# Knowledge, Learning, and Societal Change:

## Finding Paths to a

## Sustainable Future

Science Plan for a cross-cutting core project of the International Human Dimensions Programme on Global Environmental Change (IHDP)

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# Executive Summary

Human activity is generating fundamental changes to global ecological systems, which are being pushed to their limits in terms of their capacity to support life as we know it. Two key challenges have arisen as a result: the first is to understand the causes and effects of these changes, the second is to effect a transition to a sustainable societal system. Much has been done to address the first challenge, but less to address the second. Human society as a whole has yet to learn how to manage itself in ways that do not threaten the global ecological systems upon which it depends.

**This Science Plan focuses on addressing the challenge of societal change for sustainability from the perspective of knowledge and learning. It is the conceptual framework and implementation strategy for a major long-term project called *Knowledge, Learning and Societal Change: Finding Paths to a sustainable future (KLSC)*.** This plan recognizes many previous initiatives that have identified what needs to be done to bring about sustainability given current knowledge, and in some cases how that might be done and by whom. But having knowledge and learning to understand it does not necessarily mean that choosing to, or indeed being able to, act will follow. The motivations and determinants of individual and collective human behavior and how these are connected with knowledge of global change are poorly understood and yet they are crucial in responding to the challenges of global change. **A critical need in the quest for a more sustainable world is a deeper understanding of the *interplay* between knowledge and learning on one hand and individual behavioral and societal changes on the other.** This plan therefore puts forward the case for **research and actions to understand this interplay in the myriad cultures and conditions in the world and** to share the developing insights to **further enable a transition to a sustainable future through knowledge, learning, and education.**

This plan has four chapters:

**Chapter 1 introduces KLSC** from three different perspectives: the perceived challenges and the motivations for KLSC, the context of global change research, and the main goals and objectives of KLSC. *The overarching goal of KLSC is to deepen understanding of the entire process of producing, learning, understanding, and ultimately using knowledge to enable change to sustainable local and global societies.* Three research themes for KLSC are introduced: **climate change mitigation and adaptation, stemming biodiversity loss,** and **improving the equity of natural resource allocations**.

KLSC will build on an extensive body of literature on knowledge, learning and behavioral and societal change, which is summarized in **Chapter 2**. The rationale for the project is developed here and assumptions about key issues and concepts are unpacked. **Concepts and issues of central importance to KLSC in addressing interconnected, complex systemic change include the role and nature of knowledge, theories and processes of learning, and transformations leading to sustainability**. This will involve understanding how resource demands arise and accumulate from human activities, analyzing societal changes from different perspectives, appreciating a relevant range of knowledge traditions and sources, using models to examine the relationships between knowledge, learning and action, and finding out more about how legitimacy of knowledge and power relations affect behavioral choice and societal changes.

**Chapter 3** describes the **essential characteristics of KLSC research** with **its integrative and transdisciplinary approach,** including how the three themes will be used. The characteristics are focus on **narratives as visions for change**, the way **sustainability will be both a research issue and a normative goal**, the **reflective and iterative process of research and activities,** and how the KLSC **process and output will be relevant to policy**. The way in which, for instance, KLSC will use meta-analysis of case studies across scales, regions, issues and contexts and pay attention to the wider

'social ecology' of the research process, research relationships and research products will help make it distinctive.

**Key diagrams** are included in this chapter to help explain the perspective and scope of the project. **Three categories of research questions are detailed – about environmental governance and societal change, cultures of practice and societal change, and capacity building for adaptation and transformation**. Some examples are:

- How do the existence and development of grass-roots movements in communities interact with levels of governance in linking knowledge, learning, policy making, practice, and societal change?

- How do [various] learning and knowing and societal change processes evolve over time as individual changes reinforce each other to aggregate into a substantive community or institutional change?

- How do either successes or failures in change processes and innovative strategies influence learning and education for adaptation and transformation?

There is also recognition that there is a range of methodologies that can be used individually or in combinations to most effectively tackle particular types of research questions. Therefore **nine methodological options for the research and how KLSC envisages using them together are discussed**. The overall contribution of KLSC research to many of the ICSU and Belmont 'grand challenges' of sustainability is also explained.

**Chapter 4 deals with a strategy for implementation**. A list of **proposed KLSC activities** is given for research, development of a network of communities of research and of practice, one international and several regional project offices, workshops and conferences, synthesis meetings, outputs, monitoring, and assessment. **Implementation will include capacity building for KLSC research, global and regional workshop and forum series, and a KLSC database and wiki.** A **range of deliverables** is discussed including various publications, use of new and well-established social media, engaging with the art and humanities communities in collaborative projects, multiple approaches for research and outreach to share insights and expand value gained from the projects in KLSC, and generation of a new community of learning and practice. KLSC also expects to work with a wide range of **affiliated institutions and communities of practice**. **Project milestones** are detailed.

Finally, three **existing case studies** are presented in an appendix as illustrative examples of the kinds of projects that can both provide research data for KLSC and benefit from analytic approaches and new insights from KLSC.

# 1   Introduction

This chapter introduces this Science Plan from three different perspectives:

- The overall challenge and motivation for humanity in finding its way towards a sustainable future and where the primary focus of this project will lie and why.

- Exploration of the context of global change research

- Main goals and objectives of this project

## 1.1   Challenge and motivation

Humanity is facing immense challenges in finding its way toward a sustainable future. One part of the existential challenge of the Anthropocene era (Crutzen 2002) lies in understanding the causes and effects of Earth system changes to the ecological, geo-physical, social, and economic conditions on Earth on multiple temporal and spatial scales. A second vital part is enabling wise mitigation and adaptation measures under changing conditions and effecting a transition to a sustainable societal system. Understanding the first part of the challenge is not sufficient in and of itself to enable the second part. Addressing the second part of the challenge is the purpose of the '*Knowledge, Learning, and Societal Change: Finding Paths To A Sustainable Future'* (KLSC) project[1], which will itself consist of a collaborative network of research projects.

The task of KLSC is an essential part of the global change research effort - an effort that is responding to a clear and present danger to society and the planet's ecosystems. Despite, and in some ways because of, decades of tremendous progress in science and engineering, the earth's natural systems are being pushed to their limits. Human society has yet to learn how to manage itself in ways that do not threaten the global ecological systems upon which society depends, now and in the future. There is evidence that human activity is now so extensive that it is generating changes to the ecological and climatic systems on which plant and animal life depends that extends well beyond natural variability – in some cases alarmingly so - and at rates that continue to accelerate (Biermann et al. 2009; Steffen et al. 2004).

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**From the findings of the Intergovernmental Panel on Climate Change**

The Intergovernmental Panel on Climate Change (IPCC), for example, warns that we are on a path of rapid global warming that is likely to result in major, and possibly severe disruptions, to the existing climate system. Possible consequences – some already evident - include sea level rise, increased water stress in different regions, desertification, shifts in weather patterns, more frequent occurrence of extreme weather events, and the concurrent human-centered problems these changes are likely to cause: hunger, starvation, loss of life, disease, greater conflict over limited resources and involuntary migration. These changes are also likely to trigger mass biological extinctions, with large numbers of species of plants and animals being lost annually; resulting in some predictable and many unknown impacts. Tremendous inequity between individuals, between communities, and between nations has also become a major issue, both in terms of access to resources; experience of and vulnerability to adverse effects. (IPCC, 2007)

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[1] In this document, KLSC is often referred to as a program simply to distinguish between one component project within KLSC and the entire network of projects that form KLSC. The convention in the International Human Dimensions Programme in Global Environmental Change (IHDP) is to refer to each of its core research networks as projects.

Humankind's knowledge of the natural science aspects of global change continues to develop rapidly and technology continues to promise potential solutions to some of the problems. This is not matched by the necessary societal changes. Crucially, a greater recognition is emerging of the need for and contributions of trans-disciplinary research that integrates social, institutional, and economic aspects of global change issues with natural science and technology insights.

A specific and critical lack in the quest for a more sustainable world is *sufficient understanding of the interplay between knowledge and learning on one hand and individual behaviors and societal changes on the other*. Knowing something does not necessarily mean that choosing to, or indeed being able to act on that knowledge will follow. The divergence of individual (micro) motives and collective (macro) outcomes is also well recognized (Schelling 1978). Individual behaviors concerned with everyday life and livelihood, which in isolation may be considered reasonable in terms of resource use or production of wastes, can pose significant risks and unintended consequences when the individuals interact and the collective action is amplified. Instead, there is a need for *actions to be harmonized in adaptation to rapidly changing, uncertain conditions and for transformation to sustainability.* Thus a deeper understanding of knowledge, learning, and societal change needs to be developed in a global context of diverse cultures and governance systems, and across multiple scales of space and time.

Since the need for sustainable development was first recognized internationally in the early 1980s, knowledge has been seen increasingly as crucial to achieving its goals. Both the technical progress of the digital revolutions and the increased economic importance of intangible goods in 'the knowledge society' fostered the vision of developing countries leap-frogging whole stages of economic development. This, however, has not been achieved as yet. Similarly, initiatives based on knowledge (e.g. knowledge of more sustainable energy options) offer substantial potential for transitions towards more sustainable societies. These need to be up-scaled and integrated into societal and cultural innovation systems. Tremendous progress has been made in terms of lifting millions out of poverty, yet billions of people are still living in abject poverty without adequate access to essential resources and no chance to improve their condition substantially. Equally important, the unequal distribution of wealth, opportunities and risks within societies (at local, regional and global levels); is intertwined with subsequent unequal distribution of cost and benefits of 'improvements'. This is the source of major political conflicts and forms a domain that needs further scientific research.

The first decade of global change research focused on understanding the interaction of human actions and environmental responses. In the context of natural sciences, the changes triggered by human action led to the development of the Anthropocene paradigm (Crutzen 2002), the view that human action fundamentally alters parameters of global natural systems. In the second decade, social science programs focused on environmental changes and human responses to such changes. How human behavior affects the environment has been well researched, there is also evidence that environmental change influences human behavior. However, the processes and mechanisms that constitute links between environmental parameters and behavioral or societal patterns are largely unclear.

As research on global environmental change enters its third decade, the insights generated by the first decades have begun to penetrate the public consciousness in some parts of the world. The rising level of risk and the responses that will be required in future give rise to urgent calls for immediate and long-term action. To enact the requisite behavioral changes across the world's communities and institutions, a collaborative effort by individuals, communities, nations, and the international community as a whole is proposed as an inevitable course of action (Kaufmann and Gutscher 2001).

However, many thorny questions remain regarding what actions to take, and how to motivate and empower action by sufficient numbers of people in highly diverse contexts (political, economic,

ecological, physical and cultural). Whether concerned with issues of food, water, mobility, wastes, wildlife, cities, markets or livelihoods, many unresolved questions arise about the relationship between knowing and acting. The wide range of possible actions to take based on current knowledge and the positive and negative, anticipated or unintended consequences of those actions also lead to contested knowledge, ambiguity, and uncertainty. Some individuals or societies may believe that they are already pursuing the 'correct' paths to the future and thus resist certain actions or changes, while others interpret failing international negotiations as symptomatic of a lack of meaningful opportunity or ability to act.

Actions currently underway and taking shape in response to global environmental change involve all sectors of society: the polity, science and technology, the private and public sectors, and civil society. Initiatives range from the United Nations multi-level action plan for sustainable development 'Agenda 21' to international protocols and environmental legislation to networks of transition towns to various efforts of individual communities and families to live more sustainably. In evidence are all types of policy instruments – command and control, economic, service and infrastructure, communication mechanisms and participatory forums. However, the motivations and determinants of human behavior and how these are connected with knowledge of global change are poorly understood, yet they are crucial in responding to the challenges of global change.

There is little information and evidence-based research that assesses the degree to which initiatives are well-informed, constructive, and adaptive in the transition to a sustainable society. Validation mechanisms for knowledge-based initiatives for sustainability need to be developed and incorporated in projects to improve on this record, yet they are hard to conceptualize, as positions remain torn between global policy issues and specialized case studies. This indicates a wide-spread disconnect between knowledge and action in adapting to environmental change. Focused research and critical, reflective thinking is needed that (i) helps to understand the enablers and inhibitors of change to sustainable practices and that (ii) helps avoid mistakes where efforts and actions in one direction unintentionally undermine initiatives in another. It is crucial to develop deeper insights into human behavior and societal change in relation to available knowledge and understanding, because these profoundly affect not only policy decisions, but also the outcomes of those decisions in society.

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**An example to highlight the need for a substantive large-scale KLSC research endeavor**

Economic models are perceived as the most formalized, well-accepted and practically relevant scientific tools in political decision making, for example, in steering financial markets. By nature, such models are based on assumptions about human behavior and thus inevitably have their limitations. As in previous financial crises, the recent one that reached public attention in 2008 revealed the flaws in the theories in use at the time, as no model conclusively predicted or explained the full extent of the crisis. Nevertheless, economic tools are introduced and used for better environmental governance, e.g. in the establishment of emission markets or in the valuation of ecosystem services for international compensation schemes. Therefore, a deeper understanding of human behavior to inform and improve economic models and better understanding about the nature of models and the assumptions and limitations inherent in them will be crucial to avoid politically-induced distortions or blind business-as-usual responses to crises with their attendant devastating consequences.

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Concerns in the (social) scientific community about the effectiveness of the interaction between science and policy led to an initial impetus for developing cross-cutting research on knowledge and societal change. This concern has been voiced within the International Human Dimensions Programme on Global Environmental Change (IHDP) (see e.g. Young 2008 and Young, et al. 2008) of which this initiative is a part. The concern is also voiced among social scientists worldwide (Jasanoff and Wynne 1998; Haas and McCabe 2001; Siebenhüner 2002; Jasanoff 2004, 2010; Bolin 2007).

Out of the considerations above, this new IHDP initiative on *'Knowledge, Learning and Societal Change: Finding Paths To A Sustainable Future'* (KLSC) emerged. KLSC can be seen as *an examination* of *critical enablers and obstacles to adaptation* coupled to the use of the new understanding to *catalyze adaptation and transformation processes in response* to global environmental change. The KLSC project requires an integrated approach that combines theory, practice, policy, and public participation in understanding and supporting adaptation based on knowledge and learning (see Patwardhan et al. 2009). This focus is articulated in three broad research question domains, outlined in Chapter 3.

In this science plan for the KLSC research program - which will be constituted as an ensemble of networked research and action projects – initially three themes that are crucial in the global change and sustainability arena have been chosen to strengthen the focus, without restricting the applicability of KLSC results. These three focal themes for KSLC are:

1. climate change mitigation and adaptation

2. stemming biodiversity loss

3. improving equity in natural resource allocations.

These themes have been chosen because of their relevance at different scales and levels and their perceived urgency. This rationale is explained further in chapter 2. Understanding the interplay of knowledge, learning, and societal change within each of these themes is of tremendous importance in its own right. Choosing these three themes is also intended to narrow the focus to create a critical mass of work on each theme. This will facilitate making comparisons between the insights gleaned from case studies and activities tied to each theme. Because KLSC will address the themes in the context of the underlying issues of knowledge, learning, and societal change, it is also likely that insights developed within studies of each of the three themes will prove valuable in a much wider array of contexts.

## 1.2    KLSC in the Context of Global Change Research

The fundamental importance of this project about knowledge, learning and action is evident in reviewing how it permeates the frameworks supporting both the broadest current effort to change the conditions in which humans live - the Millennium Development Goals (MDGs) - and the core challenges in addressing global environmental change research as formulated in the International Council for Science (ICSU) visioning process (ICSU 2010) and the Belmont Challenge undertaken by ICSU at the request of the Belmont Forum of the International Group of Funding Agencies for Global Change Research (IGFA) (http://www.icsu.org/2_resourcecentre/Resource.php4?rub=8&id=400).

The ICSU Visioning process sets out a guiding framework for global change research over the next decade with five Grand Challenges. The criteria for selection of the Grand Challenges were scientific importance, global coordination, relevance to decision makers, leverage to help in addressing multiple problems and other global change challenges. In the priority research questions posed under each of these challenges, several stand out as examples of the questions that KLSC is particularly well suited to address. These include:

- What strategies for avoidance, adaptation and transformation are effective for coping with abrupt changes, including massive cascading environmental shocks?

- How can improved scientific knowledge of the risks of global change and options for response most effectively catalyze and support appropriate actions by citizens and decision-makers?

- What changes in behavior or lifestyle, if adopted by multiple societies, would contribute most to improving global sustainability, in the context of global environmental change, and how could they be achieved?

- How can effective, legitimate, accountable and just, collective environmental solutions be mobilized at multiple scales? What is needed to catalyze the adoption of appropriate institutional, economic or behavioral changes?

- What changes in communication patterns are needed to increase feedback and learning processes to increase the capacity of citizens and officials, as well as to provide rapid and effective feedback to scientists regarding the applicability and reliability of broad findings and theoretical insights to what is observed in the field?

The Visioning document, in its list of deliverables, includes the following, which is of particular significance for KLSC:

New methods for doing research (involving innovation in synthetic research approaches, participatory practices, and collaborations) and communicating results, in which stakeholders are empowered, informed, and motivated through the research process to take effective action.

The Belmont Challenge states that "the objective is to develop and deliver knowledge in support of national and international government action to mitigate and adapt to global and regional environmental change and its associated regional hazards." This immediately raises the point that it is insufficient to 'develop and deliver knowledge' as a packaged commodity. The crucial components of locally appropriate processes of developing and using best available knowledge, learning to understand it, and engaging stakeholders to use their understanding to support and catalyze action are the core issues for KLSC. This is reflected in the research process framework of the KLSC Science Plan in Chapter 3.

The focus in the Belmont challenge on broad societal issues is particularly relevant to the KLSC project, in particular the key challenge to understand the roots of human behavior and societal change processes as they pertain to human-environment interactions.

## 1.3    Goals and Objectives

The overarching goal of KLSC is to deepen understanding of the entire process of producing, learning, understanding, and ultimately using knowledge to enable change to sustainable local and global societies. This goal relates directly to the forecasting and response framework articulated in the Grand Challenges document. The broad objective of the KLSC project is to identify and understand the levers of behavioral and societal change that are linked with knowledge and learning and that lead to constructive, adaptive and transformative societal change. This will be done through the combined efforts of a collaborative community of researchers, practitioners, and stakeholders working at multiple temporal and spatial scales.

Objectives:

- The KLSC project will *contribute to Global Change research* by its specific perspective on societal adaptation to global change and a specific set of questions focused on climate change, stemming biodiversity loss, and increasing equity in resource allocation.

- KLSC will *contribute to the social sciences* by enhancing concepts of the production of knowledge, the links between learning and behavior, and the relationship between individual decisions and collective change processes. In particular, KLSC will broaden the perspective to investigate ways in which knowledge is understood and used by different actors, thus going beyond the traditional study of knowledge.

- KLSC will *contribute to the integration of disciplines*, including the integration of natural and social sciences, by giving priority to assessing and integrating the existing stock of research

through examination of the influence and interplay of knowledge, learning, and change. In particular, investigating the framing, perception and use of scientific knowledge will support the link of natural science findings to the processes at the heart of social science research.

- KLSC will *contribute to theory-practice integration* by focusing on the valuing and use of knowledge on the one hand and the connection of knowledge as a tool to address societal needs on the other hand. Given the urgency and complexity of challenges such as climate change, biodiversity loss, resource limitations, and other sustainability issues, the KLSC initiative will foster science-policy-society interactions as an integral part of the research project and which are framed by the project's research findings and at the same time contribute to them.

- Finally, KLSC will generate *impacts beyond science*. Aside from its contribution to some of the most pressing questions of our time, in the trajectory of this project, successful implementation should also be sought after in research and education. Insights generated in the project should lead to shifts in research agendas, based upon the insights generated through the project. It should also lead to shifts in both formal and informal (i.e., schools, colleges and universities on one hand and museums, science centers, zoos, aquaria, after-school programs, on the other hand) educational practice and educational systems, because it is likely that the need for different knowledge and different core competences will become clearer and more compelling.

The research questions and issues are further elaborated upon in chapters 2, 3 and 4. In chapter 2 they are addressed from the perspective of the existing scientific literature on knowledge, learning, and societal change. Chapter 3 formulates research questions on the relationships between knowledge, learning and societal change, which can be considered starting points for defining research. It also provides broad guidance on research process and methods that are suitable to KLSC research. Chapter 4 lays out the implementation strategy for the KLSC project in terms of its deliverables, desired outcomes and a timeline.

# 2   Key issues and concepts

## 2.1   The need for systemic change – environmental and societal

This section introduces chapter 2 and explores the broad context of KLSC by considering three inter-related aspects of a perceived need for systemic change that includes both environmental and societal dimensions:  These are:

- the need to appreciate interconnections and complexity

- issues of sustainability, in particular those of focus, level, scale and urgency

- issues of societal change and global environmental change

### 2.1.1   Appreciating interconnections and complexity

The primary focus of this plan is the knowledge and learning associated with the human dimensions of a particular kind of change, framed as *societal change*.  The concepts of knowledge, learning and societal change and the main issues arising for investigation through the KLSC project are elaborated in what follows. First, and in keeping with systemic traditions, a step back is taken to explore the *context* of the main issues the project will address - in particular the interconnected nature of environmental and societal change and issues of complexity.

Recent work on 'planetary boundaries' undertaken by Rockstrŏm et al. (2009) is helpful to illustrate *interconnections.* They define the 'safe operating space for humanity' with respect to Earth systems and argue that human activity is leading to the crossing of key 'boundaries' that are likely to de-stabilize the environmental state of the planet. The boundaries under review include thresholds for climate change, rate of loss of biodiversity and interference with the nitrogen cycle. These all have *both* environmental and social aspects, not just one or other. As stated in Rockström et al. and implied in other contemporary analyses of planetary trends (e.g. Speth 2008; Park et al. 2008), it is humanity, not the non-human elements of Earth systems, that has transgressed these boundaries. They warn too, that human activities may soon be approaching the thresholds of other boundaries. The idea of 'tipping points' also draws attention to the possibility of irreversible system level shifts (Grodzins 1958) a concept that is being applied in the context the Earth's climate system (for a distinction between the concepts of 'tipping points' and 'tipping elements', see Lenton et al. 2008). These analysts of planetary trends and dynamics, concerned with avoiding detrimental consequences of human activity, imply a need for systemic change – change to a whole system, rather than to just its parts.

To understand something systemically means to put it in context, to establish the nature of its relationships (Open University 2010). Developing this understanding depends in part on how boundaries and purposes of a system are perceived. A fundamental purpose of the work organized by means of this plan is to understand the key societal factors which can help humankind to avoid systemic destabilization of the Earth systems. Unveiling the complex interaction between the geobiochemical system that we are all a part of and upon which we all depend and the production of social constructs and institutions should help us to anticipate and avoid unintended consequences resulting from the way humans live their lives in contemporary societies. KLSC's 'system of interest' is the Earth's social-economic-ecological system and those working in KLSC will be primarily concerned with the kinds of knowledge, learning and societal change that might lead to *sustainability*, which will be discussed in the next section. KLSC researchers and practitioners, who work in a broad range of geographic and institutional contexts, will also seek to identify what kinds of change are, in Checkland's (1999) terms, 'systemically desirable' and 'culturally feasible'.

In appreciating the interconnections within KLSC's system of interest, and between it and others, it is inevitable that there will be a need to engage with *complexity.* The causes and effects of, for instance, acceleration in loss of biodiversity in Amazonia are many and various and not geographically bounded. The idea of developing an understanding of the relevance and role of knowledge, learning and societal change in bringing about improvements in such a situation is considered complex.  But in what sense is it complex?  Considering the amount and breadth of relevant domains of information and knowledge related to sustainability, behavioral and cognitive scientists working in the field of sustainability increasingly focus on complexity and complex information as a fundamental challenge with which human beings must grapple.

Complexity in this context can mean being a property of a situation or system, something experienced or perceived, a branch of science with methods, models and heuristics to contribute and a way of thinking about the world (Ison 1994). Starting with just the first of these meanings - natural systems, such as climate systems, include substantial non-linear effects from multiple sources that may lead to emergent phenomena, such as extreme weather events. They are often too complex to allow for a complete description and understanding of their operations. What is more, the interaction of the bio-geo-physical systems with social and economic systems adds layers of complexity. Consequently, all aspects of the Earth as a system cannot be accurately and simultaneously represented.  Knowledge, which is always changing and evolving, will always contain a degree of uncertainty and be limited by the nature and capacity of human cognitive capacities. There is a constant challenge in dealing with uncertainty and the absence of clear knowledge and understanding that characterizes sustainability questions (Funtowicz and Ravetz 1990; Faucheux and Froger 1995; Chichilnisky 1998).

KLSC's approach to working with complexity and complex systems is further considered in section 2.3.1, where the relationships between knowledge, learning and action are explored.

### 2.1.2    Sustainability – issues of focus, level, scale and urgency

Sustainability is another much contested term that has been explored from many different perspectives in the literature (e.g. Holling 2000 - futures; Hopwood et al. 2005 - different approaches; Porrit 2006 - capitalism;  Kamara et al. 2006 - GMOs;  Kates 2010 – science). When considering sustainability, many questions arise about what is to be sustained, for what and whose purposes and for how long (Kates et al. 2005). Perspectives vary but practitioners and theorists alike have identified sustainability as firstly 'living within our means' and have in groups agreed on some of the basic principles of sustainability (e.g. Robèrt, 2002). Secondly, there is general agreement on what fuels unsustainability (e.g. Jones et al. 2010). In the context 'living within our means' general principles such as eliminating progressive build up of pollutants, degradation and destruction of nature and natural processes, and the conditions that undermine people's capacity to meet basic human needs are widely cited. In the context of 'what fuels unsustainability, it is becoming increasingly clear that interrelated issues need to be assessed and addressed.

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**Biofuels - an example of interrelated issues of sustainability**

There are unsustainable consequences of the recent shift to bio fuels; because their production is linked to water supply constraints; and increased competition for land for food production. This in turn is linked to how fossil fuel use, agricultural practices and globalized food chains are contributing to climate change; and so on.

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Discourse on sustainability has extended a long way beyond specific groups agreeing on basic principles. There is, for example, a mature body of literature about evaluation and reporting of sustainability, activities that rely on methodologies developed in a range of different contexts, including science-based accounting methodologies used to evaluate resource macro-balances in

biological and geographical terms and systems approaches developed and applied in contexts where communities have decided on their own indicators of sustainability (e.g. Bell and Morse 2003, 2008). At the societal level, the decision about what constitutes improvement in terms of moving towards sustainability is a political one to be made in the frame of the societies' political systems; as was most evident in the recent COP talks on climate change. To understand the transformation of society, it is therefore crucial to analyze economic, ecologic, social, and institutional societal subsystems, e.g., industrial transformation, governance systems, or consumption patterns. (Transformation is discussed further in section 2.4.)

It is important to recognize that people striving for sustainability have different systems of interest. The major groups who have participated in the United Nations conferences since the Rio Earth summit in 1992 provide a case in point. These are business and industry, children and youth, farmers, indigenous peoples, local authorities, NGOs, the scientific and technical community, women, workers, and trade unions from 'developed' and 'developing' states. A recent statement on a 'new era of sustainability' presented in the process of preparation for the Rio+20 conference on sustainable development (to be held in 2012) considers the journey towards a sustainable *economy* (Lacy et al 2010), whereas the sustainability focus for Jones et al (2010) is more aligned with natural resources and agriculture. KLSC processes relating to the focus of aspects of sustainability are therefore likely to be *contested,* and will require recognition of diversity of perspective and interest. Of significance to KLSC research however, is the insight that divergence of norms and perspectives is increasingly being viewed as an important *learning resource* in sustainability oriented social learning and change processes (Wals, 2007a, b).

The KLSC project position regarding sustainability will need to evolve in recognition that knowledge and learning are cross-sectoral and that there are many different perspectives to build on, including communities and groups who are already focusing on education and learning for sustainability. People from a wide range of sectors have already been involved in the development of this plan and more will become involved as the momentum of this project builds. At this stage, the position taken by the project team is that the project will focus on issues that are perceived as urgent and strategic. This focus is not only on developing better understanding of the interplay between knowledge, learning and societal change, but also on how this interplay might be enhanced in order to help address some of the most urgent issues, such as those discussed by analysts of planetary trends mentioned above. The KLSC project's choice of themes and research questions (discussed in Chapters 1 and 3) has been influenced by its focus on *urgency, level* and *scale.*

In making a distinction between level and scale we follow Gibson, Ostrom and Ahn (2000) and Cash et al. (2006) in defining *scale* as the spatial, temporal, quantitative, or analytical dimensions used to measure and study any phenomenon, and *levels* as the unit of analysis that are located at different positions on a scale. Concerns with scale are often expressed in terms of size (large-scale/small-scale, long-term/short term, etc.) whereas our use of level usually refers to a level of hierarchy, as it is used in systems theoretical traditions[2]. It is partly for reasons of scale and level that KLSC will focus on *sustainability* rather than just on sustainable development. Although meanings of these concepts vary, the focus on sustainability is used here as a reminder that there is a need to focus not just on local-level or small-scale processes of development, but also on how resource demands from human activity accumulate.

Knowledge, learning, and behavioral and societal change are necessary for sustainability at all levels and across different societal sectors. Major shifts from the status quo will be required to achieve a more sustainable world. This will require the scaling up and diffusion of many pilot initiatives (Gibson, Ostrom and Ahn 1998).

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[2] These distinctions sometimes become blurred e.g. terms such as global level and global scale are used interchangeably in some instances.

**Best practices and scale**

There are countless examples of specific 'best' practices for sustainability - the individual who builds a passive house, the school that decides to only buy green power, the restaurant that minimizes food waste, the farmer who limits the use of pesticides. These practices, while laudable, are often too small on a regional, national, or global level to have much impact unless many others follow similar practices. Moreover, their collective impact is also poorly understood.

Scale matters, meaning that expanding communities of practice and strengthening networks of such communities will be essential. The aim of this expansion would be to help link individuals with a shared sense of vision and purpose, so that individual changes are undertaken in the context of a wider social movement leading to substantive structural, societal or behavior pattern changes. The challenge becomes finding how to develop a sense of shared purpose between the different levels of activity that might allow knowledge and learning to develop across the different levels. The hope is that such knowledge and learning would influence changes in practices at all levels and lead to concerted action for sustainability. While there are some signs that this can occur, e.g. in managing water resources at whole catchment level (see Collins and Ison 2009, 2010) and in the examples below, the rate of change to more sustainable practices needs to be greatly accelerated.

**Examples of local initiatives and scaling up**

China has chosen a handful of cities to become model environmental cities – cities whose ecological footprints are well below the average. In Germany, there are half a dozen towns that have chosen to go 100% renewable. In Japan, the government requires that governmental offices not be cooled below 28 ° C in the summer time. In the Netherlands, a third of the population commutes to school and work by bicycle. Bogota, Columbia has introduced one of the world's most eco-friendly public transportation systems. Costa Rica has allocated a third of the country as national park in an effort to protect biodiversity, while stimulating ecotourism. How this is being done, and how such initiatives can be further up-scaled remains largely unknown.

Change can be considered as occurring in different or multiple scales or levels. These include the following:

*Local arena:*
One crucial arena for change in the direction of sustainable development consists of communities, neighborhoods and initiatives on the local level. Promoting sustainable lifestyles, implementing Local Agenda 21 initiatives, launching community projects, bringing together local actors and reaching out to other communities and regions are challenges and learning tasks for local communities in this respect. Social learning is a desired outcome of public participation processes and at the same time, public engagement may stem from greater awareness and social learning around a particular issue (Webler et al. 1995; Johnson and Wilson 2000; Dietz and Stern 2008; Collins et al., 2009).

*Domestic politics:*
This class of approaches addresses questions like: How do political systems and particularly political decision makers learn? Where does the knowledge come from that is applied and diffused in the learning process? What has been learned? How could the resulting changes be measured? The different concepts in this field vary in their focus on the learning agents. Some focus exclusively on governments such as Etheredge (1981), while others like Heclo (1974) and Sabatier (1987, 1988) additionally examine societal actors such as elite

structures, networks, and other social groups as learning agents. The latter approaches stress the role of norms and belief systems in learning processes within a network structure, called 'advocacy coalition' by Sabatier.

*International relations and comparative country case studies:*
Another group of studies in policy learning address the international arena and investigates whether and how states learn from each other and whether and how international communities are able to learn (Schreurs 2002). Rose (1991, 1994) addresses issues of 'lesson-drawing' where one state benefits from the experiences made by other states. The concept of epistemic communities as developed by Peter Haas (1992) and Adler (1992) draws the attention to mostly internationally organized networks that are united by their shared beliefs and convictions about particular political problems and the favorable solutions to them. These networks usually consist of scientists, lobbyists, political decision makers and advocacy groups. Beck (1999) refers to these as 'discourse coalitions' indicating the common political interests that often bind such networks. This concept also draws attention to inclusions and exclusions that exist in and around such epistemic or discourse coalitions. Insights on issues of sustainability in the field of learning between countries are to be found in diffusion studies, which analyze the spread of (environmental) policy innovations across countries (Jänicke and Jörgens 2000; Tews, Busch, and Jörgens, 2003; Lafferty 1996, 2004).

*The global society as a whole*:
Many environmental problems such as climate change, ozone depletion, biodiversity loss, health problems such as life-threatening diseases like Malaria, Tuberculosis, HIV/AIDS, water borne diseases and others are global threats to the entire human society. Humanity has countered a number of these problems successfully through forms of collective learning; but many challenges remain, as is evident in the annual Human Development Progress Reports produced by the United Nations Development Programme. A number of authors have developed conceptual frameworks for the understanding of this kind of global learning. These draw on empirical case studies of particular learning areas such as combating plague, cholera and smallpox (Cooper 1989), implementing Keynesian economic policy (Hall 1989) or managing global environmental change (The Social Learning Group 2001).

### 2.1.3    Societal change and global environmental change

Societies are constantly changing. Causes of societal changes range from natural processes, such as the replacement of a society's members through generations or changes in the surrounding environment, to decisions about where to live and how to behave towards each other, to active efforts for improving the functioning of society. The latter are a special case, as they are based on predictions and visions about what societies should look like, visions that evolve among leaders, activists and the general population. Social change processes observed partly reflect individual and collective multi-level learning processes and behavioral adjustments from which societal trajectories emerge. But while all learning processes involve change of some kind, it cannot necessarily be claimed that all change processes involve learning.  Loss of biodiversity at a global level and climate change provide cases in point. As discussed in the last section, many examples can be found of community-based approaches to address issues that arise in these areas that involve learning and adaptation (e.g. Weaver, 2011; Mukute and Lotz-Sisitka, in press 2011) but institutional constraints at other levels of organization are often encountered. It remains far from clear how learning and adaptation take place beyond local levels when global as well as local environmental changes take place e.g. at regional or international levels. How these processes can be enhanced also remains far from clear.

Societal change can be fast. Changes that lead to radically new developments and behavioral patterns in societies can be observed.

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**What counts as societal change?**

Classical examples are revolutions that overhaul political systems and require entirely different patterns of political decision-making, administration, discursive practices and educational systems. Other examples include the rapid changes in purchasing behavior in the case of new information on harmful effects of consumer products. Likewise, new products can sometimes expeditiously change behaviors on large scales, such as mobile phones.

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In the climate discourse, a shift in the level and intensity and hence the sense of urgency of the debate followed the publication of the Stern Review (Stern 2007) and the IPCC's (2007) Fourth Assessment Report. While this is the case, continuities in old practices remain difficult to shift, as can be seen in the case of inertia surrounding climate negotiations in 2009; and continuities associated with colonialism, which manifest in various neo-colonial attitudes and practices (Said 1993; Bhaba 1994; Radhakrishnan 2003). This often creates deep-seated paradoxes in societies, which also need to be understood in the KLSC framework (e.g. the giving of development aid or the switching off of lights to reduce carbon emissions, while at the same time, overconsumption continues apace).

Societal changes can be analyzed from various angles, the most prominent perspectives being the dynamic or speed of change, the direction of change, the level of change, the duration or persistence of change, and the source of change. Analyzing and understanding enabling and constraining forces and structures influencing change is also an important focus of change research. The roles of knowledge and learning in influencing these change processes will be a key area of inquiry for the KLSC project. Issues of societal change will be discussed further in the context of transformation in section 2.4.5

In summary, challenges that have been identified for the KLSC project **in relation to the need for systemic change include:**

- KLSC's 'system of interest' is a sub-system of one that has the overall purpose of avoiding systemic de-stabilisation of Earth systems

- Identifying what kinds of change are, in Checkland's terms (Checkland 1999), 'systemically desirable' and 'culturally feasible'.

- In appreciating relevant interconnections it is inevitable that there will be a need to engage with complexity.

- KLSC's position on sustainability will need to evolve as knowledge and learning are cross-sectoral and there are many different perspectives to build on.

- KLSC's choice of themes has been influenced by its focus on urgency, level and scale.

- It is partly because of scale and level that KLSC will focus on sustainability rather than just on sustainable development. There is a need to focus not just on local-level or small-scale processes of development but on how resource demands from human activity accumulate.

- Societal changes can be analyzed from various angles. the most prominent perspectives being the dynamic or speed of change, the direction of change, the level of change, the duration or persistence of change, and the source of change. The roles of knowledge and learning in influencing these aspects of change will be a key area of inquiry.

## 2.2 The role and nature of knowledge

This section is all about **knowledge** – its role and its nature.  Two broad aspects are considered:

- Disciplinary, multidisciplinary, interdisciplinary and trans-disciplinary perspectives on knowledge

- How and why knowledge can and should be viewed as both a product and a process

- The discourse around knowledge, science and society

- Boundaries of knowledge – both conceptual boundaries and limits to knowing

### 2.2.1 Perspectives on knowledge – from disciplinary to trans-disciplinary

The nature of knowledge, its representation, transferability and production, as well as the social value and effect of education has been a subject of philosophical debates for thousands of years. For instance, over 2000 years ago, Plato believed knowledge was innate and inherited, while Aristotle believed that it came from sensory experience. In the 1600s Hobbes and then Locke also focused on the senses, while in the 1800s Mill argued that new ideas emerged from others (Blackmore, 2007). But even so long ago knowledge was not just the domain of philosophers. Among the oldest written records known to humankind are the Egyptian "wisdom books", passing on the lifetime experiences of older generations to younger generations.

Other pre-20th century disciplinary foundations that present modern day understandings of knowledge are built on are those of psychology and biology. Many ideas on behavioral and cognitive processes have their roots in these disciplines (e.g. in Darwin's insights into the ability of behavior to adjust to environment and into biological continuity of the development of humans and in Peirce's work on understanding human perception (Pierce 1960)). Today, education, pedagogy, and didactics are disciplines specifically dedicated to investigate and facilitate the process of learning to develop, acquire, and use knowledge, both for its own sake and to shape behavior and societies. The research in these fields is based on psychological, philosophical, sociological and biological foundations.

The challenge in researching knowledge for societal change is not first and foremost the definition and description of unexplored theoretical grounds, but the selection, combination, and integration of the range of existing theories to shape the framework of KLSC.

Although it would be possible here to continue to consider the role and nature of knowledge from disciplinary perspectives, from the twentieth century onwards early ideas about knowledge of relevance to societal change were built on in so many different ways that it is more relevant to the KLSC project to broaden this consideration to include multidisciplinary, interdisciplinary and trans-disciplinary insights which can be collectively referred to as 'cross disciplinary' (Dyer 2003; Wall and Shankar 2008). Working from starting points of one or many disciplines, from collaborations between them and from transcending disciplines to focus foremost on the issues, a wide range of contributions to understanding knowledge can be recognized, outlined below.

*Knowledge traditions*

There is a wide range of knowledge traditions, though they are not mutually exclusive, with many people contributing to more than one tradition. In striving for sustainability it is important to recognize and work with a broad range of knowledge traditions as various theories and practices can inform each other. Transformations that might lead to sustainability do not start in just one place –

history has shown that they are just as likely to grow from local knowledge as they are to be influenced by theories and related practices (Shiva 1998). This point will be discussed further in section 2.4.

The traditions detailed below – epistemological; scientific and technological; indigenous and local and economic - are examples selected because of their perceived relevance to the KLSC project. There are many other knowledge traditions associated with disciplines and cross-disciplinary perspectives - for instance, the tradition of 'knowledge management' (KM), which is often associated with business communities, but crosses many other traditions. (The KM tradition is particularly relevant to section 2.2.2 so will be discussed in more detail there.)  How the history of each tradition is told will vary with perspective.

### 1 Epistemological

Epistemology concerns the theory of knowledge - its nature, varieties, origins, objects, limits, claims made about knowledge and how it relates to other concepts such as truth and belief.  Going back several centuries, different philosophical schools had different ideas about where and how knowledge originated. For instance for *rationalists* like Plato and Descartes, knowledge came about through thinking, reason and reasoning, whereas for *empiricists* such as Aristotle and Locke, knowledge developed from individual sensory experience. Leibnitz and Hume established the fundamental distinction between *analytical knowledge* and *empirical knowledge*, a separation with persistent impact on education and scientific understanding to this day. Much more recent examples of people who contributed to this tradition include Piaget, who believed the development of knowledge had a biological base and referred to his own work as 'genetic epistemology' (Campbell 2006). William Perry's ideas about learners progressing through developmental stages in their views on knowledge, from dualism to relativism, provides another example (Perry 1968).

The philosophical discussion of knowledge has always been linked to the search for truth. How knowledge is often theorized today (within the post-modern turn) recognizes many perspectives rather than one universal truth. But as we endeavor to contribute insights into options for a sustainable future, we recognize a tension between scientists being asked to deliver more certainty to policy-makers and societies, and knowledge questions that come heavily loaded with normative or religious connotations or inherent uncertainties. This is exemplified by various controversies reported in the media regarding climate change skepticism and public access to scientific research (e.g., see Grundmann 2007). Internal inconsistencies in an assumed equality of 'many truths' are raising questions amongst contemporary epistemologists and philosophers about the problems of relativism (Bhaskar 1993, 1998; Sayer 2000). These theorists are differentiating between transitive and intransitive truth, and thus the possibility of making ontological claims whilst recognizing epistemological relativism (i.e. different and competing knowledge claims about that reality). This allows for *judgmental rationality* and a "rational criterion for theory choice ... and *a fortiori* a positive sense to the idea of scientific development over time" (Bhaskar, 1998:xi, original emphasis). These distinctions are interesting for KLSC research, as KLSC is responding to the ontological claim that the planet is changing in particular ways, whilst recognizing that different knowledge claims, ways of knowing and responding to this ontological condition are simultaneously in play in society. We also recognize that individuals and communities ought to be able to make 'rational judgments' in response to their understanding of the changing planetary condition.

### 2 Scientific and technological

There is no hard boundary between scientific and technological traditions and the others mentioned here. For instance Piaget's contribution could be referred to as both scientific and epistemological and local knowledge traditions can be just as grounded in science and technology as in other factors. There is widespread recognition of the significance of scientific and technological knowledge in the context of striving for sustainability. This ranges from knowledge about how ecosystems function to

how information spreads to how human activities affect biophysical processes to how some of these effects can be mitigated. This kind of knowledge often develops from use of models and tools, which include iconic, graphical and mathematical models used for communication, prediction and optimization (Ison et al. 2006). In a global change / sustainability context, such forms of knowledge are not unproblematic; and require ongoing reflexive review, because many forms of science and technology have in themselves contributed to the problems to which the KLSC program seeks to respond. Beck (1992) drew attention to the need for scientific and technological reflexivity in late modern societies. This has implications for *how* science and technology knowledge is used in KLSC research. Models are discussed further is section 2.2.4 and the relationship between knowledge, science and societal change is discussed further in section 2.2.3.

### 3 Indigenous and local

This tradition is broad in scope, but tends to focus on knowledge of people who maintain relationships with their ecosystems of support and therefore have sophisticated understandings about where resources come from and what it means to live sustainably. This tradition tends to be grounded in practices and does not rely only on academic theories (although these may be present in various forms). Examples of the use and extension of this tradition in projects are provided by a range of community management initiatives in Latin America, Africa, and elsewhere (Weaver 2011; Fabricius and Koch 2004; Shackleton, Pasquini and Drescher 2009; Worldwatch Institute 2011). There is international recognition of 'indigenous intellectual property' with the acknowledgement that indigenous peoples have special rights to claim all that their indigenous groups know now, have known, or will know and that traditional knowledge needs to be protected from appropriation and exploitation. These debates are linked to histories of colonization and (often exploitative) appropriation of knowledge and are thus linked to arguments for decolonizing research, knowledge production, and associated learning and change processes (Said 1993; Bhaba 1994; Radhakrishnan 2003; Smith 1999; Shava 2008). Experiences with implementation of the United Nations Convention on Biological Diversity (CBD) have shown how such initiatives can trigger the necessary national and regional policy and legal initiatives. Industrialized countries are seen as the main users and economic beneficiaries of genetic resources and traditional knowledge that are produced in developing countries. A need has been identified to provide a legal and social mechanism for balancing inequities between the north and south in access to genetic resources and financial benefits from using them (Carrizosa et al. 2004). Relevant to KLSC research are processes of appropriation, re-appropriation and representation of indigenous and traditional forms of knowledge in the learning process, since these have implications for meaning making, intentionality, and power-knowledge relations that shape the efficacy of learning and associated forms of agency and change (Shava 2008; Radhakrishan 2003). This holds particularly in contexts where modern institutional forms of knowledge dominate a wider range of knowledge possibilities in and for learning.

### 4 Economic

One concern often associated with a tradition of economics, though not exclusively, is the scientific investigation of the value and use of knowledge and information. With the surge of information technologies and the supposedly cheap or free flow of information and knowledge, the topic has attracted much attention. While information technologies influence the way information is used by people, they do not change its fundamental function. Economics and markets in themselves are and have always been entirely an information problem, entailing transactions and coordination between interdependent people. Information asymmetries create room for profits and are thus the very basis of entrepreneurship and growth (Schumpeter 1942). As we consider the use of information for sustainability, society faces the fundamental inherent dilemma of this mechanism – information can be a scarce good itself. No transaction can be completed unless two information problems are solved, first the problem of actors 'not knowing' relevant facts (coordination problem) and second the problem of actors 'not wanting' to act accordingly (motivation problem). Solving both problems takes time and effort, the cost of which is called transaction cost. Information asymmetries are,

however, also implicated in problems of access to knowledge with social justice impacts, particularly where power-knowledge relations maintain dominance and structural inequalities (e.g. in the dominance of the languages of trade, etc).

### *Knowledge typologies and distinctions*

Many people have developed typologies and made conceptual distinctions about knowledge such as the distinction between analytical and, empirical, knowledge established by Leibnitz and Hume, mentioned above. These typologies and distinctions can be important in understanding the nature of knowledge and its role by providing the vocabulary that can enable people to articulate and communicate about what they notice. Different knowledge traditions have different distinctions.

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**Some knowledge distinctions from different traditions**

- Polanyi (1967) pioneered a distinction of tacit (or procedural) versus explicit knowledge as a problem in the philosophy of science, which proved important to understand, amongst others, difficulties in the transfer of technology or institutions.

- Zollo and Winter (2002), from business and management perspectives, distinguish between factual knowledge (knowing what), procedural knowledge (knowing how), and normative knowledge (knowing why).

- McGinn (2001), when considering the implications for education of findings about knowledge management made in the corporate sector, distinguishes (1) symbolically expressed knowledge (media), (2) embodied knowledge, (3) embrained knowledge and (4) encultured knowledge (of social collectives).

- ProClim (1997) considered another categorization of knowledge used as a particular part of a process of sense-making by following Ackoff (1989) amongst others, in a business management perspective and thus being relevant to decision making. First, there is systemic understanding of the problems at hand (system or current state knowledge). Second, individuals need knowledge about sensible targets that are considered of sufficient worth to be pursued (target state knowledge). Third, effective action requires the knowledge about behavioral options to achieve the goals and about the efficiency of these options regarding their ecological and social impacts (transformation knowledge).

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It is not necessarily these distinctions that will be of most interest to KLSC research, but instead how they might be used as analytical tools to gain insights into the interplay between knowledge, learning and societal change. Cook and Brown (1999) provide an example of how this can be done in their use of Polanyi's tacit and explicit distinctions in individual and group contexts. They distinguish a range of different kinds of knowledge and in the process aim to broaden understanding of what and how people know. The diversity of distinctions and typologies associated with knowledge and their contradictions can be seen in terms of both problems and opportunities. A major challenge for the KLSC project will be to value the diversity of traditions and distinctions concerning knowledge and not to synthesize or collapse them in a way that might lead to the whole set of discourses and practices around knowledge in the context of KLSC becoming less than the sum of its parts.

### 2.2.2   Knowledge as product and process

Whether knowledge is viewed as a product or a process depends partly on the kind of knowledge and situation under review. For instance, it is relatively easy to perceive the knowledge required for travelling from one place to another as a product. Whereas knowledge required to, say, reduce

diffuse pollution in a water catchment, where the systemic effects of individual actions are experienced as complex, is likely to be more process oriented. 'Existing' knowledge has a role in this example, but production of knowledge specific to the situation is also required.

There is an extensive discourse around whether and how knowledge is shared, transferred, exchanged, created, constructed, produced or indeed lost. This discourse occurs within and across disciplines and well beyond them.  Over the past twenty years or so there has been something of a paradigm shift concerning knowledge, which includes a move towards more sociological and living systems approaches and more use of process-oriented theories focused on knowledge production, rather than transfer. These include economic sociology (Dobbin 2004; Granovetter 1990), post-structuralism (Foucault 1980, Dreyfus and Rabinow, 1982), neo-functionalism (Haas, 1958, 1964), post-modern theory (Sim 2001), the new political economy, (Higgott and Payne 2000), second order cybernetics (Pask 1976; Maturana and Varela 1987), systems thinking (Capra 1996; Ramage and Shipp 2009) and sociology of knowledge (Meja and Stehr 2002, Evers 2000; Latour 1986).

> **The evolution of ideas about knowledge and learning**
>
> Snowden (2002) talked of entering a 'third age' of knowledge management. In broad terms he considered that the first age focused on knowledge sharing and knowledge transfer, the second age focused on knowledge creation, tacit and explicit knowledge and the third age was more informed by theories of social constructionism and complex adaptive systems. Many others have also mapped and worked with this kind of evolution of ideas and practices about knowledge and learning (e.g. Best and Holmes 2010; Illeris 2002).

A related epistemological shift from positivism to constructivism and towards use of multiple epistemologies has been noted in many discourses about knowledge and learning in the context of sustainability (Finger and Verlaan 1995; Ison et al. 2000; Rickinson 2001, 2006). From a KLSC and global change perspective, this interest in constructivist ways of knowing and learning is being enriched through engagement with ontological arguments for differentiating between transitive and intransitive truth. For example, it is possible to recognize that coastal marine resources are being depleted (ontology); but that there *are different ways of knowing this* (e.g. through Traditional Ecological Knowledge *and / or* through Scientific Indicator Development) (epistemology). Of significance for KLSC research is the *interplay* between diverse ways of knowing, and associated knowledge representations, or what Beck (1992) referred to as *inter-epistemological dialogue*.

There are many theories of knowledge and knowing and many theories of learning that can help to provide explanations for how knowledge arises (as discussed for instance by Greeno et al. 1996; Cook and Brown 1999; Snowden 2002; Blackmore 2007; Tàbara and Pahl-Wostl 2007; Illeris 2002). Piaget (1926), Bruner (1973) and Vygotsky (1978) are among those who contributed ideas about how individuals construct their own knowledge and understanding of the surrounding world through learning. These ideas also evolved to consider how knowledge is socially rather than individually constructed – a theoretical position referred to as social constructionism (Papert and Harel 1991; Gergen 1985; Berger and Luckmann 1966); which takes account of the role of culture, language and mediation processes in learning (see further discussion on this in section 2.3 below). The increasing influence of ideas about the social construction of knowledge is particularly relevant when considering the interplay of knowledge, learning and societal change.

This ongoing epistemological trend also resonates in the discussion around transition to sustainable societies, which involves many calls to create a new science. The history of a society provides crucial determinants of individual thinking that through interactional support enables individuals to 'scaffold' and build knowledge. The perspective of social construction of knowledge also lends more weight to contextually bound knowledge, i.e., informal, local, or indigenous, sources (Bruner 1973; Vygotsky 1978; Schütz 2003a, 2003b; Kwok 2004; Rogoff and Lave 1984; González et al. 2005).

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**Knowledge systems – a way to recognize both product and process**

One tradition that allows for representation of both product and process and the interrelated cognitions and perceptions that are often related to specific behaviors is that of *knowledge systems*. For example, in issues of land use or resource governance, formal knowledge and local or traditional knowledge may come into conflict when the opposing sides of the conflict each use their own knowledge system without understanding or acknowledging the other's system. As integrative research has shown, these knowledge systems need to meet particular purposes and fulfill specific conditions to become effective in solving sustainability problems (Cash et al. 2003). Considering them both as systems also enables other related knowledge systems to be considered. However, to avoid relativism or dominating knowledge politics problems in such integrative contexts, it is useful to recognize the 'common' ontological referents, which brings together both forms of knowledge in meaning-making processes for sustainability.

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Although conceptualization of knowledge will undoubtedly be important to the KLSC project, it will not just adopt one epistemological position, but will aim to appreciate and build on multiple perspectives on knowledge, as both product and process. As the KLSC program is located within a social-ecological paradigm, it will also consider the relationships that exist between ontological claims and epistemological positions and/or perspectives (Tàbara and Chabay, in press; Cornell, et al. in press). This has particular methodological implications, which are discussed in chapter 3.

### 2.2.3 Knowledge, science and society

When considering knowledge and learning associated with societal change one area of discourse that is particularly relevant is that around science and technology studies (STS). STS considers the co-production of knowledge in the interaction between science and society and in particular, regarding policy making (Jasanoff and Wynne 1998; Jasanoff 2004; Lemos and Morehouse 2005). This concept of co-production of knowledge reflects the mutual dependence of science and societal actors to generate identity and legitimacy. Neither science nor politics can claim dominance in this interaction. It is the process of their interaction that generates knowledge and social order at the same time. What is more, both domains draw on each other and one cannot proceed without the other.

This interdependence becomes clear in four key areas of co-production as described by Jasanoff (2004).

1. Identities of scientists and engineers are formed within the processes of scientific knowledge production.

2. Institutions, such as rules of decision making, are created through scientific debates and their interaction with society.

3. Discourses are processes in which science and society can mutually create and shape meaning.

4. Representations of the political and social world are influenced by historical, political, and cultural understandings, which are informed through scientific concepts and theories.

A clear delineation cannot be drawn between the political and social spheres and between the norms and values that are shaped by cultural and political, as well as scientific influences. Further work also needs to be done to understand how changing ecological conditions and social-ecological relations shape STS. Much remains to be done in terms of incorporating STS approaches into climate change and human dimensions research and in the engagement of the STS tradition with different kinds of social theory and understandings of the contemporary social-ecological condition.

Kuhn's (1962) ideas that science does not progress through a linear accumulation of knowledge, but undergoes paradigm shifts, are also relevant here. There are many traditions within science and technology besides STS, and while these traditions often complement each other, they sometimes compete (e.g. quantitative and qualitative approaches, positivist and constructivist epistemologies, individualist and collectivist worldviews). In addition some historical, political and cultural understandings regarding sustainability are more informed than others by scientific concepts and theories or informed in different ways than others.

Scientific knowledge has been considered to be pre-eminent in many different contexts, which has sometimes made its production quite a visible process. This pre-eminence and visibility come about partly because the scientific community developed a set of experiments, methods and symbolic language that could be read in many cultures, "This is essentially because the receiving parties, despite their widely varying local cultures, share with the originator certain ways of observing, analyzing, describing, and interpreting natural phenomena" (Inter Academy Council 2004:30). The cultural spread (and uneven uptake) of this methodology is also intimately linked to the emergence of modern institutions, particularly educational institutions, which reproduced the scientific method. This can be seen as strength as well as weakness when the knowledge produced is requested to provide answers to questions of existential importance to the survival of societies. The language and methods of science might have the ability to cross cultural boundaries (albeit unevenly), but the values behind some of the uses of science are not necessarily shared across the world e.g. when considering the consequences for agriculture of the global pre-eminence of Western-style scientific knowledge (Shiva 1998; Jones et al. 2010). With the rise of ideas about co-production of knowledge have come some major challenges to what counts as expertise with some shifts in power and influence (discussed in section 2.4.2). This raises the question of how post-colonial and other critical science studies may be useful from a methodological perspective in KLSC research (see Chapter 3).

Some of the processes of deliberation and production of knowledge around, for instance, climate change and loss of biodiversity have shown that knowledge supporting the need to address an issue initially tends to be contested. Some stabilization of knowledge claims is needed before international policy can be developed to address the issue, but this requires breadth of perspective if it is to gain legitimacy at different scales and in different societal contexts. Certainly when stakes are high and solutions not easily implemented, the struggle around stabilizing can be long lasting and involve many parties in complex relationships (Funtowicz and Ravetz 1993).

The suggestion above that knowledge claims can become stabilized does not mean that from the time that policy development starts knowledge is no longer contested. Conca (2006) has shown that groups may try to delegitimize knowledge that had been stabilized up to the point that international treaties were based on it. Indeed destabilizing knowledge when treaties that appear from some perspectives to be fundamentally flawed is sometimes judged to be a legitimate process. Such developments parallel the extensive literature that addresses the importance of the way in which issues and knowledge are framed (Baumgartner and Jones 1993; Schreurs, Selin and VanDeveer 2009). The stabilization and possible contestation of knowledge is an important aspect to take into account when considering knowledge in relationship to learning and societal change.

**Building and gathering consensual knowledge
– a comparison between climate change and biodiversity**

A comparison can be made between the cases of climate change and biodiversity. There is a notable difference in the extent to which there have been international attempts to understand and frame existing knowledge about these issues. In 1988, the World Meteorological Organization and the United Nations Environment Programme set up the Intergovernmental Panel on Climate Change (IPCC) to study and assess the risks associated with human-induced climate change based on the findings of thousands of peer-reviewed scientific and technical articles. The IPCC is divided into working groups that assess the physical basis of climate change (Working Group I); climate change impacts, adaptation, and vulnerability (Working Group II); and mitigation (Working Group III). Each working group has released several reports. The most recent assessment report (AR 4) released by the IPCC's in spring 2007 states that "warming of the climate system is unequivocal" (WG I) and can be seen in rising global average air and ocean temperatures, the melting of snow and ice, and rising average sea level. In addition, the report concludes that it is very likely that rising average global temperatures are caused by anthropogenic greenhouse gas concentrations. Notably, the IPCC shared the Nobel Peace Prize with Al Gore in 2007. The findings of the IPCC are frequently cited by decision makers as an important reason for pushing forward on an international agreement to follow the Kyoto Protocol. It can be argued that the IPCC's innovative practices for integrating and making sense of climate knowledge has been critical in building an international consensus on the need for action. There are clearly still differences in the extent of concern and commitment among actors and institutions. The recent, much-publicized errors in statements by the IPCC have raised the level of debate about climate change; and have also drawn attention to the politics of knowledge; and how this can be used strategically to further dominant interests. Again this draws attention to the need for socially critical approaches to research in KLSC studies.

In contrast, comparable efforts to assess biodiversity loss across existing scientific efforts have been less comprehensive. While the Millennium Ecosystem Assessment (2005) was tremendously successful in developing an interdisciplinary understanding and strong results among the research community, it was hardly noticed by the larger public. Currently, it is interesting to note that efforts somewhat analogous to the IPCC efforts are forming in relation to biodiversity. The IPBES (Intergovernmental Platform on Biodiversity and Ecosystem Services) has been debated for a while and processes are ongoing to implement an International Mechanism of Scientific Expertise on Biodiversity (IMoSEB) (Koetz et al. 2008). The lack of attention to biodiversity issues also raises interesting questions about the politics of knowledge. The letter in *Science* by Hulme et al. (2011) emphasizes the need for using diverse sources of knowledge and the interplay between knowledge, decision-making, and capacity building at multiple scales.

Investigating, comparing and contrasting cases such as IPCC and IPBES and consequent or related changes in attitudes, knowledge, and actions might prove to be fertile grounds for KLSC research. The sort of questions that could usefully be addressed when trying to understand the interplay between knowledge, learning and societal change in these contexts are:

- To what extent does the difference in how knowledge (in this case, primarily knowledge in the form of scientific and technical reports) is structured influence and shape public and political understanding of the seriousness of a problem?

- Are there lessons, both positive and negative, to be learned from the IPCC case? To what extent have these lessons already been incorporated into the emerging IPBES?

- To what extent can one identify inclusions and exclusions in knowledge products, such as those produced by the IPCC and IPBES, and what are the effects of this on KLSC processes?

- Are similar initiatives in other areas of sustainability desirable?

- What might be done differently to strengthen further the legitimacy of such major knowledge gathering initiatives. Among which groups or sectors is greater legitimacy needed?

- How is knowledge and understanding of changing global conditions mediated by politics, interests, practices, and technologies at individual, community and governance levels?

Such questions are closely linked to the ICSU visioning goals of understanding how knowledge can be made usable and how it is used in processes of learning discussed in Chapter 1. In addition, these questions show numerous similarities to the well-established discourse on knowledge for development, an area in which knowledge and education have long been supported as the "silver bullet" (Brooks et al, 2009), even leading the World Bank to declare its own transformation into a 'Knowledge Bank' in 1996. It should be noted here that claims of knowledge and education being 'the silver bullet' are also contested. Such theses are often critiqued for not taking full account of structural antecedents and the structural conditions necessary for knowledge and learning to flourish in social change processes. Simply put, good quality learning facilities and access to basics such as adequate food, are also important contributors to the success of the knowledge – learning relationship (UNESCO 2004).

Reflecting the vast historic background of knowledge and learning and current political context, the KLSC project embraces a broad notion of knowledge that goes beyond a notion of cognitive, science-based forms of knowing. Knowledge is approached in its sense as a resource in all its forms; feeding into and shaping learning processes, attitudes and actions. In this sense, knowledge can be conceptualized as any form of mental representation of the world, including explicit and tacit knowledge, academic (e.g. scientific journals, reports) and non-academic, local, and traditional (indigenous, cultural, religious), cognitive, procedural, and experiential forms.

Recognizing the agendas and perspectives of different groups already working at the interface of knowledge, science and society will be important for the KLSC project. There will be a need to work with a diversity of ideas and claims about knowledge.

### 2.2.4    Boundaries of knowledge

In considering the nature of knowledge and its role in finding paths to a sustainable future there is a need to recognize some boundaries of knowledge. Two aspects of boundaries that are particularly relevant to the KLSC project are: (i) conceptual boundaries between knowledge and other concepts and (ii) limits to knowledge and to human understanding.

#### *Conceptual distinctions*

The terms data, information and knowledge are widely used, but what one individual or group means by information can quite easily be referred to as knowledge by another. The previous examples from section 2.2.2 of the knowledge required for travelling from one place to another and for reducing diffuse pollution in a water catchment can be used to illustrate this point. In such situations is information or knowledge required, or both? And what do these terms mean in this sort of context? The answer to the first question would probably be 'both' but there is no definitive answer to the second, as these terms are not used consistently. It depends on how both knowledge and information are conceptualized. Models that distinguish these terms are well recognized, such

as the continuum from *data* to *information* to *knowledge* to *understanding* to *wisdom* (Zeleny 1987; Ackoff 1989).

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**An early reflection on a knowledge-related hierarchy**

"Where is the Life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?"

From 'The Rock' by T.S. Eliot (Eliot 1934).

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Bercic and George (2009: 189) provide a summary of some of these knowledge-related concepts:

"...data ... does not have any meaning in and of itself. When connected to other data (e.g. the name of the entity it refers to, by way of a relational connection) it becomes information (i.e. data with meaning obtained from the context). Knowledge is the collection of information for useful intent. Understanding is cognitive and analytical. It is the process by which new knowledge is synthesized from previously held knowledge."

Interpretation of data to develop meaning is a widely recognized process (Checkland 1999) but there are many different kinds of data and interpretation, e.g. from qualitative, quantitative, first and second order traditions (Ison and Russell 2000). In general, if data are communicated in a context subject to interpretation a transformation might be triggered so that data becomes information. Seen in this light, the ICSU visioning call that research in the next decade should be 'solution focused' can be understood as a call to transform the production of scientific data into scientific information by giving higher priority to context. This leads to the crucial questions of how knowledge is produced, framed and delivered; and how meaning making processes intersect with data, information and other 'information products'.

There are a range of theoretical perspectives about whether and how information becomes knowledge. Wenger (1998:9) suggests that different perspectives can act as a guide about what to pay attention to, what difficulties to expect and how to approach problems. He contrasts the perspective that knowledge consists of information stored in the brain with the broader perspective of information stored in explicit ways being just a small part of a process of knowing that involves active participation in social communities. Developing knowledge from the first perspective focuses on delivery, whereas in the second it involves engagement in meaningful practices.

As outlined above, in most information theories intention is absent. Information might be something potentially perceived as representation, though not created or presented for that purpose. Yet in this regard, wide differences occur between scientific disciplines. Natural sciences consider any pattern that forms or transforms other patterns as information, whether or not a central system or conscious mind perceives the influence. The other extreme is economics, which defines information in terms of 'purpose-oriented knowledge' (Wittmann 1959), which requires not only the presence of a human mind, but also introduces intention as an additional defining element of information. Such a narrow approach is difficult to integrate with learning processes and human behavior, since learning takes place both consciously and unconsciously. Information input that kicks off a learning process is often received without clear purpose as any child learning from touching a hot flame realizes at early age. However, it is crucial to acknowledge that an act of selection by the learner defines the ultimate relevance of any given information and triggers a learning process. Learning processes are discussed further in section 2.3.

In summary regarding conceptual distinctions, the KLSC project will not adopt just one definition of knowledge and related concepts. It will instead develop project-wide understandings of the

multiplicity of these concepts. It will also develop a critical appreciation of the significance of similarities and differences in language and epistemology in the process of negotiating meanings that are relevant to sustainability.

### *Limits to knowledge and human knowing*

Other boundaries concerning knowledge that are relevant for KLSC concern the limits of what humankind already knows and the limits of our abilities to know and understand or process. It is appropriate here to consider *wisdom* - the final concept in the hierarchy from data to wisdom mentioned above. Among those who have developed this hierarchical model wisdom stands out as being a knowledge related concept that is particularly relevant to the future  "…wisdom, deals with the future because it incorporates vision and design. With wisdom, people can create the future, rather than just grasp the present and past."   (Ackoff 1989; Bellinger, Castro and Mills 2004). Among the studies that initiated the debate that led to the sustainable development concept was 'Limits to Growth' by Meadows et al. published in 1972 and commissioned by the Club of Rome. This report was challenged because of some of the assumptions in its central model regarding for instance, the predicted rate of technical progress. But nonetheless, its main points about constraints on human development on a finite planet did have a long term influence. Less well known than their original report are some of the authors' reflections of some 20 years later (Meadows et al. 1992:xiv) in which one of their conclusions was that

> "A sustainable society is still technically and economically possible. It could be much more desirable than a society that tries to solve its problems by constant expansion. The transition to a sustainable society requires a careful balance between long-term and short-term goals and an emphasis on sufficiency, equity, and quality of life rather than on quantity of output. It requires more than productivity and more than technology; it also requires maturity, compassion, and wisdom."

The idea of employing wisdom to live within Earth system boundaries makes a direct link between planetary and knowledge-based limits. In times of uncertainty because of absence of scientific consensus about the effects of human activity on climate change it has for instance been considered wise in many societies to try and adopt the precautionary principle, which became prominent following the Rio Earth Summit in 1992. There has been a range of more recent explorations of wisdom in the context of sustainability, making connections with, for instance, traditions of virtue ethics, religion and economics (e.g. Sivaraksa 2009; Smith and Pangsapa 2009).

Humans are limited in what they know not just because of uncertainties about the effects of their activities, but because of their cognitive limitations. One example of this kind of limit, brought into focus by the Chilean neuroscientist Humberto Maturana's contributions to the field of second order cybernetics, is human inability to distinguish between perception and illusion at the time of an event (Poerksen and Maturana 2006). It is often only afterwards that this distinction can be made. Hence humans often make mistakes. This is not just an expression of our capacity to know, but of how our biology operates. Maturana has therefore questioned cultures that make it difficult for us to admit we have made mistakes. The extent to which $CO_2$ emissions affect climate change and to what extent we can tell this is so is just one example of a context renowned for difficulties in distinguishing between perceptions and illusions (see Blackmore 2010a).

Models, such as that developed by Meadows et al., or those developed through scenario thinking, or the IPCC scientists, can be used to address both the lack of knowledge about how a system functions and the limitations on human cognitive capacity. Models have become fundamental to human thinking and functioning. There are many kinds of models ranging from mental models to iconic models to complex mathematical models. They serve many different purposes ranging from description to inquiry to prediction, but they are all simplified representations that build on what is already known. Models can be used to represent and understand the behavior of things. They

reflect perceptions of patterns and efforts to categorize, explain, and predict future behavior. Models are essential in organizing and interpreting information, whether from direct observations done by an individual or produced with sophisticated Information Communication Technology (ICT) systems, so developing a strategy for their use within KLSC will be important (Burnham and Anderson 2002; Ison et al. 2006; Chabay, in press). One potential area of investigation for the KLSC project is to examine the relationship between the construction, use, and understanding of models, both mental (internal, heuristic) and computational (external or explicit), in shaping choices of behaviors in response to the complex issues of climate change, biodiversity loss, and resource allocation.

But models also have their limits. Geoffrey Vickers who contributed a great deal to the fields of systems thinking and practice was one amongst many who has cautioned against becoming over dependent in our use of models in case we reached a stage where we lose our ability to know any reality we cannot explicitly model. For Vickers (1978: 89-90):

> "…the clear message of systems thinking is that human scope is limited and that we cannot use even what scope we have except in a situation in which we are sensitively and intimately engaged … we can know more, as well as less than we can model and we shall be doubly hampered, even by comparison with our present plight, if we overrate our models and underrate ourselves."

In KLSC research it is not so much the models themselves that are of significance, but *rather how these are* used in stimulating and supporting processes of learning and societal change. Models therefore need to be seen as a useful way of providing representations of past, future and current conditions *in relation to* situated experience, cultures and histories. As Folke et al. (2010) state in their review of social-ecological resilience and adaptation research "General resilience… is about coping with *uncertainty* in all ways"... [there is a need to] recombine sources of experience and knowledge for learning and spark novelty and innovation. It may lead to new kinds of adaptability or possibly to transformational change." KLSC research should therefore include studies of the *way in which policy decisions are linked to understanding of models, modeling, and their limitations and strengths, including how models allow societies to recombine sources of experience and knowledge with new possibilities for innovation and transformative change.* This also indicates the importance of developing an educational strategy that will support greatly improved understanding and use of models. The strategy should extend across all educational levels for learning for sustainability by modeling nature and society that a) focuses on the fundamental human need for models to cope with complexity, b) how metaphors, media, and games can be used in a coherent trajectory of learning from elementary school through lifelong learning, and c) why this learning is essential for making socially constructive decisions as individuals and as public policy.

In summary, challenges that have been identified for the KLSC project **in relation to the role and nature of knowledge include:**

- selecting, and synthesizing a range of existing theories on knowledge and learning to help shape the KLSC research framework.

- considering multidisciplinary, interdisciplinary and trans-disciplinary insights

- appreciating five [knowledge] traditions – epistemological; scientific and technological; indigenous and local; economic and knowledge management that are particularly relevant to KLSC

- understanding how [knowledge] distinctions might be used as analytical tools to gain insights into the interplay between knowledge, learning and societal change

- valuing the diversity of traditions and distinctions concerning knowledge and working with a diversity of ideas and claims about knowledge.

- appreciating and building on multiple perspectives on knowledge, as both product and process.

- developing project-wide understandings of knowledge and related concepts, including a critical appreciation of the significance of similarities and differences in language and epistemology in negotiating meanings o to sustainability

- investigating, comparing and contrasting cases and consequent or related changes in attitudes, knowledge, and actions

- embracing a broad notion of knowledge that goes beyond a narrow notion of cognitive, science-based forms of knowing .

- recognizing the agendas and perspectives of different groups already working at the interface of knowledge, science and society

- recognising and sometimes re-negotiating (i) conceptual boundaries between knowledge and other concepts and (ii) limits to knowledge and to human knowing.

- examining the relationship between the construction, use, and understanding of models, in shaping the choices of behaviors in response to the complex issues of climate change, biodiversity loss, and resource allocation.

- developing and testing an educational strategy for improving the understanding and use of models in public and policy decisions

**2.3    Learning theories and processes of relevance to sustainability**

This section is about **learning** in relation to sustainability – how it is conceptualized, how it relates to other relevant concepts and the processes and dimensions involved.  Four aspects are explored:

- The relationship between knowledge, learning and action

- Theories that can be used to understand how learning takes place and what needs to be done to facilitate it

- Individual and social learning and how they relate to responsibility and agency

- Issues of social learning and scale

**2.3.1    The relationship between knowledge, learning and action**

The analysts of planetary trends, modellers, theorists, and committees already discussed in this Science Plan have indicated that there have been many major works and initiatives that have both warned of the dangers of humankind living beyond planetary and societal limits and put forward proposals for more sustainable alternatives. Some of these proposals have been taken up e.g. through international agreements such as the Kyoto Protocol and through related international and national level changes in policies and practices. There have also been many initiatives at local and national levels e.g. for more efficient use of energy, increased generation of energy from renewable sources; reduction, re-use and recycling of wastes and, at city level, more sustainable transport systems  (e.g. in sustainable cities and transition towns initiatives around the world). Yet as shown by the work of planetary trends analysts and the number of Governments and communities fully taking up the challenges of global environmental change, a large scale move to more sustainable ways of living is not yet evident anywhere  (Rockström et al. 2009; Folke et al., 2010). Given that, e.g. in the transition network, at least 350 communities have risen to the challenge of sustainability[3] while many others have not, there is evidence that societies are constrained not just by their lack of knowledge, but by their lack of ability or willingness to act. While this may be the case in contexts where similar conditions exist for comparison; in other contexts there is evidence that deep seated structural conditions influence not only how knowledge is distributed and used, or willingness to act, but very significantly, *abilities* to act, including a sense of empowerment and meaningful agency or lack thereof.

**What constrains ability to act?**

It is difficult for poor fishing communities on the shores of Lake Malawi (even if they may be both knowledgeable and willing to act), to harvest fish sustainably unless the conditions affecting their poverty are addressed at policy and structural levels, and unless other less sustainable fishing practices (practiced by large artisanal fishers) are legislated, managed fairly, and transformed.

Learning builds on prior knowledge and learners will attempt to make sense of anything unfamiliar. When they do so, the meanings they construct may be quite different from what was intended if they cannot activate an appropriate context for learning. Just as is acknowledged for early development: "Children are ignorant but not stupid: Young children lack knowledge, but they do have abilities to reason with the knowledge they understand" (National Research Council 2000:234). The complexity of information about sustainability presents a big challenge to those trying to bring about particular action-based learning outcomes. People will try to build highly complex facts into

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[3] see - http://www.transitionnetwork.org/

their current living context, and not necessarily seek to build the knowledge scaffold needed for a meaningful interpretation. This way of dealing with complex information, also called 'naïve interpretation' (Schulmeister 2006) makes the outcome of learning for sustainability highly unpredictable. Obstacles to learning as such, obstacles to subsequent behavioral changes, *and* obstacles to wider societal changes have to be considered. Focus on one at the expense of the other will not fully probe the KLSC relation.

In the KLSC research contexts, it is therefore important not to make assumptions about how knowledge, learning and action are related but to develop a critical appreciation through systemic inquiry in a range of situations. This relationship can be examined from many different perspectives. For instance, ethnographic studies in education and health care are among those that have produced evidence-based findings of the relationship between knowledge, learning and action (e.g. le May 2009; Lehoux et al. 2010). Critical emancipatory studies in environmental education also reveal interesting relations between knowledge, learning and action (Fien 1993; Robottom 2005; Jensen and Schnack 1997; McKenzie 2006; Mukute 2009; Masara 2010).

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**How do knowledge, learning and action inform each other?**

One specific, practice-based example where there is evidence of knowledge, learning and action informing each other is provided by the international NGO Water Aid that works in partnership with local communities to provide water and sanitation in the world's poorest countries. This NGO is involved in a range of activities including socio-technical projects, evaluations and advocacy work. It is also involved in action research where, for instance, documents are produced proposing how sustainability issues can be addressed using lessons from case-based research to inform future projects (e.g. Taylor 2009).

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Many studies of communities of practice, a tradition that has both systemic and ethnographic roots, further illuminate the knowledge, learning and action relationship in a wide range of contexts (Wenger 1998; Coakes and Clarke 2006, Snyder and Wenger, 2004). Expansive learning studies (Engeström 2001, 2007; Mukute 2009; Masara 2010; Mukute and Lotz-Sisitka, in press), with cultural historical, systems, and social-psychological roots show how dialectical engagement with tensions and contradictions in interacting activity systems can be drivers of knowledge, learning and agency development at multiple levels. Growing pressure for evidence-based policy in, for instance, Europe and South Africa has led to needs for knowledge brokering between science, research, policy and practice communities to ensure that purposeful research questions emerge from practice and that findings are taken up and used (Godfrey et al, 2010).

Another perspective for examining the relationship between knowledge and learning and action is through use of models and frameworks. Three examples relevant to the KLSC project are included here[4] because of the dimensions and relationships they represent:

(a) cyclical **models of experiential learning** which assume that knowledge is produced by the transformation of experience e.g. the model produced by Kolb (1984) represents this kind of learning in a cycle around (i) concrete experience, (ii) observation and reflection, (iii) formation of abstract concepts and (iv) testing in new situations.

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[4] There are other examples that are also relevant.
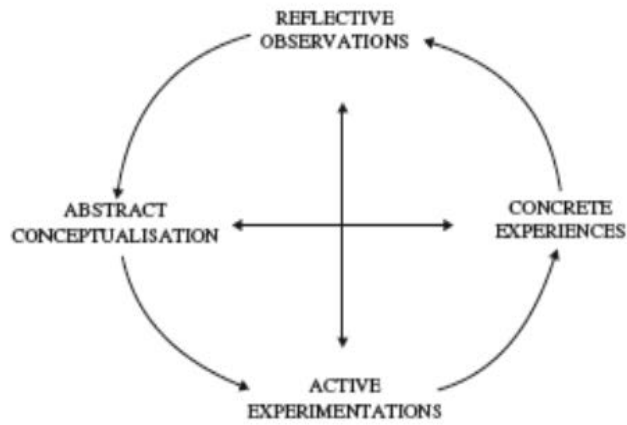
**Figure 2.1        An experiential learning 'cycle'**

Source: adapted from Kolb (1984) by Bawden (1999: 47)

What constitutes 'knowledge' 'learning' and 'action' in this model depends on interpretations.  As much is represented by the arrows, including iteration, as by the stages identified.

(b) the **appreciative systems model** of Checkland and Casar (1985, after Vickers) which shows how processes of appreciation (perceiving, judging and envisaging desired relationships) are informed by the Lebenswelt (day-to-day experienced life) as a flux of interacting events and ideas; standards are developed iteratively alongside; and results of these processes, whether or not they lead to action, contribute to the flux.
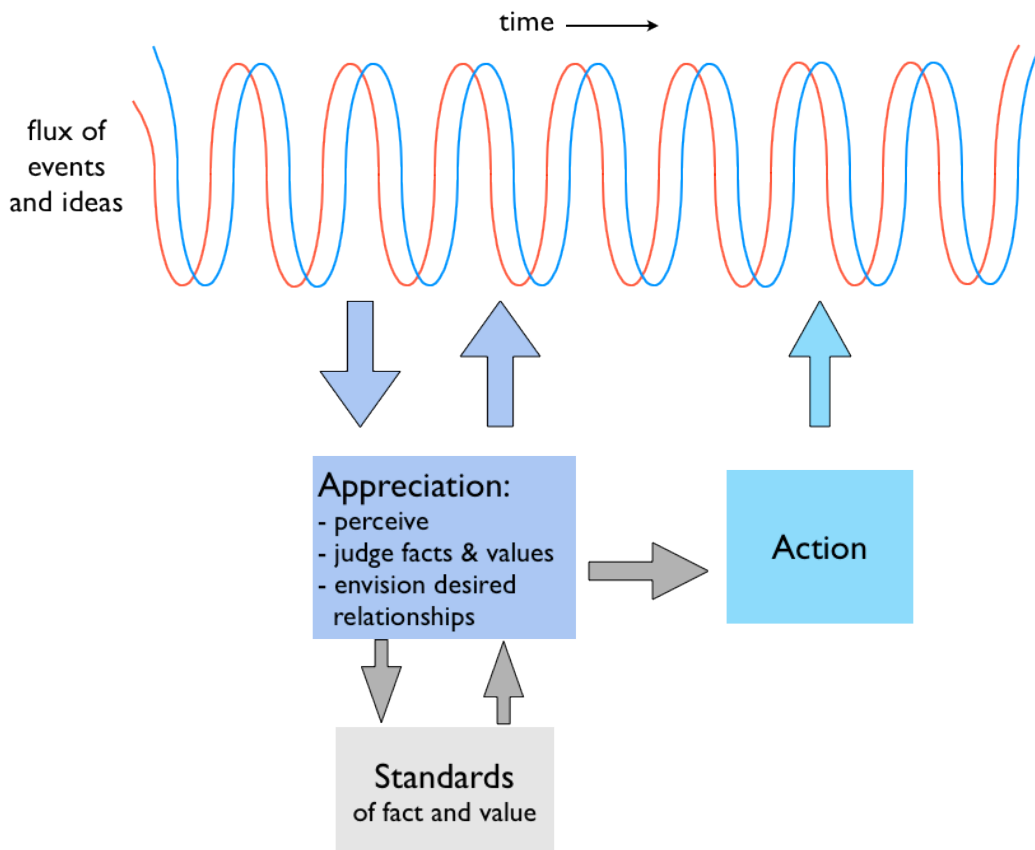


**Figure 2.2        The structure of an appreciative system**

Source: adapted from Checkland and Casar (1985) and Checkland (1999)

This view of learning as a system can help to reveal the importance of different ways of knowing, and times of not knowing and acting, as well as more tangible knowledge and action, all important to overall processes of learning and change (Blackmore, 2010).

(c) Figure 2.3 is an example of a model that represents relationships between different aspects of *social learning* processes. It illustrates some key components of social learning and their interconnections, highlighting the reflexive relationships that exist between agency, contexts, structures and change.



**ACTION**
Who, why and how?
Individuals, organisations, goals, attitudes, motives

**CONTEXT**
In what specific conditions?
Resources, organisational practices, capabilities, situational languages, ICT...

**STRUCTURE**
What structural conditions have changed and how?
institutions, policy making, resources, markets, culture...

**CHANGE**
How do things change?
e.g., frames, boundaries, strategies, networks, knowledge production, environmental quality, perceptions, discourses...

**Figure 2.3     Social learning as a sequential, reflexive, and open-ended process of structural change induced by social action.**

Source: adapted from from Tábara, 2005b. Note: The Roman numerals in Figure 2.3 refer to the number of iterations of the cycle.

It is anticipated that the KLSC project will use and develop a range of models and frameworks to investigate the relationships between knowledge, learning and actions that lead to societal change.
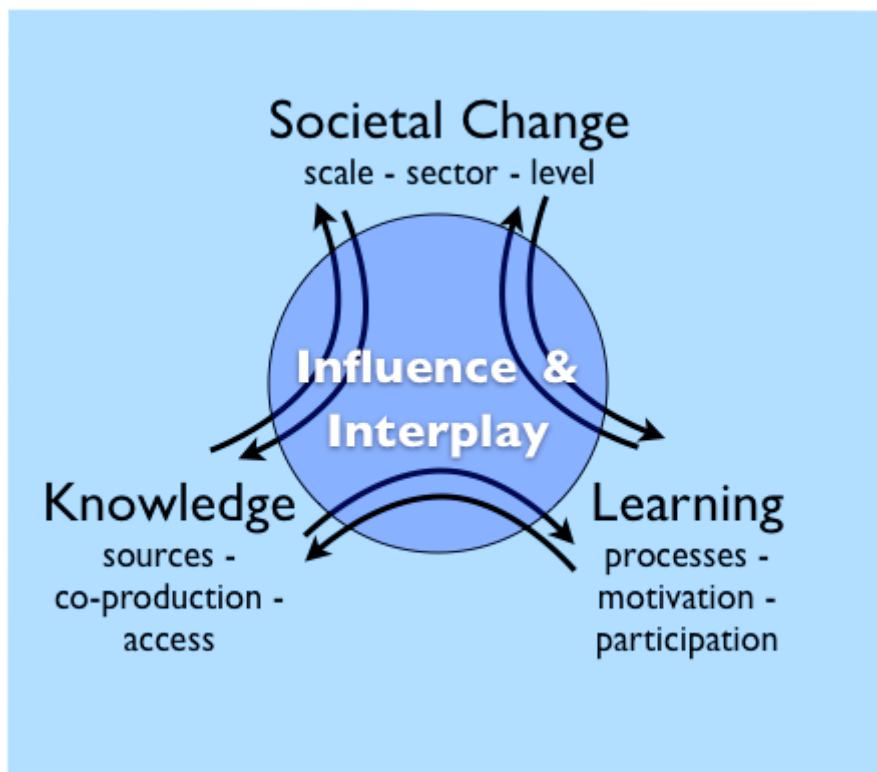
**Figure 2.4 Schematic diagram identifying the areas of focus and relationships among which the interplay of knowledge, learning, and action will be studied by KLSC**

Models such as those above could be used could be used as heuristics to help generate questions about how knowledge, learning and actions are related in different contexts e.g. with respect to the IPCC and IPBES processes mentioned in section 2.2.3. Removing specific arrows could show that no relationship is perceived and using thinner and thicker arrows could show which links were most significant.

The rationale for KLSC actively investigating this line of inquiry lies partly in the way that many reports of group processes that are focused on sustainability indicate *who* has contributed to the process, but not necessarily *how* different contributions have led to learning or to action. It is also linked to theories of 'relational morphogenesis' (emergence and change) which propose that globalised societies need theories of learning and change that take account of relational differentiations, not according to which 'parts' of society are specialized in a functional manner, but rather by how they relate to each other through networked and relational interactions (Donati, 2011).

### 2.3.2    Which learning theories?

Besides the examples of experiential learning and learning as an appreciative system given above, there is a wide range of learning theories that can be used to understand how learning takes place. Many chapters and books have been written on theories of learning and knowing (e.g. Hergenhahn and Olson 1993; Merriam and Caffarella 1991/1998; Brockbank and McGill 1998; Illeris 2002; Ison et al. 2000; Finger and Asun 2000; Daniels 2008; Daniels, Cole and Wertsch 2007). A broad-based review of learning theory research however, shows distinct developments in the field of learning theory over time; from earlier behavioral learning theory established through the behavioral psychology tradition; to later cognitive psychology traditions which theorized individual learning and cognition; to more recent participative social psychological; cybernetic and sociological learning

theory traditions which are theorizing social-cultural, situated, networked and participative theories of learning (Greeno et. al 1996). This can be summarized in tabular form (see Table 2.1 below).

**Table 2.1        A broad overview of developments in learning theory research**

Adapted from Reid & Nikel (2007, 40) Note: this table is intended to be illustrative rather than exhaustive

| Perspective | Behaviorist | Cognitive | Situative / Social / Cybernetic |
|---|---|---|---|
| **Epistemology** | Empiricism | Rationalism | Socio-historicism / Pragmatism Relational |
| **Traditions and sources of concepts contributing to learning theories** | Associationism Behaviourism Connectionism | Gestalt psychology Constructivism | Social-cultural psychology and sociology Activity Systems Communities of Practice Networks / Cybernetics |
| **Knowing as...** | Having associations affecting behaviour | Conceptual and cognitive development Personally meaningful | Distributed, relational and embodied cognition |
| **Learning as ...** | An organized accumulation of associations and components of skills | Understanding of concepts and theories in different subject matter / disciplinary domains, and general cognitive abilities | Becoming more adept at participating in distributed cognitive systems; engagement in interpersonal relations and identity in communities of practice; engagement with dissonances that exist in and between people and activity systems; networked relations |
| **Learning and Transfer...** | Acquiring and applying associations Behavioral and attitudinal change | Acquiring and applying conceptual and cognitive structures | Initiation and induction; development of shared repertoires; collective and relational forms of knowledge and agency; uncertainty |
| **Motivation and Engagement ...** | Extrinsic motivation | Intrinsic motivation | Engaged participation Connectedness |
| **Focus on accountability and assessment ...** | External | Individual | Community; Networked relations |
| **Underpinning links to theories of societal change ...** | Societal change is attendant on responses to conditions or stimulus inputs | Societal change is attendant on the 'knowledgeable actor' | Societal change occurs through learning interactions amongst members of communities of practice and/or through within different human or cybernetic activity systems and networks |

While the table above presents distinctive positions on the focus and motivation for participating in learning processes, and reflects assumptions of the KLSC relation, it also serves to illustrate the common ground that emerges across them. A key feature of the table is "that people's capacity for participation in societal change processes is *learnt, constructed and dynamic* – and that this can be enhanced (rather than being regarded as something that is, for example, fixed, largely inherited, or stable)" (Reid & Nikel, 2007: 41). Greeno et al (1996: 16) note that

"All three [perspectives] … have contributed, and continue to contribute, important insights to fundamental scientific knowledge and understanding of cognition and learning and have influenced educational [and other social practices concerned with learning] significantly. While each perspective is valuable, they frame theoretical and practical issues in distinctive and complementary ways."

As noted in Chapter 1, the KLSC program is concerned with behavior change; knowledge acquisition and use in the learning process; but also with social change. A consideration of learning *across the spectrum of available learning theory traditions* is necessary for KLSC research. As indicated below, this broad framework is also being extended and enriched in interesting ways that are important for KLSC research.

Out of a long history of learning theory research (very briefly summarized in Table 2.1 above), it is well recognized that learning occurs in a variety of ways and settings, formal and informal, as individuals and as groups, consciously and unconsciously. Everyday occurrences and experiences teach us practical knowledge, and a lot of effort is invested by most societies in teaching its members shared conventions such as language or script. Interaction with and reaction to the environment plays a crucial part in everyday learning as, for example, when people learn from a large-scale disaster like a tsunami to run when the ocean recedes. Learning includes active reflection on experiences to integrate them with the existing stock of knowledge in a society, drawing conclusions or generalizations from patterns, and generating predictions and expectations.

General concepts and approaches to learning processes are numerous and diverse, often bound to academic disciplines such as psychology and education, but they also feature in cross-disciplinary discourse and in less academic, practice-based approaches. In one characterization, learning can be understood as all processes of developing, acquiring, and processing knowledge. From another perspective, learning is the process of producing lasting change in the cognitive, perceptual, or affective state of an individual as a consequence of a stimulus or experience.

Specifying which learning theories are most relevant to the KLSC project is not easy because there has been much cross-fertilization of ideas. Aspects of some theoretical traditions, for instance behaviorist, cognitive or cybernetic, permeate many other theories, and these three traditions also have informed each other.  Hence learning theories are not mutually exclusive and do not have clear-cut boundaries, particularly if different generations of theories in particular traditions are taken into account.  Blackmore (2007) considered twenty four theories or models of learning and found that each of them could be used to raise different questions about learning in environmental contexts.

**Behaviorist** theories started with the most obvious aspect of observable changes in behavior, grounded on the works of B.F. Skinner and Ivan Pavlov and thus in a mostly biological perspective (Lefrancois, Chase and Joyce 1988). This concept was quickly broadened to include changes in dispositions and behavioral potential as well caused by repeated experiences of a subject in the situation (Hilgard and Bower 1981). **Cognitive** theories are more concerned with changes that occur within a learner and the mental processes associated with knowing though in recent years these ideas have been extended to focus on multiple, collective and distributed cognition (Piaget 1926; Hutchins 1995; Roling 2002). **Cybernetic** theories focus on systems, communication, control and regulatory feedback. First-order cybernetics assumes an observer of a system can stand outside a system of interest, the position also adopted in traditional behaviorist theories of learning. Second-order cybernetics includes an observer in a system-of-interest and assumes that individuals are structurally coupled with their environments. Bateson (1972); von Foerster (1981); Maturana and Varela (1987); Wiener (1948) and Engeström (2001; 2005) are among those who have contributed to these theories. Examples of learning theories developed from second-order cybernetics include conversation theory in which 'teachback' forms an important part of learning (Pask 1976).

The following examples, which are based on Blackmore's (2007) analysis, illustrate the fertile ground of learning theories that will be drawn on, bearing in mind that the rise of *social constructionism* and traditions such as *knowledge management* and *appreciative systems* (as discussed in sections 2.2.1, 2.2.2 and 2.3.1) are also relevant here. While all the following theories have a key role to play in understanding and facilitating learning, in some cases they are not always presented primarily as 'learning theories'. This reflects the way that considerations of learning permeate many different aspects of human activity:

- Theories of **experiential learning** that focus on transformation of experience through reflection (e.g. Kolb 1984,) including Schön's (1983 distinction between 'reflection on action' and 'reflection in action' and Mezirow's (1990) focus on critical reflection in transformative learning leading to changing meaning structures and perspectives. Dewey's (1916), Lewin's (1952) and Kolb's (1984) learning cycles are sometimes thought of as learning by trial and error.

- Bateson's three **levels/orders of learning** provide insights into different ways to conceptualize learning in terms of the focus of what is being learned. First order learning corresponds to routine learning that takes context as given. Second order learning involves learning about the context of first order learning so that is it possible to compare different approaches. Third order learning takes another step outward again, in order to learn about the contexts of second order learning or, as Bateson suggests, to break the habits of level II learning (Bateson 1972). Some have taken this further to suggest that first order learning is about cognition and deals with knowing, second order learning is about meta-cognition and deals with knowing about knowing and third level learning is about epistemic cognition and deals with knowing about the nature of knowledge (Kitchener 1983; Bawden 1999).

- Bandura's (1977) understanding of **social learning** as an individual learning process that is triggered through social contexts such as other people, social situations, and institutions. Learning is conceptualized as model learning where the models from which individuals learn can be presented in different forms via different media: stories, texts, pictures as well actual observable model behavior by others, which is then emulated. Social learning theory has developed from the earlier work of Bandura and is concerned with broader, multi-levelled societal change and action (Reed et al. 2010; Tabara & Pahl-Wostl 2007).

- Vygotsky's (1978) work, conducted at the turn of the 20th century, is recognized as the source of some of the earlier **social constructivist** theories of learning. Vygotsky's work theorized social learning from the perspective of how language and culture mediate and are mediated in the learning process. Post-Vygotskian theorists have further developed Bandura's and other work, describing in more detail how learning is mediated by social interactions, language and artifacts (e.g. Wertsch 1991, Cole 1996). Relevant here too are insights that social interactions lead to learning by processing experiences and symbolic languages and signs through interactions with others, e.g. through imitation, discourse, and dialogue (Bakhtin 1981, Mead 1964, Bohm 2004, Senge 2006).

- A recently emerging body of research extending the earlier work of Vygotsky and associated social constructivist researchers, is **Cultural Historical Activity Theory** (CHAT). This is a cultural–historical theory that explains how people learn to perform activities in activity systems. Three generations of this theory can be identified (Engeström, 1987; 2001; 2005; 2007). Started with a focus on artifact-mediated and object-oriented action, it moved on to explain collective human activity systems and then interacting human activity systems. Core to this theory is the identification of tensions and contradictions that exist in and between activity systems which provide dialectical possibilities for expanding learning in and through social interactions (Engeström 2005; 2007)

- Theories of **organizational learning**, since the organization provides a highly defined frame of roles and objectives for a group of people (see e.g. Spender 1996). Research by Agyris and Schön (1996) laid the foundation for the modern understanding of organizational learning, taking place in three possible **'loops' of learning**: (1) lower-level (single-loop) learning: associations between behaviors (explicit) and outcomes, here knowledge transfer between individuals is highly effective, and leads to short-term problem solving ability which is and highly effective in stable environments, (2) higher level (double-loop) learning: develops interpretive schemes to understand or explain sets of situations, (3) dynamic routines (third-loop learning): generating patterns of interaction (much like cultural norms and rituals) that result in unique (non-transferrable) organizational features and abilities (McGinn 2001). In this theory, it is considered possible to learn by reflecting critically upon the governing variables implicitly driving our actions (theory in use) rather than going through entire learning cycles (Finger and Asún 2000).

- Theories of **situated learning**. This approach focuses on systems, in which individuals act as members of social groups and interact with material resources (Gerstenmaier and Mandl 2001). This approach is characterized by learning as an active and constructive process. Knowing and learning are located in processes of co-participation in social practices, i.e. in a situation rather than in heads of individuals. The focus of the analysis is the learning environment and the question of effective variables. In this theory attention is paid to the quality of shared knowledge and knowledge sharing often in relation to, or in the context of shared social practices. Communities of Practice approaches draw on and contribute to theories of situated learning (Brown, Collins and Duigud 1989; Lave and Wenger 1991; Rogoff and Lave 1984; Wenger 1998).

- **Actor network theory** is a theory that is not just seen as a learning theory, but is an example of several traditions that have led to a focus on the role of objects in learning. Attempts to explain both social and technological evolution partly by providing a conceptual framework to integrate human and non-human factors in social processes; suggesting both have agency (Latour 1986, Callon 1999, Law 1986).

- Theories of **adaptive management and complex adaptive systems**, informed by cybernetics focuses on learning how to effectively influence the resilience, adaptability and transformability of social–ecological systems through understanding and monitoring the dynamics involved. From a learning perspective these theorists seek to understand how dissonance gives rise to combining new forms of knowledge with existing experience to produce new innovations (Folke et al. 2010). These processes are often theorized as social learning processes (Reed et al, 2010).

- Theories that focus both on the role of emotions in learning and on **emotional learning,** recognize that emotional aspects are an integral part of some learning theories (e.g. as one domain of learning, in theories informed by cognitive neuroscience and in transformative learning) but have also become a focus in their own right, e.g. in emotional intelligence (Goleman 1995, Egan 1992, Rogers and Freiberg, 1993, Maturana and Varela 1987)

- **Critical social learning systems** theory - values epistemology, ethics and systemic praxis. These theories build on theories of experiential learning, critical theory, appreciative systems and other systemic theories and are concerned with the transformation of worldviews that underpin action and on developing ability to act systemically in the world. Such theories have been used to explicate assumptions about the nature of reality, the nature of knowledge and of knowing, and the nature of human nature  (Bawden 1992, 1999, 2010; Woodhill and Roling 1998; Ison, 2005; Sriskandarajah et al. 2010; Gadotti 1996). This work is related to earlier forms of critical pedagogy in the tradition of Paolo Freire (1975; 1992); Apple (1982) and Giroux (1988) which sought to enhance empowerment of people through consciousness of structural conditions and capacity to challenge and restructure these.

Because of the range of possible learning theories and the extent of the discourse about them, this plan does not attempt to give a comprehensive account but has selected examples of relevance to the KLSC project. It is anticipated that some project activities will draw on and use specific learning theories whereas in the process of other activities there will be fresh synthesis of ideas in the process of praxis – where theories and practices will inform each other. Significant to the 'choice' of learning theories in KLSC research in a global change context, however, is the point made by Bauman (2001: 125) who comments on learning in late modernity when he states that:

> "These times of ours excel in dismantling frames and liquidizing patterns – all frames and all patterns, at random and without advance warning. Under such circumstances 'tertiary learning' – learning how to break the regularity, how to get free from habits and prevent habitualization, how to rearrange fragmentary experiences into heretofore unfamiliar patterns while treating all patterns as acceptable solely 'until further notice' – far from being a distortion of the education process and a deviation from its true purpose, acquires a supreme *adaptational value* and fast becomes central to what is indispensable 'equipment for life'" (our emphasis).

### 2.3.3   Individual and social learning, responsibility and agency

Learning and knowledge development take place on and among different levels, in individuals, organizations, communities, and entire societies. Processes of social learning and knowledge-based change are increasingly a part of discussions about sustainability in both academic and practitioner contexts (Schusler et al. 2003; Folke et al. 2005; Keen et. al 2005). Social learning can have many meanings depending on how it is conceptualized (Reed et al. 2010). For some it is about societal learning generally, for others it is about multi-level and multi-stakeholder processes of interaction that lead to concerted action for change and improvement of situations. Meanings include individual learning in social contexts as well as the group learning concerned with improving professional practice (Blackmore, 2007).

De Laat and Simons (2002) explained some of these individual and collective distinctions by plotting learning processes against learning outcomes at both individual and collective levels. They distinguished four kinds of learning as a result: (i) individual learning; (ii) individual learning processes with collective outcomes; (iii) learning in social interaction and (iv) collective learning. In many situations different kinds of learning are likely to be going on at any time. The KLSC project is most concerned with learning processes, both individual and collective, that have <u>collective outcomes</u>. For KLSC research the point made by Glasser (2007) and Edwards (2005) on social learning is significant. They argue that there is nothing transformative about social learning *per se,* and that without adequate critical engagement with the eco-cultural relations and structural conditions that create and sustain dominant patterns, social learning *can potentially be conservative.* This is being theorized in the southern African context, where the notion of *change oriented social learning* is being developed (Lotz-Sisitka 2008, 2009, 2010). Associated with this, is the point made by Edwards (2005) who notes to that there are three important learning questions of relevance to the 21$^{st}$ century that have not been adequately resolved through scientific understandings of learning (i.e. through learning research). These are: 1) working on new problems, 2) working with instability and uncertainty, and 3) distributed knowledge and expertise (Edwards, 2005). All three of these have significance to the problems of risk and uncertainty, which characterize sustainability questions, and thus are interesting areas for further development of KLSC research.

The meanings of knowledge and learning already discussed make it clear that it is not simple to share or co-produce knowledge and bring about learning in a targeted way. Learning as tapping into 'existing' knowledge is however deeply ingrained into the human consciousness and forms a building block of our social nature. In this view of learning, knowledge that has been developed is shared forming humankind's collective memory. Collective knowledge is seen as constantly

increasing, as people share their observations, as media report events, as professionals or volunteers document patterns they discover in the 'practical empirics' of their work, and not least as the scientific community catalogues observations following specific conventions of design and documentation.

From a different viewpoint however, learning brings information into concordance or integration with prior states of knowledge and creates the capacity for using new knowledge through understanding. Without establishing a link between prior knowledge and perception (the scaffold on which new building is constructed), new knowledge is highly unlikely to become usefully integrated into a person's cognitive toolbox. So in the context of striving for sustainability one may ask how significant is the apparent accumulation of knowledge and how collective is this knowledge or indeed humankind's memory? Schön (1973) analyzed how 'ideas in good currency' emerge in our societies that are powerful for the formation of public policy. He argues that some ideas drive out other ideas, lag behind changing events and often leave us with prevailing ideas that are inappropriate to our times. Bauman (2000: 125) raises the problem of fragmentation and habituated forms of knowledge, and of the rapidly changing nature and relevance of knowledge produced when he states that "humans … must be capable not so much of unearthing a hidden logic in the pile of events or concealed patterns … but of undoing their mental patterns at short notice and tearing down artful canvases in one sharp move of the mind". This raises the question of what view of learning would be most appropriate to our times.

Formal intervention in an individual's development to steer learning processes towards a socially acceptable behavior or collective outcome has traditionally been the domain of education. Research on economics of education as such started in the 1950s with Vaizey and Schultz studying the cost of education and investment in human capital respectively, but it was developed more fully only in the 1970s, when demographic pressures sharply increased the cost of education (Rumble and Latchem 2004: 9). Scarce public funds caused strong political interest in cost efficiency and quantity in access numbers, so from the beginning the research field had a strong focus on cost effectiveness, begging the question of what effectiveness meant with regard to learning outcomes, particularly over longer time periods. This affects the current situation in education that emphasizes discrete disciplines and operational skills, rather than problem-based, trans-disciplinary learning, collaboration, and communication. Effects of this trajectory are more pronounced in resource poor contexts where educational quality (of any kind) remains a critical issue; but also in education contexts dominated by market forces. A telling case here is the recent survey of African universities, which showed that private universities were not including sustainability content while public universities were beginning to do so (GUNi/AAU/IAU, 2011). For KLSC this raises the question of if and how the knowledge and learning in both formal and informal educational settings influences the sense of agency and responsibility of students and families in terms of sustainable practices, and how the current situation can be transformed (see for example work on place-based education by Grunewald and Smith 2008).

The wider discourse about knowledge and individual and social learning of relevance to sustainable futures is also closely associated with the concepts of agency and responsibility. Who is responsible for what and how? Who has the motivation and capacity to act? There are both moral and structural considerations in these questions.

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**Individualization of responsibility can be limiting**

Maniates (2001), writing from a North American perspective, is among those concerned about how responsibility for environmental problems has become individualized, limiting our collective imagination in terms of engaging meaningfully with doing things differently in order to address issues of consumption. He uses the example of how a prevailing conceptual model in relation to consumption - IPAT (impact = population x affluence x technology) unhelpfully

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connects everything to everything else, avoiding questions of agency, institutions, political power or collective action.

Linking inquiries associated with knowledge and individual and social learning of relevance to sustainable futures with inquiries into agency and responsibility, as Maniates and others have done, contributes ideas and understanding to one of the key challenges that the KLSC project is setting out to address – the gap between what we already know about problems and what we are doing about them. It also helps to explain why the idea of social, rather than just individual learning, has gained prominence in the discourse about knowing and learning for sustainability (Glasser 2007). Other perspectives that challenge existing paradigms concerning learning and sustainability and that connect issues of collective learning, responsibility and agency include those that focus on ecological citizenship, 'just sustainability'; cognitive justice, and governance of the commons (e.g. Dobson 2003; Agyeman 2004; Dietz et al. 2003; Mukute & Lotz-Sisitka, in press).

How issues are framed and the ways they are communicated also appears to influence people's receptivity to the issues and possible responses (Lukes 1974; Schön and Rein 1994, Entman 2004). A central theme of recent work on social learning explores what constitutes valid knowledge and how that is dependent on the processes by which it is generated by whom, in what context, and for what purpose (see Ison et al. 2007; Wals 2007, Ison 2008). As a result knowledge claims are often contested. This has been very much the case with the climate change debate, especially in the United States (Jacques 2009; Jacques, Dunlap and Riley 2008), and in the ongoing debates about IPCC (2007, 2010).

In some strongly conflicted situations of diverse stakeholders in participatory dialogue, the use of methods such as joint fact-finding and question framing/reframing are designed to stabilize at least a portion of the knowledge (Adler 2002, Stöhr et al. 2009, Stöhr and Chabay, 2010). The process of joint fact finding, and more broadly, social learning, functions as a form of co-production or at least co-definition of knowledge that becomes the basis for dialogue, shared understanding and, ultimately, concerted action (Ison et al. 2007; Collins and Ison 2009). By stabilizing the knowledge in this way, the terms of the dialogue can be clarified and a greater chance for agreement on at least a part of the issues is produced. Such processes can also lead to the emergence of different forms of agency within the change process: individual, collective and relational forms of agency *that interact* to generate societal changes at different levels of a system (Sannino 2008; Mukute, 2010).

Policy learning, social and organizational learning related to sustainability is seen in policy science as crucial for policy change within governments and international organizations (Folke et al. 2005). However, what is learned by whom and how well this learning can be subsequently incorporated into changes in attitude and practices strongly depends on the context. The nature of these changes, whether and how they can be brought about is discussed in section 2.4.

### 2.3.4   Social learning systems and scale

As already discussed, processes and products of learning and knowing can be considered as systems and as social phenomena (Blackmore, 2010b). Systems thinking and practice focuses on acknowledging interconnections; systems, boundaries and environments; multiple causes and non-linear dynamics; multiple levels; emergent properties and relations. Considering social learning in a systems perspective is particularly appropriate for consideration of issues of level and scale.

Some issues of scale in the context of sustainability were discussed in section 2.1.2. Links have also been made between social learning and scale. For instance Gibson et al. (1998) put forward a multiple level collective action theory in which they discussed both scaling-up and scaling down. They explored how a range of variables may be relevant to scaling-up to larger scale public good problems. Examples of social learning that lead to concerted action (see Ison et al. 2007) also concern scale in the sense that many actors from different levels start to work together in harmony.

Accounts of scaling up through collective learning from small initiatives, both within and across levels, are more common than those of scaling down. The notion of learning or not learning from the practices of others is relevant here.

Sustainability learning often occurs from acquiring knowledge about best (and worst) practices in other countries, towns, or villages (Tews, Busch and Jörgens 2003). The idea of 100% renewable electricity cities, while still limited in scale, is beginning to grow in Europe. Through observing first movers and early adopters, other communities learn that achieving 100% renewable electricity is feasible and then begin to find ways of implementing strategies at home. There is growing attention to sustainability best practices and how these practices might be implemented in other groups and societies. The choices of some cities to close off their inner shopping districts to automobiles to promote more attractive atmospheres is a practice that has spread widely, presumably due to a process of cross-city learning.

Of course, not all learning that is initially thought to be sustainable turns out to be best or even good practice when viewed from a more systemic perspective. The initial rush into biofuels as a 'sustainable' alternative to oil during the price hikes of 2007 and 2008 was quickly countered by voices raising concerns about food security and biodiversity loss from agricultural and forested land that was suddenly being diverted to biofuel crops (Jones et al, 2010). This suggests a process where learning was occurring, but which had insufficient safeguards in place for precaution and making sense of unintended consequences of the new practices. In other words, the learning was undertaken with limited insight about the system-wide effects; or the learning was 'too slow' or 'unreflexive' in the face of adverse consequences. Some would also argue that learning was compromised by dominant interests.

This example cautions us against assuming that learning always leads to a more sustainable outcome. The extent to which learning contributes to a more sustainable society is dependent on the ability of those involved to appreciate the complexity and interdependency of the elements of the situation they are in and the levels of power that they have to establish counter-movements or alternative perspectives. This illustrates the crucial role of sense-making and reflecting as we learn, and highlights the need for second- and third-loop learning with revision of theories-in-use and an awareness of how our epistemologies might constrain moves towards more sustainable behavior (Collins and Ison 2009). It also connects to the need for building, testing, and communicating with meaningful models and scenarios that help consider the range of conceivable outcomes of actions or policies. Furthermore it links these to power relations and knowledge/power dynamics.

There are many examples that in-and-of-themselves could be called a best practice. Yet, unless such kinds of examples are scaled up, their net impact on global sustainability will be limited at best. The world is full of entrepreneurs. At the individual, organizational, regional, and national levels there are already many good sustainability practices that have been put in place. The question then is how such good examples can be more widely implemented, so that their impact can be enhanced. Scaling up may happen as a result of what David Vogel has called regulatory competition (Vogel 1995). In the environmental policy field, it is not uncommon for the standards that are established by ecological pioneers (Jaenicke and Jacob 2004) to be adopted by other businesses and countries that wish to remain economically competitive or to hold on to an image of being modern and environmental. Drawing on this, Vogel argues that there is not an inevitable race to the bottom in environmental policies. Yet, clearly, not in every case do best practices diffuse. Nor do they diffuse to all regions equally quickly. Scaling up action for sustainability needs to occur along both vertical and horizontal dimensions. The active diffusion of sustainability practices across regions is another way to achieve scaling up. When good ideas introduced in one location can be introduced through appropriate forms of knowledge and learning and catch on in others, the scale of action grows.

Better understanding of how sustainability learning has occurred or been blocked may also shed light on ways that such learning processes could be stimulated. It is often said, for instance, that one

reason that recycling spread as quickly as it did in northern countries, had as much to do with the power of the voice of children as it did with economic considerations. Children who learned about the importance of recycling in schools took this message home to parents, who in turn, were pressured to begin separating and recycling waste. It may well be that children, receptive to new ideas and new practices, can in many important areas be some of the most persuasive carriers of sustainability messages. In other contexts, children's messages of recycling can't work as well when infrastructure at the local level is not in place to maintain the recycling systems, which again points to the need to consider more than just the knowledge-learning interface in KLSC research. Archer's (1995; 1998) morphogenic theory of change proposes careful analysis and consideration of the *interactions that exist between* structural conditions; social interactions (e.g. knowledge, learning, reflexive deliberations); and structural elaborations (what changes do or don't occur). She argues against conflating these; a point which would seem significant for KLSC research (see also Donati, 2011).

In summary, challenges that have been identified for the KLSC project **in relation to learning theories and processes of relevance to sustainability** include**:**

- examining the relationship between knowledge and learning and action can be done through use and development of models and frameworks.

- recognizing that many reports of group processes that focus on sustainability indicate *who* has contributed to the process, but not necessarily *how* different contributions have led to learning or to action.

- specifying which learning theories are most relevant to the KLSC project is not easy because there has been much cross-fertilization of ideas.

- KLSC activities will draw from specific learning theories, whereas in the process of other activities there will be fresh synthesis of ideas in the process of praxis – where theories and practices will inform each other.

- a critical concern with learning processes, both individual and collective, that have collective outcomes.

- understanding if and how the knowledge and learning in both formal and informal educational settings influences the sense of agency and responsibility of students and families in terms of sustainable practices.

- linking inquiries about knowledge and individual and social learning for sustainability with inquiries into agency and responsibility in order to contribute understanding of the gap between what we already know about problems and what we are doing about them.

## 2.4    Transformation

This section is about **transformation** from unsustainability to sustainability and what is involved. It focuses on:

- What is meant by transformation, exploring transformations that emerge and those that need to be facilitated

- Issues of power and influence and how they can affect transformations for sustainability

- Understanding behavioral change and its role in transformation

- The nature of social systems transformation

- Issues and concepts of societal change

- Social learning and knowledge systems for multi-level purposeful action

### 2.4.1    Perspectives on transformation

Transformation is used here in broad terms to refer to a change in a system from a state of unsustainability to sustainability. The system of interest in this case is the KLSC project system referred to in section 2.1.1, which is concerned with knowledge, learning and societal change, contextualized within a broader system that has the purpose of avoiding systemic failure of Earth systems. This view of transformation is in keeping with various 'soft' systems theories that focus on human activities (e.g. Checkland and Scholes, 1999). This view is also influenced both by the resilience tradition of socio-ecological systems (Folke et al. 2010), in which the concept of transformation is widely used and the tradition of transition management ( Geels 2002, 2005; Geels & Schot, 2007 , Grin et al. 2010, Kemp et al, 2006), which instead of transformation uses the concept of 'transition'. The resilience tradition developed form a primary focus on ecological systems and the transition management tradition from a focus on radical social change. But over time both traditions have come to recognize the interconnections of social, economic, ecological and technological systems, and the KLSC project can benefit from drawing on both traditions.

The KLSC project will explore transformations of different kinds – those that are *emergent* and those that are *facilitated*. This is in recognition that certain kinds of change associated with sustainability or unsustainability happen unforeseen and cannot be controlled. But it is also in recognition that some changes for sustainability can be influenced, affected or supported. This latter kind of change particularly applies where collective human activity starts to cross key thresholds likely to destabilize the state of the planet (Rockström et al. 2009) or conversely allows the society to alter its current path toward a less destructive one.

### 2.4.2    Issues of power and influence

Issues of power are highly relevant when considering what transformations for sustainability can be influenced and how. For instance in section 2.3.1 it is argued that societies are not necessarily constrained by their lack of knowledge, but by their lack of ability or willingness to act. Power relations can for instance affect whether stakeholders in a situation can get on with an activity, rather than waiting for someone else to decide. Heron's (1989) 'three levels of power' to be consciously recognized in the process of project or activity design:

    1      Hierarchical, with 'power over' leading to' deciding for'

    2      Cooperative, or 'power with', leading to 'deciding with'

3        Autonomous, or 'power to', leading to 'delegating deciding to'

can help to distinguish ways in which facilitators of transformations might work. Of course there are many issues associated with each of these categories. For instance one is how a process of delegation of authority or agency may be experienced. But the idea is one of facilitating an increasingly 'bottom up' rather than 'top down' approach.

One factor heavily influencing knowledge construction is power. Bacon famously quoted that 'knowledge is power' and since Foucault, it is difficult for social researchers to see knowledge independently from power (McGrath 2001). Nevertheless, in international political discourses on development and sustainability, knowledge often retains a glow of something wonderful and beneficent, with power often discussed in terms of north-south knowledge asymmetries (Denning 2001). Considering the need to validate knowledge as part of a learning process a broader set of questions is needed: What processes generate broadly 'valid' or accepted knowledge in a particular societal context and what modes of communication of knowledge about climate change and biodiversity loss are required by individuals, groups, and societies to enable changes in understanding and practices?

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**Co-production of knowledge implies a new role for scientific experts and expertise**

Van Bommel (2008) addresses some questions about power and influence in her research about the nature and role of experts and expertise. She follows Jasanoff (2004), Shapin (2007) and Latour and Woolgar (1979) to consider:

- how, historically, experts and expertise have been distinguished from non-experts and local knowledge

- that far from being neutral and apolitical, expertise may follow the preferences of those with the power to set research agendas and may incorporate the biases of gender, culture or nationality; reproducing exclusions.

Van Bommel's research, in the context of nature conservation in the Netherlands, drew attention to two theoretical trends of relevance to power and influence

(i)        a shift from hierarchical governance to multi-actor governance and

(ii)       a shift from traditional scientific experts producing knowledge and policy makers using it, to knowledge being co-produced by multiple actors.

The need for co-production of knowledge was highlighted by Jasanoff (2004) who argued for a co-evolution of science and policy on the grounds that ways of knowing the world are inseparably linked to the ways in which people seek to organize and control it. Van Bommel suggests that if applied to the nature and role of experts and expertise, co-production of knowledge often implies a new role for scientific experts and expertise that recognizes that science alone cannot provide the uncontested means and methods for solving problems. She argues for cognitive communities that include scientific actors along with other types of expertise and ways of knowing.

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It is important to recognize that knowledge from different sources may be differently used and accepted. In different cultural contexts, different kinds of knowledge may have greater acceptance. Who delivers a message can also be important for its legitimacy. To what extent do we understand how the structuring, presentation, and source(s) of knowledge influences the extent to which it is viewed as legitimate? And in the perspective of KLSC, how does legitimacy, however established or contested, affect behavioral choices and social change processes? One recent concept highlighting

the effect is that of 'high-powered' knowledge by trusted people and institutions (which may be wrong) and 'low-powered' or 'zero-powered' knowledge by sources not known or trusted e.g. in patronage situations (which may still be correct) (Clift 2001). This also includes the role of gatekeepers, role-models and multipliers who may have a disproportionate influence on group behavior.

Similarly, Visvanathan (2006: 167) refers to the concept of *cognitive justice* involving "... simultaneous congregation of knowledges and knowledge-makers to debate their assumptions … a parliament of knowledges for science, where a sense of plurality prevails". He argues that this is an important tool to address complexities in a risk society. Cognitive justice intends to "create a pluralist world of cognitive possibilities where emergence rather than reduction ... [is] emphasized" (Visvanathan 2006: 169).

What counts as valid or trusted knowledge has further dimensions associated with power that are not always apparent.  For instance Woodhill (2002) argues that power structures in current forms of liberal democracy have biased decision making against sustainability and instead tend to appease powerful economic interests at the expense of the overall well-being of the majority and the environment.

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**The influence of powerful economic interests**

Even in educational systems examples of the influence of powerful economic interests can be found. The international polity often assumes that higher education institutions have an inherent innovative power to match the pace of changes in society and implement new ideas (Plomp 1999). But publicly financed education institutions usually follow innovations from the economy (Reinmann 2005), and educational reformers regularly face conflicts with established practitioners (Jonsson 2004). While most major developments in education have political and ideological foundations, the practical construction and implementation may follow other institutional interests (Evans 1995).

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An alternative way forward is proposed by Avelino and Rotmans (2010), who have developed a dynamic conceptual framework of power that is relevant to sustainability, because it includes long-term dynamics, accounts for non-linear transformative change, and enables interdisciplinary and inter-paradigmatic dialogue. They stress that the dimensions of time and place should take a central role in a conceptualization of power in relationship to sustainable development. This is not the case in most interpretations of power found in social theory as they tend to focus on *existing structures* of domination and *existing resources*. Their alternative conceptualization of power is partly based on Parson's definition of power (1967) as the capacity of actors to mobilize resources to achieve a certain goal.[5] It explicitly incorporates the creation of *new* resources (innovative power) and the development of *new* structures (transformative power). It focuses on the dynamics between 'power to change' and 'power to maintain', and thereby on how actors either reproduce existing structures and institutions or transform them. In this regard Bhaskar's (1993) notion of power is also interesting for KLSC research as he theorizes a distinction between Power 1 and Power 2 (power 1 being the inherent powers of the agent; and power 2 the powers inherent in social and structural conditions and resources). Enhancing Power 1 may require absenting aspects or dimensions of Power 2 that constrain actors to achieve goals or capabilities. It may also mean enhancing aspects of Power 2 that are enabling and/or productive.

Exploring different types of power is important in debating sustainability and societal change, especially regarding the relationship between existing regimes ('powers that be') and innovative entrepreneurs or change movements that provide alternative practices (e.g. technologies).

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[5] Resources are defined as persons, assets, materials or capitals to realize a certain goal.

Considering different types of power can help to analyze the possibilities for change. It may also support multi-stakeholder dialogues on sustainability policies.

The KLSC project recognizes that the ability to shape the ways in which discussions about subjects as complex as climatic change, resource use, and biodiversity evolve is closely intertwined with power. Knowledge must be legitimated to have influence. The credibility, respect, and persuasiveness of the framing of information can be central to effective communication. Institutional structures can strongly influence which groups in a society have voice and influence. Thus, the way that institutional structures promote or inhibit the generation and dissemination of sustainability knowledge is clearly significant. Equally important to KLSC is the cultural and economic context in which societal change occurs or is even considered. The issues deemed critical in one context may be seen entirely differently in another context or culture. Understanding how issues of power constrain and enable different perspectives on knowledge, learning, and societal change to come to the fore is then crucial to developing effective strategies and meaningful implementation for sustainability on a larger and more inclusive scale.

### 2.4.3   Understanding behavioral change and its role in transformation

Human behavioral change is a key part of any large-scale transformation from unsustainability to sustainability (Folke et al. 2005; 2010). People have been trying to understand and affect human behavior since the beginning of humankind, but our contexts and challenges are constantly changing so understandings continue to develop. There is therefore much in this area that the KLSC project could usefully investigate and address in terms of understanding the kinds of behavioral change that are most relevant to sustainability and in appreciating how interventions associated with knowledge and learning can be made to help bring about the necessary transformation.

Historically, a classical view of the link between knowledge and action directed at invoking societal change has been that knowledge would, or at least should, lead to appropriate rational action. Scientific insights are expected to lead to technical and political responses that will address health, environmental, and other policy problems. However, both the direct link between knowledge and human behavior, and the direct connection between scientific insights and societal decisions were challenged by later theories and findings such as those on bounded, or limited, rationality and 'garbage-can decision making' which recognize that decision makers often try to be rational, but are constrained by limited cognitive abilities and the confusion and complexity surrounding decision making (Simon 1957; March 1982, 1994; Archer 1995). It was also recognized that decisions often meet minimum rather than optimal requirements, hence the term 'satisfice' which is used to describe a 'good enough' decision (Simon 1957). A lot of decision making starts off in a rational way but is only 'rational up to a point' when no one course of action stands out as 'best' and there are many different factors to take into account. The way that individuals often act differently depending on the collective they are currently situated in (e.g. as employee or as family member) highlights the significance of the context of decision making and illustrates the difficulty of understanding the knowledge-base used to decide on a course of action or the knowledge needed to induce change. Archer (1995) argues that rational choice theories of change suffer from inadequate accounts of how structures influence agency (they assume a 'rational freedom' from structures); and deterministic theories of change suffer from inadequate accounts of agentive powers (they assume that everything humans do and think is structurally determined). Instead, she proposes a morphogenic theory of change, which recognizes the reflexive deliberations of the agent as being significant in a course of action that exists in a context of, and in relation to pre-existing structural conditions or histories of knowledge and practice. Donati (2011) theorizes this relation not only at the level of individual or collective agency, but in wider networked relations within a contexts of globalization and wider system transformations. This would seem to be significant for the interests of the KLSC project.

*What factors affect behavioral change?*

It is well established that merely receiving information does not necessarily have an impact on people. Motivation or incentives are needed for people to engage in interpretation of information in meaningful ways. Behavioral changes will not occur automatically because new information becomes available or because new knowledge is generated about sustainability or global change. Insights into what does lead to behavioral change have come from many disciplines and practices and in relation to sustainability are evident in a variety of discourses e.g. in environmental psychology, public understanding of science and technology, ecological citizenship, knowledge sociology, sustainable consumption, sustainability ethics, politics of sustainability, transition management, cultural studies and from advertising and the use of media for communication. In addition revolutionary change is well studied in history, sociology, history of science and related disciplines (Kuhn 1976/1991; Skocpol 1979; Johnson 1983). Although this literature rarely focuses on environmental implications of revolutionary changes, much can be drawn for the analysis of behavioral changes with regard to earth system transformation (Radkau 2000). Most studies analyze rapid negative changes in societies resulting from changing environmental conditions. In situations of collapsing societies or social systems, social factors often play crucial roles (Axtell et al. 2002; Diamond 2005). Yet these studies only partially explain why and how rapid change towards solving global environmental problems may occur.

In social psychology, numerous studies have shown the effectiveness of different ways and instruments to induce individual, group and larger scale behavioral change. There is an extensive set of literature on advertising and marketing (Vakratsas and Ambler 1999, Sutherland and Sylvester 2008) as means for influencing behaviors. However, behavioral change in those cases is often not through accepted and validated knowledge or learning, but rather by implicit emotional or identity creating drivers. The role of knowledge and understanding in these processes is not yet well studied and much of this knowledge is widely dispersed in many academic disciplines and not readily accessible to other communities.

How different media mediate the message to affect the perception and decisions for or against behavior change is also of interest. An example is the debate that has raged as to how much media space should be given to competing climate change positions. What is meant by fair access and coverage in the media? This tension between evidence-based reporting and "balanced" reporting has been studied and discussed by many in the context of the role of media in influencing perceptions (Burgess et al. 1991; Dunwoody 2007; Jacques 2009; Jacques, Dunlap and Freeman 2008; Grundmann 2007). A question for KLSC is how that coverage ultimately affects changes in attitude and behavior by the users of the media.

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**What shapes pro-environmental behavior?**

Kollmuss and Agyeman (2002) considered a range of influential theoretical frameworks and models developed to explain the gap between the possession of environmental knowledge and environmental awareness, and displaying pro-environmental behavior. They concluded that the question of what shapes pro-environmental behavior is such a complex one that it cannot be visualized through one single framework or diagram. Although many hundreds of studies have been undertaken, no definitive explanation has yet been found. Kollmuss and Agyeman's analysis of factors found to have some influence, positive or negative, on pro-environmental behavior included demographic factors, external factors (e.g. institutional, economic, social and cultural) and internal factors (e.g. motivation, pro-environmental knowledge, awareness, values, attitudes, emotion, locus of control, responsibilities and priorities).

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This plan does not discuss all of these factors, but the KLSC project will consider the interplay of such factors. Using models of behavioral change, such as that developed by Kollmuss and Agyeman, could indeed help in understanding how incentives and constraints to behavioral change work together. From another perspective the IHDP project on Integrated Risk Governance, define sustainability in the negative by saying that un-sustainability is taking risks that exceed society's coping capacity. KLSC can therefore consider 'factors' that influence behaviors from different viewpoints, in this case in relation to the knowledge, understanding, and mental models of such excessive risks among members of different cultural and socio-economic groups.

In some of the many studies referred to above, it has been shown that cognitive knowledge plays a minor part in explaining human behavior, while other factors such as habits, social norms, attitudes, given infrastructures and context conditions in which knowledge arises or is situated are in many cases more relevant to understanding behavior (Deci and Ryan 1985; Ajzen and Madden 1986; Gigerenzer 2000). There is a range of behavioral patterns that often contradict generally shared norms and understandings. For instance, many consumption decisions openly contradict verbally expressed good intentions of individuals. e.g. Mobility choices in industrialized countries may also be driven by overriding factors such as expense or lack of easy access to public transportation, in contradiction to expressed values or knowledge (Heine and Mautz et al. 2001). In other terms, individual decisions are made under conditions in which norms and ethics are in conflict with other factors, which may be dominant.

The concept of shifting baselines covers some aspects of this phenomenon. Originating in social psychology and ecology, it describes the subconscious change of perceptions and terms of reference over time, in particular from one generation to another (Pauly 1995; Dayton et al. 1998). Here, most individuals refer to the conditions they became used to in their youth and fail to perceive longer time perspectives. This has extensively been studied in the case of fisheries and oceans (Roberts 2003; Sáenz-Arroyo et al. 2005) and could be extended to other fields of environmental degradation and ecosystem overuse (Welzer 2008). The research challenge is to understand the cognitive dynamics of changing perceptions vis-à-vis highly dynamic environments and how perceptions can be promoted that are more adequate to the problem dimensions and its dynamics.

Many of the foundational assumptions of behavioral change research focusing on individualized choice assumptions of behavior change have been critiqued for lacking adequate location in wider sociological, historical and cultural contexts. Bourdieu's (1980) research, for example, illuminated the role of *habitus* interactions in social fields; the improvisatory logic of practice; and the influence of cultural contexts as being perhaps more useful as categories of analysis in social change research, than in analysis of individual behavior *per se.* Bauman (2001) too, in his commentary on individualization in late modern society notes that humans have little *real capacity* for reflexivity beyond individual 'life stories'. He states that "people make their lives but not under conditions of their choice" (2001:7). These perspectives challenge some of the foundational assumptions of behavior change research, and could provide interesting perspectives on KLSC research focusing on behavior change.

### *How can inaction be better understood?*

There can also be complete denial or ignorance in societal reactions to global environmental change. Often societies are well informed about problems, but show no sign of learning or behavioral change. They may not have the social or cultural structures to value scientific data and try to continue conventional development paths. In this case, there are no significant changes in either public perception and discourse, or in the dominant patterns of behavior. This limited capacity or refusal to learn and change can also be open and deliberate (Cohen 2001), or simply a lack of appropriate incentives. In environmental policy, this phenomenon occurs often with regard to global problems such as climate change and loss of biodiversity. On climate change, focus groups showed several mechanisms of denial and barriers to linking the global phenomenon to their daily

lives and lifestyles (Stoll-Kleemann et al. 2001). Climate adaptation research in China and Europe has also shown that knowing 'more' about potential risks is not enough to trigger the attendant actions and to build the necessary capacities to adapt to global warming. Developing processes aimed at managing different perceptions and interpretative frameworks, generating suitable incentives, options and resources, and distributing responsibilities in the long term are also required (Tàbara et al. 2010). Other examples include the neglect of scientific warnings of ozone depletion in the early and mid 1980s (Milburn and Conrad 1996). Likewise, in the preparation of IPCC reports, several governments openly expressed denial of climate science (Siebenhüner 2003).

Conceptually, processes of denial or ignorance can be understood psychologically as reducing cognitive dissonance or the denial of fundamentally challenging insights (for example, see the paper aptly entitled "I'll See It When I Believe It - A Simple Model of Cognitive Consistency" by Leeat Yariv http://www.hss.caltech.edu/~lyariv/Papers/Believe.pdf)

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**Changing habits of practice and mind**

Changes in behavior for sustainability typically require going against existing habits. When that behavior is habituated, such as getting in the car and driving to work alone instead of car-pooling, taking public transportation, or riding on a bicycle, it can be difficult to alter even when learning has taken place. Giving up the necktie in the heat of the summer (as is being pushed for by climate policies in Japan) is a behavioral change difficult for many as it is a strongly habituated and socially enforced dress code. Exploring ways to provoke re-calibration of habits of practice and mind is important in changing patterns.

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Theories of cognitive dissonance (Festinger 1957, 1978; Elliot and Devine 1996, Harmon-Jones and Mills 1999) explain habitual practices and selective perception and denial on the individual level. What remains to be further explored are the social and individual dynamics, motivation, and cognition that affect the ease or difficulty with which people change their perspectives and choices of behaviors; and the conditions under which they can or can't do so (Bauman, 2001). Related to this, is a growing sense in which refusal to act is being seen as a somewhat paradoxical 'rational choice' in the face of increasing uncertainty about the scientific 'facts'. This exemplifies a bounded rationality in environmental issues (Simon 1990; Gigerenzer 2004). Personal experiences coupled with high profile disputes over climate change projections and anticipated effects, such as glacial melt and corresponding retraction by the IPCC (IPCC 2010), add to this growing unease. The tension between specific scientific knowledge and thinking and the campaigns to discredit or deny the science will also be a fruitful area for research. Central to this will be the role of trust in relation to knowledge, learning and social change and the key factors that determine how trust leads to new understandings and practices (Siegrist et al., 2010). This will extend into research to understand the reasons for success or failure of certain discourses among the public, scientists, and corporate or governmental voices.

A particularly vivid discourse related to globalization has arisen on a new way of constructing reality, namely the necessity of individuals to now consider all aspects of life, social organization, economic activities, spatial arrangements and others under a world-wide perspective (Evers 2000). This is so complex that it often exceeds the cognitive capacities of individuals, leading to reactions ranging from denial to aggressive opposition and to egoistic responses (Beck, 2009).

Learning may also be inhibited by fear or disdain or supported out of excitement. The kinds of shifts in behavior being asked for to move societies towards low-carbon futures can be frightening. It may be for this reason that it often takes a crisis for major changes to happen (Slovic et al., 2006). Habits also are a barrier to change. For individuals and organizations, it is usually easier to continue to do what one has always done. Routines are formed for a reason. They help to structure our world and limit the need to make constant choices about everything. As a result, routines are often hard to

break (Kahnemann et al., 1991). This pattern also occurs in policy settings. Policies continue along a certain path because that path is well worn. Moreover, interests tend to develop around the status quo. Learning can even be used to better justify inaction. Empirical research showed that people naturally resist higher or second-loop learning, operate from their initial theory-in-use for as long as possible, and as a primary action strategy seek unilateral control of the environment and task plus the unilateral protection of self and others. The initial reaction to errors for many people is to look for another strategy that will address and work within the existing governing variables, i.e. to stick with single-loop learning and not question our underlying motives as long as possible. This often leads to deeply entrenched defensive routines on the individual, group or social level (Argyris and Schön 1974; Argyris 1985; Edmondson and Moingeon 1999; Agyris 1990). Such behavioral patterns suggest that current research approaches strongly underestimate the importance of local and indigenous knowledge, as they mostly focus on its contents, but not on its importance for value systems, local theories-in-use, and hence its role in learning processes.

A discussion paper prepared in the UK by Halpern et al. (2004) focused on how Government could not simply 'deliver' key policy outcomes to a disengaged and passive public. It called for policy to be tailored around better understanding of certain aspects of human behavior (e.g. about how people make choices and engage in society) and for sustained dialogue about citizen's and state's responsibilities. There is a wide variety of relationships among people and their Governments across the world, but also widespread recognition (e.g. in the process of Rio + 20) that active participation of all sectors of society and all types of people is needed for sustainability.

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**Examples of current initiatives to understand human behavior for sustainability**

Two examples of current initiatives that are already responding to calls for better understanding of human behavior in relation to sustainability are:

- The Millennium Assessment of Human Behavior (MAHB), launched by environmental pioneer, Paul Ehrlich, which intends to catalog human behavioral patterns across spatial and cultural dimensions (see Ehrlich and Kennedy 2005, and http://mahb.stanford.edu).

- An OECD project on household behavior and environmental policy that aims to enhance understanding of what affects people's attitudes and decisions and households' responses to environmental policies to provide guidance to policy-makers in five key public policy areas: residential energy and water use, transport choices, organic food consumption, and waste generation and recycling (see OECD, 2011).

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### 2.4.4 The dynamic and evolutionary nature of social systems transformation

There are many relatively recent examples where insights from natural sciences have been drawn on to understand wider socio-ecological systems, for instance in use of concepts of critical mass, tipping points, system stability, and resilience. Ideas about cognition developed through work at individual level grounded in natural sciences have also been applied to social systems (e.g. in the way Varela built on the work of Maturana). While care is needed not to jump to conclusions in transferring ideas from one context to another there is an increasing number of studies that demonstrate the usefulness of this cross-fertilization and use of ideas. Drawing on such studies to develop new innovative ideas to understand social dynamics and scenarios for potential far-reaching regime shifts might be highly valuable. For instance, social tipping points can be seen as processes where small-scale events induce large-scale changes in social systems (Gladwell 2000). But its application to social systems provides challenges (Moser and Dilling 2007b), not least in terms of determining the interplay of factors and drivers, and knowing when the threshold is reached and a new 'state' is in place. Recent work (Carpenter and Scheffer, 2009) suggests that researchers need to be increasingly aware of and develop ways of making sense of the indicative 'squealing' of these

systems prior to the tipping points being reached. Another example is use of the idea of 'critical mass' in understanding collective behavior (Schelling 1978). These works are of particular importance as they highlight how outcomes of social selection processes might be against both the interest and explicit wishes of all individuals involved. New works considering what is called arbitrary coherence, and the influence of anchors and relativity might further inform such approaches (Ariely 2008).

Many processes of societal change are gradual and follow evolutionary dynamics that last years, decades or even centuries. Here, innovations and novel insights diffuse stepwise, often meeting severe resistance, being neglected, or even forgotten. Insights into some of these dynamics, for instance, into the way that cultural norms can change have been provided through the use of cultural evolutionary models (Newson et al. 2007; Richerson et al. 2001) showing that use of culturally inherited information as a basis for improvement can lead to the fairly rapid evolution of adaptations.

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**The challenge of understanding the evolution of social systems**

Unlike evolution in natural systems where change occurs over many generations, social and social-ecological systems often evolve through communication, negotiation and conflict resolution within the lifespan of one or a few generations. These dynamics can apply for example to the phase-out of chlorofluorocarbons (Litfin 1994; Benedick 1998; Andersen and Sarma 2002; Canan and Reichman 2002; Parson 2003; Jänicke and Jacob 2004), to the implementation of environmental management schemes in companies (Pesonen 2000; Freimann and Walther 2002; Morrow and Rondinelli 2002), or to the development of air pollution abatement systems (Mathews 1997; McCormick 1997; Turco 1997; Jagusiewicz 1999; Siebenhüner 2002; Tuinstra et al. 2006). One difficulty is to understand the link between micro-behavior and macro-shifts in such a process, the sources and motivations for change. Similarly challenging is the question of when such evolutionary processes take place within a current value system and when baseline shifts occur.

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Evolutionary economics has also addressed processes of societal change and learning. Here societal change is explained on the basis of evolutionary dynamics where individuals, social entities or entire societies are required to change when selection forces in a competitive environment force them to develop new responses and to find better solutions to the problems of survival. These concepts study routines and technological paths as well as the processes of routine development and path creation and path breaking (Nelson and Winter 1982; Hodgson 1993; Coriat and Dosi 1995; Dosi et al. 1996; Witt 2001b.). While evolutionary economics has been focused on technical developments and the supply side (and fails to theorize for example historical power relations), only recently have consumption behavior and its changes over time become an object of study (Witt 2001a, 2001c). The latter field is of particular interest in the analysis of knowledge-driven societal change in the area of earth system transformation.

In discussing the dynamic and evolutionary nature of the transformation of social systems it is important to recognize discontinuities, as well as continuities. What appears to be an evolutionary spread of ideas and practices from one level or perspective might look quite different from another. Evolutionary processes can focus as much on discontinuity as continuity. Van Notten et al. (2005) conducted an extensive review of literature in this area and noted that "Gradual discontinuity is a long-term process of change that leads to the transformation of society, or a part of it, over a period of many years or even decades." The notion of discontinuity and surprise in relation to evolutionary processes has been taken up by other researchers such as Guijt (2008) and Kates and Clark (1996).

There is considerable diversity in whether and how learning takes place, knowledge is produced and used and whether and how societies change. For instance, some might see an evolutionary pattern

in use of genetically modified organisms if considered from parts of the world where their use has become widespread. Yet Jasanoff (2005) identifies deep rifts among some Western nations when comparing the ways that they govern innovation in genetics and biotechnology. Of particular relevance to KLSC, Jasanoff also found considerable variation in how knowledge is produced and used when making cross-country comparisons.

Social learning concepts have also contributed to the understanding of gradual, as well as more rapid evolutionary and dynamic processes associated with the transformation of social systems, particularly in the field of global environmental change.[6] These studies highlight the conditions of learning and change that predominantly adapt to external pressures or that include basic values and related behavior into the change process. They also gave rise to questions regarding the connection between knowledge and behavioral change on societal levels or to the interaction between knowledge and other societal driving forces such as political power structures, economic pressures or technological developments. In addition, there is not yet much understanding of the failures and interruptions of social learning processes and of the role of issue-specific factors, e.g., those that distinguish climate mitigation from adaptation or the protection of biodiversity.

### 2.4.5    Issues and concepts of societal change

The development of human society in a more sustainable direction requires large-scale behavioral and social systems change that spans all levels of societies. However, the systemic and dynamic nature of social systems transformation means that this kind of societal change is not simply the sum of behavioral changes by individuals, groups and formal institutions. It also concerns the interplay of these changes. There are many different views of societal change in relation to global issues. From the perspective of direction of change, it has been viewed as the process of formal implementation of international agreements. Significant research has also been devoted to bottom-up processes of societal change and how it emerges from individual and group initiatives. Much less attention has been devoted in the literature on international environmental policy to the translation of the formal 'top-down' process in a lived process on the micro level (e. g., The Social Learning Group 2001, Mitchell et al., 2006; Moser and Dilling 2007a) or to how bottom-up processes accumulate at the macrolevel.

In social and planning sciences, there is a rich body of understanding on why, when and how societal change takes place. These include ideas about *social movements, social media, networks and communities.*

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[6]      See for example the following: Parson and Clark 1995; The Social Learning Group 2001; EEA 2002; Siebenhüner 2005; Pahl-Wostl et al. 2007; Wals 2007a, 2007b; Van de Kerkhof and Wieczorek 2005; van Kerkhoff and Lebel 2006; Ison et al 2007; Blackmore 2007, 2010b; Collins and Ison 2009; Reed et al. 2010).

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**Examples of social movements**

Two academic traditions concerned with post-1960s social movements emphasized either how people organize themselves into effective social movements or why they choose to do so.

1     The largely U.S.-based 'Resource Mobilization' theory (RMT) of social movements accepted that grievances always exist within a society, Smelser's (1962) influential work described the sequence of contextual factors that would allow them to take form in society. For RMT scholars, the key question was mobilization: how some grievances were worked up into social movements, while others were not (Klandermans and Tarrow 1988: 4). RMT scholars developed a lexicon to describe the effective roles of individuals ('entrepreneurs'), organizations, and networks in social movements as they mobilized resources and channeled discontent into organizational forms, usually oriented to the state (Edelman 2001: 289; Scott 1990). Researchers thus examined the available 'opportunity structures', repertoires of action, and cultural 'frames' used to contextualize movement activity (Tarrow 1994; McAdam et al.,1996).

2     European researchers took a broad historical view of the causes and meanings of social discord, which they described not as manifestations of discrete social grievances, but instead as expressions of mass alienation within industrialized society. As a consequence European scholars developed a different interpretation of the goals of social movement activity. In place of material and legal welfare politics, they emphasized that of individual and collective sense of self. In brief, according to New Social Movement (NSM) theory, social movements were popular reactions to the bleakness of mass society and its commodification of public life and private relations, bureaucratization of political process, and substitution of material convenience for human fulfillment. The problem was the 'system'.

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Societal change can occur gradually but can also take place under conditions that require immediate reaction, such as a catastrophic event, without the deliberate effort to generate new knowledge and learn collectively. This may lead to longer-term changes not only in behaviors, but also in understanding and attitudes. In such cases, basic values or dominant cognitions in society may shift without society-wide discourses or deliberate choices taken by the majority in a society.

The work of the two traditions of social movements discussed above have been conjoined and extended by the forms of protest and social movement emerging since 1999, when street protests derailed the World Trade Organization (WTO) meeting in Seattle. One interpretation of that event is that it signaled that a formerly unaligned range of social groups and actors (labor unions, environmentalists, farmers, immigrant-rights organizations, anarchists, and any number of unaffiliated individuals) had identified a new object of movement activity (supra-national institutions), and was using a variety of new technologies, including cell phones and new social media, and spatial techniques as organizing and protest tools. Examination of such 'network-based movements' revealed movement analysis of shifts in governance and movement attempts to identify new points of leverage. This emergence of **diffuse, network-based social movements** often targeting supra-national institutions has challenged previous traditions of thought in productive ways.

As the above example shows, **social media** are increasingly important mechanisms for distributing knowledge, increasing engagement (if not understanding), influencing attitudes, and changing behaviors regarding global change issues. The rapid spread and adoption of social media and the tools for participating and communicating widely by widely dispersed individuals, groups, and institutions has changed the entire process of communication and, more importantly for KLSC, it is changing the process of acquiring and assimilating knowledge and promoting actions, and

simultaneously it offers a new means of observing and assessing the influences mediating between knowledge production, distribution, and action.

**Networks** that are not necessarily framed as social movements can also be important transmitters of ideas. Organizations such as ICLEI, Local Government for Sustainability, the Clinton Climate Initiative, and the C40 Large Cities Initiative are examples of network organizations that are working to disseminate information about sustainability practices and needs among cities. Given the growing percentage of the global population that is living in urban areas, stimulating change at the urban level can be a powerful way of reducing the ecological impact of cities. This integrates well with the IHDP project on Urbanization and Global Environmental Change (UGEC).

Many other kinds of networks exist as well. Schools and universities are creating networks that promote the exchange of information about sustainability practices and an element of positive competition (e.g. the recycling Olympics) among young people as they work to green their schools and campuses, promote more efficient resource use, and demand more sustainability education.

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**Academic networks to improve institutional coordination for sustainability**

One such network, the Alliance for Global Sustainability (http://theags.org/), links the Massachusetts Institute of Technology, ETH Zürich, Chalmers University of Technology, and the University of Tokyo and serves both faculty in research project coordination and students in engaging in collaborative projects and competitions. Another similar network in Africa, the Mainstreaming Environment and Sustainability in African Universities network (MESA) links professors and lecturers from diverse disciplines together to bring about institutional changes for sustainability (www.unep.org/training).

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It is important to understand in which areas and in which places networks are and are not arising. It is also important to learn more about how networks operate, which of their practices are successful and which not, and what might be done to improve their effectiveness. It is also critical to consider what could be done to expand the channels for sustainability learning across those who are already actively working to promote it.

**Communities of learning or practice** (see Lave and Wenger 1991; Wenger 1998; Wenger et al. 2002) constitute another domain which can be examined for insights into how learning and knowledge, focused around a set of values begins within a small group or an individual leader to become a more widespread and acknowledged community of advocacy and action. Key to the community of practice is the development of a shared sense of purpose and learning through ongoing interaction within the community. Thus three key characteristics are essential for a community of practice to be said to exist:

1) the domain or shared interest among the community;

2) the community itself comprising those members that interact with each other; and

3) the shared (and evolving) repertoires of practice that arise from the interactions.

Interesting new dimensions of communities of practice research for social learning and sustainability include how communities of practice deal with cognitive dissonance and how communities of practice function as activity systems that interface with other activity systems. Interesting lines of inquiry for KLSC research include issues of power, structural conditions in communities of practice, and assumptions of equilibrium in communicative actions in communities of practice (Barton and Tusting 2005).

*Issues arising from societal change concerning knowledge and learning for sustainability*

There is little systematic or indeed systemic knowledge about what the communication mechanisms are that are being used to spread information about sustainability, what kind of messages are being spread, and how effective such efforts are. In what way is the Internet being used by a range of communities and individuals to promote sustainability and is the internet an effective channel for fostering changes in attitudes and behavior? How much attention does the media give to sustainability questions with a system level focus as opposed to single-issue agendas? Are non-governmental organizations – both large and small – effective communicators of new understandings and practice that are contextually relevant and feasible?

It is not only a question of what medium is used for communication in what communities, but also who is communicating and what his or her role is in the community that makes the communication effective. In other words, what is the role played by *leadership* in promoting social learning, knowledge and change? What do leaders do that foster social change? We can also ask if and how leaders opposing change use knowledge and learning in some fundamentally different manner or use different information and interpretations to recruit people to their cause? What roles do deeply held beliefs and values play in hindering or advancing change toward sustainable issues? What are the links to change agents and social entrepreneurial organizations? This is also an area in which a substantial amount of scholarship and action research has been done. Here the role of practitioners as partners in KLSC is vital.

In the existing literature, the purpose of such communities is to serve learning, respond rapidly to requests from peers, develop, capture and transfer best practices, promote dialogue, link diverse groups and promote innovative approaches. However, given the use of advanced technologies, many Communities of Practice tend to represent not the stakeholders of a particular issue, but those who are in a position to participate (Cummings, Heeks and Huysman 2003). Furthermore, research on online forums showed a high level of agreement among members, which suggests a tendency to form coherent groups and separate opinions instead of seeking active dialogue. While a degree of coherence in a group provides scaffolding for individual learning, a lack of constructive criticism, challenge and opposition from peers will effectively block learning (Stark and Mandl 2003). It seems that knowledge-building communities require sophisticated social engineering elements and levers to enable learning for sustainability as much or even more than real-world communities (Scardamalia et al. 1994; Collins and Bielaczyc 1997). The relationship that exists between on-line / virtual communities of practice and actual changes in social systems, and sustainability practices is another area of interest for KLSC research, as the potential also exists for virtual learning communities to become simulacra or hyper-real, with little effects on everyday sustainability practices or changes required for sustainability to emerge.

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**The U Process - how the framing of problems can affect social process**

Another important literature reference on social change processes linked to learning and personal development is Otto Scharmer's (2007) 'U Process'. Bohm, Senge and Scharmer and to some extent other authors within the domain of leadership for change bring an interesting approach to *how problems/reality are framed by individuals* and *how this framing affects social processes*. These questions can be seen as central when looking at bridging the knowledge/learning/action gap by creating an environment that promotes social learning (Bohm 1996; Senge 2006; Senge et al. 2004; Scharmer 2007).

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Regarding the persistence of change, there are times when new practices diffuse, but then over time begin to fade from use. For example, after the first oil crisis in the 1970s, in many countries there were campaigns to convince individuals to save energy, and to some extent, these campaigns worked. Yet, over time, as the energy crisis became more distant in people's minds, their

conservationist habits faded. This suggests that in many cases continuous learning is critical for the implementation of sustainability behaviors. It should not be assumed that lessons learned by one generation will necessarily be understood and adopted in subsequent years, much less by subsequent generations, without adequate and effective education.

A challenge before the KLSC initiative is not only to gain better insight into the connections between knowledge, learning and societal change, but also to derive ways in which this insight can enable better participatory processes and public fora on which good policy design and societal adaptation are ultimately based. KLSC therefore identifies and addresses two important and related dynamics in social transformations for sustainability: the knowledge that is needed, and the activation of knowledge in lived environments. In short, KLSC attempts to re-assess and redesign the related practices of knowledge-making, learning, and the governance practices (defined broadly) that lead to social-environmental change.

In summary, challenges that have been identified for the KLSC project in relation to transformation for sustainability include the needs to:

- be open to insights from many different traditions

- explore both emergent and facilitated transformations

- recognize that the ability to shape the ways in which discussions about subjects as complex as climatic change, resource use, and biodiversity evolve is closely intertwined with power

- recognize knowledge must be legitimated to have influence

- find out how legitimacy of knowledge and power relations affect behavioral choice and societal changes

- find out how media coverage ultimately affects changes in attitude and behavior by the users of the media

- consider factors that influence behavior and societal changes from different viewpoints

- find out how the many factors affecting behavioral and societal changes affect each other

- use cross country comparisons to find out about the interplay of learning and knowledge production and use at different levels and scales

- understand how the adoption of social media affects the process of acquiring and assimilating knowledge and promoting actions

- work with practitioners as partners; and consider how people engage with practices in and out of knowledge and learning engagements

- re-assess and re-design the related practices of knowledge-making, learning and governance that lead to social-environmental change

How the KLSC project will rise to these challenges and others identified earlier in this chapter is discussed in chapter 3 where the characteristics of the KLSC research process framework are elaborated. Underpinning these characteristics are a group of principles that emerge from chapter 2 as a whole, namely:

- processes and products of learning and knowing can be considered as systems and as social phenomena

- focusing on learning in social contexts is concerned in different ways with managing or influencing systemic change
- striving for sustainability involves learning to think and act systemically and knowing how to act and interact effectively and purposefully in situations experienced as complex, messy and changing
- KLSC will appreciate and build on multiple perspectives on knowledge, learning and societal change
- systemic thinking and practice will be at the core of this approach, acknowledging interconnections; systems, boundaries and environments; multiple causes and non-linear dynamics; multiple levels; emergent properties and relations

# 3   Research Framework

## 3.1   The nature of KLSC Research

This section introduces the KLSC research framework and explains the main characteristics of KLSC research which are:

- An integrative and transdisciplinary approach

- Researching narratives as visions for change

- Sustainability as a research issue and normative goal

- A reflective and iterative process of research and activities

- Relevant to policy, the public-policy-science interface and practice engagement

The essential characteristics of the research envisioned within the KLSC framework are outlined in this section. These position KLSC research in respect to the wide range of academic traditions from which it draws and identifies the intellectual boundary regions in which KLSC will need to work with new methodologies and approaches in order to achieve its objectives. Methodological innovation will, by necessity, be a key feature of KSLC research since the broader object of KLSC research is social-ecological in nature. Montuschi (2003) argued that *the nature of the research object has significant implications for methodologies and research orientations in a research program.* As outlined in Chapter 2, the KLSC program is ultimately focused on sustainability interests, and the knowledge, learning and societal change focus of the research will only gain meaning and significance in relation to the social-ecological context of the research and the envisaged sustainability outcomes. Scientific research in previous centuries was focused primarily on a differentiation between natural and social research objects. Investigating natural objects gave rise to methodological trajectories suited to this object; while social scientific and humanities research has focused on social or philosophical objects with associated methodologies that have allowed for increasingly nuanced investigations and understandings of the social / human object. Social scientific research has only recently 'escaped' from the dogma of naturalism or the 'unity of science' thesis (Topper, 2005), developing a legitimate broader range of methods and methodologies for social scientific inquiry.

KLSC research, while being primarily social scientific and humanities oriented in the human dimensions frame, also needs to 'cross borders' to engage with a social-ecological object (sustainability of human life on planet earth). Sustainability Sciences in all their forms are increasingly integrative, inter- and trans-disciplinary (Kates, 2010; Max-Neef 2005). Transdisciplinarity according to Max-Neef (2005:5) represents "an unfinished scientific program that offers fascinating possibilities for advanced reflection and research." Max-Neef argues further that there is an urgent need to "complete and consolidate transdisciplinarity as a project destined to improve our understanding of the social world and of Nature" (2005:15) if we are to refrain from doing further harm to human-nature relations due to our fragmented views of the world.

KLSC research processes also operate in what has been termed a 'post normal' scientific context (Funtowicz and Ravetz 1994), where complexity of issues requires a wider range of knowledge producers (other than the expert scientist) to be recognized in scientific knowledge production relationships and practices. Dealing with environmental and global change challenges, and developing different forms of innovations to address them requires more inclusive ways of knowing and doing, as noted by Pimbert (2009:22) who state that "more inclusive ways of knowing are required to bring together the partial and incomplete perspectives of different actors faced with uncertainty, diversity and change". The key point made by Funtowicz and Ravetz (1994) is that it is

important to draw on knowledge, experiences and values of a wide range of people, not only scientific experts, when dealing with new, emerging and complex issues, where consequences of the issues are uncertain and potentially risky (as is the case in agriculture in a climate change affected world, or the case of biodiversity loss in a context where the 'planetary boundary' is being crossed).

### 3.1.1   Integrative and trans-disciplinary

A highly integrative and trans-disciplinary approach is required for KLSC research, because it is focused on the interplay between knowledge, learning, and behavioral and societal change in the context of enhancing sustainability, rather than on any one of the components in isolation. Each of these intellectual domains have themselves been developed through contributions from several disciplines. The research and activities of KLSC will build upon the extensive body of existing literature on knowledge, learning, and behavioral and societal change (as discussed in Chapter 2) in a sustainability / social-ecological scientific context, draw upon current projects in related fields, and explore new directions and methodology.

For example, learning in the context of the KLSC initiative includes the perspectives of many disciplines, including social psychology, sociology, management studies, natural sciences, systems studies, media and communications, and education. KLSC research and actions will revolve around three themes - **climate change mitigation and adaptation, stemming biodiversity loss, and increasing equity in resource allocation** - which represent central issues for global environmental change; all of which are informed by ecological studies; climate and environmental sciences. Bringing these scientific perspectives on the 'state of the planet' into relationship with KLSC research requires various forms of 'transdisciplinary synthesis'. Focusing KLSC on these three themes provides a tangible focus for such syntheses, and opportunities for sufficient intellectual and analytical depth through studies that will examine knowledge and learning not in themselves, but in relationship to specific contexts of policy- and action-relevant knowledge. Such analyses will have bearing on the three focus themes; within a wider context of change toward a more sustainable future. The focus on vital and urgent issues, the range of expertise and actors needed to address the issues, and the complexity of the issues requires transdisciplinarity, summed up in the following quotes from Pohl and Hirsch Hadorn (2007:9).

> "Transdisciplinary research: is needed when knowledge about a societally relevant problem field is uncertain, when the concrete nature of problems is disputed, and when there is a great deal at stake for those concerned by problems and involved in dealing with them.
>
> Transdisciplinary research deals with problem fields in such a way that it can:
> a) grasp the complexity of problems,
> b) take into account the diversity of life-world and scientific perceptions of problems
> c) link abstract and case specific knowledge and
> d) develop knowledge and practices that promote and what is perceived to be the common good."

Participatory research and collaboration between disciplines are seen by the authors as the means of meeting requirements a)–d) in the research process.

### 3.1.2   Narratives as visions for change and as objects of research

In what way and to what extent can the clear articulation of a positive vision for the future stimulate societal changes for sustainability? And what can we learn from the study of narratives in different forms and cultures to understand humanity's reflections on societal change and the potential for mobilizing society? We use the term "narrative" to include all forms of expression of a story or vision (e.g., visual arts, dance, music, literature, theater) and we use "visions" as a depiction of a different future than a business-as-usual trajectory that may help guide action in new directions.

The assumption here is that due in part to the complexity of information about sustainability problems, the creation and expression of compelling and appropriately simplified - but not simplistic! - visions accessible in forms appropriate to each of the wide spectrum of communities may be necessary for stimulating action.

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**What will future visions be about?**

Future visions may have to do with sustainability technologies (non-fossil fuel automobiles, LED light bulbs, geothermal power), policies (the wide scale introduction of policies to promote renewables, recycling and reuse), new strategies and methods for education that fosters understanding and practice for sustainability and equity, or innovative approaches to creating synergy between environmental and economic concerns.

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Sources of visions also matter. The movie "An Inconvenient Truth" does not deliver a new story. But the fact that it was being told by former US Vice-President Al Gore helped to legitimize, among other things, the message being told. When well-known or famous people, such as Prince Charles or Nelson Mandela, put their support behind sustainability or equity causes, it can help spread awareness among large segments of a population. Even without the cachet of an existing name brand, people can become catalysts for others to act by capturing their attention with creative events and actions.

It follows that it may also be important to examine not just the extent to which future visions and their communicators matter, but also the extent to which different visions are understood, shared and trusted by different actors and societies. How much agreement is there and does there need to be (and at what level) a common understanding about what a future of greater sustainability can, might, and perhaps should look like?

How visions are expressed or encapsulated through artistic media, including dance, music, poetry, drama, and prose is an important aspect of KLSC. The expression of ideas through emotionally connective forms that resonate in different ways in different communities and cultures can also have a significant effect on whether and how the ideas are perceived, understood, and ultimately accepted or rejected and thus on decisions for or against action. In this, the involvement of artists and humanists in KLSC may help greatly not only in engaging diverse communities in the ideas and activities, but also in understanding the role of different forms of expression of visions.

### 3.1.3 Sustainability as a research issue and normative goal

Research and activities within KLSC are explicitly intended to support a normative goal of furthering sustainable societal actions and to do so through the highest standards of rigorous scholarship and research. That is, the research conducted by KLSC must continually probe the assumptions and question the processes that are undertaken or proposed to lead from existing knowledge to new practices that may be more sustainable. That means not only questioning and conducting research on knowledge production, learning processes, and societal practices, but also on the validity and viability of knowledge and societal changes that constitute what is deemed sustainable. This, as indicated in section 2.2, is not a simple matter, as knowledge of sustainability is dynamic and in many cases remains uncertain and has global and local dimensions, as well as regional variations and implications when applied to different contexts.

A crucial set of issues that KLSC research can examine arises from the conflicts in values and/or circumstances between those who embrace or accept adaptation, transformation, and societal change as necessary for a sustainable future and others who maintain or reinforce path dependencies and cultural inertia. Related to this and also very important is the question of metrics, such as GDP or Gross National Happiness or Gross National Well-being, and how they influence the

discourse regarding societal change and sustainability and how they are conditioned on specific knowledge systems; and specific cultural assumptions and social /social-economic realities. It is also important to examine how these measures are instruments of globalization and what are the longer term sustainability implications and societal change assumptions (e.g., the global influence of particular forms of GDP measures).

The KLSC research program will gather a diverse community of people to join in its effort to understand various sources of knowledge, ways of learning and applying relevant knowledge, and the drivers of and hindrances to societal change based on the knowledge and learning. The intention is to develop this community into a network for sharing the resulting insights about societal change for sustainability among themselves and with related networks (see implementation strategies suggested in Chapter 4). This includes scientists, politicians, learning and education communities, funding agencies, industry, NGOs, policy makers, Regional Economic Communities, the United Nations University, UNESCO, UNEP, and other international and interregional players that will mutually enhance use of lessons learned.

### 3.1.4    A reflective and iterative process of research and activities

As a key interest of KLSC research is the *manner in which knowledge and learning contribute to or shape societal change;* KLSC research will be both **process** and **product** oriented.  KLSC research will be inclusive of the following **types of processes,** which are not mutually exclusive.

1. Assessment and review processes

2. Action oriented / expansive learning research processes and theory development

3. Research networking, communication and 'feedback loop' processes

Research encompassing all three areas will be needed for holistic achievement of KLSC goals; as shown in Figure 3.1 below.



**Figure 3.1        Reflective and Iterative KLSC Research Processes**

### 1.   *Assessment and review processes*

This category of KLSC research processes may involve some or all of the following forms of research:

**Situational analyses and/or contextual profiling studies** which provide contextual or situational 'maps' or perspectives on the existing status quo. These kinds of studies are similar to traditional forms of 'baseline research' but can also be constituted in more dynamic forms to enable ongoing updating of contextual data / situational perspectives. Such studies will be important *to all KLSC initiatives* to establish the wider contribution of the program, but also to monitor changes in contexts and conditions that influence or are influenced by KLSC processes. Because the wider object of KLSC research is social-ecological there is a need to consider a range of factors in situational analyses relevant to KLSC which include amongst others: local to global elements; socio-cultural elements; symbolic elements; popular or other discourses; other empirical elements; spatial and temporal elements; human elements (individual and collective); non-human elements (e.g. ecological systems; biomes etc.); political economy elements; discursive constructions of actors; organizational / institutional elements; major contested issues etc. (Clarke, 2005). Such studies in a KLSC context may require *mixed methods* (qualitative and quantitative; and natural and social science studies).

**Meta analysis of case studies** across scales, across regions, or located in different issue and/or knowledge or learning contexts. Case studies, and particularly landscape-level case studies are particularly powerful sites for KLSC research, as they allow for depth of analysis and capturing of a complex set of interacting forces and processes. As mentioned in Chapter 2, substantive cases of interest for KLSC research already exist, but there is little comprehensive analysis of the full scope and meaning of these in the scope of KLSC. Additionally, case studies are also a powerful approach to building coherent KLSC knowledge since 'context counts' (Flyvberg, 2001) in social and social-ecological research. Of interest to KLSC research is the point made by critical realists regarding generalization from intrinsic research designs (Sayer 2000; Danermark et al. 2002). Using a differentiated ontological vantage point (drawing on the depth of ontology provided for in critical realism), Sayer (2000) and Danermark et al. (2002) indicate that it is possible to generalize from case studies *at the level of the 'real' where structural mechanisms that influence individual cases can be identified,* but not at the level of diverse empirical interpretations that are evident in cases. This is an important point to consider in meta-analyses of case studies. For example, one may generalize at the level of interpreting how uncertainty related to climate change can influence KLSC in different contexts, but not at the level of the diversity of KLSC processes in the different contexts (i.e. how the uncertainty is actualized; see also Ruddin 2006 on generalizing from case studies).

**Syntheses of previous research** and **ongoing reflexive review of produced outcomes** to identify and confirm the current status of knowledge in key areas (for example the area of indigenous and traditional knowledge, or in the area related to knowledge, learning and behavior change) and to map the emergent results of new KLSC research. Such studies will be important in the 'start up' phase of the KLSC program and may require ongoing updating or renewal as new critical dimensions of the KLSC landscape open up through ongoing investigations. Examples of such research which may be of value to KLSC include, for example, the recent Mapping of Sustainability Research by UNESCO (UNESCO,2009). Biersta (2009) notes that such studies can serve two important roles in relation to practice and society, namely it can 1) provide technical support, guidance and contributions to changing practices, or it can 2) serve *a cultural innovation role.* He argues that these roles are not mutually exclusive, but that the cultural innovation role is particularly significant for furthering transformation and democracy. KLSC research needs to use such studies for both purposes.

## 2. Action oriented / expansive learning research processes and theory development

A second form of research that KLSC will require is research that uses methodologies that are stakeholder oriented, emancipatory and participatory, as well as reflexive. The purpose of such these research designs would be to *further develop the relationship that exists between knowledge, learning and societal change through praxis.* At a broad level such studies can be classified or

described as action research studies which involve cycles of situational analysis, planning, action, and reflection in dynamic cycles of reflexively constituted change (described in more detail in section 3.4 below). There are new variations of such participatory, praxis-oriented research designs that are potentially interesting for KLSC research. Notable amongst these is the expansive learning and developmental work research methodology that is being developed by Engeström (2007; 2008), Warmington et al. (2005), and other cultural historical activity theory researchers. Expansive learning research purposefully includes carefully designed intervention processes to develop new models of process and practice that stimulate and support learning and action and is grounded in in-depth analysis of situation, context, activity, and mediations. Such studies can be qualitative and/or quantitative and can make use of mixed methods and a variety of theoretical perspectives and analytical tools. Variations of intervention research processes exist, which use the principle of 'mirror data' in communicating and monitoring use of research results or findings into contexts of ongoing practice, stimulating change-oriented learning. These participatory, praxis orientations to research can be situated at landscape level or at multi-scalar institutional levels. They can involve complex cybernetic learning interactions or can also be shorter term or longitudinal in nature and form. They can also make use of different units of analysis (e.g. activity systems, case studies, networks, etc). (Engeström, 2009).

There is good reason for focusing on action oriented, expansive learning research designs within a participatory research frame in KLSC, including that such research is not a-theoretical and that it can contribute to theory development. It is important to emphasize the significance of theory development as an important dimension of KLSC as "practice without theory takes us back to blind faith …" (Stronach et al. 2004: 130) and too strong a focus on 'real world praxis' may over-emphasize political or moral agendas, leading to research that can become 'captive', its concerns and focus determined by the context, or the state of the problem and defended in terms of 'relevance'. Results emerging from a-theoretical research designs of this nature may lead simply to the installing of populist rhetorics, while obscuring the inevitably theoretical assumptions that need to be made about these processes to say anything meaningful at all (Stronach et al. 2004: 150). KLSC research will therefore engage an iterative process of theory generation in (critical) relationship to praxis and *vice verse.*

### 3. *Research networking, communication and 'feedback loop' processes*

This set of research processes is critical for the successful uptake of KLSC research and its broader location in societal movement towards sustainability. Establishing meaningfully situated 'feedback loop' processes involves giving attention to the type of research products produced and how research is located, used and shared. Attention must also be given to what the outcomes of research *are* in social change research processes, as well as how research is/ought to be constituted as a social change process in itself. Increasingly there is an argument for not only doing research on people and issues of society, but to constitute research *within* ongoing societal processes, so that the research *has purchase, purpose, and practical value.* This requires giving attention to the wider 'social ecology' of the research process, research relationships, and research products.

### 3.1.5 Policy relevance and public-science–policy and practice engagement

The KLSC research program addresses several interrelated policy issues in society and as such, it is an 'extra-scientific' question of social science (Dreier 1996). The research can thus partially be conceptualized in the logic of Policy Science (deLeon 2003); recognizing that policy science may suffer from over-determined 'relevance' and may also be a-theoretical (see the section above). As conceptualized in Chapter 2, KLSC research is not merely practical, but it is problem-oriented, context dependent, process-related, normative, and trans-disciplinary. Each of these conditions apply to KLSC research, as the perceived lack of adequate societal changes (problem) is studied in the specific setting of climate change (context) and with the focus on the levers and mechanisms of

societal change (process). The normative and trans-disciplinary nature of the research is described extensively above.

In regard to the science-public-policy interface, the KLSC project addresses several key points articulated in the IHDP Berne meeting in 2006. These include:

- "Enhanced understanding regarding the injection of scientific findings into the policy process…" This is an important area in which the KLSC project can examine the process through which knowledge is considered, understood and incorporated or discarded in developing policy to effect or reflect societal change.

- "Creation of new policy instruments and evaluation of their effectiveness in dealing with different environmental issues." It is the evaluation of effectiveness of policy that again overlaps with KLSC in that it asks whether the policy instruments are in fact instruments of change.

There is a growing body of literature about sustainability and policy responses in the form of academic studies, think tank reports, policy appraisals, and real world case studies. KLSC can ask whether and how it may be possible to make better use of this knowledge by developing new practices for engaging the public and policy makers with the knowledge and the process of producing and understanding the knowledge. While the knowledge production for the policy trajectory is important, it is also necessary to note that political life has a distinctly uncertain ontology, and that policy / political studies are a 'science of uncertainty' (Topper, 2005) that require 'critical pluralist' methodologies of engagement. Such forms of political engagement in and through research "may be a positive and even indispensable source of dynamism and renewal" (Topper, 2005: 18). KLSC researchers would therefore need to engage *critically and dynamically* with the science-policy interface.

Emphasis on the public-science-policy interface often tends to neglect an important public-science-*practice* interface; in which KLSC research informs social practices at different levels of the social system. Focusing on the public-science-practice interface requires researchers to give attention to the reconciliation of theoretical and practical intentions – not only at the level of policy. This issue was noted as being critical to KLSC research in Chapter 2. Charles Taylor (2005) in his commentary on how the modern social imaginary was constituted, explains that social imaginaries can be changed by theories or ideas that penetrate and transform the social imaginary, and when this happens, people take up, improvise, or are inducted into *new practices* (Taylor, 2005). Innovation studies however, show that the adoption of new practices is a cultural affair, and new practices tend to take root when and as cultures change. This provides added impetus for action-oriented culturally-innovative methodological arguments in KLSC research (see section 3.4 below).

### 3.1.6   A cross-scale initiative

As in other human dimensions projects, KLSC will pay particular attention to cross-scale dynamics as they affect processes of interest. KLSC will pursue analytical and action oriented research projects (drawing on the reflexive process framework outlined in section 3.1.3 above) at a variety of scales in order to develop rigorous understanding of the interplay between knowledge, learning and societal change at each of these scales and to explore iteratively, and in partnership with user communities, how to improve interventions.

Given KLSC's central imperative to integrate multiple knowledge and learning paradigms to affect behavioral and societal change, a critical set of questions relates to the cross-scalar dynamics at play in this interaction (see section 3.3 below). As argued in Chapter 2, different knowledge traditions derive their legitimacy from cultural processes and institutional dynamics at different scales and yet these knowledge systems must be brought together. Similarly, mechanisms for environmental governance developed at one institutional scale must be adaptable to other contexts and practice

innovations need to be upscaled and expanded to various contexts and scales. Furthermore, the dynamics through which knowledge produced at different scales affects individual behavioral change and how this behavioral change then aggregates to wider societal change is inherently a cross-scalar problem. Recognizing that polycentric approaches facilitate achieving benefits at multiple scales, as well as experimentation and learning from experience with diverse policies (Ostrom 2010), KLSC aims to support research and interventions aimed at facilitating solutions that cross scales. Network analysis is another form of methodology that allows for cross scalar analysis (see section 3.5 below).

In summary, the essential characteristics of KLSC research are as follows:

- primarily social scientific and humanities oriented in the human dimensions frame. But it also needs to 'cross borders' and to draw on knowledge, experiences and values of a wide range of people to engage with sustainability of human life on planet earth.

- requires a highly integrative and trans-disciplinary approach because it is focused on the interplay between knowledge, learning, and behavioral and societal change in the context of enhancing sustainability, rather than on any one of the components in isolation.

- explores the nature and role of narratives as visions for change

- intended to support a normative goal of furthering sustainable societal actions through the highest standards of rigorous scholarship and research.

- focuses on three types of processes:

  o assessment and review

  o action oriented / expansive learning research and theory development

  o research networking, communication and 'feedback loop'

- addresses several interrelated policy issues in society and is relevant to science-public-policy and public-science-practice interfaces

- pays particular attention to cross-scale dynamics

## 3.2    Perspective and scope

In this section we outline and represent in diagrams the perspective and scope of the research and action agendas for KLSC.

On one hand, the KLSC program addresses the relationships between knowledge, learning, and positive, adaptive change and, on the other hand, identifies and probes the negative or resistive responses in terms of significant factors that decouple from actions or redirect knowledge to maintain stasis or produce maladaptive change as regards sustainability. The research is intended to identify different pathways, patterns, and dynamics through which knowledge and learning may contribute to behavioral change that furthers sustainability. As indicated in Chapter 2 and in section 3.1.5 above, KLSC research is also concerned with the extent to which factors can be identified across spatial, temporal, and sectoral dimensions of society, which could facilitate shifts towards more sustainable lifestyles. To the extent that pathways, patterns, and dynamics that promote and conditions that inhibit changes for sustainability can be identified, it may be possible to mobilize resources for the promotion of sustainability in more effective directions.

Some processes envisaged in the KLSC program can be described as 'double loop' learning (Argyris & Schŏn, 1996). One loop is the process of learning from existing cases or conducting field experiments. The second is the reflection upon these lessons and deepening scientific insights through this reflection and then using the added insights to further refine subsequent research and actions as outlined in the KLSC process model in section 3.1.3 above.

Specific questions needed to refine and provide ontological relevance within the wider set of KLSC research questions identified in section 3.3 below; will evolve as input from formal and informal experts, practitioners and policy-makers is collected. Some categories and questions overlap to some degree, indicating that the questions might be addressed empirically in different ways that may complement each other.

The schematic diagram below (Figure 3.2) illustrates the central issue of linkages and mutual influences between the equally-weighted domains of knowledge production, learning processes, and societal change in the contexts in which the interplay occurs and in regard to the three themes of particular concern and the particular aspects in each domain.
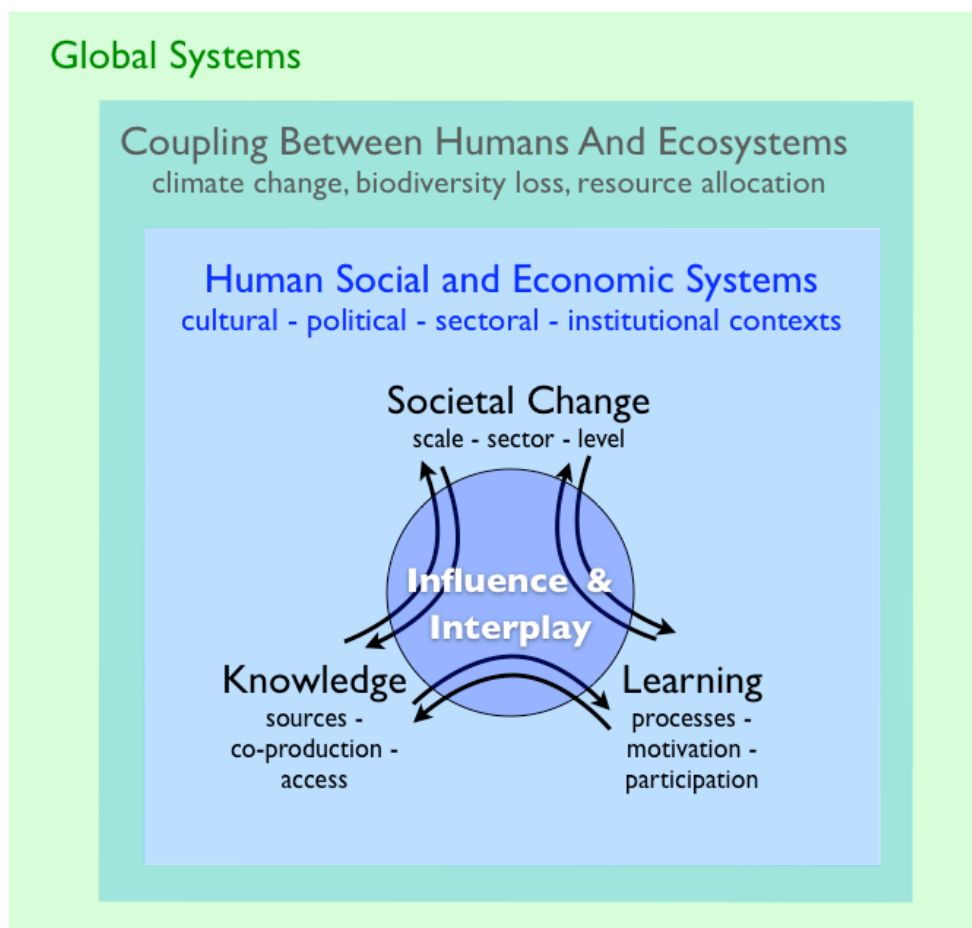


**Figure 3.2       The KLSC System of Interest (elaborated from Figure 2.4)**

From a wider perspective however, the issues that KLSC will address are situated in the Earth System, as indicated in the schematic diagram (Figure 3.3) below.
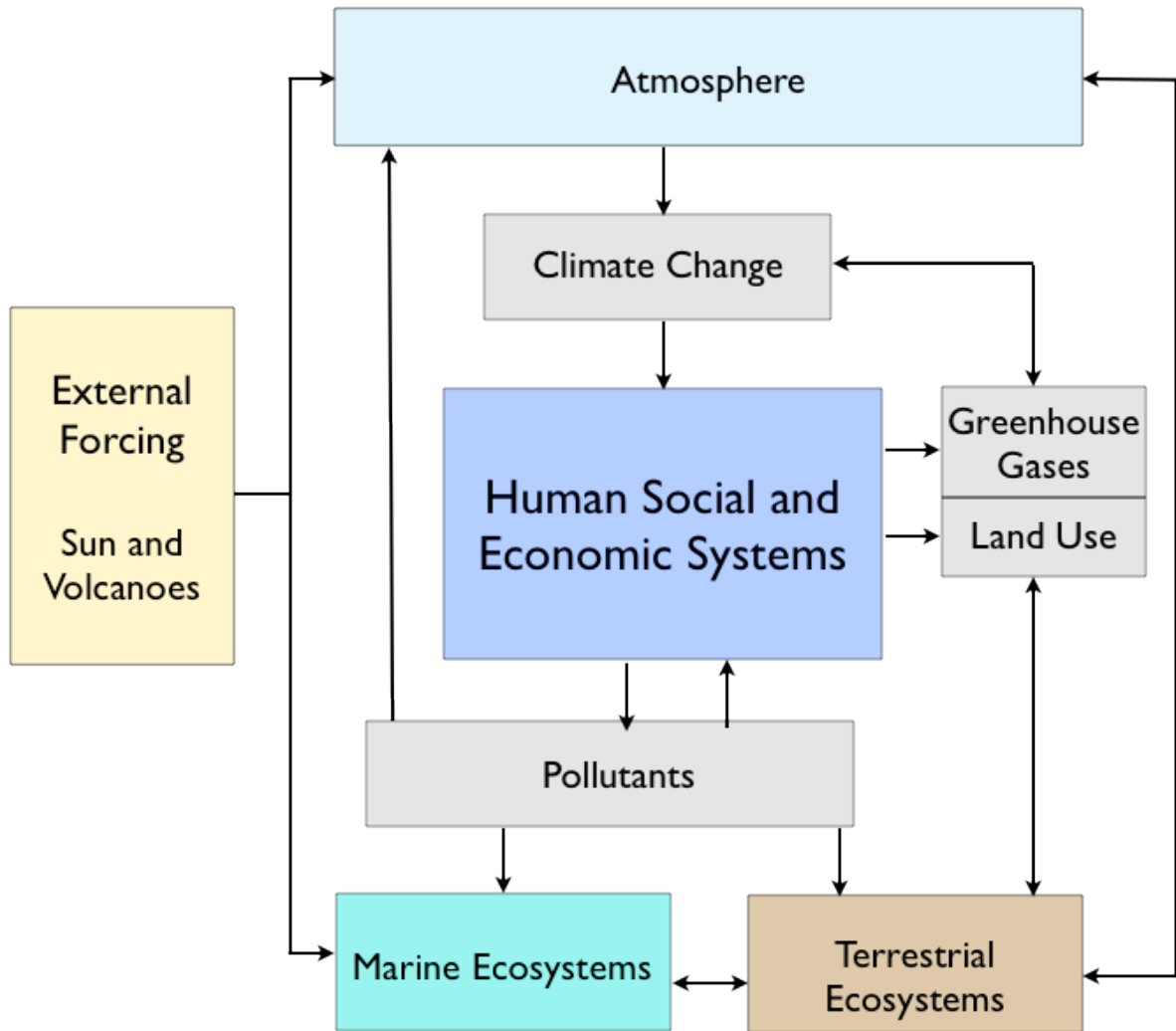


**Figure 3.3     Human society and KLSC issues in the global systems perspective**

To guide KLSC research and its objects of analysis, it is necessary to identify a set of 'core research questions' that can be further refined and developed within the KLSC international network of researchers and practitioners. To begin with, a set of **broad research questions** (framed as 'categories of questions') are defined to guide all KLSC research. The broad categories of questions probe the key patterns and dynamics of the interplay between the elements in Figures 3.1, 3.2. and 3.3 above; and address the core interest of KLSC research, as outlined in Chapter 2. A range of more refined research questions can emerge from the 'question categories' outlined in section 3.3. below.

## 3.3    Research Questions

This section details KLSC's research questions and explains how they could relate to the themes and activities

There are three large categories of questions that need to be investigated if a rigorous understanding of the interplay between knowledge, learning, and societal change is to be developed. One revolves around the relationship between environmental governance and societal change. The second seeks to elucidate the basis in knowledge and understanding for decision-

making under realistic conditions in diverse conditions and cultures. The third category is about the conditions needed to create greater individual and community or institutional capacity for change and adaptation.

**Category 1 KLSC Questions**: **Environmental Governance and Societal Change.**

This category of questions will probe the characteristics of and interaction between horizontal and vertical forms of knowledge and learning in multi-level governance processes related to global change and what societal change results or emerges. That is, how the existence and development of grass-roots movements in socio-economic, political, and cultural communities interact with levels of governance in linking knowledge, learning, policy making, practice, and societal change; and *vice verse*. This then can become an avenue for examining mechanisms of scaling up or growth of knowledge, learning and societal change mechanisms and processes, or on the other hand, addressing constraints or inhibitions to upscaling.

**Category 2 KLSC Questions**: **Cultures of Practice and Societal Change**

This category of questions probes the relationships that exist between knowledge, learning and the existing and potentially new 'identity, cultural and social fabrics' of behaviours and practices necessary for societal change. These questions can be dealt with at multiple scales and in multi-institutional contexts, and/or at landscape level. Sub-questions may include probing utilitarian and non-utilitarian factors and heuristics employed by individuals and communities or institutions that influence deployment of knowledge and learning in making decisions, adopting practices and taking actions for or against change. How these processes evolve over time as individual changes reinforce each other to aggregate into substantive community or institutional change (representing new cultures of practice in changed contexts) or how they diminish each other to retard or block change are also questions of interest in this category. Factors influencing individual or collective forms of behavior change would also be significant in this question category. This can lead us to better empirical data needed for qualitative understanding of the role of knowledge and learning in coupled social-ecological systems and better mathematical and social-cultural process modeling of these complex systems.

**Category 3 KLSC Questions:** **Capacity building for adaptation and transformation.**

This category of questions focuses on how capacity is developed for social learning, adaptation and transformability in response to global change conditions, risks and new opportunities for achieving sustainable societies. Folke et. al (2010) note that social learning, adaptation and transformability are needed to enhance social-ecological resilience. Questions in this category will focus on successes and failures in knowledge production and use, learning and communication, and successful innovative strategies, tools, and approaches that enhance learning and education for adaptation and transformation. This cluster of questions will include investigating the role and capacity of *modern learning institutions* (formal and non-formal) in facilitating adaptation and transformability in response to global change risks. They represent a significant resource for furthering the goals of the KLSC program. If indeed there is a failure to re-orient learning in learning institutions, the gains of the KLSC research program will be significantly diminished. This responds to the need to "develop understanding needed to create the conditions that enable effective adaptation decisions." (Patwardhan et al. 2009).

**Applying the research question framework**

There are many more questions that can be formulated within the intellectual domain of KLSC. More or less closely associated with each vertex of knowledge, learning, and societal change in Figure 3.2 are issues that should be explored and investigated to illuminate specific aspects of the central issues of influence and interplay among all three vertices. These can be accommodated

within the three broad categories of questions outlined above. Questions of most appropriate methodology are also likely to emerge as the research program expands.

The research questions need to be mobilized in the context of the three thematic areas of significance to this Science Plan. This process can be represented in brief in Table 3.1 below. It provides a matrix illustration of the scope of the KLSC research program and also how it can accommodate specific thematic research within the three broad-based question categories, while also allowing for cross-thematic research areas to evolve.

**Table 3.1        Matrix indicating research categories and thematic areas**

| *KLSC Research Categories (examples of broad questions)* | *KLSC research questions applied to thematic areas* | | | |
|---|---|---|---|---|
| | *Thematic area 1:* **Climate change** | *Thematic area 2:* **Biodiversity loss** | *Thematic area 3:* **Resource inequity** | *Cross-thematic aspects* |
| *How does learning occur within/across different levels of governance to cope with environmental change?* | *Activity A* | *Activity B* | *Activity C* | *Activity D* |
| *What tools, methods and processes are needed to bring about transitional change in individual and collective actions, decisions, and practices?* | *Activity E* | *Activity F* | *Activity G* | *Activity H* |
| *What type of learning, adaptive and resilience capacities (in individuals, groups and institutions) need to be developed to effect changes toward sustainability?* | *Activity I* | *Activity J* | *Activity K* | *Activity L* |
| *KLSC methodology questions* | *Innovative methodologies will be applied across KLSC research; as a whole the research program should monitor these in terms of their trans-disciplinary and action-oriented validity claims. This will provide methodological contributions to global change research.* | | | |

## 3.4    Broad action research orientation

This section explains the nature of KLSC's research - as **action** research - and why this orientation is appropriate

As outlined in the process framework above (section 3.1), a collaborative research and action network, such as KLSC, which is directed at strengthening interactions between diverse groups of actors depends very much upon the interest shown by the actors and communities involved. Not only do they need to become involved, but the practical main directions of the program will also be determined to a certain extent by the themes that are able to gain support (in-kind, financial, etc.).

The central idea is that the KLSC project can facilitate the development of dynamic processes of co-creation of knowledge amongst diverse stakeholders with different competences and expertise at local, regional, and global scales (Rocchi 2005; Wals 2007). The experiences within such processes (be they experimental interventions, case studies, or otherwise – see some possible methodological options outlined in section 3.5 below) can then also be used for systematic reflection by the scientists involved and for implementation in new research and in educational activities. The KLSC research program proposes an evolutionary perspective on knowledge, where applied practice and

scientific expertise result from an accumulation of experience (Campbell and Stanley 1966). This iterative and transdisciplinary approach is broadly referred to as action / expansive learning research and is outlined in the KLSC process descriptions.

Action research is a process in which researchers collaborate with a group or community of interest to develop interventions and learn from the process. It aims to contribute both to the practical concerns of people and institutions in an immediate problematic situation and to the goals of social science (Rapoport 1970; Lewin, 1952; Zuber-Skerritt, 1986). In the process, the research team guides or conducts the activity and collects data from it. The data is analyzed collaboratively and used to draw conclusions, and, if needed, to design an iteration or alteration of the intervention experiment or change process. In this 'action' part of the KLSC project, the objective is to strengthen capacity to integrate knowledge and implement effective solutions by developing effective collaboration between the research scientists, stakeholders in the domain of interest, and practitioners who engage with the stakeholders,. Zuber-Skeritt (1986) and Carr and Kemmis (1986), drawing on the knowledge interests of Habermas (1972), differentiate between three different types of action research: technical, practical and emancipatory. KLSC research is likely to be more oriented towards practical and emancipatory forms of action research, given the program's interest in societal change.

Conducting intervention experiments is not the only possibility for KLSC research, however. It is also possible to systematically learn from activities that have already taken place, be it in conjunction between research and practice, or experiments in society in which research was not explicitly involved. Workshops and brainstorming events – 'think shops' - are essential mechanisms for reflecting, refining, and reframing the research of KLSC as the project evolves. Such processes will provide for the integrated *process framework*.

The 'academic science'[7] part of the action research project involves science assessments, case studies, and theoretical framing and reframing activities. Research seeks to understand, for example, the ways in which framings are formed and change and what forms of knowledge construction and communication are most effective in different contexts. Findings will be communicated through normal academic publication channels, though not to the exclusion of channels that make that knowledge and insight accessible to a wide range of stakeholders appropriate to the content.

To address the barriers to adaptation for global sustainability, KLSC will initiate projects in collaboration with policy makers and stakeholders at a range of scales. Action research has historically been performed in discreet and bounded social systems in the context of organizational studies (Susman and Evered 1978), medicine and public health (Hope and Waterman 2003, Waterman, 1998), information systems (Baskerville and Wood-Harper 1996), regional economic development (Fox 1990), and educational studies (Carr and Kemmis 1986) among others. In addition to supporting action research projects in such bounded contexts, KLSC aims to initiate action research that facilitates learning and social change in global environmental change institutions and that crosses scales between these institutions and local initiatives. This endeavor represents an important innovative step by KLSC. Giddens (1991) explains such forms of institutional reflexivity as a process of *chronic revision* in the light of new information or knowledge. Donati (2011) also emphasizes such forms of reflexivity, but within processes in complex *relations* that reach from local to global and *vice verse.*

A specific and important target of the project in line with the Berne strategy regarding policy relevance (see section 3.1.4) could be to build connections to and examine the IPCC and IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services) processes. This

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[7] Note here that the 'academic science' in the KLSC process is integrally linked to wider KLSC research processes within the action research orientation.

may lead to broadening the scope of these processes to include more human dimensions into the assessment process and perhaps affecting the policy and agreement forming process. A possible route could be to start thinking about how to develop an additional assessment track, perhaps in conjunction with the Millenium Assessment of Human Behavior, which will examine the pathways through which the knowledge and policy prescriptions are integrated into environmental governance at various scales. Many other such possibilities exist for policy relevant KLSC research.

## 3.5    Methodological Options

Nine methodological options for different KLSC activities are explored in this section.  We also discuss briefly how they can work together in integrative KLSC research designs.  Table 3.2 is provided at the end by way of summary

A range of methodological options are available to KLSC researchers, as outlined briefly below. As shown in the descriptions, different methodologies allow for different types of enquiries into KLSC research questions. Some methodologies are better suited to particular types of research questions. The methodological options outlined below provide *some perspectives* on scope of methodological approaches, but the list is not exhaustive. The options also cover a variety of intrinsic and extrinsic research designs (Sayer 2000) and need to be contextualized within the broader action research orientation of the KLSC project and its objectives.

### 3.5.1    Systems Methodologies

A core set of methodologies for KLSC research are those that draw on systems theories, which are many and various (Ison, 2010; Ramage and Shipp, 2009). In the early 'hard' systems approach, problems were seen as being clearly defined and relatively well structured, objectives of decision makers were known, there were known criteria to determine when objectives had been achieved, and the problems were sufficiently well-insulated from the wider social systems (Daellenbach 2001). The failure of this goal-focused, target-oriented approach to deal with messy and complex situations that include people, and to foster sustainable development has led to alternative systems approaches that emphasize the inherent complexity of human systems. These alternative systems approaches recognize that complex social systems are ill-structured and ill-defined and that different stakeholders with different world views have different, possibly conflicting perceptions about the problem situation. Alternative systems approaches include two types of particular relevance to KLSC:  an interpretive, or 'soft', systems approach and the critical systems approach.

Soft systems methodologies aim to structure and appreciate the problem situation, rather than to solve the problem directly. Particular attention is paid to allowing multiple worldviews, many of which are often left unexamined, to surface and be examined (Rosenhead and Mingers 2001). Commonly, the approach involves building models of purposeful action toward a problem, each of which encapsulates a different worldview. The models are then used to generate questions to ask about the real-world situation, to provide coherent structure to discourse about the situation and how it might be changed, and to identify changes that are desirable and culturally feasible for people in this particular context and situation. Ultimately, the approach aims to achieve, if not consensus, then at least an accommodation between different worldviews (Checkland and Scholes, 1999; Checkland and Poulter, 2010). Particular soft systems tools include the Strategic Options Development and Analysis (SODA) (Ackerman and Eden, 2010), and others associated with soft systems methodology (SSM) (Checkland and Scholes, 1999; (Checkland and Poulter 2010).

Critical systems approaches, which evolved more explicitly from ethical systems traditions, claim that both functionalist ('hard') and interpretive ('soft') systems approaches tend to accept existing inequalities of wealth, power, authority, gender, race, and other social characteristics, and to largely

neglect the views and interests of those who have no voice in decision making processes but who suffer the consequences, including future generations, non-human species and the environment. At the heart of critical systems approaches are concerns about the process of decision-making, and about the values and social assumptions involved, more so than particular plans. It emphasizes that ideas of improvement are always subjective and therefore that decision-makers' view of improvement should be subjected to challenge and considered in light of other viewpoints (Carr and Oreszczyn 2001).

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**Critical systems heuristics**

A key example of a critical systems approach is Ulrich's (Ulrich, 1983; Ulrich and Reynolds, 2010) critical systems heuristics. The approach is based on making sense of a situation by making explicit the boundary judgments that circumscribe our understanding and constitute our reference systems. Through a set of questions about what 'is' and what 'ought to be' aimed at different types of stakeholders, the approach encourages people to consider critically such questions as: what counts as ethically-defensible improvement, who should benefit, and what should count as relevant knowledge and sources of expertise. It aims to help parties appreciate their own boundary assumptions and those of others.

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Systems-based methodologies, particularly interpretive and critical approaches, will be essential for addressing the complex relationships between knowledge, learning and societal change. They provide a means to both interpret the nature of complex social systems and to ask such ethical questions as what changes are systematically desirable and culturally feasible? By emphasizing the subjectivity of positions, systems approaches can open dialogue and facilitate the joint generation of identity and legitimacy between science and society. These dynamics may be particularly important in efforts to link grassroots movements with levels of governance at various scales. In cases where knowledge claims are sometimes contested, such as climate change and biodiversity loss, systems approaches, which emphasize the subjectivity of positions and the need for stabilization of knowledge claims, can be particularly helpful.

### 3.5.2    Social Network Analysis

Social network approaches have become increasingly widely used in the social sciences as new software packages have emerged to facilitate analyses of complex systems (Wasserman and Faust 1994; Carrington et al. 2005). Social network analysis focuses on the relations among actors, not individual actors and their attributes. It encourages focus on multiple levels of analysis by asking, for example, how individuals are embedded in structures and how structures emerge from micro-relations between individuals. It is primarily concerned with characterizing flows, of people within groups or organizations, but also of knowledge and information.

Social network analysis typically involves using questionnaires or interviews to gather information about relationships between a defined group of people and knowledge flows between them. The important characteristics revealed about social groups concern not so much the number of connections the actors have, but whether these connections overlap and constrain actors or extend outward and provide opportunity. Specific features of networks have been developed and are determined by algorithm. They include a range of characteristics related to diffusion, homogeneity, embeddedness, solidarity, social positions and other macro properties of the social groups. Concerns about centrality and power can also be considered. In the analytical mode of network analysis, power is based on having a favored position by having more opportunities and fewer constraints. Such perspectives on power can potentially be enriched through the KLSC research agenda.

Data gathering and analysis from the social network approach provides a baseline against which to

plan and prioritize appropriate changes and interventions to improve social connections and knowledge flows within groups or network. This work is critical to KLSC.

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**Social networking in the context of farming and climate change**

Social network mapping has increasingly been utilized to facilitate understanding of and coordination among social groups engaged in sustainability transitions, such as enhancing farmers' capacities for improve resilience in the face of climate change. Critical networks include the flows through which farmers receive knowledge and information about innovations, and how they receive knowledge and information about adaptations. (Fuller, et al. 2007; Isaac, et al. 2007)

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Network analysis is also useful for understanding patterns of global trade and the structures of trade flows for different commodities, which can be critical to resource management issues, as well as biodiversity management. While social network analysis provides useful insight into social patterns of practice and change, it does not necessarily provide the tools necessary for in-depth probing of *how* such changes occur.

### 3.5.3   Discourse Analysis (and Geneological Research)

Discourses are shared, structured ways of speaking, thinking, interpreting, and representing things in the world (Dryzek 1997). The analytical challenge is to decode the hidden assumptions and meanings that come to imbue these discourses, to understand the ways in which discourses are constructed and mobilized to different ends, and what their power and other effects are (Fairclough et al.,2004; Fairclough, 2005).

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**A checklist for discourse analysis**

Dryzek, who has done pioneering work on environmental discourses, offers a checklist of elements for discourse analysis.

1   Does the discourse recognize, construct, and privilege basic entities, such as ecosystems, governments, markets, humans, resources, technologies?   (While central to some discourses, such entities may be absent from other discourses.)

2   What assumptions are made about what is natural in relationships between entities, such as competition, cooperation, or hierarchy.

3   How are entities and their motives represented?  Are they ascribed agency or are they denied the capacity to act?  Are their motives and interests seen as valid, or are they repressed?

4   What key metaphors and other rhetorical devices define and advance the discourse.  (In environmental discourses, for example, the earth may be described as a spaceship, a machine or an organism, and these metaphors play a role in positioning listeners or readers to accept or reject particular perceptions.)

Source: Dryzek 1997

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The work of discourse analysis is not to decipher the meaning of discourses, but to understand their function and power effects. Rose (2001) describes how discourses operate as strategies of persuasion. In policy making, discourses frame debates, limit what are considered 'reasonable'

options, and inform environmental management structures and policy-making processes. They also structure new forms of governmentality (Darier 1999). An important ethical goal of discourse analysis, then, is to ensure that a network is not dominated by a single discourse whose terms are accepted uncritically by all involved actors in a way that marginalizes other discourses that could claim relevance. This starts with the priority that each relevant discourse gets articulate representation (Dryzek 1997).

Discourse analysis most often draws on qualitative methods, such as historical analysis, content analysis, in-depth interviews or ethnographic analysis. Surveys may lack the interpretive depth required for discourse analysis, but they can be combined with other methods, such as semi-structured interviews. A quantitative technique, Q methodology, involves measuring an individual's subjective orientation to an issue area in terms of his/her ranking of a set of statements that are keyed to the core features of discourse: agency, motives of agents, relationships, and metaphors. The rankings can then be factor analyzed, providing a summary of a limited number of discourses (Dryzek and Niemeyer 2008).

Discourses pervade the interplay between knowledge, learning and societal change and provide an important area for KLSC research. For example, decisions about what constitutes improvement in moving toward sustainability are framed by discourses that operate through social and political systems. Furthermore, as discussed in section 2.1.2, different groups striving for sustainability have different systems of interest and invoke different discourses in their framing of sustainability concerns (Scott and Gough, 2004). For example, some of the groups involved in the Rio+20 conference on sustainable development are considering pathways toward a sustainable economy, while other groups are more concerned with sustainable ecosystems or agricultural systems. The discourse about learning and knowledge in these contexts is closely associated with the concepts of 'responsibility' and 'agency', which are strongly shaped by the discourses that are brought to bear on the issue. Discourse analysis can help demonstrate both the moral and structural considerations in these questions. Discourse analysis can, however, be limited to *critique of discourses,* and additional re-imagining or practice-centred research may be necessary to either absent features of dominance in discourses, or to further develop enabling features of discourses. Discourse analysis in the context of KLSC can also be significantly enhanced through genealogical research (after Foucault, 2002), which traces the construction of knowledge power relations and how these shape discourse practices and new forms of governmentality (power effects) that structure actions and reduce freedoms at individual and institutional levels. Popkewitz (1991, 2000, 2008a) has used such approaches to great effect to reveal the way in which modern education systems create patterns of inclusion and exclusion (of knowledge and people) through patterns of dominance in discourse practices. His most recent work on cosmopolitanism and education (Popkewitz 2008b) is interesting for KLSC research as it analyses patterns of trans-boundary or 'cosmopolitan' knowledge-power relations. Geneological research is also useful for tracing and uncovering *resistance* (Nealon 2008)*,* an issue that has been noted as being important in KLSC research.

### 3.5.4    Scenario Planning Methods

Scenario planning methods offer an alternative to conventional statistical methods of forecasting. These methods generally develop a number of possible futures in which some organization or entity may find itself, for consideration of action if that future should eventuate. Scenarios are always created in ensembles of possible futures, which are designed to contrast rather than interlink, thus offering snapshots of different possible future states. They aim to capture the 'envelope' of possibilities.

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**Categories for scenario building methods**

Bishop et al. (2007) describe 23 types of scenario building methods within the following eight categories
1. Judgment
2. Baseline/expected
3. Elaboration of fixed scenarios
4. Event sequences
5. Backcasting
6. Dimensions of uncertainty
7. Cross-impact analysis
8. Modeling

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Three of the main types are expert scenarios, in which scenarios are generated by experts. Standardized scenarios are based on the principle that some sets of scenarios occur over and over again. The analysis begins with several possible end states (e.g., status quo, collapse, transformation), and explores antecedents and consequences for each entity under study, focusing on routes to those end-points. In the critical uncertainties method (Schwartz 1991), scenarios are derived around axial variables. Newer classes of scenario planning methods emphasize their participatory nature. List (2001) offers the scenario network mapping approach. Instead of developing a few scenarios in detail, a much larger number is developed in much less detail. Between the present and the target date, several broad pathways are envisaged, and then backcasting is applied to each pathway, building the pathway out into a hierarchy of possible causes, or precedents, and effects. The basic axioms of this tree like structure are that nothing ever happens for a single reason, and an event rarely has only one outcome. Groups of varying sizes can produce such scenarios, though groups of larger than 20 should disaggregate into sub-groups.

Scenario planning methods can provide a framework for integrating decision makers and knowledge users in the context of deciding how to pursue sustainability. The methods can reveal the wide set of considerations at play in decisions associated with complex issues such as GMOs (Kamara et al 2006). The potential shift to biofuels as a primary fuel source is a similarly complex issue with multiple decision criteria that include constraints related to water supplies and land. Scenario planning can put these concerns on the table and engage a range of users and decisions makers in the planning process. In a KLSC context they are useful for 'testing' the scope of available knowledge and potential routes to and/or consequences of decisions and actions. Scenarios are, however, not a replacement for actual change processes and therefore need to be worked with in the context of real life change processes where consequent decisions are taken, monitored and reflexively reviewed. Beck (2009) notes the significance of 'staging risk' in reflexive learning and decision making processes in contexts of uncertainty and risk; and it is in this context that scenario methods are useful in, for and as KLSC research. Scenario methodologies are therefore useful as tools for researching anticipatory learning; or for learning in uncertain knowledge contexts (Barnett, 2011).

### 3.5.5  Survey Methods:  Longitudinal and Cross-sectional Analysis

Longitudinal and cross-sectional analysis fall under the broad category of survey methods. Both have been key approaches in the social sciences for decades (Goldstein 1979, Nesselroade and Baltes 1979) and remain useful among the toolkit of methodologies for KLSC research, particularly as they supplement other approaches. They are non-experimental, descriptive methods used to collect data from a sample of a population, particularly on phenomena that cannot be directly observed, such as opinions.

Cross-sectional analysis is used to gather information on a population at a single point in time about, for example, how a group feels about some policy or significant for KLSC research, what a single

population *knows* about such a policy at that time. Other data can then be used to determine the relationship between that factor and some other factor, such as cultural/religious views or politics of access. Different questions can be posed by disaggregating the sample into sub-groups based on some other measured variable, such as age, gender, income or education level. In this sense, many different variables can be compared at the same time.

Cross-sectional analysis aims only to determine prevalence or association; it does not permit distinction between cause and effect. Cross-sectional analysis is generally inexpensive and can be done rather quickly and therefore is useful in identifying associations that can then be more rigorously studied. The associations discovered can be analyzed statistically using various forms of regression analysis.

Where cross-sectional research is focused on finding relationships between variables at a specific point in time, longitudinal studies involve taking multiple measures over an extended period of time. The study may follow the same group of individuals over time, or it may draw samples from the same population but not the same people. Data from several studies may be combined to show a trend. This survey method is used to discover relationships between variables as they change over time, but not related to various background variables, and thus is particularly useful when studying issues related to development, lifespan or social change, or to establish sequences of events. Longitudinal analysis can require enormous time commitments and is often expensive. Data can be collected through surveys or through administrative data, and may be analyzed using a range of statistical methods that take into account the inter-correlation of serial measurements.

### 3.5.6 Grounded Theory and Thematic Analysis

Bryant and Charmaz (2007) describe grounded theory as the most widely cited qualitative research method in the social sciences. The goal of grounded theory is to capture the meanings that objects, words, or gestures have for individuals, or members of groups and communities, while they are engaged in purposeful and reflexive interaction, and to develop theories of social action based on the idea that these meanings guide people's actions (Berg 2007). It asks, what is the reality of basic social processes, given that there are multiple non-contradictory descriptive and explanatory claims about any phenomenon?

The grounded theory approach focuses attention on the process of generating theory rather than on any particular theoretical content (Patton 2002). The theoretical commitment is to the construction of theory inductively, from the bottom up (Glaser and Strauss 1967). In what is known as the spiral theory development, data is collected and hypotheses and concepts are worked out concurrently. Analysis occurs through constant comparison, first of data to data, then of data to interpretations translated into codes and categories. The aim is to discover categories in the data and, ultimately, to identify one core category, culminating in a story line or theory. Given its emphasis on contextual embeddedness, the approach does not aim for grand theory, but for middle range theories explaining social and social-psychological processes that arise from the interactions between people, their contexts and interpretations of self and meaning (Locke 2001). The assumption underlying grounded theory is that, providing that understanding is grounded, it will resonate with anyone sharing the culture and context under study. Claims to generalization are based on this assumption rather than on logic of sampling theory.

Thematic analysis is based on the same practice of identifying and applying codes to interpret textual and interview data, yet it does not imply the same theoretical elaboration as grounded theory. It seeks only to identify themes or patterns across a data set. It allows for theoretical approaches that are realist, constructivist, or contextualist. It is also open to either inductive or theory-guided analysis and it can be used to explore both semantic themes explicit in the data or latent themes associated with underlying ideas, assumptions, conceptualizations or ideologies. The

theoretical approach remains open, but must be specified by the researcher.

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**How could a grounded research approach be useful to KLSC?**

The grounded research approach can be useful to KLSC research as the importance of contextualization in the relationship between knowledge, learning and societal change is increasingly recognized. Questions about how knowledge can be made useful, which are highlighted in the ICSU Visioning goals, can be probed through grounded approaches, which emphasize the meanings that guide people's actions. Understanding how knowledge is produced, framed, delivered, and according meaning in particular contexts is critical to transforming scientific data into information, which is effective and appropriate. This is a key to achieving the goal of solution focused research and praxis. The IPBES program, which is currently under development, raises numerous issues which could be explored through grounded research approaches. More so than the issues addressed by the IPCC, the IPBES challenge will be to engage with problems that are deeply embedded in the landscapes and livelihoods of user communities. Thus, it may be useful to probe the heuristics employed by individuals and communities that influence how knowledge produced in the IPBES can link to action.

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Grounded theory research has, however, been critiqued for not taking adequate account of the 'double hermeneutic' or the interpretation of interpretations, and for not taking adequate account of the theoretical / ideological vantage points of the interpreter. Archer (1995) describes the problem of methodological individualism, which captures some of the validity threats to grounded theory research. It does so in the assumption that what is said is taken to be 'true' or an adequate basis for theory development. She argues for ontological differentiation in grounded theory research designs to separate out the 'grounded' theories associated with empirical experiences and 'grounded theories' based on differentiated analysis of causal mechanisms and underlying structures shaping experiences. This is an important caveat for KLSC 'grounded' theory research, if inadequate interpretations of experienced realities are to be avoided.

### 3.5.7 Phenomenological Approaches

Phenomenology is concerned with how humans make sense of experiences and transform those experiences into consciousness, both individually and as shared meaning. Epistemologically, it is rooted in Husserl's (1960, 1967) concern that the basis for understanding the world is not empirical science, but instead the 'life world' or lived experience of individuals. The analytical approach aims to describe, rather than explain, how phenomena are perceived by actors in a situation. It seeks to create distance from structural and normative explanations in order to bring to the fore experiences and perceptions of individuals from their own perspectives. Factors and their effects in individual cases are extended to wider populations only tentatively, and where explanations are offered, emphasis is placed on making clear how interpretations and meanings have been placed on findings.

Methodologically, the approach involves careful and thorough capturing and describing of how people experience some phenomenon - how they perceive it, describe it, feel about it, judge it, remember it, make sense of it, and talk about it with others (Patton 2002). The foundational question that is asked is what is the meaning, structure and essence of the lived experience of this phenomenon for this person or group of people? Openness is critical to phenomenological research. Exchanges may be entirely open-ended, with few direct questions asked, as the aim is to capture rich descriptions of phenomena and their settings (Kensit 2000). Specific methods include in-depth interviews, conversations, participant observation, focus meetings and analysis of personal texts. Findings may be arranged by themes, or meaning units, with a strong emphasis placed on ethical issues associated with representing the views of participants.

A key concern in phenomenological research is whether researcher subjectivity should be set aside or placed in the foreground. Most phenomenological approaches embrace the concept of bracketing – the researcher first becomes aware of biases and assumptions in order to render them non-influential. In Moustakas' (1994) approach, after bracketing, the researcher engages in a process of imaginative variation in which she/he intentionally alters various aspects of the participants experience to free interpretations of pre-conceptions and identifying the most enduring themes. Hermeneutic phenomenologists, on the other hand, see biases and assumptions as essential to the interpretive process. In Smith et al.'s (1995, 1999) interpretive phenomenological analysis (IPA), for example, the researcher prioritizes understanding people's everyday experience of reality in great detail, while giving thought to her/his own experience and explicitly claiming ways in which their position or experience relate to the issues being researched (Halling et al 2006).

By exploring the experiences of individuals, phenomenological approaches can reveal new and important insights related to the pursuit of sustainability and the linkages between knowledge, learning and action.

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**Phenomenological approaches can help capture emotional aspects of learning**

For example, affective and motivational aspects are an integral part of some learning theories, yet most scientific methods do not capture these dynamics. A key link between knowledge and action is the affective response of individuals and groups, as evidenced by the shift in the level and intensity of concern about climate change that occurred with the release of the Stern Review and the IPCC's Fourth Assessment Report in some parts of the world. Personal experiences and emotions were also a central factor in subsequent debates and controversies regarding the IPCC process, and understanding these dynamics is critical for establishing validity and legitimacy for knowledge claims.

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Phenomenological approaches can help reveal what processes generate broadly valid or accepted knowledge in particular social contexts and what modes of communication of knowledge about climate change and biodiversity loss are required by individuals, groups, and societies to enable changes in understanding and practice.

Phenomenological methods have been critiqued for narcissism and nihilism, since the process of bracketing objectivity leaves for analysis only the possibility of that which is constructed within consciousness. This assumes that there is nothing independent of the self to which one could possibly appeal as a criterion for judging the merit of a phenomenological depiction (Alexander, 2007). As KLSC research is interested in societal change, phenomenological research designs would need to be complemented or extended to include societal referents.

### 3.5.8    Ethnography

The primary method of anthropology, ethnography, seeks to understand cultures.  While there are many perspectives on this topic, central concerns of ethnography include understanding how communities structure themselves to carry out practices and maintain identity, how they continually reconfigure themselves, and the process through which newcomers become knowledgeably skillful with respect to practices which prompt them to become core members. Originally concerned with distant or unfamiliar cultures, ethnography is increasingly applied to contemporary society and social problems, to multi-cultural settings, and to organizational environments, as it is increasingly recognized that the sociality of systems and organizations is often central to their effectiveness. Ethnography aims to make visible this social setting.

The particular methods of ethnography focus on producing detailed descriptions of the 'workaday' activities of social actors within specific contexts. A high premium is placed on the researcher's direct involvement in the setting, and participant observation for prolonged periods, sometimes lasting for several years, is common. Researchers tend to use methods of participant observation and intensive fieldwork. Field methods include extensive observations, semi-structured and informal interviews, document analysis, participant observation in group meetings, and open ended field notes on actions/activities. New approaches raise the possibility of studying cultures through distributed electronic environments (Ruhleder 2000), though Star (1999) argues that there are inherent scale limits in ethnography. Like other methods described in this section, ethnography has embraced concerns about the politics of research and the relationship between researchers and subjects, and autoethnography has emerged as a way of exploring researchers' own cultures and their role in research. Reflexive ethnography enrolls the researcher in examining his or her own 'gaze' in the social context of the ethnographic enterprise (Boswell, 2006); and is essential for more critical forms of ethnographic research which are needed to counter allegations of 'power-laden observations of 'the Other'', which plague earlier forms of ethnographic research (Smith, 2005).

In focusing on culture and culture change, reflexive and more critical forms of ethnographic research can provide insights that may help to facilitate the societal change that lies at the heart of the KLSC program.

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**Ethnography and communities of practice**

Ethnographic approaches have been central to developing communities of practice theory (Lave and Wenger 1991). In this approach, learning observations can involve, for instance, studying how learners move from being legitimate peripheral participants to core participants of a community of practice; and how the community of practice functions on a day-to-day basis. Observations could include those learning interactions and activities that are meaningful to the community and that move the learner toward becoming more central to the community of practice. Ethnographic research can therefore help to identify how the knowledge and skills to function in the community are acquired through a complex array of learning interactions; and how these may become enculturated.

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As sustainable solutions are pursued, the relationships between knowledge and learning will unfold in new cultural and social fabrics and will require new enculturation on the part of decision makers and resource users. Ethnographic approaches can be used to explore the types of practices and knowledge institutions that are necessary for this societal change. Wenger et. al (2002) describe a process of 'cultivating' communities of practice; which may be usefully studied by KLSC researchers interested in (new and emerging) communities of practice that can be supported to foster and enable change processes to take root in society.

### 3.5.9    Critical, participatory and emancipatory methodologies

There are a range of methodologies that can be categorized under the banner of 'critical, participatory and emancipatory including Participatory Rural Appraisals (PRA), Participatory Action Research (PAR), and PLA (Participatory Learning and Action). There are many variations of these research approaches which include processes such as three dimensional participatory mapping (Chambers, 2006). These methods are most often used in development contexts where views of communities are sought on key issues relevant to local decision making. Paolo Freire (1972) is famous for identifying the significance of methodologies that are emancipatory, i.e. that allow individuals and communities to become more conscious of, and able to critically review and evaluate knowledge, learning conditions and other structural conditions which affect their learning, actions and capabilities.

Habermas (1984, 1987) has worked on the notion of 'communicative action' for many years, in which he proposes dialogical strategies to enable reaching a consensus without exclusion. However, critical theorists argue that such participatory processes are more complex than they seem, as it is paradoxical to assume that empowerment or emancipation is simply a matter of 'communicative action'. Mouffe (2000), for example, argues that the political, or dimensions of antagonism in human relations need to be constantly recognised and that "every consensus results as a temporary result of a provisional hegemony, as a stabilization of power, and that it always entails some exclusion".

These types of approaches to research are also well captured by theorists interested in
- deliberative democracy which involve ongoing processes of deliberation in and through research and action (Benhabib 2002); and

- post-colonial studies where, it is argued, opportunities and methodologies should be devised that 'allow the subaltern to speak' (Spivak 1998); or to take seriously what is needed to give voice to people.

They allow for 'hybrid' and disruptive forms of agency to emerge (Bhaba, 1994). Smith (2004), for example argues for a decolonization of methodology and suggests that more attention needs to be given to 'insider perspectives' in participatory research, and that new *genre's* of participatory research are needed to allow for broader representations of diverse ways of knowing.  Narrative forms of research are often used to represent peoples' voices in more authentic ways (Andrewset al., 2008); and arts-based enquiry methods are also increasingly being used in and as participatory research methods.

Discourse analysis (described above) is another form of critical emancipatory methodology (as discussed above), but it seldom plays out in participatory forms of discourse analysis and normally leaves the researcher as 'text reader' on behalf of others. More recent forms of critical emancipatory methodologies are those practiced by critical realists who seek to provide 'explanatory critiques' which empower actors to decide on how to absent those features that constrain their agency or freedoms (Bhaskar, 1998). Bhaskar describes this process as the 'dialectic pulse of freedom'.

Many participatory methodologies have, however, been critiqued for
- relying too heavily on a 'philosophy of consciousness' (i.e. the consciousness of the individual);

- failing to fully engage communities or individuals in conceptualizing and implementing realistic alternative practices.

- the assumed 'neutrality' of those researchers who take up roles of empowerment in and through research processes.

These approaches present important possibilities for KLSC research, but need to be used critically and accompanied by research orientations that build and support capabilities for alternative practices to emerge. An interesting 'frontier' of critical, participatory and emancipatory research orientations, for KLSC research, is a contemporary interest in absenting absences (or constraints to agency); and enabling alternative or disruptive forms of agency (Bhaba 1994; Nealon 2008; Bhaskar 1998); as these provide interesting vehicles for understanding unconventional forms of societal change.

### 3.5.10 Putting it all together in integrative KLSC research designs

From the above overview of potentially useful research methodologies for KLSC research it is obvious that no one methodology will be adequate to develop a full understanding of the KLSC relationships and interplay. Longitudinal survey research can be usefully combined with participatory and emancipatory methodologies, scenario research can inform interactions within the ongoing participatory approaches, and discourse analysis can be used to analyze the outcomes of the KLSC processes (by way of example). This combination of methods is likely to provide a fuller picture of KLSC processes if conceptualized within the broader action research process framework. If implemented within a case study approach this 'mixed method' approach can provide rich data and insight into the scope and complexity of the KLSC relation. Various possibilities for using diverse approaches to KLSC research therefore exist and as such it would be important to monitor methodological innovation and rigor in KLSC research within a broader transdisciplinary, action oriented framework.

**Table 3.2    Summary of the key features of the methodological options**

| | Key features |
|---|---|
| Systems Methodologies | - structures and assesses complex and ill-defined human activity systems;<br>- integrates differing and conflicting social characteristics, perceptions and world-views;<br>- understands social dynamics as dialogue and negotiation of subjective positions |
| Social Network Analysis | - analyzes relations among actors based on flows of information and knowledge;<br>- understands social structures as emergent phenomena defined by diffusion, homogeneity, embeddedness, solidarity, and social positions;<br>- reveals social patterns of practice and change, opportunities and constraints |
| Discourse Analysis | - analyzes structured ways of speaking, thinking, interpreting, and representing things<br>- decodes the hidden assumptions and meanings;<br>- understands how discourses are constructed and mobilized, their function, power and effects |
| Scenario Planning Methods | - creates ensembles of possible futures for entities<br>- maps the effects of actions in differing futures<br>- provides a framework for integrating decision makers and knowledge users and facilitate 'anticipatory learning' |
| Longitudinal and Cross-sectional Analysis | - collects data on phenomena that cannot be observed directly<br>- determines prevalence of or correlation with phenomena across time and populations<br>- identifies associations relevant for further study |
| Grounded Theory and Thematic Analysis | - captures the meanings given objects, words, or gestures by individuals or groups in a specific context<br>- understands social action as a process based on collective generation of 'guiding' theories<br>- explains 'middle-range' social, social-psychological processes |
| Phenomenological Approaches | - describes transformation of human experiences into consciousness<br>- highlights individual and collective processes of sense-making<br>- provides insights into perception, interpretation, emotional content, judgments and sharing of experienced phenomena |
| Ethnography | - describes self-organization and continuous reconfiguration of communities;<br>- focuses on processes building and maintaining culture and identity, and defining membership;<br>- offers insights into tacit aspects of social and organizational settings including those of the scientific community itself |
| Critical, participatory and emancipatory methodologies | - involves actors in the assessment and evaluation of conditions which affect their learning, actions and capabilities<br>- integrates decision making processes with emancipated reflection on the process itself<br>- offers insights into aspects of agency |

## 3.6    Validation and Rigor

A distinctive element of the project is that it diverges from the usual operation of scientific projects, in that it is not necessarily starting from research and then looking for ways to implement the research results. The core of the project is to connect the various actors in designing ways to better connect various sources of knowledge for societal change in and through action oriented research. In this sense the project itself becomes a learning device about sustainability to bring about social change.

The normative and practice-based dimensions of KLSC projects raise questions related to sources, legitimacy, validity, accuracy and certainty, which are different from usual scientific projects (Susman and Evered 1978, Oquist 1978). An essential point is that full certainty and complete knowledge in matters pertaining to sustainability, as in other fields of science, is currently not available, nor is it likely to be available in the near future. A degree of uncertainty arises fundamentally from the nature of science as a process of forming and refining conceptual and operational models of the natural and designed universe. These models are part of an open, continually evolving understanding, not a fixed and closed body of knowledge (Tabara 2005, Tabara and Chabay 2011). Furthermore, action research concerns itself with processes of development and change and, therefore, is not amenable to the demand for certainty (Somekh 1995), but rather seeks validity in concepts of *catalytic validity* (i.e., whether the research led to change or not) and via reflexivity (Lather, 1986). The design of the methodological framework, then, is challenged by the lack of a closed theoretical foundation, the characteristics of the context and the actors, and by the interdisciplinary, interventionist nature of the problem.

Given these challenges, the literature on action research suggests an evolutionary construction process, i.e. a course of incremental-iterative prototyping. These so-called spiral models forgo clearly defined intermediate results, but allow for recurring phases of definition, design and validation. Starting with an initial configuration of goals, alternatives and context derived from the exploration, a prototype is designed and validated. Based on results or problems, the goals can be adjusted, and new theories and context variables can be in- or excluded. While the name 'spiral model' is taken from software engineering, the procedure as such is based on commonly used feedback theory and among others used in educational research. The advantage of using feedback techniques is that it solves the question of what comes first, the research or the hypothesis: Since the investigation is seen as a loop process, research can commence at any point to deepen understanding. The theoretical foundation presented in Chapter 2; and through situational analysis or 'baseline studies' recommended as part of the KLSC research process (see section 3.1.3 above) will be successively extended based on problems or gaps occurring in each cycle.

The 'action' portion of the projects also requires an expanded conceptualization of rigor, one that recognizes the engagement of the researcher in the production of the research. The goal is to improve subjects' capacity to solve problems and improve functioning of organizations and institutions, in short to create 'learning organizations' (Boog 2003) that can effectively address and respond to sustainability concerns. Validity, in this context, is derived from the pragmatic results and catalytic impacts (Lather, 1986). Ideas and practices should be judged in terms of their usefulness, workability, practicality, credibility, transferability, dependability and confirmability (Reason 2003, Lincoln and Guba 1985), and in the context of KLSC, on their innovation capabilities to seed and support societal change towards sustainability. This, as argued in Chapter 2, is not a simple process and requires ongoing research reflexivity (Lather 1986; Bourdieu 1994).

Bourdieu (2004) qualifies research reflexivity and notes relevance is not in terms of individual researcher reflexivity, but rather in terms of field-based reflexivity, i.e. in terms of the relevance and value of the research in relation to a wider societal context. Such reflexivity involves both an

evidence based iterative process in that the assessment is used to improve the process, products, and outcomes in successive stages and reflexive speculation and review. Here the perspective of Somekh (2007) is also pertinent, which may assist KLSC research to avoid the 'impetus to conformity', rather than embracing what she calls 'transgressive speculation' as validity criteria. Embracing transgressive speculation as validity criteria will encourage KLSC researchers to seek out rigor and validity through the manner in which their research 'intensifies thought' and 'multiplier capabilities' for the intervention of political and social change actions. Somekh (2007), drawing inspiration from Foucault, proposes that this requires a combination of 'anarchic creativity' with 'practical utility'. This will be necessary to give true meaning to the notion of 'methodological innovation' which the KLSC project seeks to embrace.

A further level of rigour will be required at a philosophical level, as Carr (2007) explains that action research is actually a 'contemporary rehabilitation of practical philosophy' which, after Gadamer, recognizes that 'there is not unconditional antithesis between tradition and reason (Gadamer, 1975: 250). This view recognizes that reason can only be sustained from within a tradition and that a tradition can only be sustained through the active use of reason. As such, traditions need to be affirmed, embraced and cultivated as an act of preservation. Mechanisms are required to escape this paradox, and there is a core challenge of needing to ask questions about action research methodology that are not available from within the confines of action research's own methodological debate. Philosophical, theoretical, reflective and reflexive research is required to challenge the historically rooted 'prejudices' of action research methodology in terms of practice, and how practical knowledge is to be developed for societal change to emerge (in ways that do not simply preserve the status quo). Carr (2007) argues for 'historical depth' in the philosophical understanding of action research and its emergence within modernity; if researchers are to critically engage with action research's embedded paradoxes, and thus to develop a more rigorous form of action research which has power and potential to address complex issues such as those being addressed in the KLSC research program.

## 3.7    Outcomes and Contributions to the Grand Challenges

As the KLSC program builds a community involved in studying and catalyzing societal change for sustainability, what will be the products or deliverables? The KLSC projects should produce useful new knowledge, collect and make use of the wealth of existing insights, and bring these to bear in its core themes of climate change, biodiversity, and resource allocation. KLSC should produce and provide to policy makers, scientists, and the public(s) guiding principles and concrete examples of good practice and new (creative) insights for strengthening adaptive capacity in the core themes to facilitate a re-imagining of society. Of course, given the complexity of the challenges and the wide range of often undetermined local conditions, the guiding principles will vary significantly depending on the specific issue involved and the cultural context. By the same token, the form and delivery mechanism of the guidelines and examples will have to be appropriately tuned to the particular culture, conditions, and concerns of the recipients.

At the core of the KLSC outcomes will be the interest in addressing or responding to the ICSU Visioning with tangible contributions that address the ICSU challenge framed as: "How can improved scientific knowledge of the risks of global change and options for response most effectively catalyze and support appropriate actions..." This is central to the concept of KLSC. It will also focus KLSC on delivering outcomes that address the following three Belmont Challenges (http://www.icsu.org/2_resourcecentre/Resource.php4?rub=8&id=400):

- "Develop and deliver the knowledge required to address pressing global to local environmental and societal issues." KLSC takes the view that delivery is generally insufficient without real participation by stakeholders and that is the basis for the engagement with stakeholders planned for KLSC. It also motivates KLSC research into the relationship

between participation and agency by stakeholders, particularly those involved in governance, as is intended through research question category 1 of the KLSC science plan.

- "Identify the objectives and means for effective translation and communication of scientific knowledge for targeted sectors and regions in order to realize the intended benefits from the application of such knowledge." One focus of KLSC is on the process of co-production of knowledge and the relationship between that process and the understanding and use of that knowledge in behavioral and societal change; as is intended through research question category 2 of the KLSC science plan

- "Nurture the next generation of experts." Nurture not only the single next generation, but lay the fundamental groundwork for problem based, trans-disciplinary learning for successive generations and all members of society, including experts. KLSC can contribute substantially to the process of learning for change by applying the emerging knowledge of KLSC and others to lifelong learning starting in preschool and continuing through all educational levels and beyond (EPSD 2010); as is intended through research question category 3 of the KLSC science plan.

# 4 Implementation Strategy

## 4.1 Activities

Overall, the implementation plan for KLSC consists of the following elements:

1. Obtain adequate long-term funding and establish an international project office (IPO) as the administrative center for the network of researchers, practitioners, and projects that will make up KLSC.

2. Recruit and inspire a broadly-based and extensive community of practice involving researchers, practitioners, and stakeholders,

3. Conduct academic research to illuminate the fundamental scientific issues of KLSC and relate it to existing conceptual frameworks in a wide range of intellectual domains,

4. Develop and conduct action research experiments, design experiments, and science-policy-public events on KLSC issues with individuals and groups in academia, local communities, corporations, the polity, artists, and civil society,

5. As research projects are formed and develop in regions, establish up to five regional offices to provide coordination with the IPO and to host regional workshops and conferences and coordinate capacity building efforts in the region.

6. Maintain an on-going process of scanning other research projects, policies, and conferences that relate to KLSC objectives, particularly in relation to the Grand Challenges in global sustainability research,

7. Within each KLSC project and activity, review the various forms of outcomes to ensure excellence in representation, accessibility, and usability for action and societal change,

8. Synthesize the results of the analyses and assessments and communicate them to KLSC project partners, the IHDP community, the wider scientific and policy communities, as well as using them to guide further development of KLSC projects and practices,

9. Produce and make available via a variety of appropriate channels (e.g., books, journal articles, websites, social media, conferences, social media) various forms of output strategies, products, and methods designed to influence thinking, attitudes, and practices to catalyze change toward sustainability, and

10. Monitor and assess the outcomes and impact of KLSC research and actions on a regular basis and use the information to improve the conduct and output of KLSC, including through substantive dialogue with the KLSC scientific steering committee.

### 4.1.1 Capacity building for KLSC research

The scientific planning committee proposes that in order to conduct this project successfully and in accord with the objectives of the ICSU Grand Challenges and the IHDP Strategic Plan 2007-2015, the purpose and scope of this activity requires the inclusion of the perspectives, knowledge, and participation of a global distributed set of local actors, practitioners, and stakeholders. Therefore, the project can best be developed from the perspective of community building: building a diverse community of research, learning, and practice intent on co-creating knowledge in order to better learn how to address the issue of mitigating and adapting to global environmental change.

In addition to contributing to the IHDP capacity building workshops, KLSC will also provide on-going mentoring and collaboration, primarily in situ and in regional efforts, with young and established researchers, research centers and institutions that support research in developing countries who are interested in working on projects within the KLSC umbrella. The KLSC project at the international and regional level will seek to raise funds for small seed grants to support the preparation of internationally competitive research proposals aligned with the KLSC framework by researchers in developing. It will also seek to facilitate cross regional research links and partnerships to reduce research inequalities and develop cross border and cross regional knowledge of KLSC issues. It will also adopt an approach that builds on existing strengths for KLSC research in various regional contexts.

### 4.1.2    Global and regional workshop and forum series

Workshops are envisioned as critical for development of the KLSC project. First and foremost, a set of workshops will be held to structure KLSC research and develop pilot and flagship research projects addressing the core research questions through the KLSC influence and interplay lens.

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**The KLSC Grindelwald workshop**

An initial international brainstorming workshop was held in April 2011 in Grindelwald, Switzerland to further develop the initial set of research questions and methods within the KLSC framework and equally importantly, to begin the process of developing a research, practitioner, and stakeholder community around KLSC issues. Over a period of three days in April 2011, a group of 32 people from diverse disciplines (including sociology, anthropology, psychology, journalism, neuroscience, education, physics, chemistry, scientific research network and funding agencies, economics, dance) and geographic regions (several EU countries, USA, Kenya, South Africa, Barbados, Japan, Egypt) worked together very effectively and forged the nucleus of the KLSC project in an exciting process.



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Engaging a wider community through a variety of traditional methods and evolving digital media is an essential part of the project. In addition to face-to-face workshops, KLSC will test and employ forms of virtual fora in which issues can be explored and discussed synchronously or asynchronously among sub-groups or all interested stakeholders.

Subsequent to the initial workshop in April 2011, a series of two to three workshops per year will be held. The workshops will focus on particular research targets and themes within the KLSC science

plan. For example, one workshop might be on research methodologies and processes associated with KLSC research. Workshops will be conducted with short presentations by a few researchers, practitioners, and stakeholders to set the frame for intensive discussion on concepts, methods, language, results, interpretation, and engagement of a wider community with the outcomes.

Some of the workshops will have a regional focus and be hosted in regional centers to broaden inclusivity of the KLSC project. These will address the issues, research, and actions of regional practitioners, policy makers, industry, and researchers.

KLSC should plan to take advantage of major international global change meetings at which the project can present its on-going work and attract new members to the community of practice and open new leads for funding. One such event is already on the near horizon in March, 2012, when the conference on "Planet Under Pressure: New knowledge towards solutions" will be held in London, UK. During the conference, there will be opportunities for short presentations by researchers and practitioners who want to engage with KLSC and meeting points to open new avenues for collaboration under the KLSC banner. A session will also be convened by Ilan Chabay, Bert de Vries, and Marco Janssen on a proposed KLSC educational project entitled, "learning our way toward sustainability by modeling nature and society."

Further workshop series can be envisioned to support the objectives of integrative and cross-cutting research. As global change research in general moves towards increased policy-relevance, actionable issues to which KLSC can contribute, such as multi-level stakeholder governance of fisheries or understanding local stakeholder mental models of and attitudes toward low probability, high risk conditions and attitude. KLSC is intended to provide a critical cross-cutting research perspective, since issues at the interface between the projects' knowledge production process and political and social actions form the core concern of the KLSC research agenda.

### 4.1.3   The KLSC Database and Wiki

As outlined in chapter 2, a bewildering variety of terms is commonly used discussing concepts and approaches around knowledge, learning and behavior, as well as on sustainability. Definitions may describe synonymous, independent, overlapping or even contradictory features. It will be important to include and where possible identify cultural, disciplinary, and political distinctions in terminology and usage.

The KLSC wiki will be a web-based database that is meant to facilitate effective communication among researchers, practitioners, and policy makers by capturing and connecting relevant information in all its variety and making evolving knowledge more accessible and useful.

In this regard it will be crucial to include sources in addition to the formal scientific literature. It is essential for the diverse community of practice and research characteristic of KLSC that "grey literature" and informal materials produced by practitioners are integrated into the wiki with appropriate attributions.

Explanations of what is meant by terms like learning, knowledge, or sustainability is crucial to link goals and policy intentions to practical procedure. Failure to define, reflect, and explain terms may lead to negligence of whole domains and existing research connected to them. It may prevent the incorporation of valid scientific findings to enhance initiatives, even in quite fundamental areas. In part this reflects a general problem of applied social sciences and policy making. Political debate focuses on the identification of problems in a specific context, while research focuses on in-depth understanding of a specific problem.

It can be hard to reconcile academia and practice in general not because of the guiding questions, but because of the difference in the thinking guiding the work: Academics work in what is called the

'belief mode', testing knowledge and logic of reasoning, and reacting to new ideas by collecting arguments supporting or rejecting it. Professionals work in a 'design mode', testing utility, situational fit, or growth potentials, and reacting to new ideas by searching for applications or improvements. (Reinmann 2005). The value of findings for general application is hard to judge without knowledge in what 'mode' it was written.

Addressing these discrepancies and developing a common working base through the KLSC wiki will help the diverse communities of research and practice associated with KLSC, as well as providing a basis for communication more widely.

The wiki and associated web resources will serve to cross reference and connect with the activities, research, funding status and prospects, and members of the KLSC community.

## 4.2    Deliverables

Highly regarded academic journals and books will be an important distribution mechanism for the knowledge and insights gained by KLSC. These traditional formats will be complemented by an expanding use of other media, such as blogs, the KLSC wiki, communications media, interactive games, educational materials for multiple levels of formal and informal learning, summaries of successful practices and cautionary tales, and white papers.

The project will use the new social media, which is increasing important and which for many people has become a primary means of knowledge transfer and learning. The widespread use of cell phones, and the rapid development of games and specialized information sources in them, offers new and powerful forms of communication. Because these are interactive media, they offer a direct mechanism for increased engagement and participation, rather than relying on traditional forms of dissemination. At the same time, the feedback inherent in these interactive media can provide a valuable research tool to understand the role of the medium itself in connecting knowledge, learning, and change.

At the same time, this technological avenue may not reach many individuals and communities that do not have readily available or adequate internet access. Some communities that are otherwise quite isolated, now have cell phone connections. The cell phone has already led to new communication and action initiatives. KLSC will consider new approaches to engaging with individual researchers and practitioners and community groups through cell phone or other appropriate technologies as they develop.

An important vehicle for helping KLSC reach different communities with the evolving insights and strategies for action is through art in all its many forms. The narratives mentioned earlier are 1) input as expressions of visions, 2) important research arenas, and 3) forms of output and ways of communicating the ideas developed by KLSC projects. By engaging with artists working in different media and cultures, the community of practice and research that is KLSC is richer in itself and more able to communicative meaningfully with other communities.

Multiple approaches for research and outreach to share the insights and expand the value gained from this project will be used. KLSC will distribute through multiple avenues and share its findings, the outcome of its work is also a means to enabling further learning, rather than just knowledge transfer. The project will seek to use media technologies to enable the findings and outcomes to be contextualized and used in context.

The core of the project is generating a new community of learning and practice. Therefore outreach activities are at the heart of the project. It is clearly essential that the community generated by the project becomes an effective forum in which social and natural sciences, humanities, and artistic expression meet and connect for collaboration on research and actions. The KLSC project then will serve as a platform on which the evolving research and practice can foster learning among diverse

stakeholders on how to better design transdisciplinary research and change processes for sustainable development.

## 4.3    Program Offices and organization

### 4.3.1    International Project Office and Regional Offices

KLSC plans to have both a central international project office (IPO) and up to five regional offices. The IPO will be the central hub, which will

1)    organize operations for the project as a whole, including meetings of the Scientific Steering Committee (SSC) and advisory groups,

2)    provide the necessary infrastructure, including maintaining web services, coordinating publications, and maintaining budgetary and meeting records,

3)    facilitate communication among the KLSC network and with the other IHDP and Global Change programs.

A scientific officer located in the IPO will be responsible to the SSC and, with an operations officer, will coordinate scientific and SSC meetings, will seek funding in collaboration with SSC members and the IHDP Scientific Committee, write proposals, and maintain a website and use various media to communicate with other projects within IHDP and the global change research and action communities.

The IPO will be established soon after formal approval by the IHDP Scientific Committee and official launch of the project. The location and funding for long-term operation of the office are currently being discussed with interested institutions.

In addition to the IPO, regional offices will be established over time. Several potential collaborating institutions in Europe, Asia, Africa, and Latin America have expressed interest in hosting a regional office. These regional offices will serve several key roles in organizing capacity-building workshops and mentoring, regional workshops on research and action, building a regional coherence among the KLSC community of practice, and supporting the IPO and SSC in seeking funding from regional resources. Opportunities for regional assessments and regional projects will be explored, both as stand-alone activities and in the form of regional foci within global KLSC research questions. Collaboration with regional offices in designing the KLSC Wiki and KLSC products to serve regional needs will be sought to increase the overall value and impact of KLSC deliverables.

### 4.3.2    Affiliated institutions and communities of practice

The general methodological principles and concerns discussed in Chapter 3 will be further developed as specific projects develop or are integrated within KLSC. There are multiple possibilities. The initial process will be to recruit, instigate, or pull together researchers to initiate new projects aimed at enhancing adaptive capacity and sustainability in any of the three research foci: climate change, biodiversity and resource management. KLSC also anticipates working with other core IHDP projects and global change partner projects in both analyzing certain data as case studies from the KLSC perspective and using insights from KLSC research to enhance learning and effectiveness within those projects. In addition, KLSC can serve as a core intellectual and programmatic center to which numerous action research projects are affiliated.

As a project in which interaction between scientists and other actors is essential, KLSC should have a steering committee which reflects the varied backgrounds of participants and which is charged with setting the short-, medium- and long-term strategic objectives of the project. Steering committee members must have a strong academic record in any of the wide range of relevant areas of interest or must have substantial experience in project methodology, implementation, or policy actions. The

committee must also have gender and geographic balance. It would be very desirable to also include exceptionally qualified early stage researchers or practitioners in the committee. A critical factor in selecting members to the development of KLSC is their commitment to an open and thoughtful dialogue among themselves in committee and with the KLSC chair(s), staff, and project participants.

While specific approaches for guiding sustainability transitions will be developed within the projects, general approaches are increasingly available and may be considered and drawn upon by the SSC and KLSC chair(s). The transitions management literature, for example, emphasizes the collective establishment of a shared vision, identification of specific goals, development of transition pathways and the setting of interim objectives (Meadowcroft 2007).

The existing project portfolio of the Global Change Programs provides a rich source of experience and best-practices for scientific collaboration. For example, the Global Land Project (GLP) and the Earth System Governance Project (ESG) have pioneered systems of regional research nodes, and affiliated institutions and researchers. The Population-Environment Research Network (PERN) has successfully established virtual research communities. The KLSC project will seek to explore and adopt such effective practices and adapt them as required to address issues and gaps identified in the existing models by the ICSU Visioning process.

KLSC will furthermore seek to establish modes of interaction with established communities of practice and established research networks. The three focus topics (climate change, biodiversity and resource equity) and each of the three 'cornerstones' of the KLSC interplay concept (knowledge production, learning, and societal change) are all addressed, though generally as separate issues, by specialized research groups and communities of practice. Using the insights of such groups to full effect for KLSC research, but also identifying critical issues closely related to KLSC in relevant specialized research, poses both challenge and rich opportunities.

## 4.4    Milestones

An initial set of milestones for KLSC from 2011 forward are listed below:

March 2011: external review of the first version draft science plan

April 2011: first KLSC international workshop on the science plan and development of initial projects held in Switzerland

August, 2011: Science plan revised in accord with the external reviewers' comments and the extensive input from the April workshop in Switzerland.

September 2011: Science plan version 2 submitted to IHDP Scientific Committee for review and approval.

October 2011: presentation of the KLSC science plan at the annual IHDP Scientific Committee meeting (Nanjing, China) with the request for approval of the plan and nominated SSC members.

October 2011-August 2012: secure at least five years of adequate funding for the International Project Office (IPO). Set up the IPO and hire a scientific officer and staff for the office.

January-February 2012: hold first SSC meeting to discuss initial target research activities and implementation strategy, as well as to prepare materials on KLSC for Planet Under Pressure 2012 and Rio + 20 conferences. Launch initial flagship project under KLSC.

January-December 2012: build up affiliated network and community of researchers, practitioners, and institutions.

March 2012: introduce KLSC through papers in the Planet Under Pressure conference, raise the visibility of KLSC, and build bridges to collaborations.

April-August 2012: hold a workshop in conjunction with a global challenge related conference to organize researchers and practitioners into collaborating groups to seek funding and launch projects under the KLSC framework.

September 2012: initial publications on KLSC research topics submitted for publication in reviewed journals

September or October 2012: report to IHDP Scientific Committee at its annual meeting on the current status and immediate future activities of KLSC

2012-2015: establishment of two regional offices. Each regional office will secure funding for and host at least one regional research and action conference and one regional capacity development event per year.

2016-17: mid-term KLSC synthesis and assessment conference

2017: planning workshop for second phase of KLSC research and action

2020-21: final synthesis conference

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# Appendix: case studies

**CASE STUDY 1: Researching KLSC: Perspectives from a research programme focusing on biodiversity and natural resources social learning in southern Africa**

**Contributed by Heila Lotz-Sisitka**

This is the research programme of the Environmental Learning Research Centre housed at Rhodes University, South Africa. It includes studies on social learning and change (KLSC) from countries across the African continent.

*The need for learning and societal change for sustainable futures in a southern African context*

There is little doubt that there is a need for enhanced learning and societal change for sustainable futures in a southern African context. The region has been described by the United Nations Development Programme as one of the poorest regions in the world; with the lowest human development index – a pattern which has remained largely consistent over 20 years (UNDP, 2010); it has also been described by the United Nations Environment Programme as one of the areas most vulnerable to climate change. People in the region are comparatively poorer today than they were in the 1970's due to unsustainable global development patterns; IMF structural adjustment policies and other factors such as poor governance. The region is primarily a water scarce region; and is already feeling the stress of climate variability in the form of droughts and floods which affect human security; well being and food security. The region is also home to three of the world's biodiversity 'hotspots' all of which are under threat from a combination of poor environmental governance; inadequate sustainable development planning capacity; unsustainable patterns of resource access, harvesting and distribution; and climate change. The region also suffers from poor quality education; inadequate access to education and learning; and high levels of adult illiteracy. All of these factors are exacerbated by the HIV/AIDS scourge which is weakening societies at household and community level. The loss of life amongst economically active individuals is impacting on sustainable economic growth; and is placing added pressures on natural resources and their governance and management.

*Environmental governance and societal change*

Environmental governance in southern Africa is a relatively 'new' phenomenon, with less than a 30 year 'official' history. Since 1992 most governments in the region have adopted environmental policies and a diversity of institutions have been established to implement and monitor environmental policies; some are governmental; some parastatal; and others are civil society. Major international NGOs and donor driven initiatives characterise the 'drive' for innovation in environmental governance in the region. Few countries in the southern African region have developed National Sustainable Development Frameworks as was anticipated in the run up to 2002 World Summit on Sustainable Development environment. The context of environmental governance is by-and-large fragmented with various forms of environmental policy being managed in sub-sectors of nation states; making for an extremely complex policy implementation environment. Most policies, supported by donor aid at development level, fail at implementation level, due to inadequate resources and capacity. At sub-regional level, the Southern African Development Community have developed a Regional Indicative Strategic Development Plan (SADC, XXX) that seeks to strengthen regional co-operation and regional integration. This plan includes environmental policy, governance, management and education plans and indicators; few of which are functioning optimally if at all. There are significant 'breakdowns' between policy intentions, effective governance practices and the possibilities for societal change as projected in environmental and other social development policies. These have historical, structural, cultural and material antecedents; all of which influence social learning and actions for change.

*Factors influencing decisions and actions for change*

There are numerous historical, structural, cultural and agentive factors that are influencing decisions and actions for change. Key amongst these is the relatively recent history of independence from colonial and apartheid rule; the availability and type of knowledge resources in educational and societal governance institutions; the histories of learning in different societal institutions; and the condition of the environment itself. Cultural and historical practices also shape how things are done, and how change is viewed; along with values and patterns of practice. Agentive characteristics such as levels of experience or education; and relationships are also significant influencing factors; as is the efficacy of the institutional environment.

### *Researching social learning, adaptation and societal change in this context*

There are rich knowledge resources in the southern African region, which tend to remain largely untapped in learning and societal change processes. This is linked to tendency of modern institutions to favour a narrow range of forms of knowledge (mainly formal scientific knowledge); while marginalising the knowledge systems of the majority of people living in the region. Shava's (2009) study on the appropriation and representation of indigenous knowledge in environmental learning and development settings relates this to the problem of the 'anthropological moment' in which modern knowledge institutions create abstractions and representations that are de-contextualised and which loose relevance and connectivity into societal and cultural historical contexts of practice. He concludes that this influences people's agency for change in social settings; and he argues for renewed attention to the recuperation and representation of indigenous knowledge in social learning processes in the region. Building on these insights, Sabai's (2011) study is showing that abstraction and reification in ways that alienate local knowledges in coastal natural resource management community settings can *impede* social learning.

Considering the relationship between social learning and sustainability practices in rural agricultural and natural resource management contexts, Mukute (2010) and Masara (2011) both reveal how important it is, in expansive change-oriented learning processes, to understand the structural and cultural antecedents that shape and influence the learning situation (i.e. understanding how things come to be the way they are). Masara's (2011) study for examples demonstrates that cultures of natural resource use and management practice have long, established histories. His study shows too that the same practice (in this case beekeeping) - practiced in two different contexts - is *differently constituted through historically constituted cultures of practice, and changing conditions over time.* To generate new learning and societal change; there is a need to engage with the contemporary contradictions that manifest at the interface of traditional and modern sustainability practices (ibid). Mukute (2010) and Masara (2011) both draw attention to the need to focus closely not only on the antededents of new practices; but also how they come to be constituted through agentive decision making and social mobilisation processes. Their work reveals an interesting combination of *individual; collective* and *relational* agency at work in social change processes (which de-centres the individual in the learning process to some extent); most of which are poorly understood from the vantage point of the power-knowledge-context relation.

In furthering this work on how societal change is supported through engagement with knowledge and learning, Belay's (2011) study is showing the significance of being able to translate tacit knowledge and experience into explicit knowledge which is then made available for deliberation and decision making. Using participatory mapping and three dimensional modelling in social learning processes provides some of the tools for enabling communities to develop a 'concept of landscape' that is culturally and historically situated, but which allows for sustainability deliberation and collective decision making for sustainability and enhanced social-ecological system resilience (ibid). Furthering these insights at institutional level is the work of Lupele (2008); Pesanayi (2009); Mukute (2011); Masara (2010) and Lindley (2011) who all point to the 'failure' of modern conservation education and extension learning programmes and institutions to take full account of *the nature of change oriented learning;* or the *contexts of changing* practices. Extension services and formal learning programmes oriented towards conservation; sustainable use of natural resources; and

climate change adaptation practices are not developing in-depth understanding and knowledge of *how to enable and support change oriented learning; develop agency for change; and/or engage with a more complex knowledge context.* At community and institutional level alike, few structures exist to support *change oriented learning.* This research therefore points not only to the need to support better engagement with the knowledge-learning and societal change relationship at grassroots implementation / natural resource management, use and adaptation level; but also to strengthen renewal of thinking within those modern institutions established to facilitate learning and change.



**CONTEXT (Specific)**
*In what specific conditions?:*
resources, organisational
practices, capabilities, situational
languages, ICT…

**ACTION (agency)**
*Who, why and how?:*
Individuals,
organisations, goals,
attitudes, motives

III   II   I

**CHANGE**
*How do things change?:*
frames, boundaries, interests,
strategies, networks, knowledge
production processes, environmental
quality, perceptions, discourses,…

**STRUCTURE (General)**
*What and how structural conditions
have been modified?*
(institutions: policy making processes,
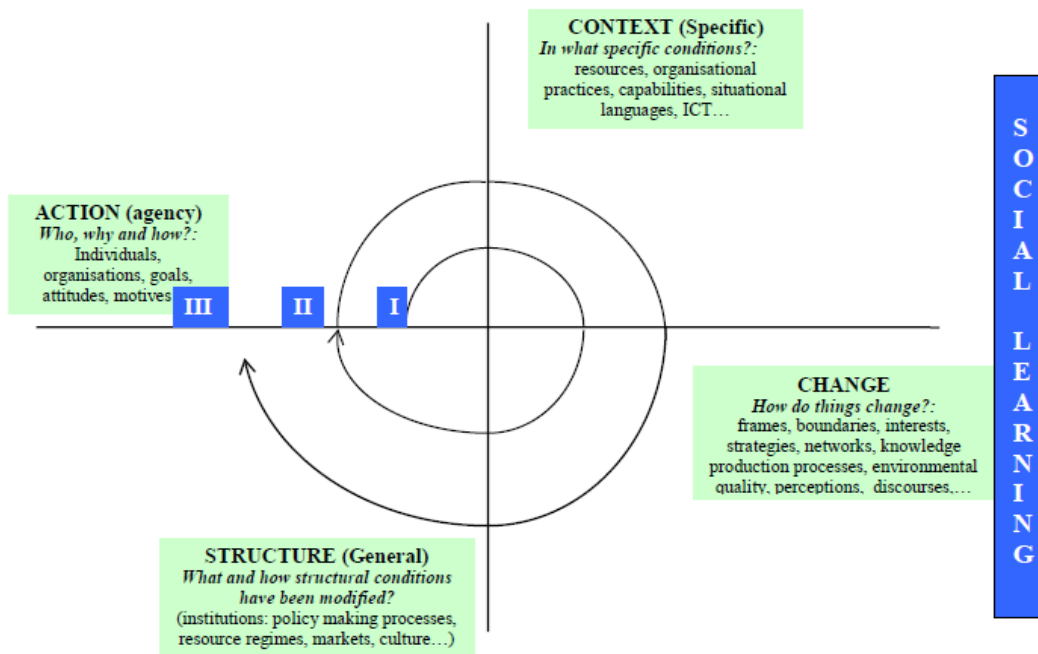resource regimes, markets, culture…)

SOCIAL LEARNING

Figure A.1 Social learning as a sequential structural change induced by social action. This graph portrays the feedback loop between context and participatory process as an iterative cyclic process.  Source: Tabara 2005b

**Conclusion**

The brief case study above, illustrates aspects of the Tabara model – namely how structure; context; agency and change inter-act in the social learning process; but also draws attention to the need for more in-depth engagement with knowledge histories; forms of knowledge; and institutional contexts for enabling engagement with a diversity of knowledge forms in learning processes that are oriented towards societal change and sustainability.  All of the studies referred to above, are showing that sustainability practices are complex; with a complex epistemological fabric that transgresses any one particular knowledge form. Engagement with this aspect of the KLSC relation is therefore important, particularly in contexts where particular forms of knowledge have come to dominate in modern institutions; including the environmental governance and mainstream education, training and extension service institutions.

**REFERENCES:**
Lupele (2007), Lindley (2011), Shava (2008), Pesanayi (2009), Mukute (2010), Masara (2011), Belay (2011)

**CASE STUDY 2   Development assistance and research capacity strengthening: the commissioning of health research in East Africa**

**Contributed by Keith Nurse**

The following is an abstract from a paper by Keith Nurse and Daniel Wright that appeared in the Journal of Eastern African Studies  Volume 5, Issue 2, 2011.  It is particularly relevant to the KLSC research questions about capacity building for adaptation and transformation.

Research capacity strengthening (RCS) is a key strategy to address the problem of health inequity and development. In spite of policy statements on "capacity development" and "North–South partnerships" among commissioning and donor agencies, most RCS initiatives operate on the conventional supply-driven, expatriate-led, short-term project, technical cooperation model which has proved ineffective in building institutional capacity and sustaining research environments. This paper analyzes the political economy of health research commissioning among bilateral, multilateral, non-governmental and philanthropic organizations, using East Africa as a case study. Instead of conventionally focusing on recipient countries and institutions, we look at the policies and practices of donor and commissioning agencies and the relationship they have with key stakeholders like Southern research institutions. While conventional approaches to development assistance predominate, we argue that the literature on RCS over-generalizes and presents it in monolithic terms. In contrast, this study provides a typology of research commissioning practices and identifies several different modes of engagement. The key findings are that the structure of the relationship between donors and recipients, as well as the governance structures of the commissioning agencies, have a critical influence on RCS. The paper concludes with some recommendations for enhancing the role of donors and commissioning agencies.

**CASE STUDY 3: The San Nicolas Project in Colombia – an example of societal change though information, exchange and empowerment of local actors**

**Contributed by Carmenza Robledo**

The UN Framework Convention on Climate Change (UNFCCC) is a global instrument aimed at promoting those changes in human behaviour that enable social and natural systems to mitigate and adapt to human induced changes in the climatic system. The Clean Development Mechanism (CDM) is the instrument within the UNFCCC that allows participation of developing countries in climate change mitigation activities. Easily said, through the CDM industrialized countries with international mitigation obligations can get credits for climate change mitigation activities that take place in developing countries.

A pilot project in Colombia (1999 – 2007) used the CDM as a mechanism for leveraging changes in the way the regional society used their forest. The project was aimed at evolving from a situation where most local social groups were engaged in forest destructive activities with a high GHG emission level (e.g. illegal logging or uncontrolled land use change) towards a sustainable use of the forest resources, including social, environmental and economic benefits.

The region of the San Nicolas' Valleys is located at the North West department of Antioquia in Colombia, South America (see map 1). It covers nine municipalities as follows: Guarne, El Santuario, El Carmen de Viboral, El Retiro, Marinilla, Rionegro, La Unión, La Ceja and San Vicente. This is recognized as a strategic region because it has the main watersheds for two hydropower dams, which generate more that 30% of the total energy-power in Colombia. The region has a size of 72.000 ha. In terms of altitude the lowest part of the project is on 800 while the highest achieves 3.000 mm. 1999 more 12.000 families were living in the rural areas of the 9 municipalities. Even if natural resources, especially forest and water, have a strategic importance for the development of the region, during the last decades of the past century these resources were seriously degraded. During the decade of the 80s and especially the 90s region was deeply affected by the social conflict in Colombia. Confrontations between guerrilla, paramilitary groups and the national army hampered dramatically the interaction between civil society, local authorities and the private sector and any effort for promoting sustainable development.

At the end of the 90s the environmental authority in the region of San Nicolas (CORNARE) was very aware of the increasing need of ensuring sustainable management of natural resources specially forest. As a consequence CORNARE agreed a legal instrument with all the municipalities establishing 40.000 ha for forest conservation and 32.000 ha for multiple forest uses, including plantations. This legal instrument is known as the Agreement 016 from 1998.

As a mean for enforcing the Agreement 016/98 and for promoting sustainable use of forest resources, CORNARE associated with a Swiss research institution (EMPA) and a Swiss development organisation (Intercooperation) in the project "Alternative financing model for sustainable forest management in San Nicolas". A project proposal was presented in 1999 to the International Tropical Timber Organization – ITTO -. Switzerland, Japan and USA agreed to co-finance it.

For the project partners was clear from the beginning that, besides technical matters related to landscape management, the project needed to face the socio economic situation of the local actors. For this reason the Regional Forum was created, a multi-stakeholder space for capacity building, dialogue and decision-making within the project. As part of the Regional Forum more than 170 meetings and workshops with the local community, private sector and municipalities were organized over a period of 4 years.

The Regional Forum was designed around three main phases: information, participation and decision-making. The first phase, information, was aimed at familiarizing all potential actors with the

relation between sustainable forest management and mitigation to climate change; as well as at understanding the existing barriers for a sustainable use of natural resources. Such barriers were not only lack of knowledge, but also lack of institutional agreements, lack of access to markets, lack of long-term investment and matters related to the violent conflict (e.g. lack of trust, migration of key social figures, etc). The mutual learning was used for adapting future activities of the project.

The second phase of the Regional Forum, participation, was aimed at exchanging knowledge and expectations on future land uses according to the institutional agreements (including the Agreement 016) and the needs expressed by the different social groups. During this phase all potential forestry activities were analyzed by experts of the project together with the members of the community. To do so the methodology of social mapping was used.

During this phase, for example, understanding was gained about the need for improving knowledge on management practices for getting and marketing non-timber forest products (medicinal plants, flowers, beauty products) or improving the land tenure conditions of the forest users. On one side the project reacted with the design and implementation of a capacity building program. Research and education institutions present in the region support the implementation of the capacity building program until today. On the other side a detailed clarification of the tenure situation in the region was launched.

The learning collected during these two first phases – information and participation - allowed the project team to elaborate a detailed forest management plan. The forest management plan highlighted the environmental benefits, e.g. mitigation of climate change, as well as the economic potential of the different possible products.

The third phase of the Regional Forum, decision-making, was aimed at ensuring a participative decision-making process between small and medium farmers, NGOs, local authorities, regional institutions and the private sector.  Main issues to be agreed in this phase were the forest management plan and the creation of an institution that could fulfill two objectives: a) to leverage the long-term implementation of the management plan and b) to facilitate trade of all products and services, including $CO_2$ certificates.

In 2008, after finalization of the project, the region was implementing a master forest development plan designed with the active participation of local actors and adopted by them. This plan integrates different forest activities, including small scale plantations and agro-forestry with activities aimed at securing the long term conservation of natural forest (sustainable production of non-timber forest products, forest restoration, eco-tourism, etc)

Furthermore, and as a institutionalized continuation to the Regional Forum, a public-private-civil society partnership was created for implementing the forest management plan over the next decades as well as for serving as facilitator in international business like the trading of $CO_2$ certificates: The Corporation for the Sustainable Management of the Forests MASBOSQUES, established in September 2003, includes all sectors of the society and represents a clear answer to the needs of strengthening civil society and of ensuring participation of communities in planning and decision-making regarding sustainable management of the forest beyond the Regional Forum (**http://www.masbosques.org.co/ingles/principal.htm** ).

Until 2008 more than 2.500 ha of agro-forestry systems were established creating a new income for the community. Complementarily, activities in forest management of existing forest were under implementation and research on traditional uses of non-timber products was conducted. The master plan includes also further capacity building and an entrepreneurship training including new forest products and markets. Beneficiaries of these programs created their own small companies are now selling non-timber products as shampoo, soap and essential oils produced in a sustainable manner A key player in the CDM, the BioCarbon Fund of the World Bank, is finalising negotiations

with MASBOSQUES. Timber and Non-timber forest products are commercialised by local actors, who remain the owners of all these products. Social returns from the project can be summarized in five main impacts: empowerment of local communities, creation of public-private partnerships, improvement of local capacities, improvement of family income and improvement in food security.

Information, participation and empowerment of the local actors made it possible in San Nicolas to promote a change in the local society from a destructive use path towards a sustainable and participative use of the natural resources.
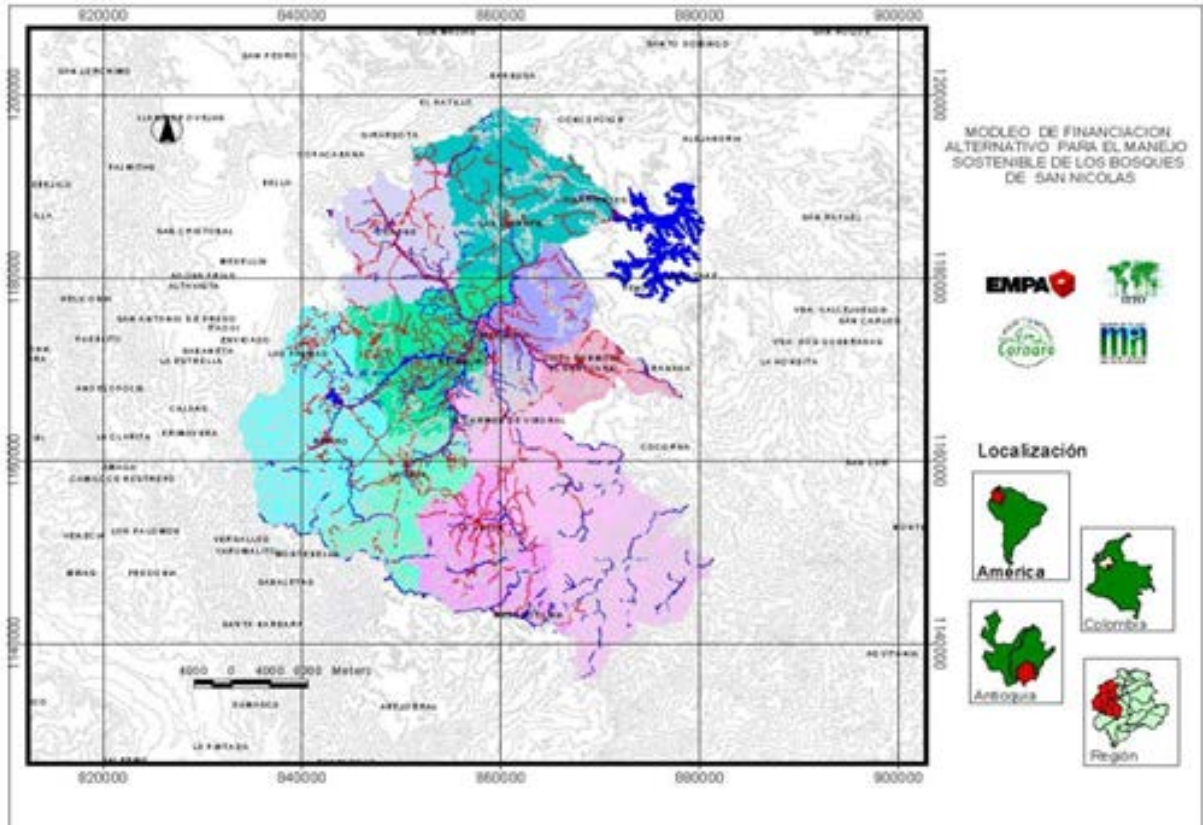
**Map 1**

**Table 1: Actors involved in the San Nicolas Project**

| | | | |
|---|---|---|---|
| **Public** | | | |
| | Municipalities of Rionegro, Guarne, Marinilla, La Ceja, San Vicente, El Carmen de Viboral, La Uribe, EL Retiro and Santuario | The smallest unit of the state in Colombian is the municipality. As a consequence of the decentralization process the municipality can independently plan and implement development programms as far a these are inline with the national strategies. For this reason today municipalities in Colombia have an extensive experience in the management of projects with local communities. | Municipios de Rionegro, Guarne, Marinilla, La Ceja, San Vicente, El Carmen de Viboral, EL Retiro y Santuario |
| | CORNARE | CORNARE is the CAR responsible for the area of San Nicolás as well as other more that 200.000 ha of the East part of the Department of Antioquia | Corporación Autónoma Regional del Rionegro - Nare |
| | MASORA: Asociation of the municipalities in the east Antioquia | This insittution associates all municipalities in the region. It facilitates coordination of local policy with regional and national iniciatives | MASORA: Municipios Asociados del Oriente Antioqueño |
| **Private** | | | |
| | ASOCOFLORES: Asociation of flower producers of Colombia | The region of San Nicolas is the second biggest producers of flowers in Colombia. Within the region epecially the municipalities of Rionegro and El Retiro are dedicated to flowers production. | Asociación Colombiana de Productores de Flores |
| | CEO: Corporation of Enterpreuners from the East of Antioquia | The CEO reunites more than 130 middle and big industries present in the project area | Corporación Empresarial de Oriente |
| **Academic and Research** | | | |
| | CORPOICA: Colombian Corporation for Research on agriculture and livestock | It is a PPP with more than 10 years experience in projects all over the country. Its work is oriented to promote the application of new agricultural techniques | Corporación Colombiana de Investigación Agropecuaria |
| | CEAM: Corporation of Studies, Education and Resarch on Environmental Matters | This is an association that promotes the implementation of projects at local level by means of environmental training and awareness in the region | Corporación de Estudios, Educación e Investigación Ambiental |
| | UCO: East Catholic University | Is the University with the major presence in the region. It was founded twenty years ago, and undertakes an important work in research and educational extension areas. | Universidad Católica de Oriente |
| | EMPA: Swiss Federal Laboratories for Material Testing and Research | This is a research institution of the Swiss Government. EMPA has been working in projects in Colombia since 1998as follows: The Cleaner Production. ITTO PD 54/99 (F) Rev. 2 and ITTO PD 240/03 (F) Rev. 1 | Instituto Federal Suizo de Investigación y Prueba de Materiales y Tecnología |

| Civil Society | | | |
|---|---|---|---|
| | Asociation of the community action boards from all municipalities | In Colombia members of a community can organize themselves in Community Action Boards. Law recognizes the importance of this institutions in promoting sustainable development. Community Action Boards are enforced to abrogate for community interests in all public and/or private decisions related to their region. This is an instrument created during the decentralization process, which empower local communities. | Asociación de Juntas de Acción Comunal |
| | AVANS: Association of Environmental Organizations in the San Nicolás Valleys | AVANS reunites all environmental and some social NGOs present in the project area | Asociación de Organizaciones Ambientales |