Sustainability Science in Practice: Discourse and Practice in a University-Wide Transition Initiative

Jean Hugé and Tom Waas

Abstract

'Sustainability science' (Kemp and Martens 2007; Hugé 2012) is an increasingly popular concept, drawing scholars and students towards inter- and trans-disciplinary approaches that are commonly believed to embody the best solutions to solve the challenges of rapidly a changing world. While the enthusiasm generated by the concept is to be welcomed, its implementation and operationalization are challenging. If it fails to deliver, it risks to trigger disillusion and discouragement and it may come to embody nothing more than semantics and 'loose words'. Engineers are—at least perceived as—the quintessential problem solvers in academia, but global change as well as the realization that any scientific endeavour cannot be performed in a societal vacuum forces engineers to reconceptualize their role in society as well as their research philosophy. Tangible processes are needed to turn this analysis of the current situation into actions for a more sustainable future. Sustainability assessment (SA) is such a process that may turn the initial enthusiasm for the broad concept of sustainability science into actions that lead to more sustainable engineering research and teaching. The objective of this paper is to identify the strengths and weaknesses of SA in a university-wide transition exercise, focusing on the views of the academic community in engineering faculties at the University of Ghent, Belgium. Drawing on the application of sustainability

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assessment processes on various systems (energy systems, development cooperation projects), and on the real-life experience of the bottom-up 'Transition at the University of Ghent, Belgium'-initiative, we use a discourse-analytical approach to sustainability assessment (Hugé et al. 2013). Acknowledging the variety of discourses, frames and worldviews embodied in sustainability science is a key step in creating actor coalitions that may trigger positive change in academic institutions. We will propose a qualitative evaluation of existing and planned concrete transition activities, building on recent insights in the field of 'sustainable higher education' (Beynaghi et al. 2014) in order to provide recommendations on how to implement sustainability science in engineering faculties.

Keywords
Sustainability science · Transition · Sustainability assessment

1 Introduction: What Kind of Knowledge Do We Need?

Generating and managing knowledge is essential to realize the ambition of sustainable development as a strategy to guide decisions. A decision-guiding strategy gains its legitimacy through the knowledge that forms the base of the strategy itself. This knowledge should be able to deal with complexity, uncertainty and multiple legitimate value-laden viewpoints—as these are key context-defining features of any sustainability issue (Andersson 2008; Hugé 2012).

1.1 Complexity

Sustainability issues are intrinsically linked to each other and the many interactions between social and natural systems are of high and increasing complexity. Complex issues concern a web of related problems, lie across or at the intersection of many disciplines and the underlying processes interact on various temporal and scale levels (van Asselt and Rijkens-Klomp 2002). Complex issues involve a large variety of technical and scientific input as well as important value-laden and ethical aspects (Andersson 2008). Indeed the interplay between environmental processes and human activity, and the values underlying the perspectives on this interplay are key in any sustainability issue. Complexity applies to systems showing deep uncertainties and a plurality of legitimate perspectives (Funtowicz et al. 1999). Studying sustainable development consequently entails studying non-linear causal networks, emerging issues and recognizing limitations in understanding (Ostrom 2009).

Complexity is present at various levels: First, the intrinsic complexity of multidimensional societal challenges is creating an ever-growing need for information and debate (Funtowicz et al. 1999). Complexity is closely related to the ever-increasing size and pace of information flows that submerge decision-makers. In other words, today's world is arguably 'messier now than it was in earlier decades' (Rosenau 2005). Rosenau (2005) speaks of 'fragmegration' (a neologism combining fragmentation and integration) to denote today's world's complexity and identifies eight complexity-enhancing forces ranging from microelectronic technologies to authority crises and to economic globalisation.

Secondly, the institutional complexity arising from the new realities of multi-level governance networks blurs the boundaries between the responsibilities and competences of 'classical' jurisdictional entities such as the nation-state and—new—players such as regions, stakeholder groups and multilateral organisations. Complexity is now also a defining feature of sustainable development governance (Jänicke 2007). This means that in order to understand the sustainability of complex systems, multi-level nested frameworks are needed (Ostrom 2009). As 'the price of increased complexity is pervasive uncertainty' (Gibbons 1999) we will now delve deeper into the latter.

1.2 Uncertainty

The context into which 'knowledge for sustainability' needs to be generated and used in order to cope with global change is characterized by inherent uncertainty. Uncertainty is a key feature of sustainability (Boulanger and Bréchet 2005), which is by definition a future-oriented concept. Uncertainties have become more significant in recent times because of the growing scope, complexity and hazardous consequences of human activities. Complex systems such as ecosystems and social systems are very difficult to predict). The interactions between the socio-economic system and the environment are mostly characterized by strong uncertainty as global sustainability problems have no historical precedent (Faucheux and Froger 1995). In order to deal with uncertainty, a learning approach and a high adaptive capacity are required.

1.3 Values and Multiple Legitimate Viewpoints

Within the interpretational limits of sustainable development, many legitimate viewpoints exist (Hopwood et al. 2005), which often reflect particular values. Values are beliefs about goals in life that are desirable for an individual or for society (Andersson 2008). Values lead to different perspectives, which differ between various actors. Some values are shared by almost everyone while others are cultivated within certain social groups (Andersson 2008). These perspectives reflect personal agendas as well as particular political, cultural or historical sensitivities and materialize for instance through differences in emphasis regarding the dimensions of sustainability. Decision-making for sustainable development hence not only requires scientifically valid knowledge but also knowledge that is acceptable to various societal actors (Runhaar 2009). Hence stakeholder input is needed to provide knowledge (Runhaar 2009). Blanchard and Vanderlinden (2010) also refer to these multiple viewpoints from a disciplinary point of view: scientific disciplines have become so specialized that coherence is lost. 'No perspective is wrong by its own measures, however, they are all incomplete without the other perspectives'. Knowledge for sustainable development needs to propose solutions to deal with these legitimate alternative viewpoints.

The recognition of the importance of the three context-defining characteristics described above has consequences for knowledge generation for sustainable development. It has even led to the emergence of 'new' forms of science, which we group under the heading of 'science for sustainable development'.

2 Sustainability Science

Sustainable development's normative character and its long-term horizon result in specific demands for science (Funtowicz and Ravetz 1993). A new concept of science, different from disciplinary, normal science seems to be necessary (Müller 2006). In the context of sustainable development 'knowledge creation' is far from the rational, cognitive and technical procedures of science as previously understood. Instead knowledge creation is perceived as a process or practice. Post-modern perspectives embrace an awareness of multiple 'knowledges', situated specificities, discourse and narrative analysis and complexities of actor-institutional interactions' (Grist 2008). Types of knowledge for sustainable development then include:

- diagnostic knowledge (with regard to the causes leading to 'un-sustainability);
- explanatory knowledge (with regard to the interactions between social activities and sustainability impacts);
- orientation knowledge (with regard to normative justification arguments);
- knowledge for action (with regard to finding solutions to 'un-sustainable' situations).

Knowledge for sustainability needs to analyse a system's deeper-lying structures, (diagnostic and explanatory knowledge), it needs to project into the future (orientation knowledge), it needs to assess the impact of decisions (explanatory, orientation and action knowledge), and it has to lead to the design of new strategies for solutions (knowledge for action) (Waas et al. 2010). We use the term science here in its broadest interpretation, as 'the state of knowing', referring to a contextually useful ordering of information flows.

Science for sustainable development is sometimes used as a generic term to describe science performed in a solution-oriented context of social relevance (Müller 2006) characterized by complexity, uncertainty and the importance of values. Scholars have proposed specific terms and initiatives describing its characteristics:

Table 1 Characteristics of science for sustainable development

Intra- and inter-disciplinary research
Co-production of knowledge
Normative and positive inputs
Systemic integration
Exploratory character
Recognition of own limitations and assumptions
Learning-oriented perspective
Production of socially robust knowledge
Attention to system innovation and transition

mode 2 science (Gibbons et al. 1994); post-normal science (Funtowicz and Ravetz 1993); sustainability science (Boulanger and Bréchet 2005; Kemp and Martens 2007). Despite differences in formulation, these approaches essentially describe the same content; and given the fact that 'sustainability science' is most probably the best known term (as exemplified in the homonymous journal http://link.springer.com/journal/11625), we use this throughout this contribution.

'Sustainability science' is defined as an integrative science aiming at the integration of different disciplines, viewpoints and knowledge types (Kemp and Martens 2007). Sustainability science is an 'evolving process of knowledge construction requiring co-operation between disciplines to arrive at a shared understanding of issues at hand' (Blanchard and Vanderlinden 2010). Hulme and Toye (2006) speak of 'knowledge communities' instead of disciplines. They argue that what matters is consensus on aims and methods within the community. Furthermore as knowledge will always be provisional and incomplete in its descriptive aspects, as well as depending on changing normative expectations, sustainability science needs to be reflexive, i.e. sensitive to the way in which knowledge was generated (and hence what the underlying uncertainties are for instance). In summary, sustainability science builds on both normative and positive inputs: the new scientific paradigm is no longer exclusively based on 'objectivity', but also incorporates normative elements (Luks and Siebenhüner 2007). Alternative problem framings are an essential element of sustainability governance and can lead to 'out of the box' thinking and to the realisation of innovative solutions to respond to complex societal challenges (Table 1).

3 Operationalizing Sustainability Science in a University: The Operationalization Challenge

Following this reflection on the specificities of the context in which sustainability science is to be applied, the main question of interest for universities is how to move from analysis to action. The ready-made answer is to turn to the multi-interpretable process of sustainability assessment. Sustainability assessment, defined as an umbrella process aimed at operationalizing sustainability as a decision-guiding strategy, through the identification of the future consequences or current and planned actions, is often presented as the key process to 'make sustainability happen'. Products, processes and organizations, policies and projects can be assessed on their sustainability content and impact, and many different methods exist (Ness et al. 2007). Similarly sustainability assessment frameworks have been developed specifically for academia (see Waas et al. 2010 for an overview).

However, one should be careful about the interpretation of what exactly is assessed, especially in the field of sustainability in higher education (SHE). Universities have a critical role to play in creating a sustainable future, as they educate many of the professionals who lead, manage, and teach in our society Moreover, they can be sustainability innovators through research activities, and act as models for the community. Yet studies show that while many efforts to incorporate sustainability within higher education exist, it is rare to find a university that has fully embraced the sustainability imperative (Wright and Wilton 2012).

To date, most of the efforts have been focused on: (1) sustainability and education (curricula/teaching), and (2) sustainability and management, in particular the environmental management of institutions (e.g. water and energy use, waste management) (Waas et al. 2010). The integration of sustainability (in one way or another) into the third pillar of academia—research—has been comparatively neglected. This is not due to a lack of attention devoted to research strategies, it can be attributed to the difficulties of grasping what sustainability means for existing and new research initiatives, both fundamental and applied.

4 The Ghent University Transition Initiative

Ghent University is one of the largest Belgian universities (41,000 students, 9000 staff members and 117 research units spread over 17 faculties) and includes two engineering faculties: the Engineering Faculty and the Bio-Science Engineering Faculty. Since 2012, a group of frontrunners consisting of professors and students has initiated a bottom-up process to foster sustainability at the university. This process has been strongly supported by the Environmental Coordination Unit and has ultimately been actively supported by the main governing bodies too. This initiative, known as 'the Ghent University Transition Initiative' is now a think tank as well as an open network, and it has produced two 'Memorandums' (in March 2013 and October 2014). The transition approach to sustainability presents societal transformation as the interplay between different levels: the landscape level describes the exogenous drivers, the regime describes the current state of affairs and the niches are innovative spaces and initiatives that can trigger changes at the regime, and eventually landscape level. The approach has been initiated by Geels (2002) and is now used e.g. in Belgium and in the Netherlands by policy-makers to understand and manage transitions towards sustainability. The 'University of Ghent Transition Initiative' chose this approach to link the wide range of—often small scale—sustainability initiatives (niches) with the bigger picture of change towards sustainability at the university-level, and to propose integrated actions towards sustainability at different levels. Figure 1 presents the transition multi-level perspective as proposed by Geels (2002). Figure 1 is a schematic outline of a sustainability transition, showing how niche innovations can be taken up by the dominant socio-technical regime (which consists of six dimensions (science, culture, policy, industry, markets, technology) and can hence modify that regime, which is also influenced by meta-level landscape developments. At the University of Ghent, transition pathways were developed for various modules (energy, water, teaching, mobility and transport etc.). We focus on the transition pathway that was developed for *research* and will subsequently reflect on the implications for engineering faculties.

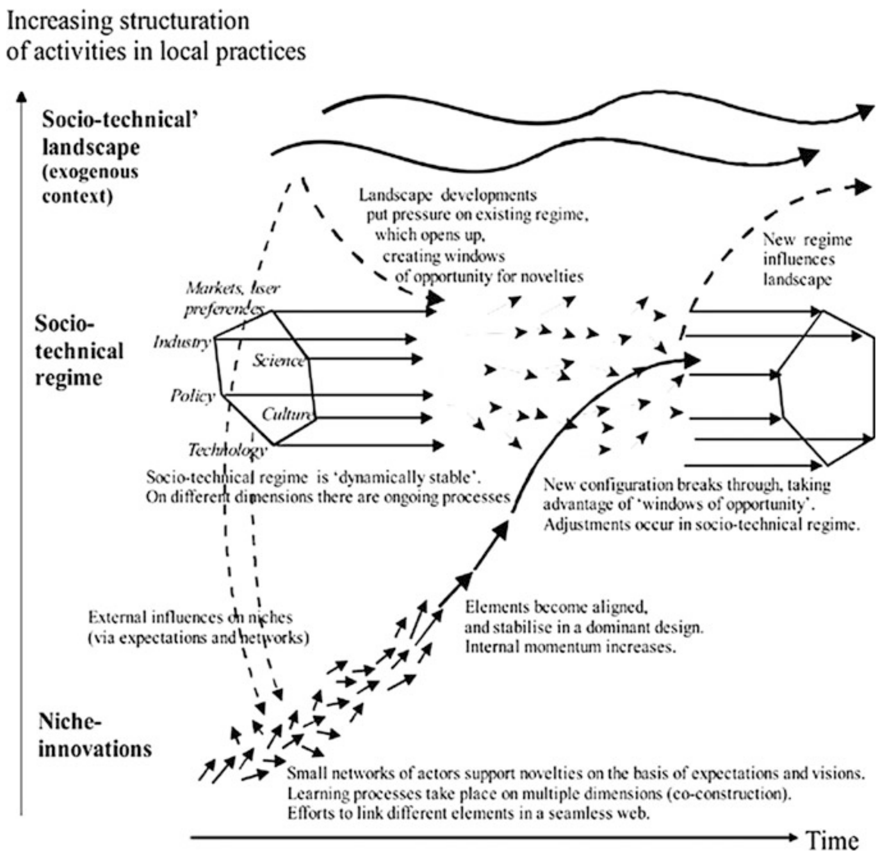

Fig. 1 The multi-level perspective on transitions (Geels 2002)

5 Transition Approach Applied to Research

Based on numerous participatory roundtable exercises held between 2012 and 2014, the following transition path for research was developed at the University of Ghent. Starting with an analysis of the situation in 2012, a stepwise transition path is proposed with 2020 as time horizon.

6 Discussion

6.1 Sustainability, Consensus and Academic Freedom

There are multiple reasons why universities encounter difficulties to grasp the concept of sustainability in research. The first one relates to the intrinsic multi-interpretability of the concept of sustainability, illustrated by the well-known weak versus strong sustainability discussion (Hopwood et al. 2005). The second reason pertains to the key issue of academic freedom. Steering research in a particular direction, even if that direction is presented as 'consensual' sustainability, inevitably raises questions about the independence of the researcher and the fear of limitations that could be imposed on academic freedom. The third objective relates to the specificity of every research tradition and the very interpretation given to 'science for sustainability'. Applied science can have positive effects on sustainability, without consciously following a self-reflexive, multidisciplinary approach, while the implications of fundamental research for sustainability are often impossible to predict. But given these caveats, how can university staff assess if they are on the right track towards incorporating sustainability in research, in order to 'implement' sustainability science? And how does one find a balance between the imperatives of fostering sustainability and maintaining academic freedom? We propose a stepwise approach.

6.2 Proposed Approach Towards Sustainability Science in Universities

The approach that is proposed here is currently being implemented at the University of Ghent, and aspects of this stepwise approach are also being applied at the University of Limpopo, South Africa. Feedback and comments on this proposed approach are welcomed, as the current state of affairs does not yet allow a systematic evaluation due to the ongoing character of the described transition initiatives.

Step 1: Initiating university-wide open discussion about what sustainability means with regard to the various roles of universities (teaching, research, societal service, facility management…) (e.g. the University of Ghent Transition Initiative).

Step 2: Combine university-wide and faculty-specific transition pathways for sustainability in research (cf Fig. 2) (e.g. the ‘campus as a living lab’ idea, entailing the conduct of academic research on proving new technology that advances sustainability on campus through operations).

Step 3: Mapping existing discourses on sustainability, and on sustainability in research, in each faculty. This can be done by using the Q methodology (Sylvestre et al. 2014) which allows to map discourses and subjective perspectives in a systematic and transparent way.

Step 4: Identify areas of consensus in the discourse mapping (Hugé et al. 2013). Start from these consensus areas (e.g. ways to define sustainability, options to realize sustainability in research) to develop pilot projects and/or pilot incentive mechanisms to support sustainability in research.

Step 5: Evaluate the success of these ‘niche’ initiatives in light of a multi-level, long-term sustainability transition strategy.

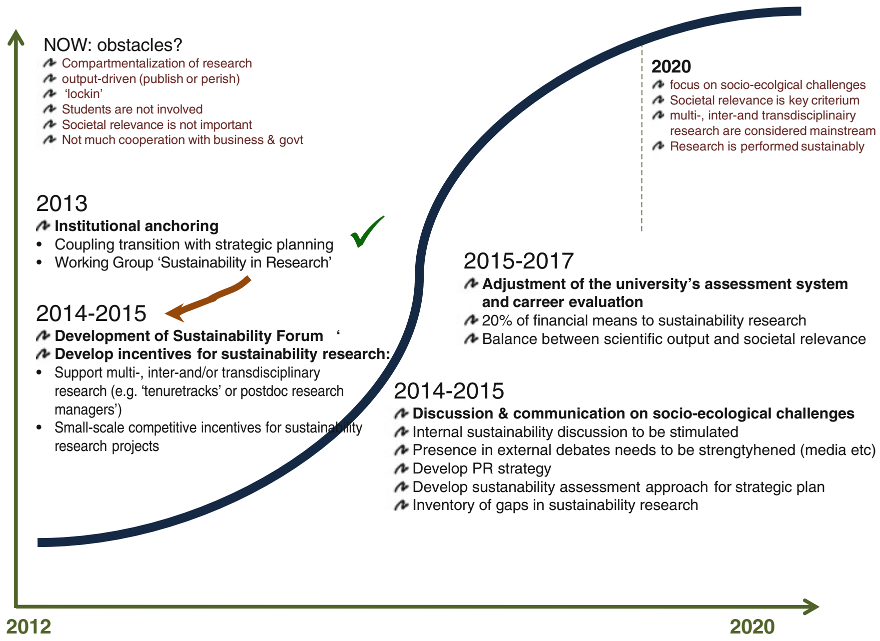

Fig. 2 Sustainability transition path for research at the University of Ghent (*Source* Memorandum for sustainable development, University of Ghent, 2014) (X axis: time, Y axis: increasing structuration of activities in local practices)

7 Conclusion and Steps Forward

While the approach presented here is yielding promising preliminary results, the empirical analysis of its potential success is still in progress. Linking strategic sustainability transition goals with niche experiments in challenging areas such as academic research is a necessary step towards the operationalization of sustainability science. Engineering faculties have a key role to play, both in actively shaping the discourses and perspectives regarding sustainability, and in learning from other discourses. Finding a balance between the awareness of the importance of sustainability in research and the need for independent academic research is certainly possible. Mapping discourses to identify areas of consensus will lead to practical ways of turning sustainability science into practice. Knowledge communities might arise from such an approach, which well then lead to the acknowledgement of alternative framings of sustainability issues and to the development of inclusive solutions. Ongoing research on discourse mapping methodologies can support sustainability transition initiatives by depolarizing debates and by providing the basis for common—interdisciplinary—approaches towards sustainability science.

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