Sustainability Science Partnerships in Concept and in Practice: a Guide to a New Curriculum from a European Perspective

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Abstract
This paper makes the case for advancing sustainability science partnerships (SSPs) both within universities and through innovative means of integrating universities with external public-private and civil sectors. It links the basic principles of sustainable development with an emerging science of cooperative learning that connects researchers to a wide range of partners. SSPs are specifically designed to be transformational through becoming active agents for societal change. Universities play a special role here because they can act both as communication networks and as laboratories for developing the capability to design and manage SSPs in the creative transition to sustainability. It is gratifying to note that these ideas are beginning to emerge in a number of universities, with European examples being highlighted in this paper. Further steps towards introducing full-blooded SSPs across the university spectrum are suggested.

KEY WORDS *Sustainability science; higher education; cooperative learning*

ACRONYMS
SSP Sustainability science partnerships

Introduction

Throughout this paper, we concentrate on the over-arching concept of sustainability science partnerships (SSPs). We suggest that such partnerships foster innovative science, and promote its attractive role for the betterment of society and its changing processes of knowledge creation, dissemination and uptake. SSPs are coming of age, as combinations of academia and various partners, whose activities and relations are integral to the promotion and pursuit of sustainable development. For example, connecting with energy companies and taxation consultancies would provide insights for carbon accounting and carbon offset arrangements (Jones, 2007). By working through academia, the inevitable tendency for 'partner capture' can be detected and, with thoughtful determination, deflected, while collaboration with non-academic actors encourages scientists to address their own biases. Hence the partnerships should be true 'learning companionships' born of common understanding and mutual respect.

This paper first explores the new realm of sustainability science and what it means for curriculum development, learning and teaching practice.

It then explains the main drivers that are promoting SSPs. Multiple versions of SSPs are emerging and flourishing in many parts of the world, with Anglo-Saxon countries often playing a leading role. Some promising initiatives from diverse continental European universities are presented. The paper concludes by suggesting how such initiatives may be adopted elsewhere, and why such experiments are required so urgently.

European universities remain very wary of vague, multi-disciplinary and non-departmental initiatives. This is partly because they are administratively messy. It is also because they require sound leadership and vision by senior management, since sustainability science benefits from close financial and learning-through-training cooperation with public, private and civic sector bodies. Addressing all of these opportunities, however, has proved to be difficult. As reviewed here, the obstacles are being patchily overcome in a number of emerging initiatives in European universities.

What is sustainability science?

Sustainability science is a special discipline which focuses on the dynamic interactions between nature and society geared to social justice, reliable prosperity, and ecological resilience. It has its own website (www.sustainabilityscience.org) emanating from Harvard University, and a special place in the Proceedings of the US National Academy of Science (www.pnas.org). A group of authors, led by Robert Kates, published a statement in *Science* on 27th April 2001 (www.sciencemag.org) on the establishment of a new scientific paradigm called 'sustainability science'. The notion of sustainability science further emerged from the Johannesburg Summit on Sustainable Development in 2002. It was supported by the International Scientific Unions and Third World Academy of Science, and subsequently promoted in the educational component of Agenda 21, and the decade of education for sustainable development, currently spearheaded by UNESCO (for example, http://portal.unesco.org/education/en/ev.php-URL_ID=27234&URL_DO=DO_TOPIC&URL_SECTION=201.html).

Essentially, sustainability science informs and interprets the transition to sustainability. More challenging, it prepares a citizenry and a particular form of governance to support this transition (Irwin, 1995; Dobson, 2003). The notion of 'sustainable development' has been defined in many different ways and has been heavily criticised for its vagueness (Robinson, 2004). However, Kates *et al.* (2005) have carefully related the different interpretations of sustainability to its overall goals and implementations. The United Kingdom official Sustainable Development Strategy (DEFRA, 2005, 16) also offers a set of principles that provide a framework for moving towards sustainability. Figure 1 summarises these five major principles.

At the heart of this figure lie the fundamental purposes of sustainable development. These are the design of economies located within the boundaries set by planetary life support systems, and creation of just and fair societies living within these limits. However, these 'planetary boundaries' remain largely uncertain, and human societies do not easily accept the necessity to accommodate to unknowable limits.

There have been many assessments of nature's tolerance to change (Vitousek *et al.*, 1997; UNEP, 2002; MA, 2005; WRI, 2005; WWF, 2006). Concepts such as *Carrying Capacity* and *Ecological Footprint*, and measures such as the *Living Planet Index* provide useful frameworks (Wackernagel and Rees, 1996; Chambers *et al.*, 2000). However, none of these efforts has yet provided a practical guide for identifying possible thresholds beyond which the 'normal' functioning of Earth systems jumps into less predictable modes (Rees, 1992; Van den Bergh and Verbruggen, 1999; Lenzen and Murray, 2003; Gausset *et al.*, 2005; Schellnhuber *et al.*, 2005). Progress in this area will involve a blend of established scientific knowledge, human monitoring, and socially mediated interpretations of appropriate behaviour towards the strengths and weaknesses of natural systems functioning (Scheffran and Stoll-Kleemann, 2002; Walker *et al.*, 2006).

In this context it is useful to introduce the concepts of resilience in general, and social and ecological resilience in particular. These concepts aim for the evolution of a citizenry that shares responsibility for its use of the planet and promotes personal obligations as a necessary counterpart to the notion of individual right. Lying behind resilience is the capacity to absorb stress, to adapt peaceably to change, and to build on mutual self-support arrangements. Modern society is continually creating economic and social arrangements, which are brittle and resistant to adjustment. The global economy is one such case, as is the building of unsuitably large energy and agricultural structures for a future that will rely on being carbon neutral.

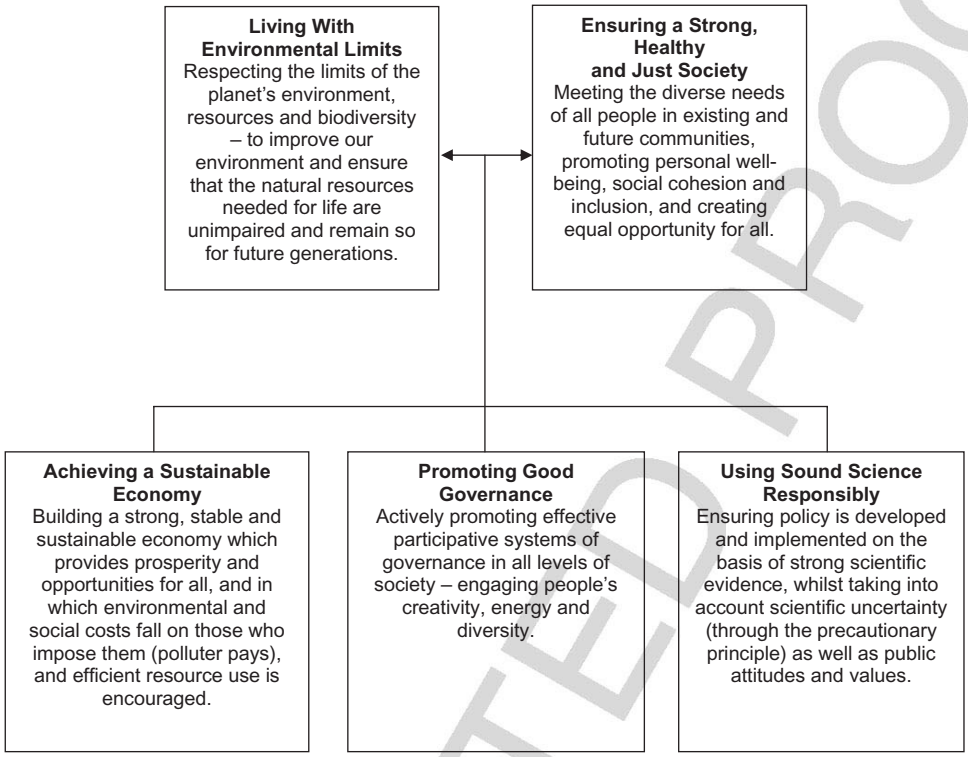

Figure 1 The five guiding principles of the UK Sustainable Development Strategy (*Source*: DEFRA, 2005).

Maintaining natural processes and creating self-aware and just social relations can be seen as complementary components of resilience (Agyeman *et al.*, 2002). This is why Kates *et al.* (2005) correctly noted that sustainability is an extension of peace, anti-poverty, civil rights and environmentalism. The parallels between ecological and social capital are very close. We neither know their limits of tolerance, nor do we recognise that both provide significant roles as economic services when allowed to function effectively. And we do not count adequately the huge costs of restoration or replacement in case of their disruption or destruction.

For sustainability science, the issue here is two-fold. First, the mechanism for devising comprehensive assessments of policy and decision chains along the grounds of these two boundary conditions (of ecological resilience and social justice) will need both 'duration proofing' and 'social justice proofing' to take into account the very long-term ramifications of any policy theme. This in turn means elaborating scenarios of how various conditions might change, including thresholds or abrupt changes in the earth system (Swart *et al.*, 2004; Lenton *et al.*, 2008, EEAC, 2008).

Lying below the challenging aspirations of ecological and social resilience in Figure 1 are three mechanisms for achieving sustainability, at least in essence. One is the well-established, but as yet poorly implemented principle of 'polluter pays'. There is a vast literature on this (for example, OECD, 1972; 1989; Bugge, 1996; O'Riordan, 1997; De Lucia and Reibstein, 2007). While few of the long-term economic and social costs are known for any given policy or action, especially regarding social justice and ecological well-being, some notion of paying for non-sustainable actions remains on the political agenda. So too does the notion of dedicating incentives for promoting sustainable behaviour from the revenues associated with penalising non-sustainable behaviour. The current debates over pricing carbon (Stern, 2007), biodiversity losses (MA, 2005), and water scarcity (WBGU 1999; UNEP, 2002) all attest to the liveliness and durability of this debate. One clear role for sustainability science is to fashion a better arrangement for justifying a levy or cap-and-trading

scheme on the mix of property rights, and to create joint compensating mechanisms to special sustainability-directed behaviour.

Precautionary science is a further important issue mentioned in Figure 1 (*Using sound science responsibly*). Precautionary science is defined as science, which follows the requirement of the Precautionary Principle (for a definition see Dovers and Handmer, 1995; O'Riordan *et al*, 2000). The essence of precaution is to accept that uncertainty is endemic in any future action or prediction, so that we need to plan for a set of plausible scenarios, worst cases, most affected peoples and places, all in a probabilistic context. This is a rich area of science communication. It allows for honest debate over all assumptions and forecasts, and enables any effective modelling to be more as a dialogue amongst engaged scientists and citizens, than as a set of science-led prognoses (Stoll-Kleemann *et al.*, 2003; Turnpenny *et al.*, 2003; Dessai and Hulme, 2004; de la Vega-Leinert *et al.*, 2008). Precaution helps to change the balance of liability, forces the scientist to share different kinds of knowledge and learning, and expects that dealing with uncertainty is always a learning experience (Burgess, 2002; Kaiser, 2002; Tickner, 2002, Patt *et al.*, 2005).

Finally, in the trio of lower tier supporting principles, as illustrated in Figure 1, is the application of good governance and civic virtue. These enter the territory of responsive, open and accountable governance (rarely found), and a participatory democracy that is inclusive and effective in guiding decisions for both present and future generations (even more rare). In the centre of this notion is the Aristotelian concept of civic virtue, the responsible citizen who recognises the right of existence as an individual, but also accepts membership of a wider civic democracy, obliged to care for others and for the planet (O'Riordan and Stoll-Kleemann, 2002; Stoll-Kleemann *et al.*, 2003: Dobson, 2009).

These principles are nearly always violated in day to day life and decision making. Yet as the world faces a prolonged recession, and as global efforts to restore the former economy, admittedly with some regulatory safeguards, are continually failing in their objective, so it is becoming more and more evident that some form of sustainability renaissance economy has to emerge. This is the message of the UK Sustainable Development Commission (Jackson, 2009), reflecting the arguments above.

Sustainability science and wicked problem analysis

Nowadays there is a much more supportive atmosphere for sustainability science partnerships, inside and external to academia. This is due to important shifts in interests of national science research councils as well as the push from governments and business (for example, National Research Council, 1999; Adger and Jordan, 2009). Thus, since the 1990s, research on climate change impacts and adaptation, and on biodiversity loss, which accompanied the ratification of UN Conventions on Climate Change and Biological Diversity, has drawn on the focus on environmental and development issues in previous decades to pave the way to sustainability science.

Van den Hove (2007, 818) usefully distinguishes between two complementary aspects of contemporary science, issue-driven 'science for action' and curiosity-driven 'science for science'. Jane Lubchenco (1998), in her presidential address to the American Association for the Advancement of Science, called for a 'new social contract with science . . . that would more adequately address the problems of the current century than does our current scientific enterprise'. Lubchenco's comment also recognises that too much emphasis on problem identification may result in the emergence of unsolvable or 'wicked' problem analysis. Verweij and Thompson (2007) characterise 'wicked problems' as being so narrowly structured that any attempted solution generates new 'problem outcomes'. This is because problem analysis is set in patterns of thinking and knowledge training which are unable to see the breadth and length of opportunity 'chains'. Lying alongside any 'problem' is an 'opportunity', if the knowledge frame and implementing institutional arrangements are altered suitably.

An example of wicked problem creation lies in the biofuel debate, where efforts to deal with climate change have pushed the opportunities for fossil, carbon-free fuels. This exciting option is backfiring because the total carbon footprint over the link between production and consumption may not be carbon neutral. Moreover, in the current context of worldwide inflation of staple food prices, such a strategy may eventually widen social injustice if staple foods become economically inaccessible, as biofuel crops absorb limited land and economic space (Boddiger, 2007). SSPs would aim to find a form of biofuel production and transportation that generates sustainability on the basis of the principles out-

lined in Figure 1. Similar 'wicked problems' can be found for dealing sustainably with very heavy rainstorms, which overload urban drainage and sewerage systems and cause devastating local and short-term flooding. Such arrangements for sustainability certification are particularly suitable for SSP treatment. Right now, there is no agreement for sustainable sourcing and accreditation for either biofuels or water.

Exploring the transformational qualities of SSPs

For SSPs to work they will have to confront four tests of excellence in both research and implementation of any transition to sustainability.

1. They will need to contribute to creating a new form of governance and coherent mechanisms that help to combine lateral networks and a horizontal hierarchy of cooperative institutions of formal government and to bridge global to local scales. SSPs have to address the growing interconnections between public, private and civil sectors so that they become more integrated rather than a series of disconnected parts. (See Adger and Jordan (2009) for an extended review.)
2. The long-term impacts of past decisions are already influencing today's world, as much as current decisions are shaping the range of options in future. Governing and regulating institutions need to be so designed that they address the consequences of their actions for several generations ahead. Currently there is no effective mechanism for bridging the gap between short-term electoral pressure, which, by and large, maintains unsustainable decision-making and behaviour, and long-term ecological resilience and social justice requirements (O'Riordan, 2009).
3. Since the long term combines the uncertainties of both planetary and political reaction to change and crises, together with the uncertainties of how policies and cultural outlooks and behaviour may shift as a consequence, approaches based on conventional modelling and scenarios offer limited and scientifically problematic insights into the future. Moving away from exclusive, top-down, 'exact' science, sustainability science is thus inclusive, participatory and adaptive. It encourages innovation, exploration, reflection, exchange and mixing of knowledge genres. Thus, alongside scenarios and computer models of change, art and drama can be valuable tools to develop narratives and creative interpretations of how visions may be generated and realised. For example, powerful and inspiring inquiring methods, such as role-plays or World Cafés, substantially draw on alternative modes of expression and experiencing, which stimulate creative collaborative thinking (Bolton and Heathcote, 1999; Brown *et al.*, 2005, Stoll-Kleemann and Welp 2008).
4. Markets may deal with risk, but have no capacity to cope with the long-term futures of a transition to sustainability. For markets to work effectively, as currently being observed with the global dialogue for new market structures, regulatory criteria for guaranteeing both social justice and ecological systems values will have to become an intrinsic part of the pricing process. This will require completely new institutions combining public-private and civil integration into operational markets. Universities and other higher education institutions can, and effectively in places already do, play an over-arching role of mediator (O'Riordan 2009).

All of this suggests that SSPs incorporate a group of particular qualities as summarised in Figure 2.

This is a possible template for sustainability science partnerships. It involves deep, prolonged and creative interaction with a variety of parties inside and outside academia. The aim is to build an effective and case-based alliance for both research and experimentation to review possible pathways to sustainable futures.

Two critical features of SSPs emerge from this analysis. One is the notion of *sustainability transitions*. Sustainability transitions are step changes in governing arrangements involving fresh approaches to regulation, markets, cooperative budget coordination and local-scale, integrated policy delivery. These transitions involve convulsive institutional shifts. They are in part creative scenarios, in part intensive zones of learning and re-analysis, and in part joint policy initiatives among politicians, businesses and civic society. An example is the effort currently being pursued by a group of major cities, including the administrations of New York and Rotterdam, to devise how their infrastructure and economies and social values might look in the event of becoming both carbon neutral and sustainable by 2050 (www.drift.eur.nl).

This theme of embedding social justice into sustainability transitions also applies to caring

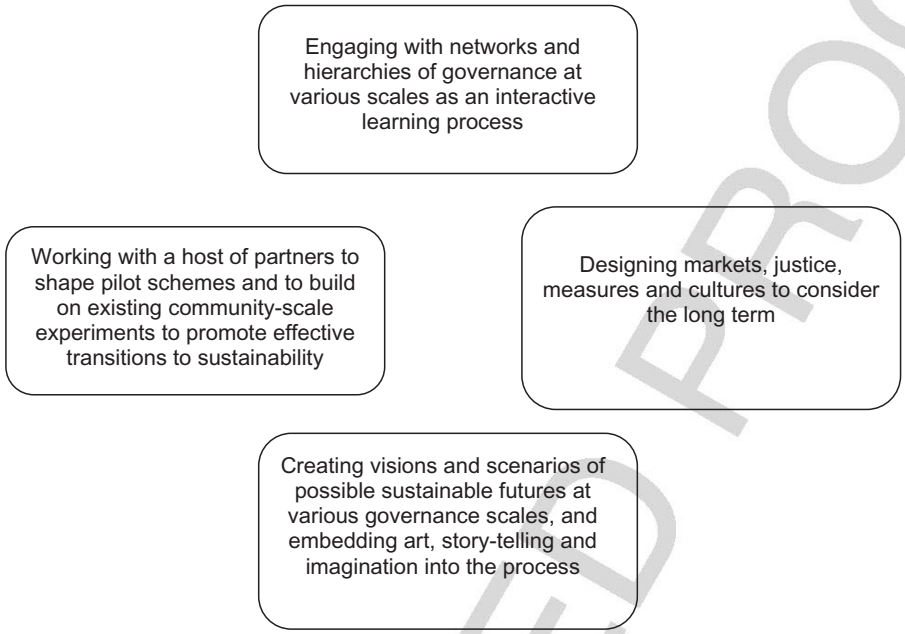

Figure 2 Key qualities of sustainability science partnerships (own compilation, 2009).

for those whose livelihoods are dependent on non-sustainable activities, and who are displaced by the shift to sustainability. Examples include fishing communities bordering on overfished coasts, and coal miners in a world of removing coal-fired power plants. Here is where sustainability transitions could prove of immense value, namely to assist the transformation of a society and economy from dependence on non-sustainability to acceptance of sustainability as the social and economic norm.

The second key element of SSP is the devising of innovative *boundary organisations* – understood as 'new forms of academic organisation that occupy the space between science, policy and business concerns' (Hellström and Jacob, 2003, 235). These are structures of creative learning where organisations and their employees transcend their boundaries of familiarity, where they embark on creative ways of measuring such outcomes as loss of social trust and civic virtue, and where sequential changes to established bodies such as local government and business responsibility units actually melt into interconnected organisms.

Higher education and sustainability

Educational institutions and educators have a particularly important role to play. Academics and universities have responded to vast societal changes by inspiring several important conceptual and methodological thresholds over recent decades, resulting in the establishment of sustainability as a legitimate research field. These include:

1. development of the systemic approach, which has opened the road for the now accepted view of 'co-evolving' natural and societal systems, 'holistic' approaches and the complex interplay between local to global scales (Harris, 2007);
2. acknowledgement of the need for inter- and trans-disciplinarity, which have fuelled a vast body of work on the hurdles and possible ways to overcome them (Graybill *et al.*, 2006, ZumBrunnen and So-Min, 2009);
3. development of inclusive, participatory exploratory research approaches and key principles for transformational collaborative inquiry (Himmelman, 1996; Freyvogel, 1998; Reason, 2002), as well as a wide range of methodologies (for example http://www.learningforsustainability.net/research/);
4. in response to gradual professionalism in the fields of environmental resources management, development aid and interpersonal conflict, the design and compilation by academics of new curricula and knowledge and method-

ologies from widely different scientific disciplines to produce practice-orientated training in cross-thematic issues. The emergence of the 'management' professionals has thus inspired the production of encyclopaedic guides and technical handbooks (Ryding, 1994; Brune *et al.*, 1997; Mirovitskaya and Ascher, 2001; Pretty *et al.*, 2007 – 'just' for the field of environment management).

5. At the same time, the dominance of technocratic hierarchies, based on exclusive, top-down decision-making, has often reached the limits of societal acceptance, as demonstrated by the recent food scandals around the 'mad cow' disease crisis and genetically modified organisms since the 1990s (Finucane, 2002; Horlick-Jones *et al.*, 2007). In response, academics have produced a critical reflection on the role of experts, scientists and academic institutions in relation to policy-making and more broadly in fostering societal change (Jasanoff, 1994; Horlick-Jones *et al.*, 2007; Adger and Jordan, 2009)
6. Finally, universities have been affected by dwindling State resources, the growing influence of private sponsors, and increasing competition at national and international levels of research and higher education establishments (Pyle and Forrant, 2002). Universities face difficult ethical dilemmas (for example on independence, property of, and access to results) and must make critical choices to achieve sustainable financing (OECD, 2004). Since the 1990s, these dilemmas have generated much needed debate and fuelled the elaboration of strategic policy guidance, which have reframed higher education as the cornerstone of sustainable, knowledge societies (UNESCO, 1998; 2005)

Sustainability is progressively gaining the status of paradigm, and as such is helping to reframe educational contents, reform pedagogical and learning processes, and question existing higher education institutions (Jucker, 2002). The last decade has been fruitful with a multitude of initiatives developed across the world to develop locally-meaningful ways of incorporating sustainability in higher education (Leal Filho, 2002a). In doing this, five distinct, though interrelated, goals are noticeable.

1. The notion of 'campus greening' encompasses all efforts towards making universities more sustainable in practice, such as recycling, water clearing and energy-saving measures, as well as in employment practice (Allen, 1999; Leal Filho, 1999).
2. An effort has been made to include sustainability in taught pedagogical contents through curriculum and textbook development (for example, Leal Filho, 2002a).
3. Pedagogical practice and process themselves have been scrutinised to incorporate interdisciplinarity, a more active learning approach, student participation, and programs which closely integrate partners in local communities and industry (Cahill and Chalker Scott, 2002; Leal Filho, 2005; Dengler, 2008, Fox *et al.*, 2008; Siegel, 2008).
4. Disciplinary departmental structures, university institutions and governance, and decision-making processes have also been questioned to create more inter-departmental fora, interdisciplinary study programs and student-led curriculum development (Wiewel and Lieber, 1998; Lock and Mohns, 2002; Graybill *et al.*, 2006; M'Gonigle and Starke, 2006).
5. Experiments in sustainability education are being documented, shared and published through a number of active platforms (such as the peer-reviewed journal *International Journal of Sustainability in Higher Education*, and academic book series such as Peter Lang's *Environmental Education, Communication and Sustainability* series), which have substantially contributed to the establishment and maturation of this novel academic field (Leal Filho, 2002b; 2005).

Some recent initiatives in continental Europe

European universities have started to take their responsibility towards a transition to sustainability seriously. There are several initiatives, including Master's programs, which teach sustainability science. Interesting initiatives reported here are primarily from Germany, Switzerland and Austria, although this list is by no means exhaustive.

At Lüneburg University in Germany, a three-year research and development project called 'Sustainable University – Sustainable Development in the context of university remits' investigates how universities meet the challenges connected to the new paradigm of sustainable development and how they change by implementing a sustainable development vision. Lüneburg University also established a study program entitled 'sustainability science'. Initiated in 2004, this course lasts two semesters and comprises students and scientists from different

disciplines (http://www.leuphana.de/graduate_school/die-masterprogramme/arts-sciences/sustainability-sciences.html: see also Beringer, 2007).

In Switzerland, at Basel University, a Master's degree in Sustainable Development is offered. This interdisciplinary endeavour is a joint initiative by the Faculties of Science, Humanities and Business and Economics. This full-time course lasts four semesters. Methodological aspects of the curriculum include the analytical and integrative skills and knowledge necessary to work on complex questions relevant to sustainability, together with reflexive skills and proficiency in dealing with policy instruments. Considerable importance is placed on competence in communication, team development and project management in order to facilitate constructive work in transdisciplinary settings (for more information (see www.msd.unibas.ch/).

In Austria, the rescoping of Graz University along sustainability lines started in the early 1990s with the Environmental Systems Sciences study program. In 2002, the student organisation for sustainable economics and management, '*oikos Graz*', was founded, which, together with the Vice-President for Research and Knowledge Transfer, furthered the integration of sustainability issues. A task force, 'Sustainable University Graz', was founded in 2004 with the common goal of publishing Austria's first University Sustainability Report in 2006. Today, a range of study programs in the field of sustainability science is available (for more information, see www.rce-graz.at).

Several other sustainability initiatives are being introduced at other European Universities such as at the School of Global Studies in Gothenburg University, Sweden and the Free University of Brussels, Belgium. There, a curriculum in human ecology has been developed to teach sustainable development issues (Luc Hens at: http://www.vub.ac.be/MEKO/gen/introd.html).

Finally, at Greifswald University (Germany), the Master of Science Program in 'Sustainability Geography' (due to start in 2010) aims to prepare future decision-makers and practitioners in the field of conservation, natural resource management and development to face global change challenges through an interdisciplinary and solution-orientated approach rooted in the principles of sustainability. Its original focus on international nature conservation, landscape ecology and geography combines state-of-the-art theoretical and methodological frameworks with a strong focus on empirical research through hands-on experience in various sites of the international network of UNESCO Biosphere Reserves. Run across two key institutes (the Institutes of Geography and of Botany and Landscape Ecology), this Master of Science is a cornerstone of the process of founding a dynamic Sustainable Science Partnership at Greifswald University, with two further strategic partners being the recently created Global Centre for Biosphere Research Advancement (for academic excellence – http://biosphere-research.org/) and the German Society for Technical Cooperation (GTZ – for practice-orientated expertise http://www.gtz.de/de).

Readers are invited to add to this list by creating a discussion in this Journal to promote the best examples of SSPs that are emerging throughout the world.

Concluding observations

Universities could be poised to adopt the framework of SSPs. But to do so with verve, will require a number of innovative procedures. Here is a possible set of actions.

1. Develop your own sustainability management team and prepare a sustainability action plan, ideally encouraged by the relevant national science funding councils, and linked to budget allocation and performance indicators.
2. Establish SSPs with local and regional government, businesses, civil society and key local actors. A clear business plan should be devised, the implementation of which should be facilitated through effective and inspiring partnership leadership with funding from all involved parties.
3. Develop a strategic set of projects, work plans and collaborative funding based on what partner members are seeking from the SSP. This should be transparent and accessible to the wider public. There is much need for serious involvement and 'ownership' of SSPs by local community groups, who can be key players in SSPs. Surprisingly; this has proven to be quite a difficult arena for universities to embrace, partly because relations between powerful local civic interests and the university community have not always been very collegiate.
4. Develop a support-based research and training outreach process with partner organisations. This should be accompanied by a web platform and local sustainability initiatives

that bring in, and in part are led by, local communities.

5. Create postgraduate courses in sustainability enterprise initiatives, and fuel them with funding originating from the partners. These should be professional development courses providing the opportunity for mixed learning between university researchers and partner employers. This may involve working arrangements that combine placements with research seminars and joint research initiatives across the university walls. A more radical suggestion is the eventual introduction of twinned arrangements for joint Master's and Doctoral dissertations linking students to politicians, local businesses and local community organisations.

Academia is changing and the idea of a sustainability transition is becoming more commonly accepted. Creative opportunities are being fostered in many campuses, going well beyond good housekeeping and viable research into green technology and business management for sustainability. The key here is to encourage a dialogue amongst a range of faculties and academic establishments, possible sponsors from charitable institutions, together with the public and private sectors, so as to open up various approaches to SSPs. The further task will be to build on these foundations in terms of career development and training programs amongst cooperating faculties, external parties, future managers and policy promoters, active citizens and social entrepreneurs.

All of this will require a step change in the normal processes of academia. While of their time outside the university walls, SSPs are still to come of age inside the campus.

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Forum: Science and Innovation for Sustainable Development: www.sustainabilityscience.org

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Human Ecology Department – Vrije University Brussel, Belgium: http://www.vub.ac.be/MEKO/HUMECO/

Learning for Sustainability http://www.learningforsustainability.net/research/

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Science Magazine: www.sciencemag.org

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