Building Transdisciplinarity for Managing Complexity: Lessons from Indigenous Practice

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Abstract

The most critical problems humanity faces today are complex problems, characterised by high levels of uncertainty, multiple perspectives and multiple interlinked processes from local to global scales. A good example of such a challenge is climate change. Traditional research inquiries with specialized experts are unable to make the connections required to manage complexity. Transdisciplinary approaches can help different stakeholder groups to share and use their knowledge and experience for problem focused inquiry. Facilitating transdisciplinarity requires good dialogue processes and the development of holistic frameworks. Through reflecting on participatory action research initiatives with the Kuna and Quechua indigenous peoples we show that indigenous societies have developed over time strong dialogue processes, and continue to link them to a holistic view of the world allowing them to manage complex societal problems. They provide opportunities for linking knowledge systems to allow innovative adaptive solutions to problems such as climate change that affect all of humanity. We offer a new approach to promoting transdisciplinarity from the Indigenous Peoples' Climate Change initiative, starting with frameworks that recognise complexity and can facilitate dialogue.

Introduction

As the world becomes more interlinked by human activities our problems become more complex - and their solutions more difficult to grasp. The environmental and social crises we face today are a combination of several worrying changes in the world. These include the high levels of environmental degradation (UNEP, 2009), the food security crisis (CGIAR, 2009; Ehrlich, Ehrlich, & Daily, 1993), and climate change (Richardson et al., 2009), among others. These problems are all characterised by complexity, uncertainty and multiple social perspectives. They are made up of processes and impacts that

stretch across geographic and temporal scales. These characteristics are challenging science and governance that use traditional disciplinary, deterministic problem solving and linear management approaches (Miller et al., 2008; Rind, 1999). Addressing these interlinked problems requires that we move beyond isolated disciplinary research towards problem driven inquiry with participation of the key stakeholders involved. This means we have to move beyond the integration of different disciplines, towards transdisciplinary approaches to inquiry that link different disciplines with local and traditional knowledge systems (Munasinghe, 2001). This requires greater emphasis on the use of dialogue across knowledge systems to improve problem focused management.

In addition to the challenges science and decision making face, questions of social and cultural inequality surface when inquiring into complex societal problems. In the climate change area for example, the most vulnerable groups, such as indigenous peoples, who have contributed the least to climate change are currently facing the most severe impacts (GHF, 2009). Moreover, these groups continue to be marginalised from science driven government decision making (Salick & Byg, 2007). Ironically, indigenous peoples have been managing complex problems within their territories for much longer than western society has and they potentially still hold valuable knowledge for dealing with complex societal problems (Ford, Smit, Wandel, & MacDonald, 2006; Posey, 2001; Stevens & De Lacy, 1997). In particular, indigenous knowledge systems are characterised by being more holistic, having a more connected view of people and nature, and including a wider range of social well-being values (Berkes, 1999; Rose, 2005).

In this paper we reflect on examples from the Kuna peoples of Panama and the Quechua peoples of Peru to show how indigenous systems can help improve transdisciplinary approaches. Indigenous collective processes for facilitating dialogue between knowledge systems, and their use of holistic frameworks can support transdisciplinary inquiry for management of complex societal problems. Our examples come from indigenous systems where a historical relationship between communities and the ecosystems they inhabit is ongoing, creating a rich biocultural systems context (Maffi, 2005).

We begin by placing our argument within the complexity and transdisciplinarity literature, and build a theoretical framework for thinking about how complexity is managed through transdisciplinary practice, focusing on two important ways this can be done; the use of collective dialogical processes and building contextualised holistic frameworks. The following sections deal with each of the two main points of our argument, using indigenous examples. Finally we discuss ways we can progress in transdisciplinarity through an indigenous climate change initiative.

Managing Complex Societal Problems

Managing complex societal problems such as climate change requires approaches to inquiry and problem solving that are able to deal with complex

interlinked processes and multiple social perspectives. Such approaches are less about producing high quality specialised knowledge that can be used to solve a 'problem', and more about bringing different knowledge systems and people together to improve a complex situation. We begin this section by looking at the characteristics of complex adaptive systems that leads to a shift in management focus. We then look at transdisciplinarity as an appropriate approach to complex problem management. Finally we look more specifically at two key elements that support transdisciplinary approaches: collective processes that facilitate dialogue across knowledge systems, and holistic, contextualised frameworks.

Complex Adaptive Systems

The theoretical foundations for researching and developing policy to deal with complex problems, in fields such as sustainability science and environmental management, are undergoing a paradigm shift. Conceptually, traditional scientific approaches are generally based on reductionist methodologies and often on expertise within single disciplines (Dahlberg, 1991). Management in such models is often based on a command and control model. Increasingly, alternative approaches to link management and policy are based on concepts of open and evolving systems. There is a growing acceptance of the need to build on principles of experiential learning and systems thinking (Allen, Bosch, Gibson, & Jopp, 1998). The new science of complexity offers a paradigm that is a viable alternative to positivist, reductionist approaches to inquiry. It calls for a different approach for science and management, away from centralised co-ordination towards a philosophy of guidance rather than control.

This new paradigm is known by several names; complexity theory, complex adaptive systems and non-linear science are but a few of them (Eve, Horsfall, & Lee, 1997; Garnsey & McGlade, 2006). Put simply, complex adaptive systems are characterised by having multiple interacting parts that exhibit non-linear behaviour leading to unpredictability and being made up of nested systems that are open and mutually affecting with each level exhibiting patterns that emerge out of the interactions of the parts. Research into such wholes must be systemic and should focus on the interactions between the parts of the system while recognising patterns produced by self-organisation and feedback loops that lead to adaptive behaviour (Capra, 1996; Kauffman, 1996; Waldrop, 1992). This new approach has been applied to a variety of fields concerned with understanding complex issues such as sustainable development (Harris, 2007), socio-economic system dynamics (Garnsey & McGlade, 2006), globalisation (Urry, 2003) and social theory and analysis (Byrne, 1998; Cilliers, 1998).

When a complex adaptive systems framework is adopted the focus for researchers and managers turns from seeking the answer to making sense of the situation; from forecasting the future to designing the future; from finding the right structure to keeping the structure fluid and adaptive; and from overcoming the limits of the system to unleashing the dynamic potential of the system (Anderson & McDaniel Jr., 2000). This involves promoting interactions between knowledge systems. Interdisciplinary approaches to research and knowledge do

this by using different disciplinary perspectives to understand a problem, and integrating their findings (Brewer, 1999; Nissani, 1997). But when dealing with complex societal problems, knowledge from interdisciplinary research on its own is not enough (Max-Neef, 2005). The multiple dimensions present in a complex societal problem involve social dimensions of conceptualisation and behaviour. Dealing with them necessarily involves understanding how people who are directly involved and impacted construct their view of the world and their engagement with it. It becomes a problem that is beyond just research; one that includes society, social action and decision making processes.

Transdisciplinarity

Dealing with complex societal problems requires knowledge across all aspects of society; research disciplines, communities, civil society and governments. Sustainability science already recognises the need for research that includes multiple knowledge spheres (Clark & Dickson, 2003; Kates et al., 2001). The inclusion of non research knowledge spheres necessarily involves the participation of stakeholders. For participation to be effective, the boundaries between the different groups involved must be transgressed, not simply worked across. Transdisciplinary approaches do this by recognising complexity and producing knowledge for decision making and action on a specific problem (Lawrence & Despres, 2004). Three drivers are thought to be responsible for shifting research approaches from disciplinary focused to transdisciplinarity; the need for research to be problem driven, a recognition that talking across different knowledge spheres when dealing with complex problems is necessary, and a call for participation of all groups affected (Wickson, Carew, & Russel, 2006). Hadorn et al. (2006, p. 122) call transdisciplinarity "research that addresses the knowledge demands for societal problem solving regarding complex societal concerns." Transdisciplinarity therefore is a process that can put knowledge generation at the service of society to deal with complex societal problems.

It is becoming clear that transdisciplinary approaches are necessary to deal with large-scale, long-term, complex and interlinked issues such as climate change. However, the evidence to date is that this sort of collaborative inquiry is easier suggested, than undertaken. In particular there is much resistance to this form of cross-disciplinary collaboration in the academic world, both principled (concerns about standards, quality, etc) and rooted in practice (Robinson, 2008). Overcoming this requires a culture change on the part of researchers and stakeholders alike. What is needed is a respect for each others' culture, which must come before the different parties will be able to develop joint concepts (Pohl, 2005). We now turn to two aspects of such inquiry that are crucial for making progress in this collaborative way of addressing complex societal problems. These are the need for collective processes that encourage dialogue and reflection, and the need for holistic frameworks that go beyond simple measures of production and economic efficiency to articulate the different values that different stakeholders need to see addressed.

Collective Dialogical Processes

The need for better dialogue between disciplines in science, and between science and other groups in society is well acknowledged. Effective transdisciplinary approaches are entirely dependent on the learning and collaboration that must occur across boundaries of knowledge groups. Simply bringing people together does not necessarily lead to good collaboration (Pohl, 2005), and as Allen and Jacobson (2009) point out the barriers to good collaboration are primarily organisational and social. Some of the challenges that effective collaboration across knowledge groups faces include a tendency to discount non-scientific forms of knowledge, communication between disciplines that are used to their own language, overcoming traditional conceptual models that do not embrace complexity and interrelatedness, and the difficulty of avoiding homogenisation of results that fail to include all points of view (Strang, 2009). Collectively, these different barriers highlight the challenge to finding appropriate processes to promote the development of respect and shared understanding among diverse stakeholders. As a number of reviewers emphasise there is a need to stop seeing dialogic activities as a limited set of events – a workshop, seminar, or a couple of meetings. If dialogue is to be more than just consultation then it must be treated as a process that is ongoing, and requires trust and commitment between the different parties (Allen & Kilvington, 2002; Reed, 2008). Nicolaides and Yorks (2008) call this an 'epistemology for learning through' that focuses on learning as an ongoing action and is necessary for dealing with complexity.

Dialogue however is not a new idea and there are many examples worldwide in which different stakeholders have worked collaboratively. There are a number of common elements that make collective processes work that shed light on how to build effective collaboration. Some of the best examples of these emerge from traditional processes, where indigenous peoples have sophisticated culturally specific protocols, values and traditions around dialogue that have been developed over centuries. Key practices include providing processes that build and support trust and respect. Winstanley et al. (2005) list some of these in relation to New Zealand Māori dialogue process. Rituals of encounter (e.g. *powhiri*), proverbial sayings (e.g. *te kai a te rangatira, he korero* – discussion is the food of chiefs), and key concepts (e.g. *manaakitanga* – hospitality) underpin these processes. Mechanisms for clarifying expectations and putting people at ease combined with entertainment and humour are essential factors in Māori based dialogue processes. These practices provide a good process for building quality relationships for long term collaboration.

Contextualised Holistic Frameworks

Inherent in the collective dialogical processes that can link knowledge systems in transdisciplinarity are the use of conceptual frameworks that recognise the different parts of the system in question. Conceptual frameworks are mental constructs that we use to frame, understand and engage with the world and are

sometimes called mind maps, mental models or conceptual models (Johnson-Laird, 1983). These mental constructs always exist in our way of framing issues even if most of the time we are not aware of how we use them to make sense and take action in the world (Argyris, 1999). Conceptual frameworks that recognise complexity can potentially support transdisciplinarity by helping stakeholder groups to recognise multiple interacting parts while also allowing self organisation by viewing the whole as more than the sum of the parts.

The shift from disciplinary to interdisciplinary approaches to research has led to the use of conceptual frameworks that recognise the relationship between different disciplinary foci. There are, for example, many models that economists and ecologists have developed to illustrate links between natural and economic systems. But, as Glaser (2006) argues, we need to go further and develop frameworks that can take account of other key aspects of complexity, for example including the ability to address the more qualitative, social and cultural aspects of development. Current frameworks, such as the adaptive cycle framework (Holling & Gunderson, 2002) which conceptualises socio-ecological systems as complex adaptive systems, fail to include the phenomenological aspect of human engagement. This is likely due to it being a research driven conceptual framework that focuses on system dynamics. When dealing with real world contextualised problem solving, where transdisciplinarity is useful (Lawrence & Despres, 2004) the inclusion of stakeholders and their values requires frameworks that can also speak to their engagement with management of real life problems.

The human and temporal dimension of transdisciplinarity can be included through using frameworks that replace abstract scientific concepts with meaningful locally developed and understood concepts. This is a challenging but fundamental step that can shift research approaches to more inclusive processes of knowledge creation and decision making that we argue are necessary for supporting society or groups in dealing with the real life complex problems they face. Moreover, discussions and frameworks at these levels also need to be able to take account of the deeper spiritual values that support peoples and societies.

In a study of religion across cultures, Rappaport (1999) points out that what is most important in the process of adaptation in human systems is not the structural changes that occur through adaptation but rather 'What does this change maintain unchanged?' (Rappaport, 1999, p. 7). This turns the focus onto what is 'preserved' through adaptation. He argues that symbolic aspects such as a spiritual connection to Mother Nature are maintained. Similarly, Bossel (1999) argues that all systems, including complex systems, have basic orientors that are useful for choosing system indicators of sustainable development. These orientors reflect human well-being, making it a central feature of desirable system dynamics. Indigenous cosmological frameworks play this role, and provide a means for keeping well-being as a central aspect in decision making around complex problems. They are local frameworks that evolve out of the interactions of social and ecological systems. These contextualised, local frameworks are holistic, and support a process of transdisciplinarity by focusing on interactions

between knowledge groups and providing a spiritual, meaningful and creative dimension to dealing with complex societal problems.

Bridging Knowledge – Kuna Case Study

Now we use an example from the Kuna indigenous peoples of Panama to illustrate how indigenous cultural and social practice supports the collective dialogue necessary to successfully manage a transdisciplinary approach to research and development (R&D). The Kuna are an example of an indigenous system that has historically been adaptive and succeeded in maintaining autonomy and self-governance in their territory (Howe, 1998, 2001). The examples provided are reflections from ongoing participatory action research in the largest Kuna territory in Panama, the Comarca[1] Kuna Yala.

Cosmological Framework

Kuna society is characterized by high levels of social capital, built and maintained both through a holistic cosmological framework and social interactions. The Kuna collective memory, *Bab Igar* (Father's Way) is a compilation of Kuna oral history (Wagua, 2000). Embedded within the stories are Kuna philosophy and theology. Within this framework, social reality is conceptualized as embedded levels of collectivity, producing a highly communal system (Chapin, 1991; IWGIA, 2006). Included in the levels of collectivity is the natural world, the Kuna believe they are directly related to *Nan Dummad* (Great Mother, Nature). The relationship between all beings in the world is reciprocal, and humans are part of an interconnected whole. This framework is holistic and highlights the importance of interactions.

Collective Dialogue

Apart from the natural interactions inherent in a society with high social capital, the Kuna use deliberate collective processes to facilitate interactions between knowledge systems for decision making that supports collective well being. The story of *Ibeorgun* from the *Bab Igar* (Wagua, 2000, pp. 79-97) tells of the prophet *Ibeorgun* arriving to teach the Kuna social organization metaphorically through building the *onmaked nega* (gathering house). Today, collective processes are still managed through the *onmaked nega* system of governance, a system that has evolved from *Ibeorgun's* teaching. It is characterized by a variety of leadership roles and an adequate supply of leaders with skills for facilitating across different perspectives and knowledge systems. Dialogue protocols help leaders facilitate participation.

[1] Comarca is a Panamanian special political division for indigenous territories. Kuna Yala was the first one to be established in 1954. Since then several other Comarca of other indigenous people have also been established.

Transdisciplinarity is supported by bringing different perspectives together. This includes community members and specialized knowledge holders. Dialogue protocols that have evolved over generations of collective practice are employed. Facilitation and dialogue skills are developed in leaders along with technical expertise and understanding of the holistic cosmological framework through long term experiential apprenticeship learning. Collective meetings involve discussions in which all community members are encouraged to participate, through listening and/or expressing their opinion. When participating in open dialogue for analysis and decision making leaders are expected to use both their technical knowledge from their field, and their facilitation skills based on the cosmological framework of reciprocity and interconnectedness. It is common for discussion about a particular community issue, management of the airport for example, or the increased levels of childhood asthma, to take on philosophical dimensions as leaders engage in reflexive discussion of different aspects of the complex problem. During these discussions dialogue protocols such as allowing all to speak until no new information or positions are presented with no time limit, allow connections to be made to all perspectives and aspects, enabling holistic thinking.

Today, the Kuna are part of a highly connected globalised system, and the complex societal problems they must deal with touch upon an ever increasing number of dimensions. The regional governance system is based on the communal system of open participation and collective dialogue. Examples of complex problems discussed at recent regional meetings include dealing with encroachment on their land by both poor migrant farmers and wealthy entrepreneurs and building new tourism management structures as a response to an increase in tourism demand. Both cases involve communication with several government departments and international indigenous rights forums. In response to the added layers of knowledge needed to manage the new challenges, the regional governance structures have evolved to include bodies of professional Kuna who are called upon to provide expert opinion. For example, there are lawyers specializing in indigenous rights who advise collective processes that require engagement with the national or international legal systems, scientists who are called upon to help evaluate potential environmental impacts of proposed projects etc. Like community governance, at the regional level transdisciplinarity is facilitated by bridging together multiple perspectives and epistemologies using collective dialogical processes.

The important lessons from examples where these processes have resulted in adaptive responses to challenges such as a the development of a bilingual intercultural education curriculum, is not that the decisions being made are correct or better, but rather, that the process used ensures they are made in the right spirit and will protect Kuna autonomy and well-being. Decisions are therefore only ever temporary, and can be reversed or changed if they are no longer serving the collective. This gives the Kuna system a high level of adaptability that has served them well even in dealing with the heightened complexity of the globalised setting of today.

Using Contextualised Holistic Frameworks – Quechua Case Study

For transdisciplinary approaches that can manage complex societal problems, we have argued that contextualised holistic models such as cosmological frameworks of indigenous peoples can provide a context for meaningful management that is coherent with local systems. We use an example to illustrate how we can move from research frameworks to more holistic contextualised ones to support transdisciplinarity. Our example comes from an indigenous sub-global assessment, part of the Millennium Ecosystem Assessment (MA). The MA made an effort to move away from the reductionist approach that has prevailed in natural resource management and produced a conceptual framework for assessing ecosystems that incorporates multiple levels and connections between ecosystems and social systems (Millennium Ecosystem Assessment, 2005). The MA framework focuses on how indirect and direct drivers of change in ecosystems impact on ecosystem services that in turn impact on human well being and poverty reduction (figure 1).

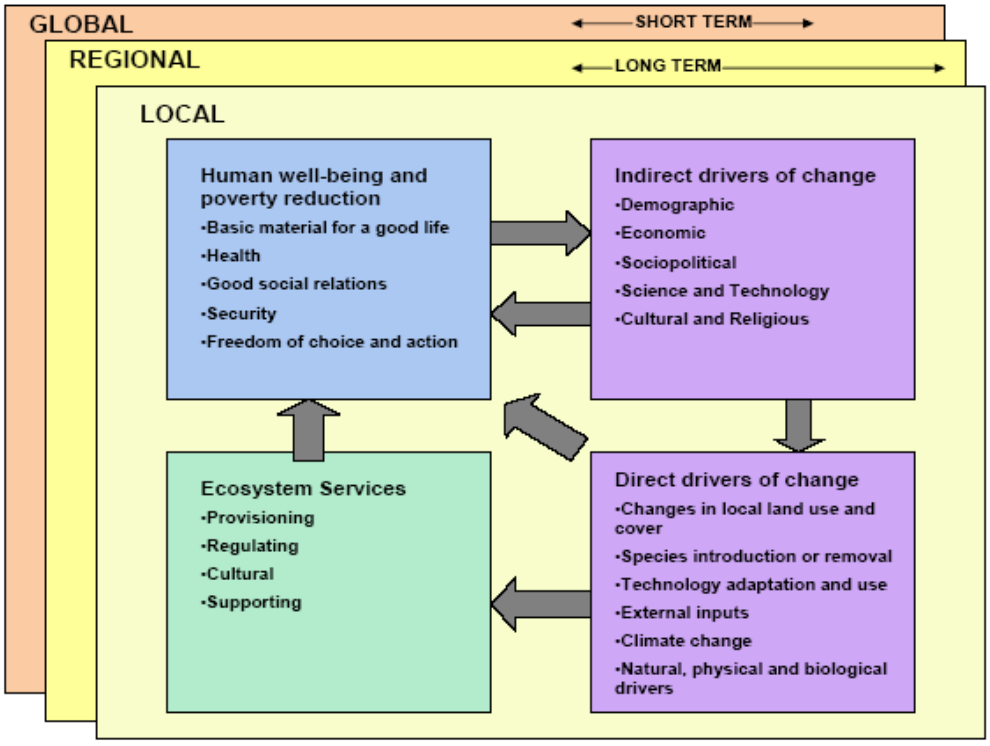

Figure 1: The MA Conceptual Framework (Adapted from Millennium Ecosystem Assessment, 2005, p. vii)

In the upper right hand corner of the MA conceptual framework, the factors that indirectly affect ecosystems are shown. Factors such as population lead to factors that directly impact (bottom right box) ecosystems such as climate change. In turn the changes these factors cause in ecosystem services (bottom left box)

which are separated into four types (provisioning, regulating, cultural and supporting), impact upon human well being (top left corner). The interactions shown are occurring across time and space scales.

The MA is primarily a scientific assessment process, and while it recognises the need for integration of knowledge it is necessarily focused on ensuring the scientific and political validity of its findings. The framework is interdisciplinary in that it recognises that biodiversity and ecosystems are interacting with human systems, requiring assessments to use both social and environmental research. The conceptual framework allows for a multi-scale assessment, and sub-global assessments are performed locally to assess the state and changes in ecosystem services and their impacts on human well-being locally. One of the local assessments was conducted in the Q'eros Quechua region of Vilcanota in Peru and proved to be an interesting exercise in making an interdisciplinary framework applicable to a local inquiry process.

Vilcanota Case Study

The Vilcanota assessment was facilitated by Asociación ANDES, an indigenous NGO. However, when using the MA conceptual framework to define the scope of the assessment locally, the team encountered difficulties in 'translating' the concepts for a meaningful local evaluation process. As Miller et al. (2008) point out, when research on a particular topic becomes inclusive of other knowledge perspectives (in this case the inclusion of Quechua knowledge and meaning into the MA approach) a re-evaluation of the entire project from the research questions to the methods used is necessary. If this does not occur, one perspective is likely to be privileged over another. To ensure that the inquiry process was locally driven and managed, a new local conceptual framework was built for the Vilcanota assessment. One that would be both coherent with a Quechua view of relationship between humans and ecosystems, while simultaneously speaking to the MA process. The Andean cosmological framework that embraces complexity was used to facilitate discussion around the concepts, and a new conceptual framework was produced (figure 2). It is holistic, recognises complexity and provides meaning to the local inquiry process.

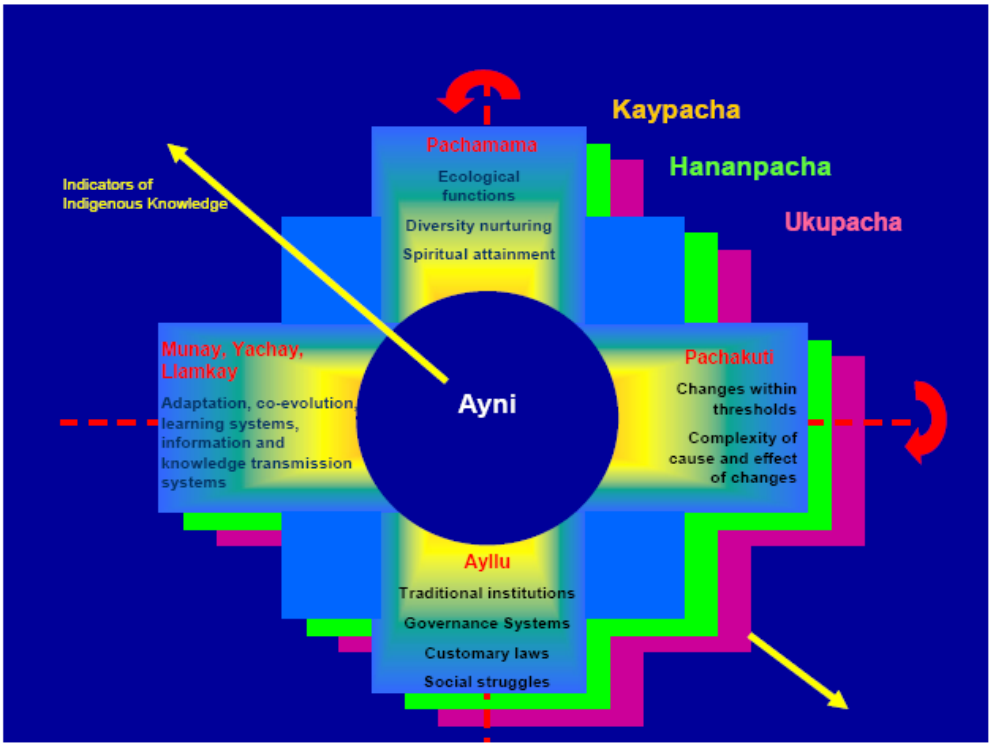

Figure 2: The Vilcanota Conceptual Framework (Sourced from Local adaptations of Millennium Assessment (MA) conceptual framework, 2005)

The Chakana cross figure used in the Vilcanota conceptual framework is sacred to the Quechua peoples and provided an appropriate pattern to illustrate how order in the world is shaped by collective processes based on the principle of reciprocity (Ayni) that runs across the Kaypacha, Hananpacha and Ukupacha scales. The scales represent both time and space and allow the past and future to come together in understanding. Ecosystems and their interactions with humans are understood through the four dimensions of the cross; the cyclical nature of all processes (Pachakuti), an interconnected system of nature and people (Pachamama), collective social processes (Ayllu), and learning through love (Munay) and work (Llankay) achieving higher state of knowledge about the system (Yachay)

Table 1 shows a comparison of the 5 principles of the MA framework with the equivalent Q'eros concepts, illustrating the main differences that led to the development of the Vilcanota framework.

Table 1: Comparison of Concepts of the MA Framework with Q'eros Concepts

		Concept	Explanation
1	MA	HWB and Poverty Reduction	Anthropocentric, globalization framework, dollar poverty indicators
	Q'eros	Ayllu	Pachacentric (systemic), localized, Ayni indicators (complementarily, reciprocity, redistribution)
2	MA	Ecosystem and their Services	Utilitarian, capital driven (social, ecological, human, economic capital), "services" are isolated entities
	Q'eros	Pacha Mama	Heritage, holistic, incommensurability of values
3	MA	Direct and Proximate Drivers	Deterministic, cause-effect
	Q'eros	Pachakuti	Cyclical; Dynamic and desirable; opportunity to learn, source of diversification and resilience
4	MA	Responses	Expert and policy makers defined
	Q'eros	Ayni	Spiritual principle, Culturally based, Social and Collective Visioning
5	MA	Interdisciplinary Methods	Integration of fields of knowledge (do not exclude power relations and agendas). Top-down
	Q'eros	Munay, Llamkay, Yachay	Integration embedded in the individual before social visioning and practice. Symbolic and transdisciplinary.

The major differences between the MA and Q'eros concepts highlight the different cultural and cosmological frameworks of humans in ecosystems that underlie each. The Quechua worldview emphasises reciprocity and interconnection with Pachamama, a holistic concept of humans as part of nature, while the MA ecosystems services and human well-being are understood from a

utilitarian, anthropocentric view. The fifth concept shown in Table 1 relates to conceptualising knowledge creation and integration, pointing out that the Q'eros framework views knowledge as integrated and embedded in the individual, and thus moves beyond interdisciplinarity to include non research sought contextualised knowledge.

The Vilcanota example shows how an interdisciplinary framework was enhanced through the use of an indigenous cosmological framework to provide a contextualized holistic framework for transdisciplinarity. This example was used by Cundill et al. (2005) in an analysis of different conceptualisations of complexity and methodological frameworks used in sub global assessments. The Andean cosmological framework is shown to have increased the view of alternative perspectives, but led from a science perspective to superficiality and less rigor in the study. With regards to the participatory methodology used, the authors argue that the ability to plan and predict was diminished while the results became simplified and therefore less scientifically valid.

The tensions around using a more open and participatory local process while still producing scientifically valid results that surface in this analysis are inherent in moving research efforts towards transdisciplinary processes. We suggest that the Vilcanota framework was developed through a view that embraces complexity, the need for contextualised meaning and transdisciplinarity. Seeing adaptive responses as outputs and using more inclusive validation processes are needed to support such efforts. In the last section of the paper we briefly provide an example from an indigenous climate change project in which we attempt to build a new approach that can help move towards transdisciplinarity in dealing with complex societal problems.

Towards a New Approach – The IPCCA

The Indigenous Peoples Climate Change Assessment initiative (IPCCA) is an indigenous led and managed transdisciplinary initiative that aims to empower indigenous peoples to use their own frameworks and practices for assessing the impact of climate change on their biocultural territories and building adaptive response strategies. The IPCCA has grown out of lessons learnt from indigenous systems using collective dialogical processes and holistic cosmological frameworks such as the Vilcanota experience. Under the IPCCA, local indigenous partners internationally will undertake climate change assessments in their biocultural systems. A conceptual framework to guide the vision of the program was required to ensure coherence across the transdisciplinary local assessments. From the outset the need to use a conceptual framework that fitted with an indigenous view of the world and its interacting parts was recognised. The IPCCA conceptual framework for understanding the relationship between climate change drivers and local biocultural systems was built on universal indigenous concepts (figure 3). The concepts used illustrate a complexity view of the world through indigenous frameworks.

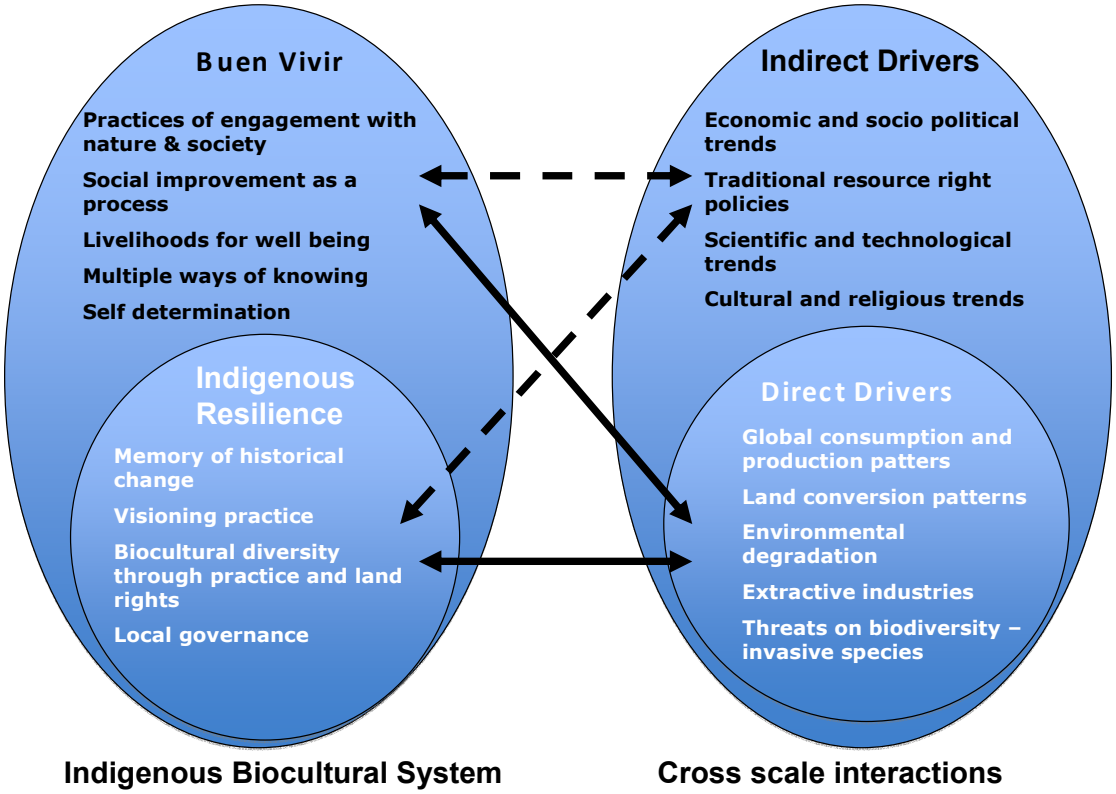

Figure 3: The IPCCA Conceptual Framework (Adapted from Apgar & Argumedo, 2009)

The IPCCA conceptual framework enables an analysis of the relationship between processes that lead to climate change on the right (drivers) and a local biocultural system on the left. Climate change drivers are processes occurring across scales of time and space, directly and indirectly impacting indigenous peoples locally (for example, global consumption and production patterns and environmental degradation as direct drivers, and economic and socio political trends and scientific and technological trends as indirect drivers). Local biocultural systems are made up of factors that contribute to indigenous resilience2 (collective memory, biocultural diversity, governance structures etc.). The end goal of maintaining resilient biocultural systems is to live by the practical philosophy of Buen Vivir (well being, based on the Quechua concept of Sumaq Qausay). Achieving Buen Vivir includes the practice of reciprocity through appropriate engagement practices with the natural and social worlds, social

[2] Indigenous resilience builds onto the socio-ecological resilience concept a long term view of recursive processes embedded in collective memory that can view today's interactions through past recurrence and future consequences, and adaptation as opening towards future opportunities as well as reacting to feedback.

improvement or development as an ongoing process, livelihoods for enhancing well being, among others. Complexity is embraced through the interactions indicated by the arrows as being across scales and cultural systems

At the time of writing the IPCCA local assessments are commencing, the first to be conducted in Quechua and Kuna communities. As with the MA, the IPCCA local assessments will use the IPCCA framework and local cosmological frameworks to build a new conceptual framework that can provide contextualised meaning to the inquiry process. Initial scoping of development of a conceptual framework with the Quechua participants, has shown that the IPCCA framework is adaptable to the local context because it embraces complexity and interconnectedness and is synergistic with indigenous cosmological frameworks. This builds confidence in the ability of the approach to support the inclusion of indigenous worldviews in the collective inquiry process. It is too early yet to evaluate how useful the IPCCA framework will be in different biocultural contexts worldwide, but we use it here to illustrate how it is possible to start with approaches that are grounded in local cosmological and cultural concepts. Using holistic frameworks that explicitly work with complexity are a starting point for facilitating transdisciplinary approaches for building adaptive responses to complex societal problems such as climate change.

Concluding Remarks

The responsibility for progressing transdisciplinary approaches between scientists, indigenous peoples and other stakeholders does not rest with any one sector. It will be achieved through the development and linking of policy, management, public and science cultures that genuinely value input from multiple social perspectives. Good processes for collective dialogue and frameworks that can support a world view of humans as a part of nature are important underpinning elements for such transdisciplinary approaches. These processes are not new, and we have much to learn from indigenous approaches to collective decision-making which have evolved over thousands of years. Lessons from the Kuna highlighted the benefits of long term social learning processes that work towards collective well-being. Leaders with good facilitation skills are pivotal to ensuring that a quality process is maintained. We need to focus on the quality of the engagement process, and move away from a reliance on using a science disciplinary filter to judge the quality of the information or knowledge we use.

The Quechua examples illustrated how cosmological frameworks can be powerful tools for creating local, contextualised frameworks that embrace complexity and support transdisciplinarity. Our first steps towards facilitating contextualised and locally managed processes that we hope can help locally driven societal problem management come through the IPCCA endeavour. The experience of local indigenous climate change assessments to be conducted under the IPCCA in a variety of biocultural systems worldwide is an opportunity to learn from a variety of indigenous systems, to deepen and broaden understandings

of how transdisciplinarity can be enhanced to help communities deal with such challenging issues as climate change.

Acknowledgments

The IPCCA is supported by Oxfam-Novib and The Christensen Fund. It is being implemented by a consortium of indigenous organizations and partners. Please see http://www.ippca.net for full details. This paper is archived here with the kind permission of the International Journal of Interdisciplinary Social Sciences. More information about the journal can be found from the publisher's website at http://thesocialsciences.com/journal/.The original journal on-line article can be accessed directly from http://iji.cgpublisher.com/product/pub.88/prod.828

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