power to n revoke oil prospecting license or oil mining lease where operation is not being conducted in accordance with good oil field practice or in accordance with the provisions under the Regulations made under the Act or in a vigorous and businesslike manner in accordance with the basic work programme approved for the licensee or lessee. Under section 7 of the Mineral Oil Safety Regulations drilling, production, and other operation necessary for the production and subsequent handling of crude oil and natural gas are to conform, with good oil field practice where no specific provisions is made on what the good oil practice should be , compliance with the standard under appropriate current institute of Petroleum Safety Codes , the American Petroleum Institute Codes or the American Society of Mechanical Engineers Code would suffice. Further under section 43 (3) Petroleum Refinery Regulation, the manager shall adopt all practicable precautions including the provision of up –to- date equipment as may be specified by the director from time to time to prevent the pollution of the environment by petroleum or petroleum products and where such pollution occurs the manager shall take prompt steps to control and if possible end it.

THE ASSOCIATED GAS RE- INJECTION ACT

Gas flaring in Nigeria is as old as the discovery and exploitation of oil, in fact Nigeria flares more natural gas associated with oil extraction than any other country on the planet. (Ejumudo et al ,2012). According to Adeyemo et al , gas flaring has been trailed with serious condemnation, and accounts for the release of methane, carbondioxide, nitrogen dioxides, sulphur dioxide, benzene toluene, xylene, hydrogen sulfide, carcinogen benzapyrene, and dioxine that despite its adverse effect on the environment, there has not been any committed effort to stop it (Adeyemo et al ,2004), .The chances of survival of any living organism in the face of such chemical assault is minimal.

The Associated Gas Re- Injection Act Cap A25 Laws of the Federation of Nigeria 2004 is an Act to compel every company producing oil and gas in Nigeria to submit preliminary programmes for gas re-injection and detailed plans for implementation of gas re-injection. It further mandated every company producing oil and gas in Nigeria to submit to the Minister not later than 1 April,1980 a preliminary programme for schemes for the viable utilization of all associated gas produced from a field or groups of field and for project or projects to re-inject all gas produced in association with oil but not utilized in an industrial project . Such companies are equally to submit to the minister not later than 1 October, 1980, detailed programmes and plans for either the implementation of programmmes relating to the re-injection of all produced associated gas or schemes for the viable utilization of all produced associated gas. Under section 2 of the Act , no company engaged in the production of oil or gas is permitted to flare gas produced in association with oil after 1 January, 1984 without the permission in writing of the Minister . In what can be considered a summersault, the Act further permits the minister where he is satisfied after 1 January, 1984 that utilization or re-injection of the produced gas is not appropriate or feasible in a particular field or fields, to issue a certificate permitting a company engaged in oil and gas production to continue to flare gas on terms and conditions to be dictated by the Minister and such company is to continue to flare gas once it is able to pay whatever the Minister charges for every 28.317 Standard Cubic Metre (SCM)of gas flared.

The penalty for the offence of flaring gas after 1 January, 1984 without a certificate from the minister is for the person concerned to forfeit the concessions granted to him in the particular field or fields in relation to which the offence was committed and in addition the Minister may order the withholding of all or part of any entitlements

of any offending persons towards the cost of completion or implementation of a desirable re-injection scheme, or the repair or restoration of any reservoir in the field in accordance to good-oil field practices.

The Associated Gas Re-Injection (Continued Flaring of Gas) Regulations which is a subsidiary legislation to the Associated Gas re-injection Act further provided that the issuance of a certificate by the Minister under section 3(2) of the Associated Gas re-injection Act for the continued flaring of gas in a particular field or fields, shall be subject to any one or more of the following conditions, that is-

(a) Where more than 75 per cent of the produced gas is effectively utilized or conserved;

(b) Where the produced gas contains more than fifteen percent impurities, such as N_2, H_2S, CO_2, etc., which render the gas unsuitable for industrial purposes;

(c) Where an on-going utilization programme is interrupted by equipment failure:
   Provided that, such failures are not considered too frequent by the Ministers and that the period of any one interruption is not more than three months;

(d) Where the ratio of the volume of gas produced per day to the distance of the field from the nearest gas line or possible utilization point is less than 50,000 SCF/KM:
   Provided that, the gas-to-oil ratio of the field is less than 3,500 SCF/bbl, and that is not technically advisable to re-inject the gas in that field.

(e) Where the Minister, in appropriate cases as he may deem fit, orders the production of oil from a field that does not satisfy any of the conditions specified in these Regulations.

Gas flaring therefore became legalized on satisfaction of certain conditions. This speaks volume on the in sincerity of Nigerian government to protect the environment against the polluting effect of the oil and gas industry.

FACTORS MILITATING AGAINST ENFORCEMENT OF ENVIRONMENTAL LAWS IN THE OIL AND GAS INDUSTRY.

Chapter 2 of the 1999 Constitution titled fundamental objectives and directive principles of state policy states in   section 20 that the State shall protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria howbeit section 6 subsection 6© of the said constitution provides that the judicial powers vested in the judiciary shall not except as otherwise provided , extend to any issue or question as to whether any act of omission by any authority or person or as to whether any law or any judicial decision is in conformity with the Fundamental Objectives and Directive Principles of State Policy set out in Chapter II of the Constitution .In other words no citizen has enforceable right against the government for its refusal, neglect or failure to enforce environmental laws and thereby protect and improve the environment and safeguard the water, air and land, forest and wild life of Nigeria

Also in Nigeria the position of the law is that a litigant who wants a remedy must be able to prove that he has the locus standi to bring such an action. In this case an individual or the community would be required to show how they have sustained or how they are in danger of sustaining some direct injury from loss or depletion of biodiversity. According to Oluyede. A *locus standi* appears to have the following elements:

(a) A litigant to show that he is directly affected by the act he complained about before he can be heard.

(b) Obviously a general interest general to the public at large is certainly not an litigable to accord a right to sue or standing in court proceedings.

(c) The litigant must have a right peculiar or personal to him and that right must have been infringed on that there is a real threat of an immediate infringement of such right. . (Oluyede. A ; 1992)

Loss of biodiversity and ecological degradation are general problems of which no one has locus standi to sue since there is more or less no definite victim . An individual may sue for pollution to his farmland but certainly not on loss of plants, wild animals and habitats

Conclusion

General Assembly Resolution 1803 (xvii) provided that the right of peoples and nations to permanent sovereignty over their natural wealth and resources must be exercised in the interests of their national development and of the well – being of the people of the state concerned. Pollution as occasioned by the oil industry in the Niger Delta has negatively affected biodiversity and consequently the well- being of the people. Legislative efforts at combating pollution has been haphazard and have not been deliberately targeted at preservation of plants and animals and the various habitats, this is borne out of the fact that plants, animals and are hardly recognized as resources to be preserved and cherished, neither is the stark reality that their extinction could affect man"s well being widely acknowledged in policy making.

An appraisal of some of the laws regulating the oil and gas industry in Nigeria by learned authors have revealed gross inadequacy as many of the laws have become obsolete for example, the major law regulating the industry is the 1968 Petroleum Decree which had been re-enacted as Cap 350 LFN 1990 and later as Cap P10 LFN 2004 .

Over the years the problem of failure , neglect and refusal to effectively implement and enforce environmental laws especially against foreign oil companies who hold the leases and the licences in the oil and gas industry have been the bane in Nigeria. This dilemma is further compounded by the fact the duty to ensure that exploration for petroleum does not pollute the environment is placed on the oil companies whose activities generate revenue for the government and who at the same time receive government backing.

In summary, exploitation of natural resources, particularly in the oil and gas industry in Nigeria, has been identified as the major challenge to survival of biodiversity. We highlighted the prospect in the Niger Delta of Nigeria as typifying the richness in biodiversity and crude oil deposits. Though, oil and gas industry is the major source of pollution in the Niger Delta, its persistence without political will to stem its deleterious effects, has continued, in no small measure, to the gradual depletion and destruction of plants, animals, and habitat existence. Finally, our assessment of the three of the legislations and the regulations of the oil and gas industry in Nigeria leads us to the inevitable conclusion that the only way forward is to ensure adequate protection of the biodiversity for the sustainability of the earth.

Recommendations

The balance of two competing interests, that is the right and the desirability of a state to exploit its natural resources and the people"s right to healthy environment and the co existence of both without one hindering the other should be the guiding principle in the Niger Delta.

The general culture of refusal by government to enforce environmental laws should be jettisoned. There should be more decisive legislative and executive actions on the part of Nigerian government, who is equally a participant in the industry as well as a regulator through the NNPC, to significantly reduce pollution in the Niger Delta.

Chapter 2 of the 1999 Constitution titled fundamental objectives and directive principles of state policy especially as it concerns the duty of government of Nigeria to protect and improve the environment and safeguard the water, air and land, forest should be justiciable against the government of Nigeria who consequently will be challenged to see to effective implementation of environmental laws both in Niger Delta and in Nigeria generally.

A re-orientation that healthy environment is a fundamental basis for economic growth as only a healthy environment can produce a healthy workforce.

Public interest litigation in the area of environmental law should be judicially approved.

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Indicators of Ecosystem Services in an Atlantic Forest, Pernambuco - Brazil

Abstract

The use of Ecosystem Services (ES) indicators may help when designing, implementing and monitoring public environmental policies. In addition, using ES assessment and communication may support decision-making processes and improve the involvement of stakeholders. Moreover, the process of selecting and identifying these indicators may be used as a management support tool for natural protected areas. Quantifying ecosystem services and developing related indicators need a great deal of data and information, which are sometimes neither easily accessible nor available. Similarly, there are many obstacles which may prevent the analysis and use of environmental services data. This can include a lack of ecological and social knowledge on how these services are shaped and used and how they vary in time and space. The main aim of this research study is to identify environmental service indicators for Atlantic forests, using a participatory approach with different types of stakeholders. A case study is made of an Atlantic Forest area in the Northeast of Brazil, under the jurisdiction of the Brazilian Army. To accomplish this aim, a questionnaire survey was sent to a group of stakeholders in order to evaluate an initial set of proposed 44 indicators for several forest ES. Supported by the participatory process, 26 ES indicators for Atlantic forests were obtained, for which stakeholders's perceptions and views were weighted. Some of the indicators identified were specifically tailored for the military forest context, thus showing an approach that balanced common and site-specific aspects of ES. Having a good understanding of ecosystem indicators can support managers in decision-making processes on environmental issues.

Key words: ecosystems services; forests; indicators; stakeholder engagement.

1. Introduction

The concept of Ecosystem Services (ES) emerged with the need to demonstrate that natural areas fulfil essential functions in the processes of maintaining life, as opposed to the false idea that preserved or intact ecosystems are unproductive or represent obstacles to economic development [1]. This means that every ecosystem produces a series of benefits, such as water, wood, food, landscaping, climate regulation and air purification, all of which man takes possession of. ES can be defined as flows of materials, energy, and information from stocks of natural capital which are combined with both manufactured and human capital services to produce human welfare [2]

ES are fundamental for human survival and for social and economic development. These services are generated by all ecosystems at different scales. These ecosystems can be cultivated, urban, polar, marine or coastal land, inland waters, forests and woodlands, dry lands, islands or mountains [3]. Forests provide several intangible benefits such as they regulate local and global climate, protect watersheds protection, prevent soil erosion, and cycle nutrients [4].

Forest ecosystem services have been analyzed in different research studies [5] [2] [6] [7] [8] [4], some of which focused on marine, biodiversity, cultural and forest ecosystem service. Several other authors [4] [9] [10] [11] [12] [13] [14] [15] explored the identification and valuation of forest ecosystems services, including the role of indicators [16] [8] [17] [18] [19] to assess and report the state of and pressures on ES. Most studies focused on the concept of ecological indicators, including provisioning services, regulating services, cultural services as well as supporting services and their importance in the decision-making process.

In a more extensive approach, [20] presented a group of environmental services specifically available in forests. The authors gathered the mentioned services into groups that were broader than the ones detailed below (Fig. 1).

HYDRIC SERVICES

Outflow regulation
-flood control during the rainy season
-availability of water during the dry season
Improving the quality of water
-for recreation and bathing
-public supply of water
-downstream irrigation
-use of water by animals

BIODIVERSITY CONSERVATION

-connection with fragments of forest (connectivity)
-protection of plant and animal species
-production of non-wood resources (phytotherapeutic herbs, materials for handicrafts, flowers, fruits)
-production of ornamental plants (seeds, propagules)
-refuge for plants and animals
-protection of genetic diversity
- biological control of pests

EROSION CONTROL AND NUTRIENT CYCLING

-reduction in landslides on hills
-reduction of landslides on the banks of water courses
-reduction in silting up of water courses
-soil formation and stabilization of biogeochemical cycles

TOURISM, LEISURE AND NAUTICAL SPORTS

-recreational bathing
-ecotourism (tracks, walks, bird-watching)
-nautical sports
-picnics and hiking

CLIMATE AND CARBON RETENTION

-maintenance of the natural landscape
-conservation of the *relief*
-well-being and meditation

EDUCATION AND CULTURE

-environmental education
-rites and religious practices

SCENIC BEAUTY

- maintenance of the natural landscape

-well-being and meditation

RESILIENCE

Fig. 1. Ecosystem services provided by forests. Adapted from [20].

Indicators are special signs that convey "value added messages" in a simplified and useful manner to the different stakeholders. An indicator can be derived from a single variable to reflect some attribute or from an aggregation of several variables (indices) [21] [22]. As synthetized by [23] indicators are variables which provide aggregated information on certain phenomena. They are also used by organizations to monitor, evaluate and report if a process, activity, product or service was able to either fulfil its goals or reach its minimal performance level [24]. In the context of ES assessment they may have similar meanings and understandings: (i) ES can be used as indicators in in human-environmental systems, as stated by [18]; and (ii) indicators can be used to assess and report ES attributes [25].

An ecological indicator is defined as a measure, an index of measures, or a model that characterizes an ecosystem or one of its critical components. An indicator may reflect biological, chemical or physical attributes of an ecological condition [26]. The primary uses of an indicator are to characterize current status

and to track or predict significant changes. With the foundation of diagnostic research, an ecological indicator may also be used to identify major ecosystem stresses [27]. These indicators must provide information relevant to specific assessment questions, which are developed to focus monitoring data on environmental management issues [26]. Other authors, such as [28] state that any measuring system must go beyond the simple creation of indicators. Thus, it must enable different dimensions of effort and result, with different weights, to be created. Moreover, it should also allow the attribution of a grade to every indicator that expresses a relative measure, which represents a weighted and aggregated measurement that enables a measure to be created that synthesizes performance, this being a global grade that carries within itself the result of the evaluation.

Quantifying ecosystem services as well as developing their indicators need a great deal of information which is sometimes neither easily accessible nor available [29], Similarly, there are many obstacles which may prevent the analysis and use of the ecosystem services data. This includes a lack of ecological and social knowledge on how these services are formed and put to use and how they vary in time and space. Moreover, standardized quantification and mapping of the main components in environmental servicing may be absent [31] [12] [29] [30]

The selection of ES indicators may help when designing public environmental policies. Similarly, the communication of ES may support the decision-making process and improve communication with stakeholders [24]. Moreover, identifying these indicators may contribute as an administrative tool towards managing and conserving natural areas [13]. Thus, by balancing the demands of government policy and regulations with private initiatives, developing and protecting natural resources has become the greatest challenge in environmental management. Also, instead of simply protecting the ecosystem from any potential harmful impact, an environmental approach may be considered as a form of investing in the sustainable management of ecosystems [32] All definitions and classifications of indicators, as well as of ecosystem services, depend strongly on the characteristics of the investigated ecosystem and the context of the decision in which they are being applied [17]. Consequently, service indicators are policy-relevant representations that identify gaps and communicate trends and information on the sustainable use of these services and the benefits derived from maintaining them for future generations [33].

For an effective development and use of ecosystem indicators, quality as well as acceptance is very important and the inclusion of stakeholder perspectives can be an important contribution to both [16]. Several authors have stressed the need to integrate 'technical' and 'participative' approaches when selecting indicators and development processes [22] [21] [34] [35].

Overall, and despite the above-mentioned studies on ES indicators, there is a lack of research on how to select and use ES indicators in practice in order to improve and facilitate data collection for indicators, processing, analysis and reporting. Also, participatory approaches are becoming well covered by research initiatives on general sustainability indicators but are still poorly explored for ES indicators. Therefore, ES indicator approaches, frameworks and case studies should be further investigated to analyse if they can introduce added-value in the process of assessing ES services and communicating, understanding and exploring their potential weaknesses and strengths.

In this context, the main aim of this study was to identify and select a set of indicators of ecosystem services for forest areas, through a participatory process. The proposed approach was tested in a fragment of Atlantic Forest in the Northeast of Brazil, under the jurisdiction of the Brazilian Army.

2. Methods

2.1 Study Area: fragment of Atlantic forest located in the CIMNC (Marshal Newton Cavalcante Instruction Camp)

The Brazilian Army is directly responsible for around 22,352 km² of Brazilian territory, which represent about 0.71 % of the national territory, an area bigger than countries such as Israel and El Salvador. Included

in these are the most different biomes, such as Atlantic Forest, Caatinga, Amazon Forest, Brazilian Cerrado and Pantanal [36].

The study area is a forest located inside the Marshal Newton Cavalcante Instruction Camp of the Brazilian Army which was created in the 1940s. It is located in the Northeast Region of Brazil (Fig. 2). Originally, the area consisted of ten sugarcane plantations, the vegetation of which mostly comprised sugarcane plants and pasture, and also included twenty small fragments of Atlantic Forest. Currently these woods of the CIMNC have undergone a process of natural or involuntary regeneration.

The selection of this forest area was supported by the following main criteria: (i) it is the largest fragment of Atlantic forest located in the northeast of Brazil [36] (ii) is an isolated forest fragment in a region close to large urban concentrations; (iii) is an area with exceptional concentrations of endemic species and experiencing exceptional loss of habitat [37].

Fig. 2. Location of **CIMNC** in the Northeast of Brazil.

The expression 'Atlantic Forest' (Mata Atlântica, in Portuguese) was first proposed in 1884 by J. E. Wappaeus who defined it as a coastal forest of evergreen trees, which may or may not be located on hills, mostly at low altitudes and even a little above sea level [36]. The Atlantic Forest ranks among the top five biodiversity hotspots in the world, yet it is also one of the rainforests most adversely affected by man [37]. The Atlantic Forest and its related ecosystems originally covered an area corresponding to 15% of Brazilian territory. Currently, it only represents about 1.2% [38] [39].

The processes of deforestation suffered by the Atlantic Forest since the late 19[th] century has restricted this biome to only dispersed fragments in its original area. Such fragmentation introduced a series of new factors into the evolutionary history of natural populations of plants and animals. These changes affected in different forms the demographic parameters of mortality and birth-rate of the existing species, thereby affecting the structure and dynamics of the ecosystem as a whole [9]

The remnants of Atlantic Forest in metropolitan areas have major relevance, since they are under potential or real pressure of urbanization due to new roads being constructed, the setting up of industrial plants, creating new construction lots and housing areas and to informal urban occupation, factors which are very typical in the so-called peri-urban perimeters. Most of its original areas have been transformed into residential neighborhoods or, in rare exceptions, into urban forests, such as isles of native vegetation [40].

The fragments of Atlantic Forest inside the CIMNC are evergreen woods with a canopy up to 50 m high, and emerging trees up to 40 m tall. They also possess dense shrubby vegetation comprising ferns, arborescent trees, bromeliads and palm trees. This composition is due to high temperatures (average 25° C) and high rainfall, which is well distributed throughout the year. The dry season varies from 0 to 60 days. The predominant soil is dystroferric red latosol (Oxisol Haplustox) and, exceptionally, eutropherric red latosol (purple eutrustox), originating from granite and gneiss, as well as sandstone with volcanic spills from various geological periods [36].

The annual average insolation in the CIMNC is 2,556.4 hours. Catucá is the most important headwater in the area. After it runs through the area of the MNCIC it is dammed upstream, thus forming the Botafogo Dam (The Botafogo System is a part of the Water Production System in the state of Pernambuco). This dam has an area of 1.79 km², a capacity of 27,600,000 m³ and an average outflow of 1.2 m³/s. The area of the basin of the Catucá stream is 88 km² mostly located inside the CIMNC [36].

2.2 Survey questionnaire

A questionnaire survey was designed and administered by the research team to obtain an evaluation of a proposal of forest ES indicators for the selected study area (questionnaire in appendix) by a selected group of stakeholders. The method was implemented over several steps, as described below (Figure 3).

The first stage of this survey approach was to select ES related to forest areas. In order to do so, the profile of services presented by the [41] [20] [2] [3] [14] was observed. The ES proposed by these studies were inventoried and then divided using the classification suggested by[20] , due to their extensive division and subdivision of specific ecosystem forest services (Fig 3). After this selection step, intermediate services were discarded in order to eliminate services that did not create direct benefits, thus avoiding the double count of any particular service, as suggested by [42].

Afterwards, a second stage was conducted. Supported by the literature review on ES indicators and an expert qualitative analysis conducted by the research team, indicators were identified and selected which relate to different forest ES. These indicators were mostly derived from the structure (measurement/state) of the basic elements in an ecosystem or from either the supply or use of the services [43]. It is worth noticing that for some selected services more than one indicator was selected in order to use different forms of measurement, and cover the wide scope and complexity of certain services. During the process of analysing and selecting the set of indicators, several criteria were observed. The criteria suggested by [32] among other authors (e.g. [44]) were adopted. Beyond the scientific robustness and related aspects of credibility, the practical usefulness and the capacity to support decision-making processes were two of the main drivers for this stage, so that they could be more useful and practical for the design, implementation, operation and follow-up of policies, plans, programmes and projects. The set of indicators obtained comprises 44 forest ES indicators.

In a third stage, a survey questionnaire was developed with the list of ES and their respective indicators. It contained both multiple choice and open-ended questions. A pre-test to the questionnaire with a set of selected environmental researchers was conducted. The pre-test was performed to assess the quality of the

draft questionnaire and integrate the necessary adjustments in the identified questions, as recommended by [45].

A group of stakeholders was selected to evaluate the proposed set of forest ES indicators, using a scoring procedure developed for the questionnaire. The following took part in this process: 21 stakeholders from academia, business, local, regional/state and national administration, local community and no-governmental organisations; environmental managers in the Instruction Camp, and of military units of the Brazilian Army which deal with environmental issues in both local and national levels, and also of the surrounding community which included a rural settlement, as well as a sugarcane plant, and a public company which collects water from the hydrographic basin located inside the study area.

Stakeholders were asked to evaluate each indicator using three main dimensions: (i) Comprehensibility – how clear is the indicator to illustrate the intended ES and to support good communication; (ii) Relevancy – how important is the indicator to represent the ES and underpin decision-making; (iii) Feasibility – what potential does the indicator have for use in practice. A scale of 1 to 5 was used for scoring each indicator in each dimension 1 (very low performance) to 5 (very high performance). Missing cases (blank responses) and 'don't know' responses were dealt with as non-responses. Also, stakeholders could propose new or adapted indicators, and for those cases the same scoring scheme was used. The indicator evaluation followed the approaches conducted by [46] [47].

The survey questionnaire was sent by email or hand delivered during June 2014. The use of questionnaires was a very appropriate choice because of the number of interviewees and their great dispersion. Therefore, this process was conducted over a more extensive target zone, and demanded less time and cost, as suggested by [48]. When necessary or requested to clarify important doubts, a Skype or in-person meeting with the stakeholders was held, to clarify the goal, scope or scoring procedure.

During the selection process, an analysis was made of surveyed data, the arithmetic mean of each scoring dimension (C – comprehensibility, R – relevancy, F – feasibility) was calculated for each evaluated indicator, and this was followed by calculating the mean of the three aggregated dimensions, in accordance with the following equations:

$$C = \frac{20}{n}\sum_{i=1}^{n} C_i \qquad R = \frac{20}{n}\sum_{i=1}^{n} R_i \qquad F = \frac{20}{n}\sum_{i=1}^{n} F_i \qquad\qquad G = (C + R + F)/3$$

Where C is the degree of acceptance of the indicator i for the attribute Comprehensibility; R is the degree of acceptance of the indicator i for the attribute Relevancy; F = degree of acceptance of the indicator i for the attribute Feasibility; G is the degree of general acceptance (converted into a percentage scale - assuming that 5 is equal to 100%, the score was multiplied by 20) and n is the total number of stakeholders' evaluations by indicator i.

After calculating the general degree of acceptance for each indicator, only those with an upper value of 70% were considered. The adopted cut-off threshold was supported by the assumption that the high rated indicators in the three dimensions were the most consensual and representative among stakeholders, as suggested by other authors, e.g. [49] [50]. From the 44 indicators initially proposed in the questionnaire, only 26 were selected by the arithmetic procedure.

In a final stage, based upon the general index of acceptance, the indicators were ranked from the highest to the lowest scores. The research team conducted a final post-scoring evaluation, supported by a qualitative analysis of the set of final indicators selected. At the same time, the suggestions presented by the

interviewees were evaluated, resulting in either keeping the indicator as it was, or modifying or discarding it. In the process of discarding an indicator, factors such as the level of difficulty for measuring it, its appropriateness to the respective ES and its resemblance with other indicators were taken into consideration.
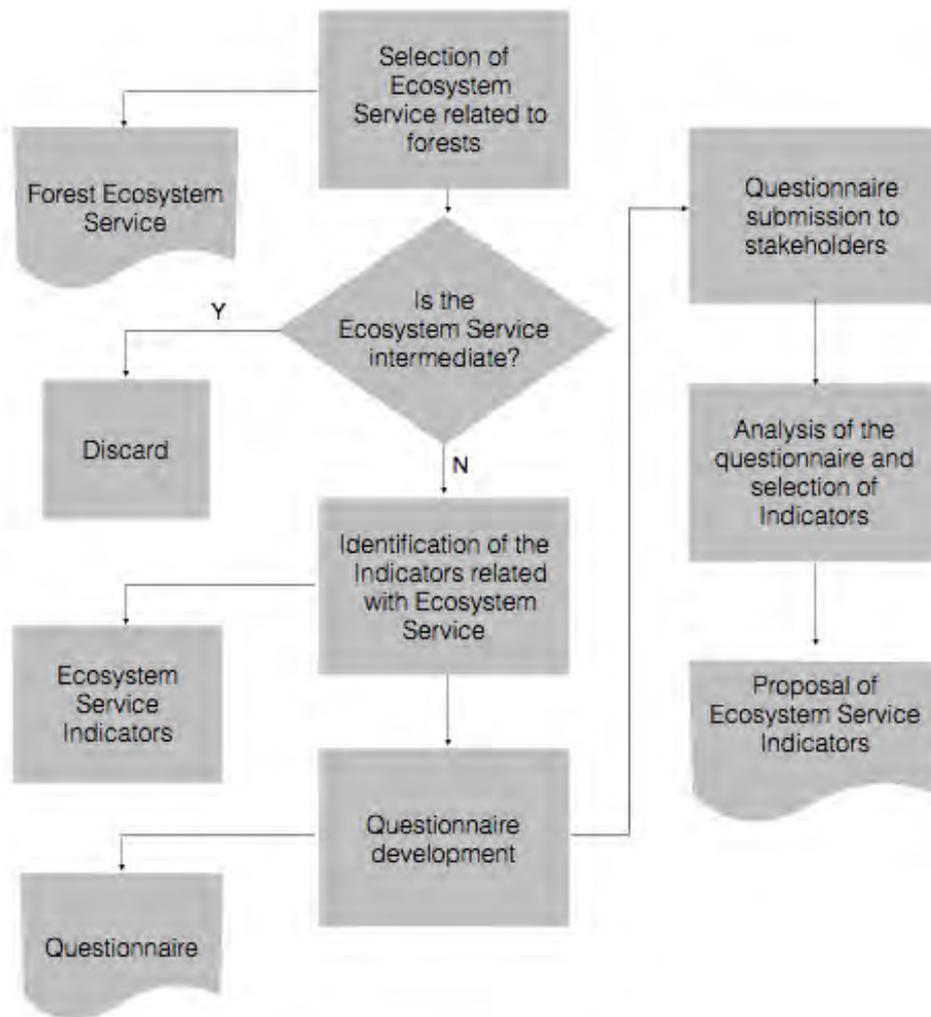

Fig. 3. Flowchart of the method used in selecting the indicators.

3. Results and Discussion

3.1 Stakeholders′ Scoring of the Indicators

All the invited stakeholders answered the indicator scoring survey. Although stakeholders were allowed not to evaluate some of the indicators, the vast majority evaluated all of them. This was possible due to the stakeholders involved having extensive knowledge of and interest in the concepts of ecosystem services and/or in the study. Also, an initial process of making personal to explain the aim and scope of the research was conducted to ensure effective engagement with the survey.

The participatory scoring also led to the respondents making several suggestions, thereby allowing a more detailed analysis of the weaknesses and strengths of the indicators proposed. In addition to the scores given to the indicators, qualitative contributions were of substantial help in evaluating and selecting the indicators.

It is also worth emphasizing that, as a result of the comments and suggestions made by stakeholders, some adjustments could be made when drafting the initial indicators proposed which led to their being more comprehensive.

It was identified that there was an uneven distribution of the indicators as to the types of environmental services suggested. It was found that there was a higher concentration of indicators relating to hydric services, there being a total of seven of these; while services for biodiversity conservation; tourism leisure, sports and nautical activities; and education and culture had four indicators each; erosion control services, climate service and carbon retention and resilience services had two indicators each and services on scenic beauty that did not show indicators with attributes above 70%.

3.2 Specific features of the set of selected indicators

The three selected indicators with highest scores were the I(1), I(11) and I(14) (Table 01). These indicators came from the same type of ecosystem service (the hydrological ES suggested by [20]. This result supports the relevant role that a forest has in the process of the cycling of water, which was reflected in stakeholder's inputs to the survey inputs. Note also the occurrence in this group of indicators, the indicator I(14) that expresses the cost avoided on purifying water within the CIMNC. This type of indicator is relatively easy to measure and, consequently can be part of a database which may give support to decision-making and management systems [51]. In addition to these first three indicators, there are I(2), I(17), I(10) and I(19) which are also derived from the ES. This type of service had the highest number of indicators, which highlights its relevance in the context of the study area. This observation is reinforced by [36] [52] [20] when they argued for the aspects of the benefits generated by forest fragments and the possibility of measuring easily them.

Table 1. Set of forest ES indicators ranked by decreasing order of acceptance

Indicator code	Selected indicators	Types of Environmental Services							
		Hydric	Biodiversity conservation	Scenic beauty	Tourism, leisure and nautical sports	Education and culture	Erosion control	Climate and carbon retention	Resilience
I(1)	Volume of water captured by the public water system in Catucá Basin [m3]	X							
I(11)	Outflow of Catucá Stream during the dry season [m3/s]	X							

ID	Description								
I(14)	Cost avoided on treating water for consumption [R$/m3]	X							
I(13)	Average Temperature Variation inside and outside the study area [ºC]							X	
I(33)	Number of academic research studies in forest habitats [Number of related studies per year]					X			
I(26)	Number of endangered native species of the Brazilian Atlantic Forest found at the MNCIC. [Units]		X						
I(41)	Number of people participating in Environmental Education events inside the woods [people/year]					X			
I(27)	Number of native species from the Brazilian Atlantic Forest found at MNCIC. [Units]		X						
I(6)	Number of plant species per hectare found in the woods [Units/ha]		X						
I(35)	Area of Atlantic Forest existent in the limits of the MNCIC [Atlantic Forest area (km²)/area of the Instruction Camp (km²)]								X
I(8)	Existing plant biomass [t/area(km²)]							X	
I(2)	Amount of water in Catucá Basin used for irrigation [m3]	X							
I(40)	Number of people who engage in ecotourism in the MNCIC area [Units/year]				X				
I(17)	Average volume of rainfall intercepted by the forest [mm.ha]	X							
I(10)	Ratio between hydric response of the basin studied and another basin with similar physiographical characteristics, but without vegetal coverage [Adimensional value]	X							
I(31)	Number of military exercises in forest habitats [Units/year]					X			
I(24)	Extension of headwater sections in Catucá Basin in the process of degradation [km]						X		
I(29)	Accidents due to any military training activity with people from outside the MNCIC [people who suffered any accident/ year]								
I(19)	Percentage of water bodies with parameters adequate to their respective classes [%]	X							
I(44)	Number of people who participated in sports activities which take place in green areas or open spaces [People/year]				X				

I(5)	Quantity of seeds collected for seed banks [t or kg]		X					
I(25)	Fragment area of the forest forming ecological corridors [km ²]							X
I(43)	Number of people who participate in activities based on observing species in the wild [Units/year]					X		
I(24)	Number of people who use the headwaters in the MNCIC for recreation, bathing and leisure[Units/year]				X			
I(21)	Forest area protecting hillsides thus preventing landslides [km ²]						X	
I(39)	Number of people engaging in nautical sports in the area of the Catucá Basin [Units/year]				X			

The indicator I(13), which is the second most relevant indicator, is related to the variation of temperature inside and outside the study area (Table 1). It is noticeable that the indicators related to climate environmental services in forest areas are of particular importance, since they need to represent and monitor fundamental phenomena such as the control of local climate, where extreme weather events are mitigated by the forest. These services and related indicators may also have an impact on the urban morphology, since mapping and understanding of local climate phenomena provide better conditions for managing urban spaces [6]. Together with I(13), the indicator I(8), which expresses the existing plant biomass, is also a member of the group of indicators which are related to environmental services arising from climate and carbon retention. This type of indicator is highly relevant for the sustainable management of vegetation, since forests represent important carbon drainage areas [11].
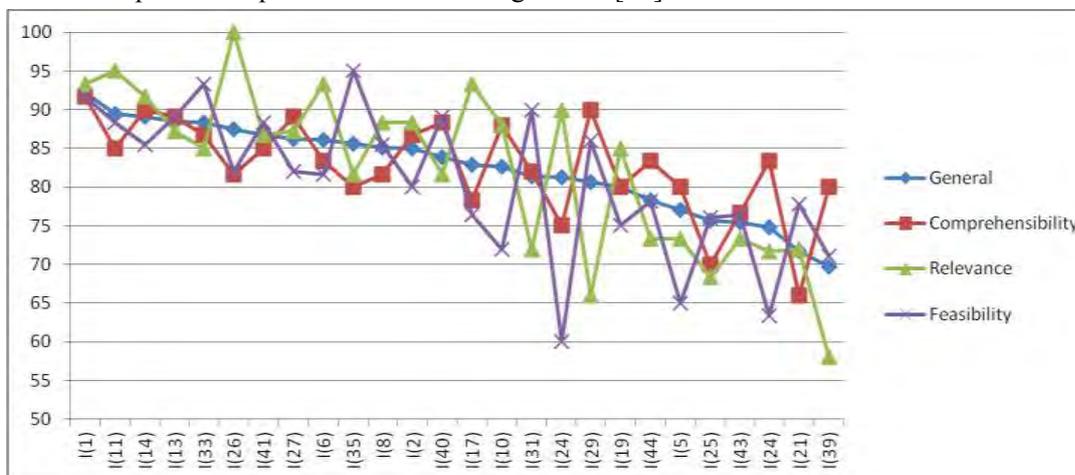

Fig. 4 – Degree of acceptance of indicators per attribute.

The indicator I(33) represents the number of academic research studies in forest habitats. This is an indicator related to the environmental services of education and culture. These services are still a little unknown because they have intangible characteristics. Also, their value is difficult to assess both monetarily and biophysically. They are interrelated with other services, and there are few indicators to monitor their non-tangible effects on – or direct contributions to – social systems [5] [7]. It is evident that the cultural services indicators reviewed are generally lacking in terms of conscious conceptualization of the subject to be measured, which may lead to confusing results [53], most specifically about the object of study it is possible to find several works that describe environmental aspects of CIMNC.

The indicators I(41), I(31) and I(43) are also derived from the environmental services of education and culture, which account for the second largest number of indicators per type of service. I(31) has an

innovative characteristic since it is only directed to forest areas which are also used by the Armed Forces for military training. However, this specificity does not mean that the indicator cannot be applied in other types of biomes, such as military training areas in other regions in the world. Indicators derived from cultural services are still incipient, unlike the indicators of other types of services. One reason for this is that transdisciplinarity is required to address non-tangible issues, since by definition cultural services (encompassing physical, intellectual and spiritual interactions with biota) need to be analyzed from multiple perspectives, such as ecological, social and behavioural ones. A second reason is the lack of data for large-scale assessments, as detailed surveys are a main source of information [8].

The indicators I(26), I(27), I(6) and I(5) are related to the environmental services of biodiversity conservation. They are mainly associated with quantitative aspects of the fauna and flora found in the study area and with the existence of endangered species. I(26) specifically addresses the number of native endangered species in the Brazilian Atlantic Forest, like the ones found inside the study area. This indicator was also identified by the interviewees as the one with highest Relevancy thus presenting a degree of almost 100% importance in this attribute (Fig. 4). As to the indicators related to sustainability, most of them are related to the quantifying species, rather than to identifying them [10]. In a study on drawing up appropriate biodiversity indicators for monitoring sustainability on a local level, [54] affirmed that the data derived from such a system would be instrumental in supporting the work of policy- and decision-makers as well as stakeholders.

The indicators I(35) and I(25) were specifically designed to address spatial analysis of the resilience of the forest. Besides that, if associated with other indicators, such as those derived from services of biodiversity conservation, they strengthen the generation of information and provide better conditions for the decision-making process, as stressed by [55]. The indicator I(35), which refers to the area covered by Atlantic Forest inside the study area, was considered the indicator with the highest degree of Feasibility (Fig. 4). [55] mentions that indicators related to resilience are useful for evaluating whether an ecosystem has the ability to keep its function despite the environmental variability.

Despite not being among the priorities of the activities undertaken in military training fields, leisure and tourism activities inside military areas may occur [15]. These activities are directed to the public from both inside and outside the barracks. I(40), I(44), I(24) and I(39) were suggested based on activities which take place inside the study area. Sustainable tourism is currently being consolidated at the international level as an approach which must be used in promoting other types of tourism since it is beneficial environmentally, socially, and economically [19]. A common practice in forest areas is the use of an indicator system for both conceiving and applying a sustainable tourism model, as explored by [36] [19] [20]. Therefore, these kinds of indicators will also have an important role for the study area, since tourist activities take place in the CIMNC [36].

The dynamics of the erosive process is influenced by variations in climate, geomorphology, soil and hydrology of the area, and also by land use and its vegetal cover. Thus, forest environmental protection services against degradation and erosion of rivers are often mentioned by many authors [56] [57] [58] [59]. In this context, the indicators I(24) and I(21) were initially proposed because they measure the extent to which the Catucá Basin is being degraded and forest areas used to prevent landslides from the hillsides, respectively. Surveyed stakeholders confirm they accept these indicators, which they score with high values for Relevancy (Figure 4), and as highlighted by [59] [56] [57] there is a series of techniques and methods used to study erosive processes. These techniques depend on many factors such as the objective of the study, the human and financial resources available, climate conditions, types of soil and environmental conditions. This are probably some of the reasons that many of the interviewees score I(24) as the most difficult to implement.

Finally, the indicator I(29) is related to accidents that occur due to some military training activity with people from outside the MNCIC, and is specific to military forest areas. Stakeholders considered it the easiest to understand among all the selected indicators. It is also important to observe that I(29) has no association with any of the environmental services suggested by [20] (Fig. 03).

4. Conclusions

The development of ES indicators for forest areas, using a participatory process, enables the main services provided with the integration of stakeholders' views and values to be recognized. This tool could support decision-making about and the management processes of forest areas, and facilitate assessing the state of the ecosystem and reporting mechanisms. In Brazil, as in other countries, large areas of forest are under the jurisdiction of the Armed Forces and are used for military training. Therefore, the ES indicators proposed for the forest case study of a forest, an area under the guardianship of the Brazilian Army, may indicate that their potential use and results could be adapted and applied in other similar areas, at national and international levels.

The set of 26 ES indicators obtained for Atlantic forests reflects the results of a participatory approach in which stakeholders' perceptions and views were integrated. Some of the indicators identified were specifically tailored for the context of a military forest, and showed an approach that balanced common and tailor-made aspects. Some of these indicators integrated innovative aspects, since they reflect particular features related to nature conservation areas within a military operation and management context, such as the occurrence of accidents, as a result of military activities, to people from outside the study area. This is a similar service to those related to biodiversity protection or hydrologic resources, since all of them also reinforce the physical integrity of humans.

Despite there being a relevant amount of research on ES indicators, studies on their integration and use in the environmental management of natural forest areas is still scarce, since few studies have explored practical applications of data from the indicators, such as the role of stakeholders to support the design, implementation and operation of this tool.

The ES have grown in importance due to the increasingly perceived need to conserve natural resources. ES indicators may be of great use as tools to policy-making in areas where these resources have special value. However, further research should seek to include other forest areas, with different institutional management systems, distinctive legal frameworks, and covering different geographical and socio-economic contexts. Also, approaches on how best to engage stakeholders could be used after the indicators have been selected and identified to explore how to implement and operationalize ES indicators, with a view to obtaining effective and useful outcomes for the management of forest ecosystems that face several pressures from humans.

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INDICATOR SYSTEMS FOR MUNICIPAL SUSTAINABLE DEVELOPMENT GOVERNANCE:

DESIGN AND STRUCTURE, CONSTRUCTION AND INTEGRATION

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ABSTRACT

The theoretical basis of indicator systems (IS) development for the sustainable development governance (SDG) has been step-wise developing, but insufficiently linked with the practice of municipal governance process and legal documents. The research has been completed about SDG indicators elaboration, design and construction of IS for the planning and management process of municipal territorial development. The **set of complementary prerequisites for building IS** has been established, including further development of the concepts for integrativity of SDG indicators, relationships between sustainability dimensions (particularly including governance and communication dimension), horizontal and vertical integration approaches. Concepts has been tested and applied, including full scale application of SDG IS at the Saulkrasti local municipality, while Sustainable Development Strategy as official long term planning document was elaborated within related participatory process. Theoretical and practical recommendations have been produced and disseminated. Demo examples of testing various thematic IS and legal **implementation of the first IS for SDG into municipal practice** in Latvia has attracted interest and, even such implementation of IS requires enough complex resources, municipalities are close to the further 'point of transformation'.

Keywords: municipal indicator system, structure, construction, horizontal integration, vertical integration

1. INTRODUCTION

The IS for SDG had been developing initially on the basis of environmental indicators, later environmental, social and economic dimensions gradually became more evenly balanced and were more often supplemented by the fourth dimension – the governance dimension [6;16;17;24]. Important contribution for practically applicable IS has been given by FAO producing theoretical outlines and practice conclusions [3]. The IS formation models were based upon functional analysis of system to be researched [2] or the problem analysis of the territory [19], but were not always linked with the practice governance of the territory and consequently with the content of official development planning documents, e.g. process of making governance decisions. Indicators, being the main informative assessment and communication instrument for the SDG, have lately become increasingly important in the process of elaboration and assessment of documents. Nowadays the government, but also more and more the municipal planning and different cross-sectorial planning (coast, agglomerations, sectors, etc.) are demand much better elaborated principles for formation of indicator systems, information basis for provision of it and practical recommendations for the usage of it and appropriate sustainable decision making.

General purpose of the research performed was to study and to design the set of prerequisites for the building of SDG indicator systems, their structure and complementary composition in order to be used for municipal development planning and management supervision process as well as to produce, approve and test local level indicator system for selected coastal municipality (Saulkrasti case), looking also ahead towards linking that local IS hierarchically and structurally with the IS of higher governance levels. As the result of the

research, theoretically based and flexibly applicable, various planning/management instruments had to be generated, allowing to produce and use indicators of SDG and their systems for practice supervision of middle and long term sustainable development planning documents as nowadays requested from municipalities for the purposes of territorial governance of different levels and functions.

There were internationally and especially locally taking place the necessary developments of the understanding about structure and construction of SDG indicator systems as such, since having some initial list of parameters this is not yet ready IS, having structured, logical and deliberated reciprocal commitments. Especially important is the integration principle application for to be developed IS, reflecting links between elements of sustainability dimensions both in the municipal practice and/or between one sector planning document and other sector planning documents at the same governance level (horizontal integration) and between other governance levels (vertical integration). Finding of such links at indicator level is described [20] and at planning formulation level also [18], however the majority of IS construction research is devoted to the problem of some very practical aspects [6;15;16] or applied studies without theoretical generalizations on IS as systems [13;16;19;21;23].

2. SCOPE AND METHODS

When planning the realization of the research purpose formulated, there is necessary to scope all appropriate theoretical understandings and particular approaches accordingly to the general situation problem analysis as mentioned above, select related set of complementary research methods representing both academic and applied studies, and, elaborate **step-wise research and development (R&D) process** in order to construct and test initially the separate SDG indicators understanding/formulation and application in the governance process as well ongoing work with various IS applications. Working with design and construction of IS being necessarily to be adapted on national and regional/local (municipal) governance levels, it should be recognized and taken as overall approach for R&D work, that municipal IS building requires both - **complementary integration** of the indicators itself as well as the whole IS into development planning/management process and development planning documentation, to be finally legally approved by municipal Council (incl. at least formal public participation process) and later on implemented. Subsequently, R&D study was also subdivided into all related complementary parts: designing approach and principles; IS structure understanding and building; construction of IS at the planning process and content application/information; integration – horizontally and vertically as well as within stakeholder process mutually; and finally – all parts altogether at full scale testing as SDG IS for Saulkrasti municipality.

The following main groups of research methods were complementary used: (1) **case study research** (CSR), which implies acquisition of thematically coordinated information during the field studies [26] using the analysis of socio-economic and natural environment data, document studies, field observations, interviews with target group representatives and focus groups, inquiries (not all methods must be included for particular specific study); (2) **approbation research,** using all various possibilities of testing R&D results; (3) **expert interviews** beyond the CSR frame.

The CSR was mainly applied in five research studies carried out within the framework of the development planning works of municipal territorial development (Aglona, Beverīna, Cesvaine, Salacgrīva and Saulkrasti municipalities). The research begins with complex analysis of natural environment, socio-economic environment and their interaction data as for **socio-ecological systems and their governance** process and institutional-stakeholders constellation that allows to obtain initial overview of different types of resources of the territory and to form the informational basis for the further procedure of the research. Likewise, information sources and types were also explored that would be possible to use later on in application of IS for SDG. Most important are the semi-structured and deep interviews with the representatives of all **main target groups**: (1) municipal governance (all three main employment layers - councilors, management and

also auxiliary service organizations and institutions) and complementary (2) general public representations, (3) local/regional corporate sector; (4) national governance representations at the local/regional level; and (5) all mediators (incl. NGO's, media, education (formal and esp. non- and in-formal), science/technology representatives). Each CSR case included 30 – 50 interviews and at least 1-2 focusgroups. Regarding the IS, the common goals of CSR for all cases were two: (1) —unsorted" list of parameters, that are candidates for use as SDG indicators and (2) eventual structure of the future indicator system, including priority integrated problem areas, dimensions of sustainability and links with related indicator systems, if such exist.

The expert interviews (altogether 15) were complementary with CSR and mostly useful for establishing of an IS structure by priority integrated problem areas, identifying leading and strategic (or integral) indicators, extracting non-applicable parameters. The interviews included also information about the aspects of integrated planning and indicator usage in elaboration of municipal development planning documents.

Three types of approbations can be distinguished among the methods: in seminars of practical research, in the planning process and final approbation. The **final approbation at the Saulkrasti municipality** - indicators were used both for information acquisition and structuring in the planning process and as a part of supervision of sustainable development strategy. IS for SDG was implemented in three phases. First of all, the indicator list was specified and elaborated based on the results of research carried out during the planning process. After that, the manual of indicator system was produced, consisting of system's description, instructions for the result reflection, all indicator statements, detailed data acquisition and calculation methodologies and samples of how to demand information from related institutions. The training of the personnel of the municipality also took place within the process of implementation.

3. RESULTS AND DISCUSSION

IS development studies described above has been planned-organized-realized as R&D program: (1) as mutually complementary four components for IS development - designing approach and structure building, construction and integration as well as (2) full scale testing and legal application of SDG IS for Saulkrasti municipality. In the meantime also various other thematic municipal IS, e.g. for climate change adaptation governance, coastal risks governance, healthy and environmental-friendly food governance, has been tested for further developments and full scale future applications.

3.1 INDICATOR SYSTEMS: DESIGN

In order to ensure the process of sustainable development governance (problem analysis, policy formulation, planning, supervision and evaluation) several basic principles must be observed, which characterize the development process of indicator systems and separate indicators within the structure of these systems. First of all, IS development is to be mandatory and **mutually linked with all governance process steps/stages** and not only with supervision and evaluation stage. The indicator informative provision and domain, the integrativity of indicator and horizontal and vertical integration of the indicator system form the **complementary set of prerequisites for SDG IS** development that allow to make the indicator system for the needs of specific territories and issues/branches. This is IS design frame.

Informative support of indicator are to be described as the conditions at which the selected factor from the list of feasible factor group becomes the real functioning indicator, the readings of which for particular indicators and their systems on the whole are the basis for the governance decision making in the process of territorial development planning and supervision. The **interconnectedness of indicators** is determined by indicator integration, which characterizes the relationships of certain indicators with sustainability dimensions and their interaction areas that allow formation of balanced indicator systems for sustainable development planning, supervision and assessment. Indicator system is characterized by **horizontal integration**, ensuring the compliance with interconnectedness of sustainability dimensions and integrative

problem areas, allowing adequately and complementary reflect sustainability dimensions, its branch integrity and distribution of common and specific factors. Indicator system is characterized by **vertical integration,** allowing forming harmonic meta-system from different levels of indicators and understanding its condition of SDG, progress and contribution within the context of the whole sustainable development in all of the governance levels.

3.2 INDICATOR SYSTEMS: STRUCTURE

Studies of a number of different indicator systems illustrate, that, regardless of the appliance field of system, the basic principles of their construction are similar: structured by reflected themes and hierarchic by levels of information generalization (Figure 1). All the levels and elements specified here may not be for any IS present. For example, indicator system for assessment of coastal sustainability DEDUCE [13] does not contain strategic indicators; it is a characteristic for areas without united, common governance.
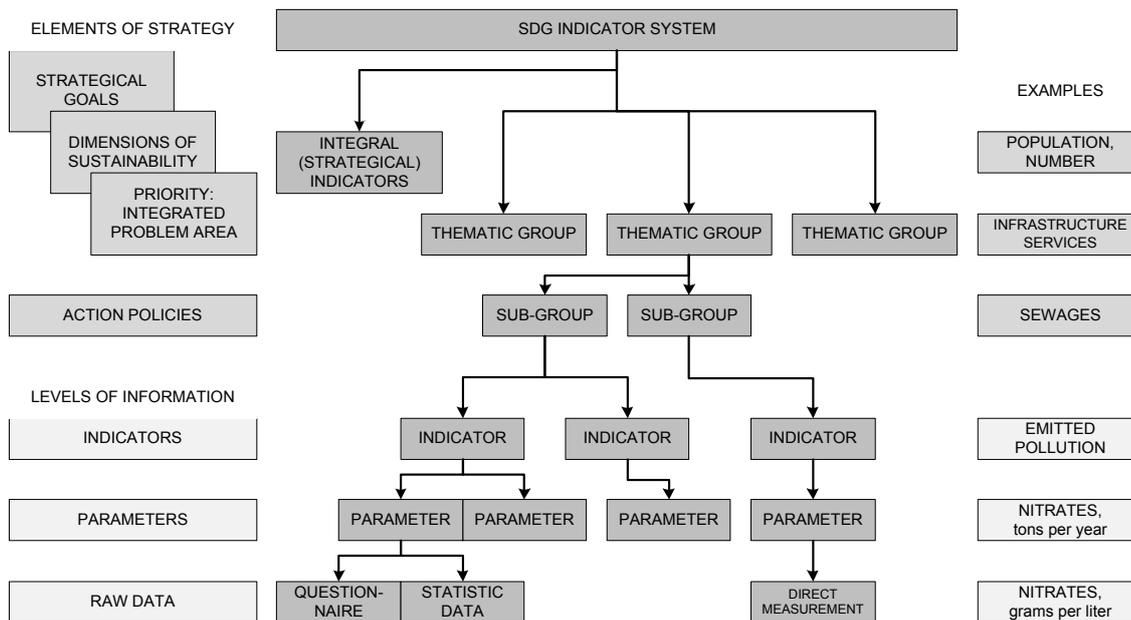

Fig.1. Hierahical structure of SDG indicator system [10]

While, national scale indicator systems [7;8;12;22;23], including strategy „Latvija-2030" [24], oriented on using of statistics, one parameter indicators are dominated, i.e., value of indicator is the same value, obtained from a data source. One-level grouping is typical for indicator systems, which are not linked directly with some planning document, for example, national system of sustainable development indicators in Latvia [9].

3.3 INDICATOR SYSTEMS: CONSTRUCTION

The studies of great number of different indicator systems reveal that, irrespective of the type of indicator system, they all have in common structured and hierarchical design. Indicators are divided into thematic groups within the system that are formed according to sustainable dimensions or of prior integrative problem principle. These groups include subgroups which, in turn, are formed according to the branch or course of action principle. Indicators that are subgroups may consist of one or several measurable parameters, but for determination of each parameter one or several value measurements might be necessary.

The indicator selection is associated with selection of definite characteristic value of the branch or course of action. It is done, first of all, according to specific algorithm, examining the relationship of these values with sustainability, governance and afterwards checking the conformity of the selected values to the informative provision of chosen prerequisites. The selection of potential indicators for possible strategic goals, prior

integrative problems and the characteristic parameters of integrated planning process related to long term courses of action are shown in figure 2. During this selection process, the verification is done to clarify if the indicator meets the requirements of indicator for the SDG, i.e., if there is a connection with the main aspects of sustainability, governance, as well as assessment of integrity of the indicator. Finally, the proposed indicators are arranged, singling out leading and strategic (integral) indicators.
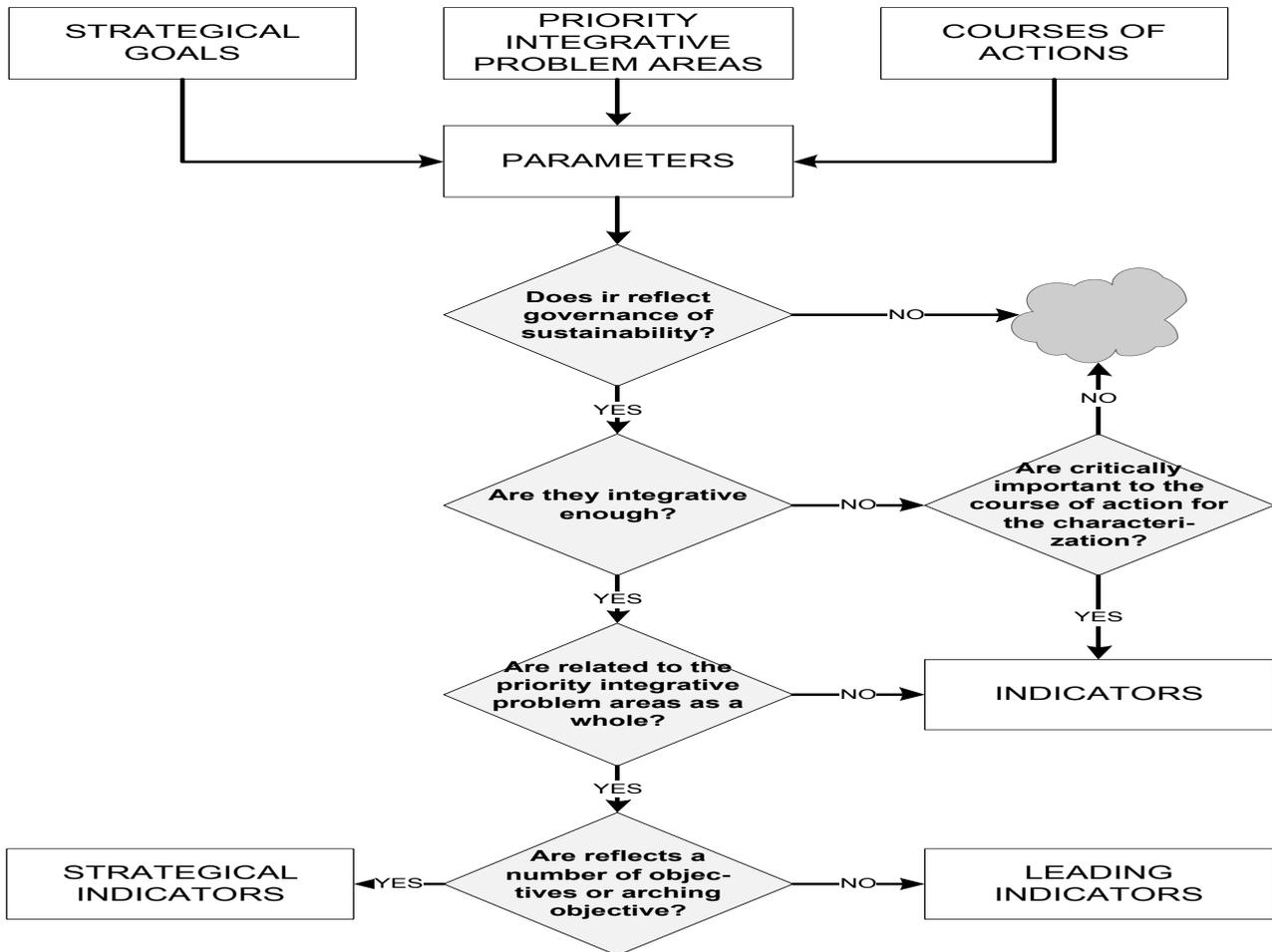

Fig. 2 Selection of indicators at planning process [11]

The verification of the selected potential indicators to comply with the set of prerequisites for informative provision of indicator and domain of governance indicator is represented in figure 3. During the selection process the significance of those parameters that formally are not included in domain of indicator for SDG is also assessed, which can be for some reason sufficiently significant in governance decision making.

3.4 INDICATOR SYSTEMS: INTEGRATION

The vertical integration principle means the relationship of indicator system with IS which is effective in other governance levels and it is necessary for mutual comparability of different territories, as well as for the clarification of common tendencies. **Three-level vertical integration** must be observed in municipal model (Figure 4): at least part of the main parameters, related to the strategic goals, must be associated with governance indicators and on the whole, with non-existent for the moment regional level indicators. Territory is characterized not only per administrative-territorial division, but also via areas of special significance, which can be indirectly associated with administrative division. National SD Strategy „Latvia-2030" [24] prescribes several of such territories that are areas of national interest, e.g. coastal territories.
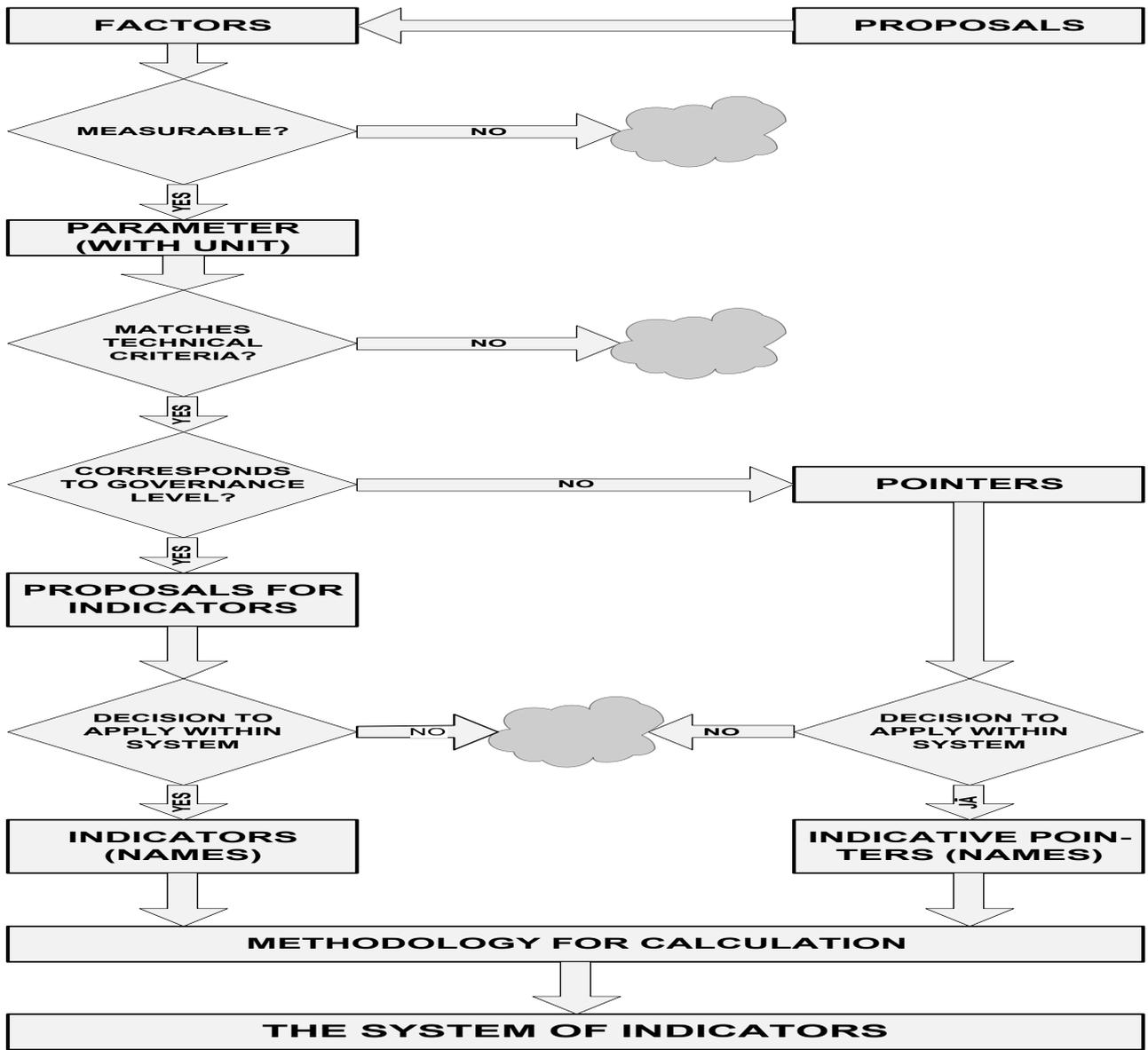
Fig.3 Selection of indicators by the set of prerequisites for informative provision of indicator [5].
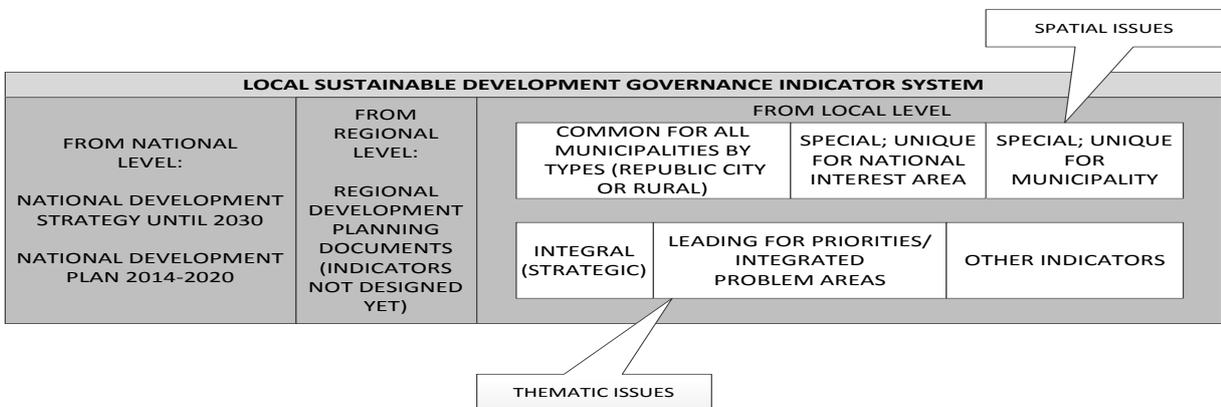

Fig.4 The principle of vertical integration for municipal SDG indicator system [11]

Principle of vertical integration, declared here, now is at further studies and elaboration processes. The main tasks for vertical integration is to find a suitable representation from higher level governance indicators at lower level of governance and to find the right proportions for different components of the system.

There is also an example of the realization of horizontal integration principle in formation of IS in governance practice of local municipality (table 1). This indicator system has been elaborated for the Salacgrīva municipality in the course of planning of sustainable development strategy. System is characterized by horizontal integrity as it was evaluated among problem fields and sustainable development trends, **consequently transferring** this **relationship to the indicators**, which describe particular fields. System contains 16 integral (strategic) indicators, referring on various aspects of ultimate targets for the strategy and 64 indicators, referring to all defined long-term action policies and groups of tasks.

Table 1. Horizontal integration of indicators via integrativity of long-term action policies

Nr.	Action policy	1.1.	1.2.	2.1.	2.2.	2.3.	3.1.	3.2.	3.3.	4.1.	4.2.	5.1.	5.2.
1.1.	Social ennvironment and services quality		x		x		X	x	x	x	X		x
1.2.	Professional knowledge and self-development of society	x		X		x		x	x		x	x	
2.1.	General business competitivness		X		X	X	X	x	X			x	X
2.2.	Environment-friendly food cycle	x		X		X				x	x	X	X
2.3.	Tourism information, paths and targets		x	X	X		X	X	X			x	
3.1.	Traffic services and organisation	X		X		X		X	X	x	x	x	
3.2.	Coastal infrastructure	x	x	x		X	X		x			X	
3.3.	Port development	x	x	X		X	X	x				x	
4.1.	Colaboration governance for nature values	x			x		x						X
4.2.	Adaptation to climat changes and nature risk factor mitigation	X	x	x	x		x						x
5.1.	Municipalities image and brand substantive policy		x	X	X	x	x	X	x				X
5.2.	Public environmental awareness	x			X					X	x	X	

X – close relationship, x – detectable relationship

3.5 INDICATOR SYSTEMS: SAULKRASTI MUNICIPALITY SUCCESS STORY

In the 2012-2013 the fully functioning system of indicators for the SDG has been produced and implemented in the Saulkrasti municipality as for the first time in Latvia, being direct supervision instrument for the SD Strategy implementation progress and for the usage in the governance practice of the local management level. The IS has been elaborated based upon theoretical conclusions arising from the research on **integrated development planning** and the significance and position of necessary indicators. Indicator system for SDG is incorporated into sustainable development strategy as the informative basis of nowadays mandatory supervision process/requirements and assessment mechanism.

SDG IS consists of the **structured list of indicators, grouped into four sustainability dimensions and integrative problem fields** (in total 62 indicators; generalized overview of their groupings see on table 2). The main practical document for usage of the system is the manual, containing general instructions, methodological recommendations for each of individual indicator, instruction about data processing and

representation for the needs of decision makers and other public target groups are provided. During the system's implementation the training of the municipality's personnel was organized on practical implementation and usage of indicator system. The indicator system is approved for the practical use by the resolution of municipal Council, being as a complementary part of the municipal sustainable development strategy document.

During 2014-2015, as for every two year period of SD Strategy realization, the first full-scale assessment of SDG has been provided as all indicators were calculated within framework of the Latvian National Research Program Project SUSTINNO. As for R&D approach there is started also new policy initiative, involving all main stakeholders – the work on **Municipal Sustainability Report 2015** is in the process now as the first of this kind of SD evaluation processes and related documents in Latvia.

Table 2. Saulkrasti coastal municipal indicator system – content list of indicators grouped by sustainability dimensions and thematic groups [25].

Nature environment (D)	Economic environment (E)
D1. Status of the „Green web" (3*)	E1. Economically active people (1)
D2. Real and potential loads on environment by public utilities (5)	E2. Budget of municipality (2)
D3. Air quality and impact on climate changes (4)	E3. Entrepeneurship and employers (3)
D4. Surface water quality, coastal zone (2)	E4. Traffic routes (4)
D5. Land use for development (2)	E5. Local port development (3)
D6. Natural risks (2)	E6. Tourism characteristics (6)
D7. Common indications (1)	
Social environment (S)	**Governance and communication (P)**
S1. Health care characteristics (2)	P1. Municipal governance (3)
S2. Supporting for cultural environment (2)	P2. Municipal information and communication(3)
S3. Social care and social security (3)	P3. Activieties in non-governmental sector (2)
S4. Education system (3)	
S5. Household life quality (4)	
Integral (strategic) indicators (I)	
I1. Number of inhabitants (1); I2. Complex indexes (2)	

*Number of separate indicators (altogether 62) within each of the thematic groups mentioned.

4. CONCLUSIONS

R&D program realized for the SDG IS development and its related application into municipal practice were based on mutually complementary IS development components - design and structure, construction and integration – and, subsequently, policy initiative elaborated and IS introduced and now also tested at the Saulkrasti municipality.

The indicator informative provision and domain, the integrativity of indicators, horizontal and vertical integration within/outside of the indicator system are those main components to form the **complementary set of prerequisites of indicators and their system development** for SDG, that allow to make an adequate and content/process representative indicator system for general/particular needs of any specific territory and dimension/branch.

The **fully functioning indicator system for SDG** has been for the first time produced and implemented in the municipal practice in Latvia as the direct supervision instrument for the SD Strategy design and municipal SD governance implementation progress assessment. **The manual for use of indicator system**

and indicators for SDG monitoring has been produced as complementary part of the formally approved SD Strategy document. There are provided methodological recommendations for the usage of the whole indicator systems package – to be used by municipality step-wise independently of any consultancies/services, but with recommended development of SDG public monitoring instruments and stakeholder capacities. The first in Latvia **Municipal Sustainability Report 2015** is in the preparation now.

Further research on both **horizontal** and also **vertical integration,** esp. specifying the proportions of integrated components into indicator systems for SDG at the different governance levels, is to be conducted, as well as approbation of horizontal/vertical integration on the regional IS level and more detailed linkage with national level. Growing number of demo examples testing various thematic IS and full scale implementation of the first SDG IS into municipal practice in Latvia is raising more and more interest, even IS do require complex resources and qualifications.

5. ACKNOWLEDGEMENTS

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Use of indicators to assess the sustainability of housing developments in Australia

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ABSTRACT

Most new housing in Australia is occurring on greenfield sites on the edges of the capital cities. These housing developments are often criticised for their social and environmental unsustainability. These unsustainable suburbs are a legacy for future generations. They will create dire social and environmental problems if a serious economic downturn was to occur or a resource shortage e.g. oil was to make accessibility impossible. Coupled to these threats is that of the social 'undesirability' of isolated suburbs where only those on low incomes made their home. Most of those on higher incomes seek established suburbs which have 'character', social amenities and ease of access. Typically, these are in older suburbs close to city centres. This paper describes a methodology that has been developed to analyse past and future housing developments. The results of the analysis can provide a guide to improving the sustainability of these suburbs. The methodology uses several criteria to reflect the fact that no single criterion is adequate to describe or analyse the sustainability of a housing development. Sustainability should embrace social and environmental perspectives, so a multi-criteria analysis is appropriate. The theoretical framework for this methodology has been described elsewhere. However, in this previous work only five criteria were considered: energy use, resource use, neighbourhood character, neighbourhood connectedness and social diversity. In each case, high and low sustainability practice has been identified so that ranking is possible. This paper initially summarizes the way in which these previous five criteria are assessed but then adds a sixth criterion (social connectedness) because of a perceived gap in the previous assessment. The results of an analysis of three suburbs reported in the previous work are updated. They score poorly in terms of social connectedness underlining the need to 'repair' these suburbs in order to improve their overall sustainability.

1   INTRODUCTION

Consideration of future generations is one of the fundamental tenets of sustainable development. Palmer et al. [1] called it the Futurity Principle and it encapsulates the oft-quoted statement from the Brundtland Report about compromising the needs of future generations through our present actions. The legacy for future generations from our inadequate planning of urban expansion is becoming increasingly apparent. Almost ten years ago, one of Australia's major newspapers stated that new housing was "failing future generations" and that, according to Melbourne's top planners and architects, "poor planning, indifferent design and cost-cutting …. are condemning residents to a life of misery" [2]. More recently, an editorial in the same paper labelled "Our outer suburbs are a disaster in the making" [3].

Concern about what we are creating in our suburbs and elsewhere is behind the movement called 'suburban retrofit' and 'sprawl repair'. Much of the literature on this topic has come from the US (e.g. [4][5][6] where there are similar problems to Australia. This awareness of what we are creating in the outer suburbs of our cities is increasing as it is exacerbated by the cost of housing. Once the demands of mitigating and adapting to perilous greenhouse gas emission levels are factored into the equation, 'business-as-usual' and lip service to sustainability will no longer be possible. While this appears to be a looming 'crisis', it also presents opportunities. There will be a demand for genuine action to revisit these housing developments, determine their shortcomings and take action.

Current evaluation methods of suburban development, however, have shortcomings. Firstly, they are either limited in perspective or overly complex. They often do not include criteria which are considered essential to a sustainable housing development. The results from complex methodologies are often hard to convey to non-

experts such as residents, policy and planning professionals. Finally, most studies do not define what is regarded as sustainable practice and so comparison at the time of analysis or some future date is not possible. The purpose of this paper is to introduce a new development to a relatively simple multi-criteria methodology that has been previously used to assess the sustainability of three suburbs of Geelong. The paper begins with a critique of past research, particularly one study from Australia. The differences and shortcomings of the approach used in that instance are discussed in relation to the methodology described in this paper and elsewhere [7][8]. A brief overview of the five criteria assessed in this past work is then presented. This is followed by a detailed description of the method used to add a sixth criterion. The previous results based on five criteria are then updated to include the new criterion and these are presented and discussed.

2   PREVIOUS RESEARCH

The use of indicators to measure, evaluate and monitor progress towards sustainability is commonplace and varies in complexity. Most evaluation of housing developments use only a single criterion e.g. [9][10] and [11]. Since sustainability has environmental and social components, this is an obvious weakness and deficiency. An exception to this single criterion approach has been the triple bottom line (TBL) approach of [12], a comprehensive study which used a suite of the indicators reflecting economic, social and environmental sustainability. The indicators included affordability, neighbourhood safety and satisfaction, transportation, biodiversity, energy use, resources and water use.

A major difference between the assessment method presented here and to that of [12] is that affordability or any other criteria which reflects an economic or financial perspective is eschewed. This is one of the fundamental differences between the strong and weak visions of sustainability [13]. The triple bottom line concept (economic, social and environmental) has been promoted in the past as a way to assess sustainability. In practice, the social and environmental arguments of sustainability have been subordinated to the economic one on the grounds of financial affordability. This approach invariably short-changes the social and environmental aspects of sustainability and is therefore considered inappropriate.

Other aspects of the AHURI study also have some limitations in this author's opinion. Firstly, the sustainability criterion of neighbourhood character and social diversity are not included in the AHURI study. The authors of the AHURI study acknowledge that the indicators used by them need "enhancement to a level more in tune with the holistic nature of sustainability" [12:3]. To assess the accessibility of some key community facilities the AHURI study used the 'radius method', which is considered to be inferior to the 'path method' which is used in this evaluation. The radius method does not take account of street layout and so can give misleading results about how far community members may have to walk in order to access those community facilities.

3   METHODS

The various methods used to assess each criterion used in this research have previously been described elsewhere [7][8]. In this previous work, five criteria were used to assess the sustainability of three suburbs of Geelong built in different eras, namely: Belmont (1950-60s), Grovedale (1970-80s) and Waurn Ponds (1990-00s). A typical 'precinct', measuring 400 m by 400 m, was chosen as the study site in each suburb. The criteria chosen were: energy use, resource use, neighbourhood character, neighbourhood connectivity and social diversity. Each criterion is measured using various indicators and in each case, the 'best' practice is acknowledged with a score of '5', while the 'worst' practice receives a score of '1'. The scores for each indicator were averaged to determine the ranking for that particular criterion. A brief overview of these criteria and indicators is presented below and interested readers are referred to previous work for more detail.

Energy Use
This criterion was evaluated by analysing the direct (or operational) energy use and the embodied energy of a typical house in the precinct being investigated. In addition, the energy used in travelling to and from the place of work was included. It was assumed the place of work was the Geelong CBD. The contradictions arising from, for example, building a large but energy efficient house in a location some distance away from the normal place of work is therefore accounted for. The operational energy use was determined from the heating and

cooling data published by the National House Energy Rating Scheme for various types of houses [14]. The embodied energy of the house was based on its floor area and used an approximation method first suggested in [15]. ABS data provided a breakdown of the mode of transport used for work travel. This data is collated by the mode of travel under various categories and sub-categories. In order to simplify the data, car and public transport usage only were used to determine an average method of work travel in this study. The relationship between the operational, embodied and travel energy per annum for a resident in the typical house of the precinct was then determined. Ratings (1-5) assumed that in the 'best case', the house required no heating or cooling (a 'passive' house) and that the owner rode or walked to work. Embodied energy was reduced significantly by the use of renewable building materials. Full details of the assumptions and ranking are given in [7][8].

Resource Use

This criterion looks at the resources (materials and land) used by a typical house in the precinct. Five indicators were used to evaluate resource use: *spatial enclosure efficiency* (the quantity of materials used to a unit of floor area); *renewable material proportion* (the volume of renewable materials used which was determined by AutoCAD Revit modelling of a typical house in the precinct; *precinct building footprint* (the ratio of total floor area to precinct area) as a measure of urban density; *house site proportion* (how well the site is used); and *land use efficiency* (the ratio of total house site area to precinct area) which reflects how well a precinct has been developed to minimise infrastructure requirements. Analysis of GIS information allowed direct measurement of land use according to dwelling site area as a percentage of the total precinct area. Once again, a rating system (1-5) (worst-best) was established for each of the indicators and an average rating for the criterion was calculated.

Neighbourhood Character

The importance of neighbourhood character is well-recognised and is an integral part of most local planning schemes e.g. [16]. Despite this, not a single assessment method appears to have included this criterion. Defining neighbourhood character is not a simple task because character is not easily reducible to a collection of elements. Woodcock and co-authors [17] argue that neighbourhood character is 'profoundly social', that it is 'fundamentally about the way built form mediates relations between neighbours and the ways such forms and practices give rise to a "sense of place"'. For social sustainability, a desire and pride in the housing development is paramount. We do not want to build housing where people live simply because they have no other option and furthermore will move out of at the earliest opportunity. This is the antithesis of sustainability. We all recognise the difference and consequently aspire to living in a house in an area which has some character. While it is possible to define neighbourhood character, it is hard to measure it. The task of evaluating 'character' is also fraught because it is subjective and place-dependent. Six physical/landscape indicators have been developed from the City of Greater Geelong's Housing Diversity Strategy [18] and other neighbourhood character studies in order to establish the physical neighbourhood character of the selected precincts. The six indicators were used: *public infrastructure and urban design, allotment size, building setback, building footprint, building type/design* and *vegetation.*

Social Diversity

Diversity has a variety of meanings in urban literature [19]. Amongst urban designers, it means mixed building types; for planners it may mean mixed uses or class and racial-ethnic heterogeneity; for sociologists and cultural analysts, it is primarily the latter. The whole idea of diversity is central to urban and future city planning and the evaluation of a multi-dimensional social mix as an approach to ascertain neighbourhood context diversity is directly linked to it [20]. It is argued by the author that social diversity is an important component of a sustainable suburb, particularly in a country like Australia. Our suburbs should reflect our national or (at the very least) regional mix. Most would agree that Australia has benefited greatly from the infusion of different cultures in the Australia of the 1950s and 1960s. Why should our suburbs be any different? Our reputation for multi-culturalism is global. We must continue to build on this by inclusion, acceptance and mutual acknowledgement at the widest level, not just in our cities. For social sustainability, a diversity of people in terms of educational status, income, country of birth and other 'differences' is fundamental for a country such as Australia. The opposite of this is either a ghetto or enclave mentality where people only live with 'people like us' [21] citing the findings of the sociologist, Dr Gabrielle Gwyther, about those who choose to live in so-called 'McMansion' estates. In this research, seven indicators are used. These are: *educational*

level, *family composition*, *dwelling typology*, *tenure*, *age group*, *weekly income* and *birthplace*. Census data for each suburb is benchmarked against the same data for Melbourne and the ranking indicates how closely the suburb compares to the mix in the capital city.

Neighbourhood Connectivity

Housing choice, mobility, connectedness to the outside world, social cohesiveness and inclusiveness have been identified as key elements for sustainable communities [22]. This criterion measures how physically connected residents are to their immediate community infrastructure facilities. The distance relationships between areas of housing and these facilities have been analysed. Nine indicators chosen by the City of Greater Geelong in their Sustainable Communities Strategy [23] have been used. These facilities are: *community centres, kindergartens and childcare centres, general practitioners, community libraries, maternal and child health facilities, aged care facilities, public transport, public open space* and *retail and convenience shopping*. GIS mapping was used to calculate the distance of these facilities from the precinct to determine their accessibility, both on foot and by public transport. A walking distance of 400 metres was assumed. The percentage of residents who lived within walking distance of a facility was then determined to enable a ranking to be awarded. If 80-100% of residents were with walking distance, a '5' was awarded and if the figure was 20% or less, then a '1' was awarded.

4   SOCIAL CONNECTEDNESS

It is proposed that a sixth criterion – 'social connectedness' – be added to the original five criteria to complement and extend the evaluation. It is argued that a sustainable suburb requires that its residents feel a sense of social connection, which they value and would be reluctant to lose if they moved out of the suburb. The desire to reside voluntarily in a suburb for a long period of time could be viewed as an ultimate test of its sustainability. The methodology used to evaluate this criterion is described below.

The number of community organisations within a suburb has been chosen as an indicator of the degree of social connectedness. While no indicator is perfect, it is believed that the number of community organisations can be assumed to be representative of the degree to which communities meet and mix, make friends and socially interact. This indicator can also often be measured from the website of the local government authority, as in this case for the suburbs of interest (Belmont, Grovedale and Waurn Ponds) which all fall within the boundaries of the City of Greater Geelong. The City publishes an on-line Community Directory (http://www.geelongaustralia.com.au/default.aspx). It is possible to search within directory for the suburbs of interest and to generate a list of community organisations for that suburb.

Not all the listed organisations, however, should be included in the evaluation. Some commercial organisations offering specific individual services appear in the directory and these should be excluded from the assessment. These include: retirement villages and respite accommodation, opportunity shops and health aid stores. Some judgement is required to decide if the listed organisation is likely to be a place where meeting and social connection is likely to occur. In this research, the following organisations and the rationale for their inclusion have been included:

- Schools – because it is assumed that parent teacher organisations, school concerts and sporting days provide parents with the opportunity to meet others.
- Sports clubs – because they are a key social gathering point for many young people and their families.
- Environmental groups – although usually small in active membership, these groups exist and take action in many communities.
- Churches – because it is assumed that opportunities to meet fellow attendants are available and encouraged
- Childcare – because it is assumed that parents will meet others when dropping off and picking up their children
- Other – other organisations such as reading groups are usually small but committed to long term interaction

- Neighbourhood house – these organisations invariably run a multitude of classes and programs where local people meet and socialise

Table 1 shows the number of selected organisations in the three suburbs of interest. The 'unedited listing' shows the total number of community organisations listed on the COGG website prior to the selection process described above. The (edited) Total shows the number of community organisations remaining after removing those that were deemed not to be those where some degree of social connectedness could safely be assured.

In order to provide a ranking (1-5) similar to that developed for the other criteria, it was necessary to establish what might represent the 'worst' and 'best' scores for social connectedness. While the absolute number of community organisations in a particular suburb might indicate a 'well-connected' community, it is also necessary to consider the size of the community. A suburb with a large number of residents would be expected to have more community organisations because of its population size.

Table 1 No of selected community organisations in three suburbs of Greater Geelong

	Belmont	Grovedale	Waurn Ponds
Unedited listing	92	68	14
Category			
Schools	8	6	1
Sports clubs	17	9	3
Environmental organisations	3	3	2
Churches	1	3	0
Childcare	11	6	3
Other – e.g. Rotary clubs, Neighourhood houses	14	6	1
(edited) **Total**	54	33	10

If it is assumed that the average size of a community organisation is 50 members, then it possible to readily calculate the number of community organisations required for an ideal level of 'connectedness'. Obviously, some organisations (churches and sporting clubs) may exceed this number of members, but other groups (e.g. environmental, book clubs) would be smaller and therefore correct any imbalance. The calculation also assumes that people would only be a member of one organisation, which in reality is unlikely. However, the method provides a simple way to calculate an upper figure (5) to reflect an ideal level of social connectedness. A suburb with few or no community organisations would score poorly (1). Table 2 shows the populations, and the actual and ideal number of community organisations for the respective suburbs and Table 3 shows the ranking (1-5) based on the lower and upper limits.

Table 2 Populations, actual and ideal number of community organisations for selected suburbs

Suburb	Population	Actual No of Community Organisations	Ideal No of Community Organisations
Belmont	13616	54	272
Grovedale	14153	33	283
Waurn Ponds	3995	10	80

Table 3 Ranking levels for the three selected suburbs
(Note: figures in bold italics are the actual number of community organisations as in Table 2)

Ranking	1	2	3	4	5
Belmont	0-53	*(54)* 54-108	109-162	163-217	218-272
Grovedale	*(33)* 0-56	57-112	113-169	170-225	226-283
Waurn Ponds	*(10)* 0-15	16-31	32-48	48-63	64-80

Tables 2 and 3 indicate that the selected suburbs score poorly in terms of 'social connectedness' using the method described above. Only Belmont achieves a ranking of 2, while all the other two suburbs score the lowest possible ranking. While the method described is easy to use, it has other limitations, in addition to those stated above. Firstly, not all community organisations will have registered on the COGG website. For example, no book clubs were listed, although these are a popular form of social interaction for many. Neighbourhood houses offer many courses and programs but these were not included and only the existence of a neighbourhood house was included in the category 'Other' in Table 1. In addition to being easy to use and provide some indication of connectedness, Table 2 does also show the relative difference between suburbs. The oldest and most established suburb, Belmont, has the most community organisations although it does not have the largest population.

Verification of Method
The number of community organisations and subsequent ranking appears low. It is therefore possible that the methodology is inaccurate and some verification was required to see if higher scores are possible using the same assumptions. It was therefore tested on another community. The Borough of Queenscliffe (BoQ) is comprised of two towns, Queenscliff and Point Lonsdale. They are located approximately 35 kilometres from Geelong at the end of the Bellarine Peninsula. Anecdotally, residents of the Borough often cite their 'sense of community' as one of the positive features of where they live. It was therefore considered to be a good 'test case' for the methodology. If a poor ranking resulted from such a community, then this would lend evidence to a poor methodology, and vice versa. The method described above was therefore applied to the BoQ to determine its ranking. The website of the Borough, specifically the Community Directory (http://www.queenscliffe.vic.gov.au/community-directory-queenscliffe), was used as before and Table 4 shows the results corresponding to those in Table 1.

Table 4 No of selected community organisations in the Borough of Queenscliffe

Category	Queenscliffe
Schools	3
Sports clubs	13
Environmental organisations	3
Churches	3
Childcare	5
Other – e.g. Rotary, Arts & Culture, Neighourhood House, Education and Learning	25
Total	**52**

According to the 2011 Census, the BoQ has a permanent population of approximately 3000 residents. Using the same assumption of 50 members per community organisation, then ideally the BoQ should have 60 community organisations for a 'socially well-connected' community. Using similar equal divisions as in Table 3, a score of 5 would be given if the BoQ had between 48 and 60 community organisations. The actual number is 52, indicating a top ranking. This exercise provides evidence of the validity of the method and the assumptions used for this sixth criterion.

5   RESULTS AND DISCUSSION

The rankings of the suburbs have been transferred to star diagrams (Figures 1-3). This method of displaying the results has the advantage of being quickly understood by non-specialists and has been recognised by users of similar systems e.g. AMOEBA for its value to inform policy makers and the wider community [13].
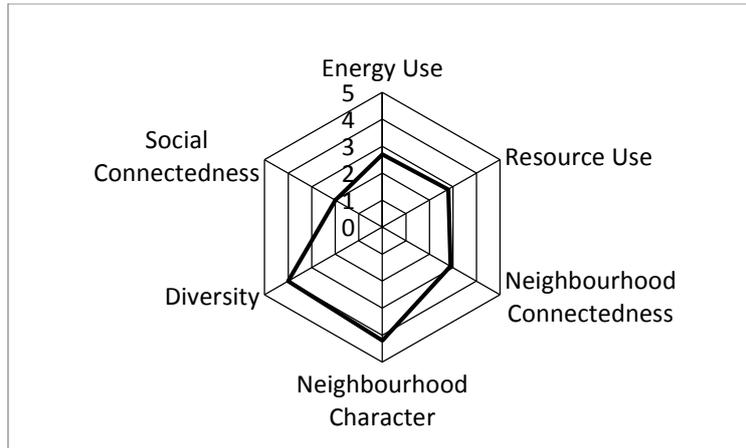
Figure 1 Sustainability rankings for Belmont[1]

[1]Note: in [7][8] two variations of Belmont were analysed and are combined here for simplicity
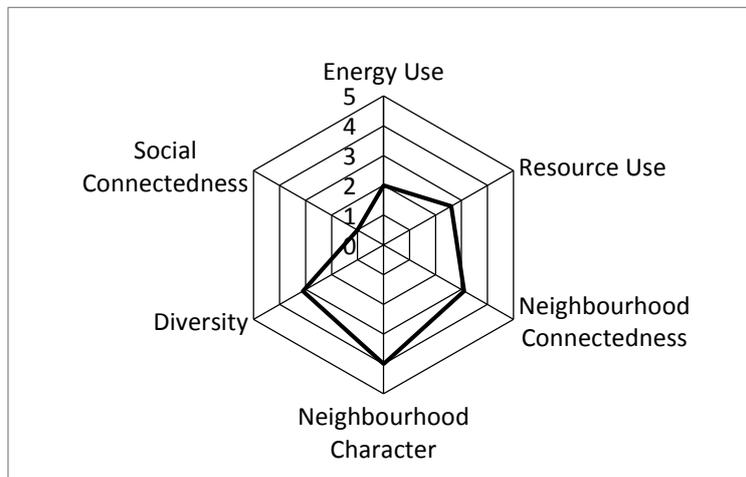
Figure 2 Sustainability rankings Grovedale
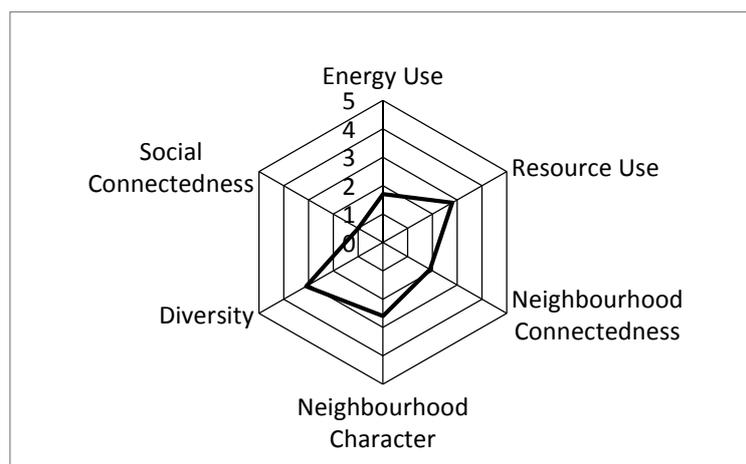
Figure 3 Sustainability rankings for Waurn Ponds

Figures 1-3 clearly show the differences in sustainability rankings for the three Geelong suburbs investigated. Some of the key findings include that Waurn Ponds (Figure 3) rates poorly overall compared to the other older suburbs. This finding is particularly disturbing because it demonstrates that rather than learning from our past

mistakes, our latest additions to suburbia are worse than their predecessors. Key contributory factors include lack of public transport, increased house size and a marked increase in unregulated individualistic housing style which has led to a decline in any recognisable neighbourhood character. Lack of vegetation has also contributed to a poor rating of this criterion.

The oldest suburb of Belmont (Figure 1) is socially more diverse compared to Grovedale and Waurn Ponds. Closer inspection of the indicator data shows that this is due to the existence of a less diverse building typology in the newer suburbs. This finding illustrates how one particular indicator might impact significantly on the overall criterion ranking because of averaging. It emphasises how a different ranking should encourage scrutiny of the indicator data behind the criterion ranking.

As noted earlier, the three Geelong suburbs perform poorly in terms of social connectedness. This can be attributed to two factors. Firstly, the need to form separate community organisations in a suburb is reduced because of its relative proximity to another suburb where the desired community organisation may exist and which is relatively-easily accessible by car. This highlights the fact that "urban areas are not self-contained entities but have links with other urban areas …. [13:13]. Secondly, verification of the method of assessing social connectedness was made with the two small towns of the Borough of Queenscliffe. By definition, this is a more isolated community which has probably formed its own community organisations, rather than travel by car for 35-40 minutes to Geelong. Towns, by definition, are more diverse and complex than suburbs, which have traditionally been regarded as little more than 'dormitories'. This highlights the need for change if sustainability is to be embraced.

6   FURTHER CONSIDERATIONS

It is acknowledged that the selection of criteria and even indicators is a subjective process and will influence outcomes. To some extent, the selection of criteria in this methodology reflected the interest and expertise of the original authors of [7][8]. Omissions are possible. However, the broad scope of the criteria chosen, some of which have not been considered elsewhere has led to a more holistic analysis. It is also acknowledged that the criteria chosen can conflict with one another. For example, achieving optimum resource use may detrimentally affect neighbourhood character, and vice versa. This conflict, rather than being problematic, is seen as an accurate reflection of the complexity of sustainability.

One weakness of the overall methodology presented here is the lack of any community participation in the selection of criteria. Participation is one of the four principles of sustainable development identified by [3] and even enshrined in Agenda 21. Stakeholder involvement in the selection of criteria is usually acknowledged to be a good thing but as [13:27] note is "rarely put into practice". There can be positive and negative outcomes resulting from stakeholder involvement. For some communities, strong sustainability might not be an over-riding consideration because lives are dominated by more immediate factors. For example, greenhouse gas emissions may not be considered important. On the other hand, stakeholders' responses may challenge 'outside experts' such as in the survey of 100 households in a Scottish village where community spirit and tranquillity were suggested as key components of sustainable development [13].

Although the suite of TBL indicators used by [12] was selected by the research team (validated by a steering committee), their findings were based on the responses (>680) to a questionnaire distributed in three states. In contrast, the results presented above are based on 'outside expert' field research (except for social diversity). This difference raises the question of which is a more productive approach. It does not, however, obviate the need for validation of the interpretation of findings by stakeholders. In the current case, the results of the work have only been presented to a small sustainability group in one suburb of Greater Geelong. The response, however, was very encouraging particularly to the method of presenting the results. This confirmed that use of the star diagrams to convey results and elicit discussion.

7 CONCLUSIONS

The previous work of [7][8] has been extended by the addition of a sixth criterion and this has enriched the overall sustainability assessment methodology. The six criteria have been evaluated using over 30 indicators which have been combined to produce updated rankings from previous work. Three suburbs of Geelong representing different construction eras have been assessed and the results shown on star diagrams. To the author's knowledge, star diagrams have not been used in this context before and the examples above show that the essence of the results can be conveyed readily. This method of presenting results will encourage planners or residents to ask the question 'what do we have to do to increase a particular rating and hence the overall sustainability of our local built environment?' The different problems of their suburb in terms of sustainability can easily be identified. This in turn means that action to rectify deficiencies can be taken. The current debate over the deficiencies of new housing developments can be better informed if a multi-criteria assessment, comprehensible to all parties (community, planners and developers), is available. Positive action to improve the sustainability of existing suburbs can then be taken to repair of damage done in the past due to ignorance**.**

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