

Prestudy

Leadership towards sustainability

Part A: Research needs to make
leadership towards sustainability
more cohesive and functional

Januari 2013

Part B: Proactive leaders' experiences
and views of obstacles to and opportunities
for strategic sustainable development

November 2013

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the responsibility of the authors.

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A.

Research needs to make
leadership towards
sustainability more cohesive
and functional

Januari 2013


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Summary

 For sustainability to become a feasible outcome of society's current efforts to manage the myriad of sustainability related problems, such as poverty, erosion of trust in the global socio-economic system, shrinking biodiversity, climate change, eroding potential of the food-producing systems and pollution, we need research with the potential of supporting a more cohesive and functional leadership across disciplines, sectors, organisations and countries. Dealing with individual problems without a thorough understanding of their interconnectedness at an appropriate system level often leads to new and aggravated problems, where also the economic and self-interest dimensions are clearly at grave.

We identify the need for research on how the creative power of governments, business and academic communities could be enhanced by following a protocol for achieving the robust systems perspectives required for building a sustainable global civilisation. The required approach stands in stark contrast with strategies that focus on solving problems singularly and in isolation or after applying an insufficiently cohesive overview of the whole system. For example, serious threats, such as climate change, may lead us to focus only on reactive responses, such as curbing CO₂ emissions, *instead* of seeking strategic comprehensive solutions aimed at moving towards a society where all sectors are sustainably designed from a full systems perspective. Without such a systems perspective, the risks are substantial of enacting costly sub-optimised investments and “solutions” in one sector that run against the development of necessary investments and solutions in another sector.

Examples of key questions that require more thorough scientific investigation are:

- ▶ How can our rich and expanding scientific knowledge base be better structured to clarify the constraints of the human civilisation and aid governments, business and academia in responding to these constraints through efficient and strategic cross-disciplinary and cross-sector cooperation?
- ▶ How can system boundaries be dealt with in a way that considers relevant aspects of the whole system (global society within the biosphere), that is, how can the constraints of the human civilisation be interpreted in order to delineate appropriate system boundaries for any study of sub-systems?
- ▶ How can trade-offs be managed in a strategic way, including considerations of the possibilities of more efficient and strategic cross-disciplinary and cross-sector cooperation?
- ▶ How can sustainable resource potentials be estimated for various technical solutions?
- ▶ How can concepts, methods and tools be selected, used and developed to best support leaders and decision makers that want to work strategically towards sustainability?

These challenges call for the development of a new kind of science, a systematic research approach of a more conceptual kind, linking transformative theory with enabling practice across the diversity of our civilisation's intellectual and functional

pursuits. To study systems from a multidimensional perspective has previously, for the right reasons, been regarded as non-focused. This needs no longer be the case. Systems thinking and systems science, an evolving science with its roots in physics, makes it possible to model and simulate complex systems in many dimensions by robust and validated methods. Systems thinking and systems science applied for sustainable development, and with the focus on strict frameworks to make multidisciplinary cooperation fruitful, is now needed. Such a new research arena partly challenges existing policies, programmes, concepts, methods and tools for sustainable development, and partly offers an inclusive and harmonizing science-based means by which to make the best use of them.

There is a need for research that explores the following three essential elements and the linkages between them. Put together effectively, these elements would offer the type of science now being needed for a more cohesive and functional leadership for sustainability.

- 1.** The sustainability goal defined at an appropriate scale, that is, a globally sustainable civilisation.
- 2.** The appropriate cohesion of approaches, that is, linking short term with long term, small scale with grand scale (individuals, individual organisations, cooperatives, etc., with global sustainability goals) and ethics and political considerations on the one hand with environmental maxims and economy on the other.
- 3.** Concepts, methods and tools that would serve as support for multi-factor analyses, decision support and monitoring of multi-stakeholder transitions towards sustainability.

Assignment

The authors of this report received the assignment from Mistra. The objective was to explore research needs for making the concept of sustainability/sustainable development at an appropriate scale (covering the whole of civilisation) more concrete and supportive of cohesive and functional/operational leadership and decision making. The assignment was based on a document with preliminary ideas of such research needs sent to Mistra (“How to make sustainability more operational – research needs”) and on a dialogue with the Executive Director of Mistra.

Background

While sustainable development has been a topic of growing concern for policy makers, scientists, decision makers in business, the general public and through three global UN summits and numerous other summits (for example, on climate change) since the 1960's, our civilisation is still on an unsustainable course. Moreover, in the interim, our civilisation has gone global to escalate and compound the negative impacts of misdirected development. The resulting damage to ecosystems and social systems, ever escalating and compounding in both scope and novelty, is unmistakably degrading the foundations of the common good for future generations. In this report, we consider that a sustainable civilisation is the system we seek to secure. By this, we mean a civilisation that does not systematically degrade the ecological and social systems that are vital to its own continued existence. By seeking such, in the words of Jonas (1984), we aim for Sweden to lead in helping “to save the survival and humanity of man from the excesses of his own power”.

There is a need for a research approach that tackles the phenomenon of inadequate sustainability leadership that pervades every corner of our world and calls explicitly for more functional and practically applicable leadership methods and tools (Huesemann 2001). The aim would be to initiate more cooperative approaches within the academic community, as well as between that community and the business and policy communities (Robert 2012). Reductionism is today a dominant characteristic of academia and society. It denotes the flawed attempt to deal with one problem at a time, outside the context of the whole system. For example, for decades, scholars focused on known impacts of SO₂ emissions from fossil fuel use, while potential climate change effects of the accumulation of atmospheric CO₂ were ignored. Furthermore, fragmented policy and legislation approaches led to airborne SO₂ emissions being transformed into sludge and disposed of in landfills that then exhaled airborne emissions through decay processes (Ayres 1994). Within the recognised sustainability threats, climate change is currently at the top of the public discourse. It represents a fearful and disorienting challenge to the leaders of our time and it is now key that we learn from the past and find the creativity to avoid previous patterns of flawed leadership as we strive to tackle climate change and other new problems. It is a self-evident truth that effective agendas for addressing the climate change challenge must embrace “whole-systems” solutions. Curbing climate change contributions from, for example, the energy sector must be done *in a way* that makes efficient use of other fields of expertise and harmonises with sustainable development in other sectors, such as agriculture, forestry, industry and transport, to advance the socio-economic system as a whole.

Effective responses to system-wide challenges are impossibly burdened by today's ubiquitous compartmentalisation within the scientific community. Even scientists within similar fields are often poorly informed and poorly coordinated when it comes to the work and aspirations of their disciplinary close-relatives. In addition, the scientific community sometimes retains a detached attitude regarding engagement in public or political discourses or active cooperation with broad groups of stakeholders. An attempt at a constructive response to this challenge has been called “The New Social Contract for Science”. According to this contract,

scientists should focus on the most urgent societal needs, communicating knowledge to inform good decision-making and exercising good judgment, wisdom and humility (Lubchenco 1998). Two recent viewpoints present complementary points of view on persuasive communication by scientists, one espousing arguments for the non-engagement of scientists (Fischhoff 2007) and the other arguing that such engagement is vital for a healthy civilisation (Collins 2008). Non-engagement is, of course, a possible point of view from a philosophical perspective. However, given the sustainability challenge that the human civilisation currently faces and the need for a rigorous and systematic approach to finding solutions, is non-engagement from the scientific community really a morally defensible stance?

More concretely, it is necessary to address (building on (Robèrt 2012)):

- 1. Subculture boundaries and limitations.** Science requires clarity of system boundaries and delimitations. This, in combination with the depth of commitment that science requires, often results in experts with insight into just one compartment of knowledge. We need innovative approaches to come around this stumbling block for the urgently needed cross-disciplinary cooperation. We need to be able to show specialists their often unrecognised importance in humanity's greatest challenge – the pursuit of sustainability – and we need rigorous approaches for how specialists could partner effectively and put themselves in the context of addressing this challenge. If framed well, future calls for research could engender significant enthusiasm for research into such innovative and rigorous approaches and in significant enthusiasm in specialist communities for joining forces.
- 2. Specialist languages.** The specialisation described in (1) has also created many specialist languages that are hard for outsiders to penetrate and understand. This is another challenge to science; how do we *communicate* science to improve cooperation between scientific fields, and how do we express research results relevant for decision making in such a way that the results will be possible to interpret outside the domain of science while, at the same time, not distorting essential elements of science?

Scientists are challenged to take active part in efforts to come to grips with these kinds of hurdles and to develop frameworks that can bridge the subcultures of science and the borders between society's sectors, to help create and embrace a sort of communal cross-disciplinary and integrative "language" for sustainable development. Indeed, numerous thought leaders in science, business and governments have described the need for, and existing lack of, such a language (Kates et al. 2001).

During the collection of increasing amounts of data pointing at the ever more urgent need for society to change its course and move towards a sustainable future, a growing number of obvious and/or intuitive solutions have evolved through innovations from science, business and policy making. The results have concerned a wide distribution of more or less concrete ideas, from the advancement of renewable energy systems and more sustainable ways of harvesting from ecosystems, through the development of new and less toxic production methods in industry including new ways of building businesses, for example, controlling energy and material flows through leasing or cooperation through value chains (product-service systems), to the testing of new policies and economic incentives, for example, green taxes, subsidies, micro-loans, complementary currencies and legislation against eco-toxic agents such as CFCs.

It is obvious that the innovations from different fields of expertise have been largely helpful in bringing about possible solutions relevant to the sustainability challenge. It is equally obvious that none of the innovations can, on their own, bring about a sustainable society. Sustainability can only be achieved by combinations of various solutions put together and launched in a step-wise mode where

each step lays the ground for coming steps and where the economy of various capitals – natural, human, political, financial – is sustained throughout such transitions. Finally, it is obvious that sustainability can appear in many ways due to differences in cultural, social, climatological, historic and other conditions. Our differences in values, as regards such designs at the more detailed level, should be kept apart from generic frameworks and boundary conditions for sustaining any human society. Both are important, but they are not the same. It is not until generic boundary conditions are rigorously explored, understood and commonly held that value-based polarities get really interesting and can provide a field of creative tension for democratic and participatory approaches towards sustainability.

Scientific challenge

The above background outlines a few facts that, when put together, point at a need for science to play an important and supportive role in a successful transition towards sustainability. People in the industrialised world have long since left the tribal community behind and now live lives that, both individually and collectively, impact the world on the global scale. Since the majority of those impacts are not directly perceived by our senses, we need science to bring about relevant models for a global “taking-care-of-the-planet culture”. It is not enough for science to respond to the question “what is happening”, that is, acquiring empirical evidence of growing unsustainability related impacts. Nor do responses to the question “what will happen” suffice, that is, descriptions of trajectories of impacts if civilisation fails to put a halt to further unsustainable development. Nor do responses to the question “why is this happening” suffice, that is, descriptions of the “tragedy of the commons” and other psychological or sociological theories aiming at explaining why more is not done to stop unsustainable development. Finally, it is not enough for science to explore, in isolation, responses to questions of “how can we change”, that is, to attempt to develop various solutions to individual sustainability related impacts. Growing success, as regards those essential topics for science, has increased the need for addressing the next big challenge: to take joint and common ownership of solutions to promote societal change at a scale appropriate for sustainability to become a feasible option for the future. It is the combined perspective of the three outlined aspects below that – together – may provide the research we need to operationalize sustainable development at a scale needed to make sustainability a feasible outcome in the future.

1. The sustainability goal outlined at an appropriate scale

Since sustainability can only be derived through combinations of measures that are collectively sustainable, how can sustainability be defined to embrace the variety of such combinations? This seems to be a crucial question for making sustainable development possible. We need to identify generic “boundary conditions” for redesign of local societies such that it also promotes the sustainability of all others. What are the fundamental conditions for a globally sustainable civilisation, and what does such a definition imply for individual organisations, regions and countries?

In this context, it is important to stress that sub-systems will not suffice alone, not even when they are explored at the global scale, for example, “global climate”, “global biodiversity”, “global agricultural system”, or “global geopolitical and socio-economic agendas”. We need operational approaches that model sustainable development of such sub-systems *together*, and we need agendas for change of a kind that make it possible for individual organisations to put themselves in the context of such a systems change. These operational approaches and agendas should take a holistic view of sustainability, including the social sustainability dimension, a component that is under-theorised (Colantonio et al. 2009) and for which there is a

lack of clear indicators that help distinguish sustainable development from unsustainable development (Spangenberg et al. 2002).

The lack of a definition of sustainability is also holding back business leaders from implementing (more and better) sustainability programmes. In McKinsey's 2010 global survey (Bonini et al. 2010) of nearly two thousand executives, more than fifty percent consider sustainability as very important, yet many do not actively address sustainability. The McKinsey report highlights "not having a clear definition of sustainability" as a potential reason for this.

Modern science has begun to approach such definitions, both with regard to sustainability principles (see, for example, Robèrt 2012) and with regard to planetary boundaries for the breaching of such sustainability principles (Rockström et al. 2009), as well as with regard to merging sustainability principles with planetary boundaries into combined frameworks (Robèrt et al. 2012). Furthermore, modern science has begun to explore the self-benefit of integration of organisational goals with the goal of a sustainable civilisation, that is, the "business case for sustainability" (Scott et al. 2011; Willard 2012). This is a relatively underexploited research area that needs expansion in itself in order to support the operationalizing of sustainable development. Over and above this, we propose that research is required where this is put *in context* of the following two research areas.

2. The appropriate cohesion of approaches

A well-structured, large-scale and principled definition of the goal in line with the first bullet above (a sustainable civilisation) is the first prerequisite for creating cohesion of sustainability agendas. Furthermore, it is a prerequisite for systematic step-wise approaches (transition paths) over time. How can transition paths within different sectors and areas be modelled and guided such that investments in various solutions, not only serve as platforms for further future progress towards a sustainable sector or area (in line with the first bullet), but also promote culturally, politically, economically and technically similar developments in other sectors and areas?

Clear and robust definitions and objectives at a principled level make it possible to avoid premature assumptions as to what will later on prove most attractive at a detailed level. This can help planners avoid "path dependency" (Hukkinen 2003a and 2003b) and undertake effective moves that are flexible with regard to future technical and cultural innovations, that is, conditions that may change as the development unfolds. It may be wise to avoid, for example, a lock onto assumptions of what will prove to be the best technologies in the distant future, for example, whether photovoltaics will be more significant in the long run than other forms of renewable energy yet to be developed or improved. Instead, planning towards compliance with basic principles allows people to cooperate on smart early investments that can serve as flexible platforms for many scenarios that might emerge.

We cannot continue to rely on trial-and-error transitions of global cultures and societies with their respective unsustainability related impacts and challenges in various subsystems. There are scientific concepts, methods and tools under development by which multi-dimensional systems can be modelled and simulated in stakeholder dialogues to avoid sub-optimisation. This brings us to the third aspect.

3. Concepts, methods and tools within context

A growing number of concepts, methods and tools have evolved from the first stages of sustainability science and have been built upon empirical collections of experiences that have evolved from more or less intuitive reactions to problems. Examples are tools for administration of sustainable development (for example the ISO

14000 and 26000), disclosures of challenges and progress (for example footprinting), monitoring (for example indicators like levels of CO₂ in atmosphere or levels of pollutants in biota), financial instruments to support local innovations in the developing world (for example micro-loans), lifecycle management and product-service systems to help value chains in business to jointly deliver services at a higher functional level and with lower negative impacts, mechanisms for collecting and disseminating social innovations that are not necessarily planned but evolve in the face of new needs, etc. How can such concepts, methods and tools be selected, used together and developed to support multi-factor analyses, decision making, and monitoring of large scale multi-stakeholder transitions of the type aimed at through bullets 1 and 2? (Robèrt et al. 2002; Hilding-Rydevik and Bjarnadóttir's 2007)

Aspects 1-3 combined

Strategic approaches, building on a robust systems theory combining the three essential elements outlined above, would intuitively allow for win-win-win solutions for individuals, organisations and for civilisation at large. How could modern systems science and systems thinking help us explore more robust concepts, methods and tools for analysis, planning, action, follow-up and re-evaluation/adjustment of plans for sustainable development?

Moving quickly between theory and practice (and back) helps in the development of effective concepts, methods and tools. We therefore propose that there is a need for projects that present a substantial real-life testing arena for the academic research. In addition, it is important to consider partnerships within projects with regards also to the dissemination. How can the developed knowledge, concepts, methods and tools be applied and implemented as shared mental models – from departments within organisations, through value chains, to cross-sector cooperation? And how can new partnerships between academic groups result in new, fresh ideas that will make sustainable development operational? Trans-disciplinary research, where societal actors and academics (from across disciplines) collaborate to define research problems, develop shared mental models and structure the research, integrates different perspectives and supports a good understanding of real-world complexities (Mobjörk 2010). It is therefore considered that a trans-disciplinary approach will promote the necessary shared knowledge generation and mutual learning. The science of strategic leadership and decision making for sustainability, inherently including multidimensional linkages between different fields of expertise, is not necessarily covered by a mix of experts from many different specific fields. It requires the presence of scientists who are well acquainted with their own specific research field, *as well as* with methodology and approaches that allow the bridging between research fields. This should be considered when, for example, putting together evaluation groups for the evaluation of research proposals on this arena.

The methods and tools developed on arenas such as “Industrial Ecology”, “Climate change”, “Ecology”, “Green Economy”, etc., do not integrate the above three aspects needed for a rational systems perspective on strategic leadership and decision making for sustainability. Some typical gaps of knowledge are keeping strategic leaders away from being proactive in the sustainability arena. Gaps that need theoretical considerations, empirical studies and testing include:

- **System boundaries.** When an organisation seeks to take sustainability seriously, where should it set the system boundaries? The organisation? The organisation including the whole value chain? All stakeholders in the world now and in the future? Intuitively we may feel that there are no given system boundaries, but

would complexity allow us to take a full systems perspective when adjusting an individual organisation's practices?

- ▶ **Business case for sustainability.** Even if leaders, managers and planners would know how to make decisions that are beneficial for the whole of civilisation, there is generally a very poor understanding of the business case for this, that is, understanding of the financial risks of *not heading* towards sustainability vs. the opportunities of *heading proactively* towards sustainability. Is it really true that sustainable development “costs money”? If so, when is that true? The result is that business is typically run in a schizophrenic mode where traditional business incentives are dealt with separately from sustainability, the latter often being added as a cosmetic side passenger to “business as usual”.

Those business leaders that are setting the example by focusing their companies' attention on sustainability are achieving higher financial returns (Willard 2012). For example, the “higher-ambition leaders” studied in a Harvard Business Review delivered greater economic value by taking a comprehensive approach, including focusing on social sustainability; they then used this improved financial performance to build more social capital within the organisation and social value outside it, thus creating additional economic value (Foote et al. 2011). Similarly, the 2010 McKinsey Global Executive Survey found that the sustainability leader companies (those companies whose CEOs reported that sustainability was a top item on their agenda) are much more likely to seek and find value creation opportunities (Bonini et al. 2010).

- ▶ **Trade-offs.** Even if decision makers would know how to define their major gaps from a sustainability point of view and the business case for closing the gaps, how can they make trade-offs between the three dimensions of sustainability – social, ecological and economic? This may occur as financial short-term progress at the cost of ecosystems and/or social systems, or ecological/social concerns that draw resources and thereby imply short-term competitive disadvantages. Furthermore, there are often trade-offs *within* each of the dimensions, for example, saving energy by use of mercury in low-energy lamps. We believe that many trade-offs of this kind are unfortunately not well informed, and are undertaken using rationales that will turn out to run in the face of all dimensions of sustainability. Also the OECD concluded recently that policy makers need better frameworks for managing trade-offs and synergies (OECD 2012).
- ▶ **Cross-sector cooperation.** As concluded by the United Nations Office for Sustainable Development's recent review of knowledge, capacity building and networks for sustainable development, there is a need to change emphasis from individual experts to cross-disciplinary groups, and from vertical hierarchies to horizontal networks (UNOSD 2012). According to the International Council for Science's report on harnessing science, technology and innovation for sustainable development, these efforts will lead to more relevant and practical research results (International Council for Science 2005). Even if all of the above would be well understood and managed amongst leaders in policy and business, and a network of relevant actors is put together, for example, in a value chain, how can the actors function effectively *together*? The UNOSD's report also states that collaboration processes must be considered in the capacity-building of groups such that groups and individuals “can work together across increasingly fuzzy lines of sector specialisation” to deliver more functional sustainable development (UNOSD 2012, 7).
- ▶ **Concepts, methods and tools.** If all the above, from understanding the business case for sustainability (including the societal level) through an understanding of how to systematically realise this business case throughout networks of sectors

and partners, how do we manage progress from such a broad perspective and what supporting concepts, methods and tools are needed?

What are the currently dominating thought models, concepts, methods and tools for decision support and monitoring of sustainable development (for example, Footprinting, Cleaner Production, Industrial Ecology, Cradle-to-Cradle, Planetary Boundaries, Framework for Strategic Sustainable Development, Life Cycle Assessment, ISO 14001 and ISO 26000 and other Management Systems)? What are their strengths and weaknesses with respect to how they relate to sustainability (social, ecological and economic) and to each other, from the above bulleted systems perspective?

How should we select concepts, methods and tools as we need them? How can these be used within context? They are typically managed by middle managers, whereas leaders in business and policy generally do not use them at all; how could we change this?

- **Economic System.** The whole economic system can actually be seen as a “macro-tool” for achieving wellbeing. This is, in itself and at large, sometimes believed to run in the face of sustainable development. How could economic thought models, concepts, methods and tools be better utilised, and/or adjusted, to better support sustainable development? Examples of research questions are: How far can we reach towards sustainability already with the economic system we have, given the more robust approaches proposed in this report? And once we have exhausted such opportunities, what adaptations of the economic system, and the norms by which it is applied, would be necessary to continue towards sustainability, and what type of adaptations could that be? How do such changes and adaptations relate to each other?

We advocate for a different approach to the traditional “green economy” approach. We advocate for a new way for society to look upon itself and for new ways of measuring the wellbeing and progress of society, and there is currently a rapidly growing demand for this among leaders (OECD 2012). Here we propose to begin in the two superordinate systems, that is, the social system and the ecological system, and with an understanding of the self-benefit of systematic approaches. And only then ask questions about the economic system and the modifications we may need in this. The economic system is a means for something else, and over and above social and ecological success there is no “success” within the economic system itself. We need approaches to free studies of the economic system from bias within the economic system itself.

Current research in Sweden

To further explore essential aspects for this report, a questionnaire survey, workshop and interview were undertaken to: (a) see if related research is going in Swedish institutions right now, (b) identify possible opportunities and to (c) learn if researchers would benefit from new calls with the focus outlined above. An invitation to take part in the project was sent to all universities and all “forskningsinstitut” in Sweden. The invitation requested that those who are both undertaking research on strategic sustainable development and would like to be involved, to nominate a contact person. All contact persons were then sent a link to the online questionnaire and requested that every relevant research group answers. Respondents to the questionnaire were then invited to send a delegate from their institution to the workshop. Two researchers who could not attend the workshop were interviewed in a separate interview round performed by teleconference.

The questionnaire was completed during October and November 2012 by 66 respondents spread across 22 different institutions in Sweden. The workshop was attended by 16 delegates from 13 institutions and comprised introductory presentations and a dialogue-based workshop. The interview was performed with 2 delegates representing one institution. Participants are listed in Appendix 1, questionnaire questions are provided in Appendix 2 and the workshop agenda is provided in Appendix 3. Responses and notes are available on request, with the exception of data from respondents who have asked for their responses to be kept confidential.

Below we present our overall conclusions from the questionnaire, workshop and interviews. Our own research was not included in the questionnaire, workshop or interview. We also want to point out that this survey was not intended to be a “statistical study”. To draw more extensive and detailed conclusions regarding related current research in Sweden we would need to complete the gathered data. During the relatively short project period it has not been possible to repeat our request for responses to get a more complete coverage. However, we think the responses we have got provide sufficient support for the overall conclusions presented below and the analysis and ideas described above.

There is some current research that partly covers the above bulleted areas

There are indications that taking a systems perspective is widely incorporated. When asked to report to what extent their research seeks to understand what is required to support decision makers to address each of the above areas, all respondents (that replied to this question) replied ‘to some extent’, ‘to a large extent’ or ‘main focus of research’ for taking a systems perspective and considering system boundaries. This gives indication of the importance of taking a systems perspective and that current strategic sustainable development research in Sweden is incorporating this aspect.

There are currently some research groups giving attention to all areas. Approximately half of respondents stated that their (research group's) research is seeking to understand what is required to support decision makers with respect to all of the above areas to some extent (or more). This gives an indication that there is currently some attention being given to these areas and so there is an opportunity to build on this existing attention and do research which exactly focuses on helping decision makers with all of the bulleted areas.

The following quotes are examples of descriptions of research given by the respondents who responded saying that their research considered all the bulleted areas to a greater extent. These examples are taken from the question "Briefly, what research are you currently doing in order to understand what is required to support strategic, as well as every-day, decision making in companies, municipalities and other organisations that want to work strategically and pro-actively towards sustainability?"

... sustainable development challenges across all scales ... apply a systems perspective to understand the interaction between these systems and between the environment and the socio-economic sphere ...

... Finding and evaluating logistic actions ... and/or bridging technologies/actions towards sustainability ...

... with the ambition [to] understand what is required to support decision making on different levels in a city. Backcasting in combination with system dynamics to guide different actors within the transportation sector in Sweden in decision making ...

There are opportunities

There is great opportunity for more research that does not just consider an area to some extent, but whose main focus is on that whole area. The biggest opportunities, that is, those areas with the lowest reported focus, are for "green economy", business case for sustainability and trade-offs – all key elements to make transitions effective.

Among the respondents there is very little research that addresses all of the bulleted areas to a large extent, or indeed focuses on supporting decision makers to consider all of the areas. Only one respondent said that their (research group's) research has its main focus on seeking to understand what is required to support decision makers with respect to all of the bulleted areas. Thus, there is an opportunity to do more research that focuses on supporting decision makers with all of the areas in a coordinated way.

Workshop attendees stated that sustainability is not well-defined and one discussion group at the workshop said that they had different definitions of sustainability within their discussion group. They also described how important visions are, and to know where we are relative to the vision. These are in agreement with points 1 and 2 in the previous section – the need to have a sustainability goal outlined at an appropriate scale and appropriate cohesion of approaches.

Understanding and recognising the business case for sustainability was also highlighted as important, in particular, research into how to change the system such that it becomes more profitable in the short term to be more sustainable. This is supportive and complimentary to the business case bullet in the previous section.

Questionnaire respondents and workshop participants also highlighted the importance of usability. The questionnaire asked respondents to list any other ways (in addition to those listed in the above bullets) in which their research aims to help make sustainable development more operational. The most frequent answer was that the research outputs, concepts, methods and tools should be highly usable.

Additional points

Workshop participants spoke in particular in support of the stated need for more trans-disciplinary research and for quick iterations between theory and practice, and said that the research should be done with companies and society. They expressed that they would like Mistra to support this type of research. And, not the least important, participants jointly wanted to highlight that the proposed research need is truly a new approach to sustainable development research, asking for a *new* and comprehensive research approach that Mistra has not included amongst its programmes before. To study systems from a multidimensional perspective has previously, for the right reasons, been regarded as non-focused. This needs no longer be the case. Systems thinking and systems science, an evolving science with its roots in physics, makes it possible to model and simulate complex systems in many dimensions by robust and validated methods. Systems thinking and systems science applied for sustainable development, and with the focus on strict frameworks to make trans-disciplinary cooperation fruitful, is now needed. Finally, and in this context, an important detail was also mentioned during the workshop: participants described how critical the wording of a call would be to not exclude relevant research groups who seek to combine their research with other scientists for joint ventures. They emphasised the need to avoid as much as possible scientific jargon as it differs across the fields and serves as a stumbling block to effective and systematic cross-disciplinary cooperation.

Summary of current research

In summary, there is currently some research being undertaken that addresses the proposed areas, in particular, taking a systems approach. There is significant opportunity for more research that seeks to support decision makers in considering all of the proposed areas. Workshop participants supported the statement of need for research on the definition of sustainability and the relationship to visioning. Researchers also expressed their opinion of a need for a new and comprehensive, trans-disciplinary and systems-focused research approach.

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Appendix 1.

Questionnaire, workshop and interview participants

Institution	Department / Group	Name, position	Questionnaire respondent?	Workshop participant?	Interviewee?
Chalmers University of Technology	Complex Systems, Physical Resource Theory Energy and Environment	Claes Andersson, Assistant Professor	Y		
	Condensed Matter Physics, Applied Physics	Patrik Johansson, Professor	Y		
	CPM Swedish Life Cycle Center	Emma Rex, Director	Y		
		Lars-Gunnar Lindfors		Y	
	Department of Earth and Space Sciences	Jo Urban, Researcher	Y		
	Department of Technology Management and Economics,	Jan Bröchner, Professor	Y		
	Energi och miljö, energiteknik	Filip Johnsson, Professor	Y		
	Environmental System analysis, Dep of energy and environment,	Christel Cederberg, Adj Professor	Y		
		Anne-Marie Tillman, Professor	Y		
		Sverker Molander, Professor	Y	Y	
		Bengt Steen, Adj Professor	Y		
		Maria Ljunggren Söderman, Assistant Professor	Y		
		Rickard Arvidsson, Post doc	Y		
	Jutta Hildenbrand, Forskarassistent	Y			
	FRIST, Bygg- och Miljöteknik,	Karin Karlfeldt Fedje, Ass. Prof	Y		
	GMV – Centre for Environment and Sustainability	Anders Ahlbäck, Project manager	Y		
	Industrial Materials Recycling	Teodora Retegan, PhD, Project Leader	Y		
Logistics & Transportation	Magnus Blinge, Director Area of Advance Transport Chalmers	Y	Y		
Maritime Environment, shipping and marine technology	Karin Andersson, Professor	Y			

Institution	Department / Group	Name, position	Questionnaire respondent?	Workshop participant?	Interviewee?
Chalmers University of Technology	Microwave electronic	Rumen Kozhuharov , Senior Researcher	Y		
	Mistra Urban Futures/ Chalmers Architecture	Jaan-Henrik Kain, Associate Professor/Docent	Y		
	Physical Resource Theory, Energy and Environment	Fredrik Hedenus, Assistant Professor	Y		
	Quantum device physics Microtechnology and nanoscience – MC2	Dag Winkler, Professor Head of Department	Y		
	Radar Remote Sensing Group Department of Earth and Space Sciences	Leif Eriksson, Associate Professor	Y		
	Vice president	John Holmberg, Professor	Y		
Göteborgs universitet	Accounting, Department of Business Administration, Handels	Gunnar Rimmel, Professor	Y		
	Department of chemistry and molecular biology	Gunnar Nymna, Professor	Y		
	Department of Philosophy, Linguistics, and Theory of Science	Gunnar Björnsson, Researcher	Y		
	Dept of Business adm., Handels	Cecilia Solér, Senior Lecturer	Y		
	Environmental Economics Unit	Jessica Coria, Researcher	Y		
		Xiangping Liu	Y		
	Industriell och finansiell ekonomi Handelshögskola	Anders Sandoff	Y		
	Land Use and Climate Change, Dept. of Earth Sciences,	Åsa Kasimir Klemedtsson, Researcher	Y		
	logistics and transportation, Handels	Niklas Arvidsson	Y		
	Marketing Centre for Retailing Business administration, Handels	Martin Öberg,	Y		
Peter Beusch, Lektor		Y			
Christian Jensen, Lektor		Y			
Mohammed Belhaj			Y		
Havsmiljö-institutet		Åke Hagström	Y		
Innventia	Paper Chemistry and Nanomaterials Group	Tom Lindström, Principal Scientist	Y		
		Anders Pettersson, Senior Vice President Research	Y		
Interactive Institute (TII)	Energy Design	Cecilia Katzeff, Research Director, Associate professor	Y	Y	

Institution	Department / Group	Name, position	Questionnaire respondent?	Workshop participant?	Interviewee?
Royal Institute of Technology (KTH)	Sustainable Development	Göran Finnveden, Professor	Y		
		Mattias Höjer, Professor		Y	
Linköping University	Avdelningen för statsvetenskap	Elin Wihlborg, Professor	Y		
	Division of Energy System Department of Management and Engineering	Louise Trygg, Associate Professor	Y	Y	
	Sustainable Logistics research group, division of Logistics Management, Dept of Management and Engineering,	Maria Hüge-Brodin, Associate Professor (docent & Universitet-slektor)	Y		
	Environmental Technology and Management, Department of Management and Engineering,	Olof Hjelm, Professor, Head of Research Group	Y		
Lund University	IIIEE	Lena Neij, Professor and director	Y		
Mid Sweden University	Department of Social Sciences,	Jesper Stage, Professor	Y		
SLU	Dept for Urban and Rural Development,	Erik Westholm, Visiting Professor	Y		
	Swedish Centre for Biodiversity	Tuija Hilding-Rydevik, Associate Professor	Y	Y	
Stockholm Environment		Måns Nilsson, Director of Research	Y		
		Åsa Persson, Research fellow		Y	
Swedish Defence Research Agency (FOI)	Environment, Energy and Climate Change at Defence Analysis,	Malin Mobjörk, Researcher	Y	Y	
Swedish National Road and Transport Research Institute (VTI)	Department of Environment	Kerstin Robertson, Appointed Research director	Y	Y	
	Mobility, actors, planning processes	Karolina Isaksson, Docent	Y	Y	
Swerea IVF	Energy and Environment, Swerea Ecodesign	Anna Karin Jönbtink, Manager	Y		
		Christina Jönsson		Y	
	Swerea KIMAB AB	Niclas Stenberg, Research Area Manager	Y		
	Swerea SWECAST	Peter Nayström, Environmental Manager	Y		
Södertörn University	Conditions for Participatory Environmental Governance in a Regional Context	Mai-Brith Schartau, Associate Professor	Y		
	Environmental Science	Kari Lehtilä, Professor	Y		
Umeå University	Dept. of Ecology and Environmental Science	Jon Moen, Professor	Y		

Institution	Department / Group	Name, position	Questionnaire respondent?	Workshop participant?	Interviewee?
University of Borås		Jenny Johannisson, coordinator research and research education	Y		
		Birgitta Pålsson, coordinator Sustainable development	Y		
University of Skövde	School of Technology and Society	Henrik Linderöth, Associate Professor	Y	Y	
Uppsala University	Department of education	David O. Kronlid, Associate Professor	Y		Y
		Leif Östman, Professor	Y		Y
	Department of Information Technology Division of Visual Information & Interaction	Anders Jansson, Associate Professor	Y		
	Uppsala Center for Sustainable Development	Ashok Swain, Professor, Director	Y		
	Urban Mind, Dep Archaeology and Ancient History	Paul Sinclair, Professor	Y	Y	
Viktoria Institute	Strategic Competencies	Mats Williander, Senior researcher	Y	Y	

Appendix 2.

Questionnaire questions

Page 1

Background information

Thank you for participating in this survey. It should only take about 50 minutes of your time. Please answer by the 31st October 2012.

On behalf of Mistra (The Swedish Foundation for strategic Environmental Research), we are identifying the research needed to make sustainable development more operational, that is, research needed to understand what is required to support strategic as well as every-day decision making in companies, municipalities and other organizations that want to work strategically and proactively towards sustainability and research needed to develop such support. Mistra will use the output of this analysis when considering priorities around research needs for future calls.

The analysis that we are performing includes understanding what research in this area is already underway in Sweden. This questionnaire forms an important part of collecting data for this analysis.

Please indicate at the end of the questionnaire whether you allow for your answers to be shared publicly and attributed to you/your institution.

Any questions marked with an asterisk (*) require an answer in order to progress through the survey.

If you have any questions regarding the survey, please contact rachael.gould@bth.se. Thanks in advance.

***1.** Name and position

***2.** Research group and institution

***3.** Email address

General questions

- *4.** Briefly, what research are you currently doing in order to understand what is required to support strategic, as well as everyday, decision making in companies, municipalities and other organizations that want to work strategically and pro-actively towards sustainability? (Answer by writing text in the box below.)

- *5.** What research are you doing to develop support, e.g., methods and tools, for decision making in companies, municipalities and other organizations that want to work strategically and pro-actively towards sustainability? (Answer by writing text in the box below.)

6. To what extent does your research seek to understand what is required to support decision makers to do the following? (Answer by selecting the button in the appropriate column.)

(If your research does not seek to understand what is required to support decision makers, then please move to the next question.)

	To no extent	To some extent	To a large extent	Main focus of research
Take a systems perspective and consider the system boundaries of their decision system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consider relationship to the global socio-ecological system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Explore the business case for sustainability to make strategic decisions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Understand and make trade-offs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Select and inform tools, methods, concepts and indicators to make strategic decisions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Utilize the economic system as a subordinate support system to the socio-ecological system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Manage cooperation across sectors, value chains/ networks and with other stakeholders?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Utilize scientific results and cooperation with academia?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments

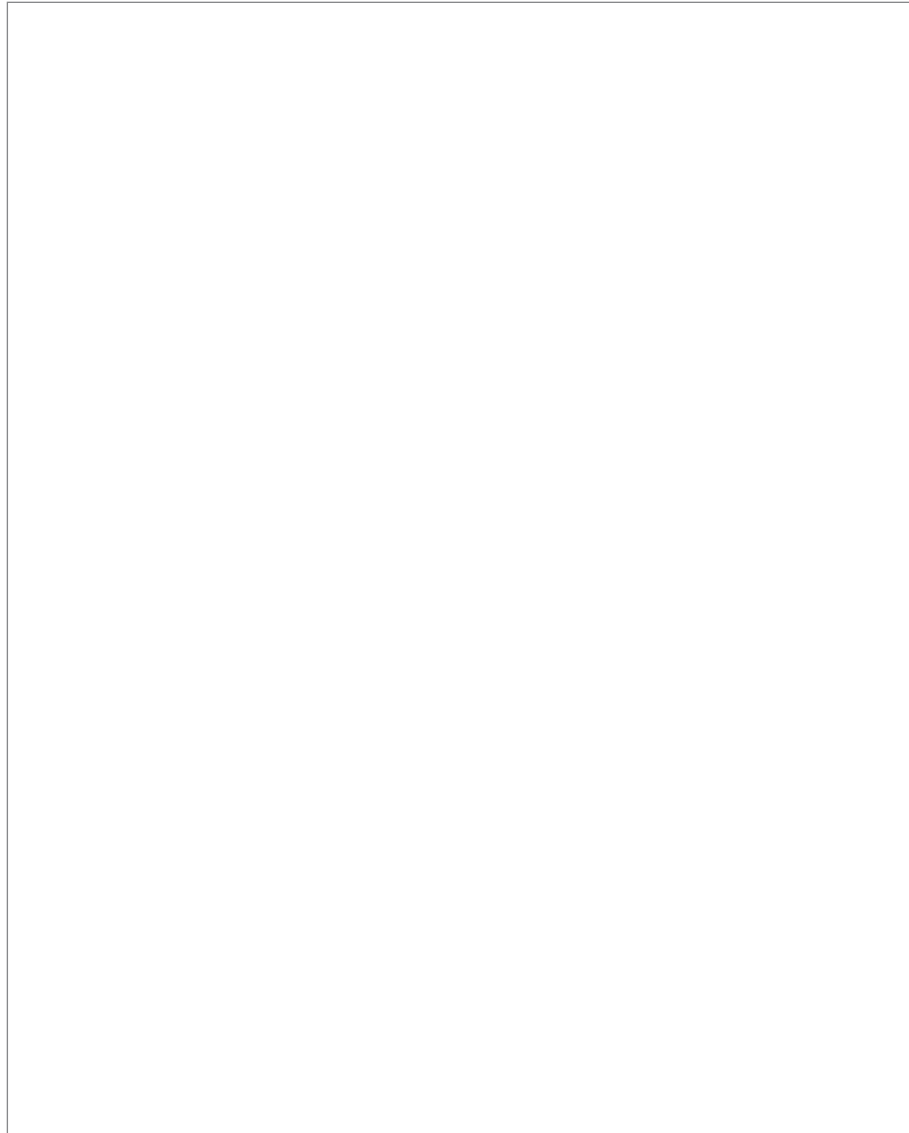
7. If you are developing decision support, to what extent are you aiming for the support to help decision makers to do the following? (Answer by selecting the button in the appropriate column.)

(If you are not developing decision support, please move to the next question.)

	To no extent	To some extent	To a large extent	Main focus of research
Take a systems perspective and consider the system boundaries of their decision system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consider relationship to the global socio-ecological system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Explore the business case for sustainability to make strategic decisions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Understand and make trade-offs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Select and inform tools, methods, concepts and indicators to make strategic decisions?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Utilize the economic system as a subordinate support system to the socio-ecological system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Manage cooperation across sectors, value chains/ networks and with other stakeholders?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Utilize scientific results and cooperation with academia?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments

8. In addition to the options in the above questions, list any other ways in which your research aims to help make sustainable development more operational. (Answer by writing text in the box below.)



***9.** We know it is difficult to categorize cross-disciplinary research into established domains. However, if you were to choose some “labels” for your research, what would they be? Industrial ecology? Green economy? CSR? Systems thinking for sustainability in general? Business administration? Other? You can state more than one. (Answer by writing the labels in the textbox below.)

10. If you develop tools, methods and concepts for decision making, what type(s)? LCA? Management systems? Indicators? Modelling? Simulation? Eco-design? Product-service development support? Or others? (Answer by listing the types in the textbox below.)

11. If you are developing support, does your research include testing it with decision makers? If yes, briefly describe how. (Answer by writing text in the box below.)

***12.** To what extent do you work together with businesses, municipalities and/or other organizations in your research? (Answer by selecting the button in the appropriate column.)

To no extent	To some extent	To a large extent	Main focus of research
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

13. Do you apply for funding together with the organizations with whom you collaborate? Do you receive match-funding from these organizations? (Answer by writing text in the box below.)

14. Do you work with top/middle management others in the organizations with whom you collaborate? (Answer by writing text in the box below.)

Final page

Thank you for participating in this questionnaire. On this page you can add any further information you may wish for us to know about your research.

15. Any further comments on how your current research will help make sustainable development more operational? (Answer by writing text in the box below.)

16. If available, please provide a link to your strategic sustainable development research or website. (Answer by writing text in the box below.)

17. Is it ok for your answers to be shared publicly and attributed to you/your institution? (Answer by selecting 'yes' or 'no'.)

Yes

No

*****ADDITIONAL NOTE:** please don't press 'Done' until you are ready to submit your final answers. Once pressed, you will not be able to access the questionnaire again from the same device.***

Appendix 3.

Workshop agenda

Programme

10:00	Welcome – Lars-Erik Liljelund
	Introduction – Karl-Henrik Robèrt and Göran Broman
	Questionnaire results – Rachael Gould
	Dialogue about the results
	Workshop where groups discuss the following items: <ul style="list-style-type: none">▶ General reflections so far?▶ Additional research not covered by the questionnaire or today’s introduction?▶ Particularly important, unexploited research area in this context?▶ Relatively unexploited avenues for cross-institutional collaboration in Sweden? If so, what?▶ Anything to add to questionnaire answers?
13:20	Dialogue in reflection of workshop
14:50	Close

Appendix 4.

Call for papers

ARTICLE INFO

Article history:

Received 14 July 2013
Accepted 15 July 2013
Available online 2 August 2013

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Systematic leadership towards sustainability¹

Göran Broman^{a, 2}, Karl-Henrik Robèrt^a, George Basile^{a, b}, Tobias Larsson^a, Rupert Baumgartner^c, Terry Collins^d, Donald Huisingsh^e

1. Call for papers for a Special Volume of the Journal of Cleaner Production

Systematic leadership towards sustainability implies utilization of systems thinking for step-wise approaches to transformative changes towards sustainable societies. This ‘call-for-papers’ (CfPs) for a Special Volume of the Journal of Cleaner Production is focused upon what types of research are needed for us to make the necessary local, regional, national and global changes. This CfPs is for anyone who wishes to address these challenges seriously, that is, to utilize essential aspects of leadership to contribute strategically to the transition towards sustainable societies. To successfully address these challenges, people from different sectors and disciplines must work together in a coordinated and efficient way. We wish to explore the question: What support do such transformative endeavors require and how can science contribute?

2. Scientific challenges and opportunities

People in the industrialized world live lives that, both individually and collectively, impact the world on the global scale. Since the majority of those impacts are not directly perceived by our senses, we need science to help us to develop and use relevant knowledge for supporting a culture of global and societal stewardship. It is not enough for science to respond to the question “what is happening”, that is, acquiring more and more empirical evidence of unsustainability related impacts. Nor do responses to the question “what will happen” suffice, that is, making predictions of impacts should civilization fail to put a halt to unsustainable development. Nor are responses to the question “why is this happening” sufficient, that is, descriptions of the “tragedy of the commons” and other psychological or sociological theories aiming at explaining why more is not done to stop unsustainable development. Finally, it is not enough to explore responses to questions singularly of “how can we change”, that is, to attempt to develop various solutions in isolation to individual sustainability problems.

There is now a strong need for making much more and much better use of the results from the above types of research and for evolving our research efforts in

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new ways. The next big challenge and opportunity is systems science for cross-disciplinary and cross-sector leadership and innovation for sustainability. We need this to develop coordinated solutions that support each other and, together, result in societal changes at a scale and rate that are appropriate for sustainability to become a feasible option while avoiding as many of the regional and global catastrophes as possible on our way. Only through such coordinated and combined solutions is society likely to be able to resolve the myriad of sustainability related problems, such as poverty, erosion of trust in the global socio-economic system, shrinking biodiversity, climate change, eroding potential of the food-producing systems and pollution. Dealing with individual problems without a thorough understanding of their interconnectedness at a global system level often leads to new and aggravated problems, where not only the human health and ecological health dimensions are at risk, but also the economic and self-interest dimensions. For example, serious threats, such as climate change, may lead us to focus only on reactive responses, such as curbing CO₂ emissions from the energy sector, instead of seeking strategic comprehensive solutions aimed at moving towards a society where all sectors are sustainably designed from a full systems perspective. Coordinated solutions for sustainability require research with the potential of supporting more cohesive and functional leadership and actions across disciplines, organizations, sectors and countries.

3. Key challenges and opportunities for authors of papers solicited for this Special Volume

We invite theoretical papers, review papers, methodological papers, original research papers and case studies that include but are not limited to addressing the following questions:

- ▶ How can goals for social and ecological sustainability be defined at a global scale and how can such system boundaries be understood to ensure that relevant aspects of the whole system (global social system within the biosphere) are fully addressed when regional, local and organizational subsystems such as governments, business, academia and other institutions are developed?
- ▶ How can sustainable resource potentials for various technical and cultural systems be estimated?
- ▶ How can relevant indicators be selected or developed and used to monitor the bridging of the gap between un-sustainability and sustainability, including indicators for human and natural capital?
- ▶ How can trade-offs be managed in a strategic way; that is, how can we balance positive and negative impacts in robust ways that align with systematic and flexible step-wise approaches to sustainability?
- ▶ How can planning and management processes be designed, which create an integration of approaches to achieve social and ecological sustainability and which effectively interlink short-term with long-term, small-scale with grand-scale (e.g., individuals, individual organisations, cooperatives, etc., with global sustainability goals), with ethical and political considerations on the one hand and with environmental and economic dimensions on the other?
- ▶ How can appropriate decision-support concepts, methods and tools be developed, and used to help leaders make more effective multi-factor, multi-stakeholder decisions, which support effective transition management towards sustainable societies?
- ▶ How can learning and governance of organizations and individuals be developed and built upon to effectively respond to these challenges and accelerate overall success?

These challenges call for the development of a new kind or next generation of science, a systematic research approach linking transformative theory with enabling practice across the diversity of civilization's intellectual and functional pursuits, and which uses sustainability as a guide. To study systems from a multidimensional perspective has often, for good reason, been regarded as nonfocused. This is no longer true, however. Progress in systems thinking and systems sciences has made it possible to explore and understand complex systems in many dimensions by robust and validated methods.

Concepts, methods and tools of systems thinking and systems sciences can now be effectively used for addressing sustainable development more systematically. This requires usage of structured but flexible frameworks to make multidisciplinary cooperation fruitful. This type of research arena constructively challenges existing policies, programs, concepts, methods and tools for sustainable development, and potentially offers an inclusive and harmonizing science-based means by which to help to guide the best use of them.

The coordinating team of this Special Volume invites authors pursuing these challenges to submit their insights, visions, results, and recommendations via their papers for potential inclusion in this Special Volume.

This Special Volume of the Journal of Cleaner Production is intended to provide academics, practitioners and other interested parties a better understanding of the challenges and opportunities of leadership towards sustainability. Academics will gain new insights in 'top-of-the line' research on the sustainability leadership arena, and governmental and corporate leaders and managers of all kinds of organizations will obtain lessons about how to utilize 'top-of-the line' methodological and conceptual support in their decision-making opportunities. This Special Volume will include comprehensive reviews, papers on theoretical frameworks as applied to real world settings, broad, integrative, empirical studies, case studies and applied studies. Critical editorials, book reviews and software reviews are also welcomed.

4. Tentative schedule for this Special Volume

- ▶ Call for papers published during August 2013.
- ▶ Submission of 500 word, extended abstract to Professor Göran Broman (goran.broman@bth.se) by November 1, 2013.
- ▶ Responses from the Special Volume Editorial Team to the prospective authors will be sent by January 15, 2014.
- ▶ Authors will submit 'peer-review ready' documents to Elsevier via the EES system by April 30, 2014. Please select Article Type: Systematic Leadership towards Sustainability.
- ▶ Peer review/paper revision process during May/October, 2014.
- ▶ Submission of final version of all revised papers by December 15, 2014.
- ▶ Authors informed of decisions and/or about minor changes by January 15, 2015.
- ▶ Deadline for revisions of all papers, including the introductory paper for the Special Volume submitted and in the corrected proof phase by January 30, 2015.
- ▶ Publication of Special Volume by March 2015.

5. Contributions

Full papers are invited for potential publication in this Special Volume of the Journal of Cleaner Production. Submissions should be between 9,000 and 10,000 words for comprehensive reviews, between 7,000 and 8,500 words for full research/theoretical papers with broad empirical studies and between 4,000 and

5,000 words for case studies. All should be developed based upon the editorial and formatting guidelines provided in the instructions for authors for the Journal of Cleaner Production, which can be accessed from the website: http://www.elsevier.com/wps/find/journaldescription.cws_home/30440/authorinstructions.

Upon receipt of the completed documents, three to six independent reviewers will be selected to provide peer reviews for each document. Upon receipt and acceptance of the author's revised or re-revised documents, all will be published in this Special Volume of the Journal of Cleaner Production.

B.

Proactive leaders' experiences and views of obstacles to and opportunities for strategic sustainable development

November 2013

Authors:

Göran Boman

Karl-Henrik Robèrt

Background

 The Swedish Foundation for Strategic Environmental Research (Mistra) placed the Blekinge Institute of Technology (*Blekinge Tekniska Högskola*, BTH) in charge of an analysis of how academia views the need for research to concretise the term ‘sustainable development’, so as to make it more operational and useful in decision-making situations of various kinds. The remit also included carrying out an overview of relevant research in Sweden in relation to this need.

Results were obtained from a questionnaire survey among Sweden’s higher education institutions (HEIs) and research institutes, from a workshop to which representatives of these organisations were invited and from supplementary interviews. The final project report (Part A) stated, for example, that it is not enough for research to accumulate more and more knowledge of already manifested symptoms of unsustainability, nor to produce ever more and better forecasts of how these problems may worsen and which new ones may arise from further unsustainable development. Neither, the report found, does it suffice to do more research on psychological and sociological theories that seek to explain why more is not being done to stop ongoing unsustainable development, or to try to develop various separate solutions of individual sustainability problems. These responses to the sustainability challenge were not condemned as such, but merely said to be inadequate for effective leadership for sustainability.

The report points out that there is now a strong need to make *coordinated* use of the good results from the above-mentioned types of research, and for systems science for interdisciplinary and intersectorial leadership and innovation for sustainability. This is in order to make the best use of specialist competences and to *coordinate* the development of solutions in various subsystems, to make them mutually supportive and capable, in combination, of bringing about change in society that is extensive and rapid enough to make sustainability achievable. It was concluded that such research is going on in Sweden but that it needs to expand to match the growing need. It was also pointed out that companies, municipalities and other organisations should take part in such research to assure the relevance and usability of developed concepts, methods and tools. It was concluded that Sweden has good prospects of taking an international lead in this type of research and development.

A call for a Special Volume of the *Journal of Cleaner Production* (Appendix 4 of Part A) has presented the identified research need internationally, thereby giving all researchers with an interest in this matter a chance to showcase their work and results. Thus, an international survey of current research in relation to this need is also obtained.

Purpose

With this background, Mistra tasked BTH with also gathering experience from some proactive enterprises and regional stakeholders that have already embarked on strategic efforts to successively adopt a robust description of sustainability goals, without waiting for the political system to take the lead and without state support. BTH's remit was to:

- ▶ investigate how these organisations regard the research need identified in academia
- ▶ probe these stakeholders' wish to take part in this type of research and, with the intention to specify the conditions for the research
- ▶ summarise the view of these organisations on the obstacles to and opportunities of collaborating, in order to jointly achieve greater benefits for their own organisations and also for society at large
- ▶ explore the possibility for involving more stakeholders in intersectorial cooperation for strategic sustainable development.

Method

Participants in the study were selected from leaders and owners in the BTH and The Natural Step (*Det Naturliga Steget*, DNS) networks that work, on various scales, to inform their methods and tools for sustainable development in businesses and public-sector organisations by use of a large enough perspective in time and space (backcasting from a globally sustainable civilization). To that end they use the Framework for Strategic Sustainable Development (FSSD), designed for leadership at any scale to ensure that today's investments can be linked technically, socially and economically in step-wise strategies to the large perspective. These people and organisations are listed in Appendix 1.

The participants first received the above-mentioned report and call (Part A) on academia's view of the research needed, and were asked to study these and form opinions on the conclusions. Thereafter, two to three semi structured interviews were conducted with each participant. This was done to obtain an up-to-date image of the stakeholders' work on strategic sustainable development. We sought to understand both the obstacles and the opportunities they perceived in this work, and to create a list of conceivable early focus areas for project collaboration with academic institutions that would correspond both to the participants' needs and to the research needs described above. This work continued during a workshop (see Appendix 2) to:

- ▶ let the participants present their respective organisations' work on strategic sustainable development
- ▶ develop and prioritise ideas for collaboration with academia that had emerged in the preceding interviews
- ▶ create an opportunity for networking and open-ended discussions free from agendas.

After the workshop, further telephone interviews and email correspondence with the participants took place to follow up and confirm the overall outcome of the workshop.

Results

Experiences, obstacles and opportunities

The workshop presentations were documented on video:

- ▶ Part 1: <http://www.youtube.com/watch?v=im9PvMxZ72E&feature=youtu.be>
- ▶ Part 2: <http://www.youtube.com/watch?v=Ts-sxOD2zk0&feature=youtu.be>

During the presentations, accounts were given of the current state of research on strategic sustainable development and how it relates to planetary boundaries (Professors Göran Broman, Karl-Henrik Robèrt and Johan Rockström; for references, see Robèrt, K-H., G. I. Broman, and G. Basile, 2013. Analyzing the concept of planetary boundaries from a strategic sustainability perspective: how does humanity avoid tipping the planet? *Ecology and Society* 18(2):5 <http://dx.doi.org/10.5751/ES-05336-180205>).

Stakeholder attendees then reviewed the work on strategic sustainable development under way in their own organisations. This included the advantages of having a robust definition of sustainability as a lens when identifying today's challenges and tomorrow's conceivable solutions from the large enough perspective in time and space. The advantages of thereby being able to also identify problems 'upstream', before these have manifested themselves as damages or costs 'downstream', were also pointed out.

In addition, all presenters gave examples of concerns that emerge when the methodology is used, but which are hard for the individual organisation to tackle *sufficiently fast* on its own. One such example is the fact that companies are in various ways dependent on the decisions of other stakeholders (including societal actors) in sectors like energy, agriculture and transport. Since these are today not always being led systematically in a sustainable direction, the companies are forced to sub optimisations. Another example is that the macro- and microeconomic systems so far have prioritised large flows of material resources at the expense of the leaders' sustainable visions. Those two factors exemplify mechanisms by which the *pace* of change is hampered amongst competent and proactive organizations. They all know how to move systematically in the right *direction*, and they do not need help from legislation to capitalize on their progress relative to competitors. But the *pace* of development is curbed by the difficulty of capitalising, in time, such major investments that would be desirable in the larger, societal, perspective.

The participants of the study thus confirmed the need, identified in academia, for more systems science research for interdisciplinary and intersectorial leadership and innovation for strategic sustainable development in cooperation with business and public actors.

Research needs and collaboration

The above-mentioned experiences and obstacles and opportunities identified thus substantiate the research need identified in academia as described in Part A. All participants have also explicitly voiced this view, and they are all willing to take part in this kind of research and wish for a structure and a programme for its implementation. Specifically, they express interest in this kind of research with an initial application focus on:

► **Business models**

The participants agreed that it is important for the above-mentioned research to serve the purposes of developing and disseminating new and alternative business models. Today, a very high proportion of companies base their success on ‘selling more products’. Clearly, this logic is very often in direct conflict with the drastically reduced and changed types of resource flows entailed by the sustainable society of the future. The ability to create, maintain and develop business models where success, instead, is derived from *reduced* and *changed types* of flows with retained or increased utility to humankind will be crucial. Here, existing forms of product-service systems probably have great unused potential, which should be investigated more through research. However, new models involving even more of a ‘multi-stakeholder dialogue’ in a broad sense (including politics and public administration, for example) are probably needed to sufficiently fast bring about the needed intersectorial work. The participants unanimously perceived a need for more research to support measures to promote this kind of system innovation and development.

► **Sectorial development**

The participants agreed on both the necessity and the complexity of shaping development in certain sectors of society. Many stakeholders in widely varying sectors are affected and they depend on, for example, energy, agriculture, waste, transport and spatial planning. Acting as responsible leaders and developing their operations to achieve full sustainability are impossible if their dependence on these large sectors, so critical to society, is not taken into account. They must be included as an active part of the individual enterprise’s analysis and planning. How can a company act responsibly and skilfully in a broader societal perspective? How can profound enough change within different sectors be modelled, unless they can be modelled *together* within the *same* sustainability constraints?

Every individual stakeholder is small and has difficulty in alone influencing and developing various sectors on which it depends. This applies although many stakeholders often agree that the existing structure does not correspond to future demands. Together, in an orderly manner, uniting on smart sector-wide development stages seems a necessity as well as an attractive option. More organised and constructive dialogue among stakeholders in the business and public sectors is needed, and this in turn calls for measures in the form of the above-mentioned research to help provide scientifically robust methods for interdisciplinary and intersectorial collaboration.

► **Tools and methods**

The participants agreed on the need for useful tools and methods for analysing, leading, steering, supporting, monitoring and communicating sustainability work in their own organisations. Today, there are already numerous scientific reports and theses on robust methodology for this kind of work, i.e., combining financially improved business models with strategic planning for sustainability that offers reduced risks and increased relevance on an ever more sustainability-driven market. But scientific reports cannot be used without first being packaged and presented in a practical, business-like way. An easily accessible knowl-

edge and methods bank for tools and methods of this kind was discussed and deemed desirable. Here, collaboration with the researchers is needed, so that the ‘translation’ into applicable language does not jeopardise the integrity of the scientific foundation. The planning methodology used by the participants in their sustainability work and the aforesaid research provide, in their view, the basic foundations for arranging harmonisation among the tools and methods, so that they support one another. Companies who base their work on sustainability in the future, and then draw conclusions on strategic ways of achieving it (‘back-casting’), need coordinating tools and methods to steer and communicate their activities. Many of the tools and methods available at present lack this characteristic and are, rather, overlapping and competing, or sometimes even contradictory and confusing.

The participants also discussed the need for education to complement the aforesaid research, by which employees, suppliers, customers and other stakeholders associated with a company or other organisation can obtain relevant training that is updated through research. Many companies have their own educational activities and experience of this, but the need for wider outreach was keenly felt. At the same time, the wish for the education to be quality-assured and relevant, and give the participants a common set of terms, was underlined.

The participants also agreed on the need to influence politicians, public servants and macroeconomic conditions in order to remove structural and systemic obstacles to obtaining a sufficient pace of sustainable development. Given the subtle challenge the participants of the workshop share, namely that of back-casting from the full scope of social and ecological sustainability, new designs of political and macro-economic incentives will not be adequate unless informed by this same mind-set. Simplistic economic frameworks derived to focus solely on decreased and/or recycled flows will not be enough and risk leading to sub-optimisations as regards innovation and leadership. There need to be cohesion between the subtle task on the one hand, and political and economic incentives on the other. As a conceivable basis for achieving this, there was an outline presentation of a sustainability workshop for Sweden/the Nordic area on the theme of ‘Overriding challenges and opportunities for a sustainable Sweden/Nordic area’. A workshop (or several workshops) of this kind would identify an overarching vision for sustainability in Sweden/the Nordic area; current major challenges in relation to such a vision and conceivable obstacles en route; conceivable alternative lines of action; and prioritised early actions for moving towards the vision. The process would involve first creating a joint outline and then, as part of the work, identifying politicians and public servants who could help to develop the outcome further. Based on this analysis, more constructive and well-informed discussions with politicians and public servants could be held and these talks could then be informed by, as well as included as an object of study in, current research according to the above-mentioned needs.

The participants call for a proposal covering a structure and a programme for the research they seek.

Appendix 1.

Participants

Aura Light

Martin Malmros, CEO of Aura Light.

Gunilla Danström, VP Marketing Director of Aura Light.

- ▶ Aura Light is a proactive company with a lighting business. Full sustainability means, for Aura Light, to apply the FSSD for backcasting from a situation in which light sources have a much longer service life and are extremely energy efficient, and where research has developed this kind of lighting with entirely sustainable materials flows, as well as business models that place lighting in a societal perspective.

Blekinge Institute of Technology

Professor **Göran Broman**, Head of Department of Strategic Sustainable Development at the Blekinge Institute of Technology (BTH).

Professor **Karl-Henrik Robèrt**, Strategic Sustainable Development at BTH and founder of The Natural Step, a non-governmental organisation.

- ▶ BTH is an international hub for development of the Framework for Strategic Sustainable Development (FSSD), a unifying and structuring methodology for strategic sustainable development. The methodology is used by companies, municipalities and other organisations to analyse and plan for sustainable development. It is also used to enhance the usefulness of other concepts, methods and tools for sustainable development, by clarifying how these are related to sustainability and to one another. At BTH, several PhD projects and two Master's programmes are centred around the FSSD.

The Natural Step

Anders Söderlund, Board Chair of The Natural Step.

Karin Schultz, Secretary General at The Natural Step.

- ▶ The Natural Step (*Det Naturliga Steget*, DNS) is an international NGO founded in 1989. The organisation works to stimulate research concerning strategic sustainable development and provide advice, mainly to companies and municipalities, by mediating, testing and refining the methods developed in research. The organisation's modus operandi is pursuit of best practice, i.e., bringing about change in society through the successes achieved by role models in academia, business and municipalities/cities.

Ericsson

Leif Johansson, Chair of Ericsson (not present at the workshop on 9 October).

Emelie Carleö, Vice President of AB Aphae, the investment and consulting company started by Leif Johansson (not present at the workshop on 9 October).

- ▶ Leif Johansson has successfully pursued sustainable development since his time at Electrolux, when he applied the full system perspective of the FSSD to be first phasing out freons without phasing in something else that would not comply with sustainability principles, as well as devising strategies to arrive at fully sustainable management of metals. At Volvo, he developed the business operations in the same way, presenting a vision of full global sustainability according to which strategies were thereafter drawn up. In both cases, he followed a clear line of supporting proactive politicians and, for example, proposed higher taxes on old-fashioned batteries as well as on fossil CO₂ emissions.

Mistra

Lars-Erik Liljelund, Executive Director of Mistra.

Johan Edman, Programmes Director at Mistra.

- ▶ The Swedish Foundation for Strategic Environmental Research (Mistra) supports research of strategic importance for sustainable social development. Every year, Mistra invests a sum of the order of SEK 200 million in various research initiatives to build bridges among scientific disciplines, and between research on the one hand and businesses, public agencies and other stakeholders on the other. The purpose of these investments is to solve environmental problems and simultaneously strengthen Swedish competitiveness. Lars-Erik Liljelund commissioned from Göran Broman and Karl-Henrik Robèrt an investigation of research needs to make leadership for sustainability more systematic and functional, and of the state of Swedish research in this area. The meeting of 9 October should be seen as a follow-up project that is also supported by Mistra.

MTT

Anu Harkki, Research Director at MTT Agrifood Research Finland (not present at the workshop on 9 October).

Professor **Hilkka Vihinen**, Research Area Manager (Green Economy), MTT.

- ▶ MTT is a Finnish government body for agricultural research that has turned to Sweden for a systematic approach to strategic sustainable development. Through backcasting from basic principles they want to connect the agricultural and industrial sectors in Finland. MTT now works systematically to engage some of the largest stakeholders in Finland and train them in backcasting from sustainability principles to enable MTT, jointly with these stakeholders, to create wide-ranging solutions suited to Finland's agricultural, business and industrial conditions.

Polarbröd

Anna Borgeryd, owner and Chair of Polarbröd.

Karin Bodin, owner and CEO of Polarbröd.

- ▶ Polarbröd runs its operations with the FSSD sustainability principles on the agenda and has, through resource efficiency and bakeries operated without using fossil fuels, achieved major in-house advances. The company is now working actively to engage its main associates who, in societal terms, face the biggest challenges in attaining a sustainable food supply. The main questions are how Polarbröd can help both agriculture and transport to develop in such a way as to meet sustainability principles, and how Polarbröd's operations can develop in parallel and profitably for such a purpose.

Ragn-Sells

David Schelin, CEO of Ragn-Sells.

Tove Olsson, Head of Quality and Environment at Ragn-Sells.

- ▶ Ragn-Sells is actively working with backcasting from a situation in which all material flows meet the sustainability principles. Accordingly, the company must evolve from an internationally leading waste-recycling company into one that organises fully sustainable material flows in general. Which materials, then, are used less, which are used more, which have been completely phased out, and what form of organisation best promotes effective collaboration of this kind in society?

Scandic Hotels

Anders Ehrling, President and CEO of Scandic Hotels (not present at the workshop on 9 October).

Inger Mattsson, Sustainable Business Director at Scandic Hotels (not present at the workshop on 9 October).

- ▶ Scandic Hotels was one of the first companies in Sweden to embark on systematic work with basic conditions for sustainability, to integrate values, visions and strategic objectives with these conditions and to start moving systematically towards their sustainable vision of the future. It is probably no exaggeration to state that Scandic Hotels may very well be the world's most proactive hotel chain.

Stockholm Resilience Centre

Professor **Johan Rockström**, Director of the Stockholm Resilience Centre.

- ▶ The Stockholm Resilience Centre is one of Sweden's most internationally renowned research institutions for sustainable development. Its research is broad, ranging from the planetary system perspective to specific problems associated with, for example, climate, agriculture and population issues.

Ports of Stockholm

Johan Castwall, CEO at Ports of Stockholm (*Stockholms Hamnar*).

Lena Ekbohm, Head of Sustainable Strategy, Ports of Stockholm.

- ▶ Ports of Stockholm is integrating the basic sustainability principles into its business and developing cooperation on these principles within the company and with its stakeholders. The company perceives the great potential of shipping in a sustainable society, and sees its mission as being to support development not only of its own port operations as such but of the entire shipping sector.

Wallenius

Jonas Kleberg, owner and Chairman of Wallenius.

Sara Gorton, Head of Environmental Strategy at Wallenius.

- ▶ Wallenius sees the great potential of shipping and has, for decades, led the way in developing shipping towards full social and ecological sustainability. The company uses backcasting in its planning, based partly on a model of a ship that in no way contributes to the violation of the basic principles of sustainability. Conclusions are drawn at a detailed level, for example regarding sustainable energy systems, and through development of advanced methods of cleaning ballast water to prevent organisms spreading from one harbour to another. Jonas Kleberg's work to develop Wallenius's own operations has yielded an extensive stock of experience concerning system resistance, and he has ideas about how training and education of business organisations and politicians could reduce system resistance.

Government of Åland

Camilla Gunell, Premier of the Government of Åland (not present at the workshop on 9 October).

Ann Nedergård, Environmental Engineer, Government of Åland.

- ▶ Åland is an autonomous, demilitarised and Swedish-speaking monolingual island province in the Baltic Sea, belonging to Finland. Its system of self-rule, secured by international guarantees, comprises both the Government (*Ålands Landskapsregering*) and the legislative assembly or Parliament of Åland (*Ålands Lagting*). In 2012 the Government of Åland appointed a committee tasked with drafting a strategy for a sustainable Åland. This committee reported on its work in June 2014 and, in the draft strategy, recommended that Åland should work according to the Framework for Strategic Sustainable Development (FSSD) and become a sustainable society by the year 2051.

Appendix 2.

Workshop agenda

Workshop on 9 October 2013

Systematic collaboration between research, the business sector and society for a sustainable world

Organisers: Blekinge Institute of Technology and Mistra jointly.

Theme: 'From Joint Sustainability Values to Competent Leadership'.

Venue, date and time: Hotell Scandic Foresta, 9.00 am, 9 October 2013.

Background and backcasting from sustainability principles

Our knowledge of the need to transition towards a sustainable society, and the consequences of not doing so, is relatively good. A great deal is also known about measures that could help to bring about sustainable development, such as renewable energy, eco-friendly vehicles, microloans and green taxes. However, there is a lack of knowledge about *how* companies and regional stakeholders — alone and together in coordinated cooperation — can work strategically to contribute to sustainable development of society with maintained or strengthened competitiveness. At the same time, there are many proactive stakeholders that, without waiting for the political system and with no state support, successfully work strategically with sustainable development. This means that they use an approach to analysis and planning that is as necessary as it is unusual. This approach, known as 'backcasting from sustainability principles', means that a basic vision of sustainability and strategic guidelines, rather than just present-day concerns, are what guides how successive change in collaboration with others can take place. Thus, it supports:

- ▶ analysis of the current situation
- ▶ generation of future opportunities
- ▶ planning and management of competitive, step-by-step changes across sectorial and disciplinary boundaries
- ▶ choice of methodology (concepts, methods and tools) for decision support, indication and management.

Purpose

The purpose of the workshop is to assemble some of these stakeholders to benefit from their knowledge of obstacles and opportunities for sustainable development of business and society. The idea is to explore the possibility for learning collaboration among knowledgeable stakeholders in the business sector and municipalities on the one hand and researchers on the other. After a few introductory presen-

tations, the workshop will pose a few questions. The participants' replies to these questions will be summarised by the organisers and a way of continuing the discussion, in some form, may then be decided upon by the participants.

Programme

9.00–9.05 am	Karl-Henrik Robèrt will review the day's agenda.
9.05–9.10 am	Lars-Erik Liljelund, Mistra's Executive Director, will welcome the attendees and speak about Mistra's interest in backcasting from principles.
9.10–9.20 am	Göran Broman: What research is needed to provide more support for proactive stakeholders? A brief report from a previous survey carried out for Mistra and a report on the current work with a Special Volume of the <i>Journal of Cleaner Production</i> .
9.20–9.30 am	Johan Rockström: An overview of sustainability in a planetary perspective that unites sectors and disciplines.
9.30–9.50 am	Karl-Henrik Robèrt: The art of working across sectorial and disciplinary boundaries, based on robust visions. An overview of research on how proactive stakeholders can place their activities in a planetary context to become more successful.
9.50–10.00 am	Göran Broman: System perspective on sustainability guides the development of methods and tools for strategic collaboration across sectorial and disciplinary boundaries.
10.00–10.15 am	Coffee
10.15–11.00 am	How can we bring our own operations into line with the overall sustainability perspective?
Stakeholders' presentations: up to five minutes per organisation. Proactive stakeholders in regions and businesses will relate their experience of strategic sustainable development and wishes for improved conditions through, for example, research support and political control instruments. How can we work systematically, step by step, across sectorial and disciplinary boundaries towards a robust vision of sustainability? Stakeholders making presentations: Anna Borgeryd (Polarbröd), Johan Castwall (Ports of Stockholm), Anders Ehrling (Scandic Hotels), Anu Harkki (MTT, Finland), Jonas Kleberg (Wallenius), Martin Malmros (Aura Light), David Schelin (Ragn-Sells) and Camilla Gunell (Government of Åland).	
11.00–11.45 am	Discussions in small groups. The points collected during the preceding telephone interviews of Karin Schultz will be discussed. Adjustments and additions may be made.
11.45 am–12.15 pm	Plenary discussion. How should we proceed?
12.15–1.00 pm	Lunch for all, followed by further discussions.



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