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Sustainability Assessment Tools in Higher Education Institutions

Mapping Trends and Good Practices Around the World

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ISBN 978-3-319-02374-8 ISBN 978-3-319-02375-5 (eBook)
DOI 10.1007/978-3-319-02375-5
Springer Cham Heidelberg New York Dordrecht London

Library of Congress Control Number: 2013953591

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

Much has been written about sustainability in higher education, from the late 1980s when the concept of sustainable development was first discussed in-depth, to the 1990s with an emphasis on curriculum greening, and the period 2000–2012, with an emphasis on sustainability research. But despite the progress achieved over the years, and the plethora of publications on sustainable development produced to date, there are still many conceptual and practical gaps which need to be met. One of them is the need to map trends and good practice in higher education, and the ever-present need to document and disseminate them.

The book "Sustainability Assessment Tools in Higher Education—Mapping Trends and Good Practices at Universities round the World" is an attempt to fill in this gap. The aim of this book is to provide a contribution to the state of the art about current sustainability practices, with a focus on assessment tools, being used or applied in higher education institutions.

The first chapters discuss issues of sustainability in higher education, namely the role of universities in promoting sustainability and the emergent fields of sustainability science and education for sustainable development and how to integrate, motivate and consider time for education for sustainability into the universities. The subsequent chapters present several international examples of sustainability assessment tools specifically developed for higher education institutions, such as the AISHE—Auditing Instrument for Sustainability in Higher Education, the GASU—Graphical Assessment of Sustainability in Universities tool, and the STAUNCH—Sustainability Tool for Auditing Universities Curricula in Higher Education. The use of other integrated tools are also presented to a lesser and to a greater extent.

All along, the papers have adopted a pragmatic approach, characterised by conceptual descriptions, including sustainability assessment and reorienting the curricula, on the one hand, and practical experiences on the other, with good practices from different edges of the world.

As the UN Decade on Education for Sustainable Development (2005–2014) is coming to an end in 2014, this book provides a concrete contribution toward showing how sustainable development principles may be implemented in practice, and the sort of action that is needed in the coming decades. This publication is therefore forward-looking and pace setting, since it outlines some areas where action is and will be needed, for many years to come.

We want to thank all the authors for their inputs, and for sharing with us their know-how, their knowledge, and their experiences. We are convinced that this unique book will contribute to fostering the cause of sustainability in higher education, and that it will inspire more work in this ever-growing field.

We wish you a productive reading!

Sandra Caeiro
Walter Leal Filho
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Ulisses M. Azeiteiro

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Sustainability Science and Education for Sustainable Development in Universities: A Way for Transition

Antje Disterheft, Sandra Caeiro, Ulisses Miranda Azeiteiro and Walter Leal Filho

Abstract The debate about sustainable development (SD) in higher education institutions has expanded over the past decades. It has been recognized that universities play a pivotal role in promoting sustainability principles, contributing to the paradigm shift toward a more sustainable present and future. Campus sustainability—commonly understood in a broad sense that includes the physical, educational (teaching, curricula, research), and institutional dimensions—is an evolving study field, as indicated by the growing number of articles in academic journals, conferences, awards, and books (like the present one) dedicated to the subject. From the academic point of view, the emergent fields of sustainability science and Education for Sustainable Development (ESD) have advanced the

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_1,

efforts of mainstreaming sustainability and implementing concrete practices in universities. But despite some progress and good examples, only a few institutions follow a SD implementation process holistically. A one-sided trend of "going green," driven by market requirements, marketing advantages, and economic benefits, increases the risks of greenwashing. Reductionist models and misconceptions may cause sustainability initiatives to be wrongly reduced to single aspects of SD like environmental initiatives, losing meaning and credibility. This chapter addresses the question of what role the emerging fields of sustainability science and ESD can play within the transition to more sustainable universities. It aims to contribute to a more holistic perception of SD and examines some of the trends being observed in the higher education sector. Universities are challenged to reflect about educational objectives and strategic goals in their sustainability implementation processes, if they aim to educate the academic community beyond eco-efficiency and recycling. ESD and sustainability science are normative academic fields, action-oriented and close to society. Along with universities as democratic institutions, these fields constitute essential vehicles to investigate, test, and develop conditions for truly transformative change.

Keywords Sustainability science · Education for sustainable development · Higher education institutions · Transition · Campus sustainability · Greenwashing

Introduction

Sustainable development (SD) and the question of how to overcome global and local challenges such as climate change, social inequity, poverty, loss of biodiversity, overpopulation, and lack of resources, has been discussed at the highest international political level for over four decades. The concept of SD has become globally accepted as a concept to guide interactions between nature and society in order to master these challenges, calling for a paradigm change at all levels, including education.

Within this debate, universities have been charged with key roles in promoting and implementing SD (UNCED 1992). Many scholars see the impact of universities on SD as vastly greater than any other single sector of society (Cortese 1999, 2003; Orr 2004), because universities educate the next generation of decision-makers, influencers and leaders (ibid., Lozano 2006; Chambers 2009). Due to their high societal impact, universities are seen as multipliers for disseminating SD principles with the ethical obligation to systematically integrate SD into their institutions (UNCED 1992; Cortese 1999; van Weenen 2000; Sharp 2002; Cortese 2003; Hansen and Lehmann 2006). An increasing number of universities have responded, and much progress in the implementation of SD in universities has been achieved.

The emerging fields of sustainability science and Education for Sustainable Development (ESD) can be seen as an evolving scientific foundation for the advancement of sustainability, including the transition to sustainable universities.

This chapter concerns these emerging fields and their role within SD implementation processes in universities. The objective of this chapter is twofold: (i) to offer a literature review with the purpose of sharing some of the most recent advancements and discussions in these emerging scientific fields; (ii) to discuss some trends across the university landscape that are adverse to a holistic sustainability implementation in higher education, posing challenges for sustainability science and ESD in universities. In this way, the authors hope to broaden the overall debate about SD and the visions for a sustainable future.

Sustainability science has emerged over the last decade as a new interdisciplinary field that attempts to conduct problem-driven and action-oriented research on the challenges mentioned above, striving to link knowledge to social actions and creating new visions of natural and social well-being (Miller 2013). ESD, being part of the sustainability discourse and policy-making process since the very beginning, has been influencing the debate on learning objectives, content, pedagogies, and competencies necessary for the paradigm shift to SD.

Both fields, sustainability science and ESD, share some similarities, as they (i) are problem-driven, (ii) employ use-inspired basic research, and (iii) deal with problems of practice and policy (Barth and Michelsen 2013). They can therefore be considered essential for university research on sustainability.

Campus sustainability, commonly understood in a broad sense that includes the physical, educational, and institutional dimensions, is a growing study field, as proven by the increasing number of articles in academic journals (e.g., in the *Journal of Cleaner Production* (Elsevier), *International Journal for Sustainability in Higher Education* (Emerald), *Journal of Education for Sustainable Development* (SAGE), *Sustainability Science* (Springer), *Higher Education Policy* (Palgrave) and others). On the institutional level, many declarations of commitment have been signed (Wright 2002; Leal Filho 2011; Lozano et al. 2013b and the high number of best practice examples and case studies are a sign of the growing importance SD implementation is obtaining (see e.g., the series of the Global University Network of Innovation on social commitment of universities 1–4, GUNI (2012)).

Despite the progress made and some signs of transition in parts of the academic community, there is still a long way to go to mainstream sustainability in higher education, and a paradigm shift from unsustainability to sustainability is still difficult to identify (Wals 2013). Even institutions with many years of experience in the field of campus sustainability are caught in situations that hinder a full sustainability implementation (Escrigas 2012; Raskin 2012; Lozano et al. 2013a). It is still too early to speak of a paradigm shift on a broader scale, since the literature suggests that universities have not yet understood the full scope of sustainability challenges (Tilbury 2012) and might be stuck in traditional academic structures and mechanistic mental models (Lozano et al. 2013b). Furthermore, due to the overuse of terms like SD, sustainability and an increasing trend of “going green" that reduces sustainability to only its environmental aspects, there is a risk of "greenwashing" and sustainability initiatives losing meaning and credibility, often driven by global market requirements (Schwarzin et al. 2012).

The chapter starts by introducing the theoretical context. A brief summary about the concepts of sustainable development and sustainability is given, in which some common misconceptions are pointed out and differences between strong and weak sustainability are explained. Building on this, a brief literature review about sustainability science and ESD is presented. In the next section, the theoretical context is applied to the question of sustainability implementation in universities. Specific characteristics of the university system and related fields of action for sustainability are noted. Milestones in policy-making for sustainability in higher education are contrasted with practical difficulties encountered in implementing these policies. The section that follows deals with the role of sustainability science and ESD within the transition to sustainable universities. University-specific recent advancements in these fields are outlined and put in contrast to trends in higher education that prevent a holistic implementation of the ideas of sustainability. Trends such as a constantly more economy-driven university deviate higher education from a sustainability-driven process. The authors name these situations "transfer problems" as they stand for the gap between proclamation and practice and as they make the shift from unsustainability to sustainability more difficult. Challenges deriving from these transfer problems are discussed and linked to the role sustainability science and ESD can play in decreasing the gap. The chapter finishes with some concluding remarks about potential future progress for sustainability science and ESD in universities.

Theoretical Context

Debating Sustainable Development and Sustainability

The concepts of sustainable development and sustainability have been discussed broadly in the literature (e.g., Kirkby et al. 1995; Hopwood et al. 2005; Baker 2006; Babbie 2010), and it is useful to briefly recall some of the main aspects of this conceptual, ideological, and terminological debate for the reflections in this chapter.

Usually, the origins of the debate about sustainable development are associated with the publication of "Limits to Growth" by the Club of Rome in 1972 (Meadows et al. 1972) and to the UN conference on the Human Environment, held in Stockholm in the same year, but the origin of the concept itself can be traced back 300 years when Hans Carl von Carlowitz published the first work about sustainable forestry (Saechsische Carlowitz-Gesellschaft 2013), and to T.R. Malthus (1766–1834) who noted the environmental limits to population growth (Mebratu 1998). So, despite the habit of linking the emergence of the sustainability concept to the post-industrial era, it is much older. But there is general agreement among scholars that the WCED-report *"Our common future"* (World Commission on Environment and Development (WCED) 1987), also known as the Brundtland Report, has mainstreamed the concept and spread the nowadays best known and most often quoted definition for sustainable development: *"SD is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*

While this definition establishes links between the social, economic, and environmental dimensions, it is also criticized for its anthropocentric focus and its vagueness (Mebratu 1998; Baker 2006; Lozano 2008; Waas et al. 2011). Some scholars recognize that due to its vague characteristics the concept of SD allows several definitions and interpretations to co-exist (Waas et al. 2011). Others see the possibility of building on a minimal common understanding as a political strategy (Daly 1996). However, an "anything-goes-mentality" (Waas et al. 2011 p. 1638) or a simple "feel-good-sustainability" (Jickling and Wals 2012) only weaken the concept, which is counterproductive to all serious sustainability efforts.

Conceptual analyses of the SD concept look at its historical evolution (Mebratu 1998; Fergus and Rowney 2005a; Waas et al. 2011), as well as at differences in the perceptions, identifying e.g. an institutional, ideological, and academic version (Mebratu 1998). Different models vary in the number of "pillars" or dimensions of SD (Baker 2006; Lozano 2008; Waas et al. 2011). Whereas it had been common to envision at least three pillars of SD—economic, social, and environmental, in recent years it has become normal to add fourth and fifth pillars—institutional and cultural (Waas et al. 2011). SD models help to visualize the complex and dynamic interrelations among these pillars, but are often highly anthropocentric and compartmentalized, lacking conceptual coherence and the dimension of time (Lozano 2008).

Baker (2006) discusses in her ladder of sustainable development (ibid., p.30) four different models of sustainable development—(i) pollution control, (ii) weak SD, (iii) strong SD, and (iv) the ideal model;—and compares, e.g., normative principles, governance, technology, policy integration and tools, and the underlying philosophy of each model, which moves from an anthropocentric to a more and more ecocentric worldview, with correspondingly stronger concepts of SD. *Weak sustainability* stands for a substitutability paradigm, in which natural capital as input for consumer goods is substitutable by man-made capital. The model relies on the assumption that technical progress can overcome any resource constraints (Neumayer 2010). *Strong sustainability* on the contrary seeks to maintain nature's functions intact and builds on the preservation of physical stock and all forms of non-substitutable natural goods (ibid.).

The term *sustainable development* is sometimes applied to economic growth as a development strategy, SD being the process to achieve a "better" type of growth, whereas the term *sustainability* would give more emphasis on the environment and stand for the final goal of humanity being able to live within the environmental limits of the planet (Fergus and Rowney 2005b; Lozano 2008; Waas et al. 2011). However, separating these terms is not a common practice in the literature, so this chapter follows the usual approach of using these terms interchangeably. Furthermore, there exists a consensus about the basic principles that the ideas of SD and sustainability comprise (UNEP 1992; Baker 2006; Waas et al. 2011): normativity, intra- and intergenerational equity, justice, gender equality and participation. These principles have been endorsed by the Rio Declaration at the UN Earth Summit in 1992 and are usually associated to both terms equally.

Sustainability Science

Sustainability science is a relatively young scientific field, still lacking shared conceptual and theoretical components (Kates et al. 2001; Clark and Dickson 2003), which emerged about two decades ago. At the beginning of 2000, a number of scientists (Kates et al. 2001) agreed on some common approaches for sustainability science: "[To] encompass the interaction of global processes with the ecological and social characteristics of particular places and sectors; integrate the effects of key processes across the full range of scales from local to global; and achieve fundamental advances in our ability to address such issues as the behaviour of complex, self-organizing systems, as well as the responses of the nature-society system of governing to multiple and interacting stresses" (Jaeger 2009, p. 2). In other words, it investigates the complex and dynamic interactions between natural and human systems and how these can be transformed in a sustainable way based on a long-term perspective.

The questions in Table 1 demonstrate the wide range of topics and underline the idea that sustainability science refers to "multiple sciences addressing a common theme—the reconciliation of societies' development goals with the planet's environmental limits over the long term" (Jaeger 2009). The underlying

Table 1 The core questions of sustainability science (Kates et al. 2001)

	Core Questions of Sustainability Science
1	How can the dynamic interactions between nature and society—including lags and inertia—be better incorporated into emerging models and conceptualizations that integrate the Earth system, human development, and sustainability?
2	How are long-term trends in environment and development, including consumption and population, reshaping nature-society interactions in ways relevant to sustainability?
3	What determines the vulnerability or resilience of the nature-society system in particular kinds of places and for particular types of ecosystems and human livelihoods?
4	Can scientifically meaningful 'limits' or boundaries be defined that would provide effective warning of conditions beyond which the nature-society systems incur a significantly increased risk of serious degradation?
5	What systems of incentives structures—including markets, rules, norms, and scientific information—can most effectively improve social capacity to guide interactions between nature and society toward more sustainable trajectories?
6	How can today's operational systems for monitoring and reporting on environmental and social conditions be integrated or extended to provide more useful guidance for efforts to navigate a transition toward sustainability?

motivation for this type of research can be described as "neither *basic* nor *applied* research, (…) [but as] *use-inspired basic research*" (Clark 2007 p. 1737).

Since sustainability science does not have a common definition, scholars usually refer to its main characteristics or set of principles, which are (i) its transdisciplinarity, (ii) the providing of an integrated analysis, and (iii) its direction toward action (Kates et al. 2001; Rapport 2007; Kauffman 2009; Lang et al. 2012).

Sustainability science above all means to bridge the gap between science and society and to link knowledge to action for sustainability (Wiek et al. 2012). These ideas embrace the principles of ESD, an emerging field within educational science with strong ties to sustainability science.

Education for Sustainable Development

> *"Education either functions as an instrument which is used to facilitate integration of the younger generation into the logic of the present system and bring about conformity or it becomes the practice of freedom, the means by which men and women deal critically and creatively with reality and discover how to participate in the transformation of their world."*
>
> *Paulo Freire (*1972*)*

The debate about sustainable development has also initiated the debate about an educational concept that would help to achieve the goals of sustainability: ESD. It has been a field for international educational policy-making since the beginning of the SD debate. The ESD concept started being institutionalized in 1992 with the international recognition of Agenda 21 and its specific chapter 36 about education at the UN Earth Summit in Rio de Janeiro (UNCED 1992). The UNESCO was assigned to be the task manager of the implementation of Agenda 21's chapter 36, and ESD received growing attention worldwide. Further milestones were the UNESCO report *"Education for a Sustainable Future"* (UNESCO 1997b), in which the necessity of a reorientation of education in all sectors and the key principles of ESD are stressed, and the launch of the *UN Decade on Education for Sustainable Development* (2005–2014) that stimulated numerous projects on all educational levels. The *"World Conference on ESD - Moving into the Second Half of a UN Decade*" (Bonn, 2009) gave opportunity for reflections on achievements and put a new focus on monitoring and assessment, leading to ESD evaluation reports of several experts (Tilbury 2011; Wals and Nolan 2012).

The educational concept of ESD refers to all educational levels, from kindergarten to primary, secondary, and tertiary education until life long learning, and consists of different learning objectives, content foci, and pedagogical approaches. Even though having clear links to environmental education, ESD goes much beyond this and seeks to:

- Promote and improve the quality of a lifelong education that is directed to the acquisition of knowledge, skills and values necessary for citizens being able to improve their quality of life

- Reorient the curricula (rethinking and reforming education)
- Raise public awareness for the concept of SD
- Train the workforce for a better understanding of ESD and how to integrate it in the curriculum.

(Læssøe et al. 2009; Wals 2009).

Reflecting the difficulty in defining sustainable development, ESD also has no single, uncontested definition, and often terms such as *Education for Sustainability (EfS)* or *Sustainability Education (SE)* are used interchangeably. Other terms used less frequently are: Earth Education; Environmental and Developmental Education; Environmental Education for Sustainability; Education for a Sustainable Future; Education as Sustainability; and Sustainable Development Education (Leal Filho et al. 2009).

There is a divergent debate about the meaning and objectives of ESD, and McKeown et al. (2006), p. 9 link it to the challenge of envisioning a sustainable world and how humanity can achieve it: "(…) while we have difficulty envisioning a sustainable world, we have no difficulty identifying what is unsustainable in our societies," and list several problems of "un-sustainability," like inefficient use of energy, lack of water conservation, increased pollution, abuses of human rights, overuse of personal transportation, consumerism, etc. (ibid.). The authors compare the lack of a definition for ESD to the concepts of justice and democracy, which are "great concepts," but approached differently depending on worldviews and cultures. As an important step of differentiation, scholars distinguish between (a) *education about sustainable development* and (b) *education for sustainable development*. Whereas the first may refer mainly to knowledge transfer about SD, transmitting facts about sustainability concepts without challenging existing assumptions, the second underlines the perception of a learning process, focussing more on a transformative approach to education (McKeown et al. 2006; Barth and Michelsen 2013). This focus is also set in the definition for ESD by UNESCO:

> *"Education for Sustainable Development (ESD) is a learning process (or approach to teaching) based on the ideals and principles that underlie sustainability and is concerned with all levels and types of learning to provide quality education and foster sustainable human development—learning to know, learning to be, learning to live together, learning to do and learning to transform oneself and society"* (UNESCO 2011).

This learning process can, however, have different objectives, and Læssøe et al. (2009) argue in their cross-national study that there are two distinct approaches, directed to different learning outcomes (Fig. 1):

Whereas the empowerment perspective focuses on enabling students to become independent critical thinkers, the behavior modification perspective strives for changes in habits. Vare et al. (2007, pp. 193–194) went in their analysis a little further and differentiate between ESD 1 and ESD 2: the first type comprises an approach of "promoting/facilitating changes in what we do" as well as

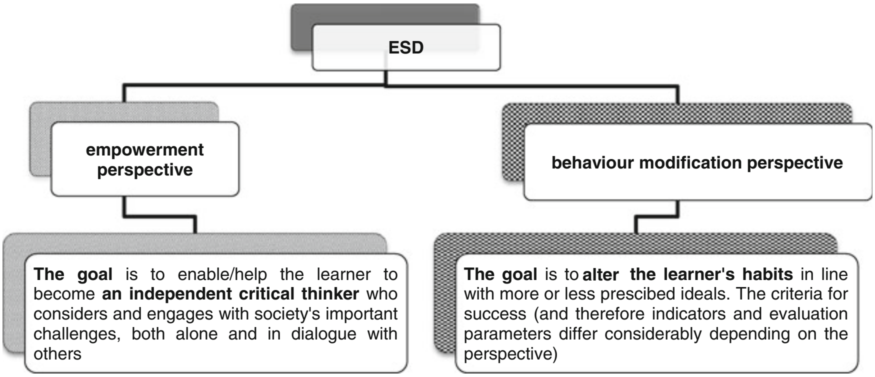

Fig. 1 ESD from the empowerment and the behavior modification perspective (based on Læssøe et al. (2009))

"promoting (…) behaviors and ways of thinking," which the authors label as "Education *for* Sustainable Development." The second type refers to an approach of "building capacity to think critically (…) and exploring the contradictions inherent in sustainable living" (p. 193–194), calling it "Education *as* Sustainable Development" and underlining the overall process-oriented attitude of any way of learning. The authors regard both types as complementary (the "yin-yang of ESD," p.195), but stress the importance of ESD 2 because "our long-term future will depend less on compliance in being trained to do the right thing now, and more on our capability to analyse, to question alternatives and to negotiate our decisions" (ibid., p. 194), as future scenarios are uncertain and request overall being able to approach new challenges systemically. In this context, Barth et al. (2013), p. 107 underline the normativity of the educational concept of ESD that lies "between the two poles of indoctrination and value-relativism" (p. 107): On the one hand, using education for political and social goals is considered inappropriate, and on the other hand the nature of education is based on human values, history, and changes in power relationships and so can never be value-neutral. ESD pedagogies should therefore foster the capacity of critical reflection. These pedagogies are often rooted in existing educational concepts like problem-based learning, social learning, situated learning, social-constructivist approaches to learning (e.g. discovery learning, participatory learning), system-thinking-based learning, among others (Steiner and Posch 2006; Wals and Nolan 2012; for an overview see Barth and Michelsen 2013). By linking these learning approaches to challenges related to sustainability, e.g. complexity, uncertainty, and interdisciplinarity, the ESD concept becomes unique (Barth and Michelsen 2013).

From Theory to Practice: Universities Implementing Sustainability

The University System and Fields of Action for Sustainability

Cortese (2003) identifies four dimensions of a university system: *Education*, *Research*, *University Operations* and *External Community*, which often have been seen as discrete, based on hierarchical and competitive structures. Lozano (2006) adds a fifth dimension of *Assessment and Reporting*. These dimensions should be considered as interconnected and dealt with in a comprehensive, dynamic and horizontal manner (ibid.), since they are crucial for implementing sustainable development in a holistic way. Strategies that are geared to sustainable universities should move beyond eco-efficiency (Shriberg 2002), as there is still an emphasis on the environmental issues and less attention paid to nonmaterialistic aspects of sustainability related to social, cultural and ethical questions. However, progress has been made in curriculum greening (Lidgren et al. 2006), campus operations (e.g., environmental management systems and their educational dimension) (Disterheft et al. 2012), system transition approaches involving large groups of stakeholders (Ferrer-Balas et al. 2009), outreach programs (Johnson Butterfield and Soska 2005) and on assessment and reporting (Lozano 2011). There are also specific conferences with a focus on SD implementation in universities (like the conferences of the Global University Network for Innovation (GUNI), of the Association for the Advancement of Sustainability in Higher Education (AASHE), the Environmental Management for Sustainability in Universities (EMSU) conference and the World Symposium Sustainable Development in Universities (WSSD-U)) as well as sustainability assessment tools (e.g., AISHE, GASU, STAUNCH among others, see Disterheft et al. (2013) for an overview), rating systems (e.g., STARS, Green League) and excellence awards (e.g., Sustainable Campus Excellence Awards) or certifications.

Some Milestones in Policy-Making for Sustainability in Higher Education

At the macro- and meso-level, there have been developed and endorsed more than 20 declarations and policy documents in which higher education institutions declare their commitment to SD (Wright 2002; Leal Filho 2011; Tilbury 2012; Lozano et al. 2013b). All of them are based on a moral obligation toward promoting and contributing to sustainable development within universities: “Perhaps the unifying theme among all declarations and policies is the ethical and moral responsibility of universities to be leaders in promoting sustainability” (Wright 2002).

Wright (ibid.) and Lozano et al. (2013b) examined in detail declarations up to 1997 and 2009, respectively. As a matter of completeness, the list was updated to the present by consulting further literature sources and conducting an internet search (Table 2).

In general, these declarations can be seen as landmarks, and if properly implemented they can contribute to facilitating change and integrating sustainable development into the universities' landscape. Nevertheless, Wright warns that without an implementation plan these policies remain just a statement of intent and run the risk of serving only to "greenwash" the institutions' image (Wright 2002; 2006). In preparation for the Rio + 20 conference in June 2012, Leal Filho (2012) gave a damning appraisal of these declarations: "Except for the Ubuntu Declaration, which has been pursued by a number of organizations since Johannesburg, the majority of the other declarations, agreements and action plans have one thing in common: they have never been fully implemented." Bekessy et al. (2007) see the lack of accountability of universities as the main problem. In their analysis of the Australian RMIT University's 12-year engagement with sustainability they conclude (ibid., p. 314): "(…) neither non-binding international declarations nor individuals or small groups are the answer to lasting institutional transformation. (…) The positive publicity that universities receive from signing declarations and releasing policy precedes putting them into practice, and it seems that there is little or no motivation to deliver on commitments, or public accountability for failing to deliver. Failure to implement rhetoric is classic greenwash and sends a message to other institutions, companies, governments, and society as a whole that universities do not value sustainability, and are unable to implement it." Christensen et al. (2008) analyzed official university documents of the University of Aalborg (Denmark) from 1990 to 2007, assessing the gap between preaching and practice. The authors ask "How to teach sustainability without practicing it?" (ibid., p. 16) and draw the conclusions that "good intentions are certainly not enough to create a vibrant and engaging working commitment that will make sustainable university practices live on for years" (ibid., p. 18). These examples show that the institutional debate about SD is not finished after the first steps of SD implementation have been undertaken, and actually call for continuous revision and new reengagement. Sustainability science and ESD can contribute systematically to reviewing sustainability implementation in higher education and promoting stronger commitment, as will be discussed in the next section.

The Role of Sustainability Science and ESD Within the Transition to Sustainable Universities

Background

It has been demonstrated above that sustainability science comprises a broad set of areas and topics, aiming to create knowledge that fosters new approaches in addressing the complex sustainability challenges of our world today. ESD is the

Table 2 Chronology of some declarations related to sustainability in higher education adapted and expanded from Wright (2002), Leal Filho (2011), Tilbury (2012) and Lozano et al. (2013b)

Years	Declaration
1972	The Stockholm Declaration On The Human Environment (UNEP 1972)
1977	Tbilisi Declaration (UNESCO 1977)(UNESCO 1977)
1988	The Magna Charta of European Universities (European University Association 1988) (European University Association 1988)
1990	University Presidents for a Sustainable Future: The Talloires Declaration (ULSF 2008)
1991	The Halifax Declaration (International Institute for Sustainable Development 1996)
1992	Agenda 21 Report of the United Nations Conference on Environment and Development—Chap. 36: Promoting Education, Public Awareness and Training (UNCED 1992)
1993	Ninth International Association of Universities Round Table: The Kyoto Declaration (Wright 2002)
1993	Association of Commonwealth Universities' Fifteenth Quinquennial Conference: Swansea Declaration (Wright 2002)
1994	CRE Copernicus Charter (COPERNICUS 1994)
1997	International Conference on Environment and Society—Education and Public Awareness for Sustainability: Declaration of Thessaloniki (UNESCO 1997a)
1998	World Declaration on Higher Education for the twenty-first century: Vision and Action (UNESCO 1998)
2000	Earth Charter *(directed to all education areas, not higher education-specific)* (Earth Charter Initiative 2010)
2001	Lueneburg Declaration (UNESCO 2001)
2002	Ubuntu Declaration (United Nations 2002)
2005-2014	The UN Decade Education for Sustainable Development (UNESCO 2010)
2005	Graz Declaration on Committing Universities to Sustainable Development (Leal Filho 2011)
2006	Declaration on the Responsibility of Higher Education for a Democratic Culture—Citizenship, Human Rights and Sustainability (Council of Europe 2006)
2008	G8 University Summit Sapporo Sustainability Declaration (Leal Filho 2011)
2009	Abuja Declaration on Sustainable Development in Africa (Lozano et al. 2013b)
2009	Tokyo Declaration of HOPE (directed to all education areas, not higher education-specific) (ACCU 2009)
2009	Turin Declaration on Education and Research for Sustainable and Responsible Development Italy (Tilbury 2012; Lozano et al. 2013b)
2009	World Conference on Higher Education (UNESCO) (Tilbury 2012)
2010	G8 University Summit: Statement of Action (Leal Filho 2011)
2011	Copernicus Charta 2.0. (Copernicus Alliance 2012a)
2012	People's Sustainability Treaty on Higher Education (Copernicus Alliance 2012b)
2012	UN Higher Education Sustainability Initiative within Rio + 20 (United Nations 2012)

educational concept to complement and stimulate these approaches. Both fields are not higher education-specific, but the growing research on sustainability in higher education can be linked closely to these emerging sciences (Wiek et al. 2011; Barth and Michelsen 2013). However, these links might not be clear to everybody.

There are some scholars who see the necessity to study further how university research for SD relates to other sustainability research fields, for example sustainability science (Waas et al. 2010). They define university research for sustainable development as "*all research conducted within the institutional context of a university that contributes to sustainable development*" (ibid.).

In this section, this type of research is embedded in the broader fields of sustainability science and ESD, as suggested in a great part of the literature. With a focus on higher education, it discusses some of the most recent advancements as well as transfer problems and challenges on the practical level.

Advancements

Interesting research is going on in these emerging fields: several research agendas and evolving frameworks have been developed for sustainability science in general (Jerneck et al. 2011; Schoolman et al. 2012; Miller 2013), and for higher education in particular (Stephens and Graham 2010; Waas et al. 2010; Yarime et al. 2012). Some scholars ask whether the concept of SD influences educational science with regard to teaching and learning development as an "outside-in approach" (Barth and Michelsen 2013) or whether educational science contributes to sustainability science as an "inside-out approach" (ibid.). Similarly, Lozano et al. (2013a) ask whether universities are taking the lead in the advancement of SD mental models or merely reacting to the stimuli from society.

Tilbury (2012) distinguishes shifts in the research for sustainability in higher education over the past 10 years toward more inclusiveness and higher social impact (Table 3).

Bibliometric studies on ESD research in universities (Barth and Rieckmann 2013; Wals 2013) have shown that environmental sustainability has been the dominating research focus—e.g., environmental management, university greening and reducing the university's ecological footprint—, but a recent shift in the

Table 3 Key movements in research for sustainability in higher education over the last ten years (~ 2000–2010) (Tilbury, 2012, p. 21)

Shifts from	To be more inclusive of
Research that is disciplined focused	Research that is inter- and multidisciplinary
Research that has academic impacts	Research that has social impact
Research that informs	Research that transforms
Research on technological and behavior change	Research that focuses on social and structural change
Research as expert	Research as partner
Research on people	Research with people

research focus can be confirmed: articles on pedagogy, learning, community outreach, and partnerships are appearing more frequently (Wals 2013). However, these analyses have also shown that the majority of publications are descriptive case-study articles, with "minimal cohesion and some degree of repetition and redundancy" (Stephens and Graham 2010, p. 611) and still lack a stronger theory development (ibid.).

Among these topics, the debate about competencies has gained particular visibility (de Haan 2006; Posch and Steiner 2006; Barth et al. 2007; Mochizuki and Fadeeva 2010; Parker 2010; Wals 2010; Wiek et al. 2011; Rieckmann 2012). Unfortunately, the terminology used in this debate is not always clear. Although scholars distinguish between *competencies for sustainability* and *competencies for ESD*, either of these terms may have different understandings: Wals (2010, 2013) understands *sustainability competencies* as those abilities that learners should develop when they engage in ESD, whereas *ESD competencies* refer to the abilities of the person who facilitates ESD in transmitting SD competencies to the learner. On the contrary, Wiek et al. (2011) distinguish between *key competencies in sustainability* and *basic competencies:* the first refer to competencies transmitted in specific higher education programs and courses in sustainability, namely (i) *system-thinking competence*, (ii) *anticipatory competence*, (iii) *normative competence*, (iv) *strategic competence*, and (v) *interpersonal competence*. Basic competencies, such as *critical thinking* and *communication*, are considered equally important, but taught in other contexts not necessarily sustainability-specific. Riekmann (2012) arrives at similar terms but does not differentiate between sustainability-specific and nonsustainability-specific competencies. He considers them all equally relevant for future-oriented learning and builds on the ideas about *Gestaltungskompetenz* (de Haan 2006) and transformative social learning (Palmer et al. 2010; Wals 2010; Brundiers and Wiek 2011; Schwarzin et al. 2012). Gestaltungskompetenz can be translated by "shaping competences" (Baer et al. 2012) and is understood as a forward-looking ability to "modify and model the future of the societies that [one] live [s] in, participating actively in the spirit of sustainable development" (2006 p.22). As key competences for ESD, de Haan (2006) identifies (i) competences in foresighted thinking; (ii) competence in interdisciplinary work; (iii) competence in cosmopolitan perception; cross-cultural understanding and cooperation; (iv) participatory skills; (v) competence in planning and implementation; (vi) capacity for empathy, compassion and solidarity; (vii) competence in self-motivation and in motivating others; and (viii) competence in distanced reflection on individual and cultural models.

These approaches can be grouped under the empowerment-perspective as outlined earlier in this chapter and may indeed be a sign of shift toward a research that strives for transformation rather than information and for social and structural change, rather than technological and behavioral change (Table 3).

Some authors alert that the competence approach is too narrow when related only to workplace performance without being also directed toward the goals of sustainability (Mochizuki and Fadeeva 2010). Tilbury (2012, p. 24) argues that "teachers, architects, accounts, doctors and business managers are still being schooled into social assumptions and practices that serve to exploit people and planet." The development of specific courses and programs on sustainability, usually called a *built-on approach*, would only improve the sustainability literacy of a self-selected group who wish to follow a career in this field (ibid.). Instead, a *built-in approach* is needed that integrates sustainability in existing study and research (Wals 2013). For Wals (ibid.), the concept of SD is still understood in a too limited manner, as "sustainability (…) remains still largely external to the student, academic faculty member, and administrator within higher education." Therefore, the reorientation of teaching, the renewal of the curricula and learning methods, and the offering of learning opportunities in higher education for staff members are considered to be key elements in the transition toward sustainability and more sustainable institutions. One pillar in this discussion is training the workforce (Zilahy and Huisingh 2009; Barth and Rieckmann 2012). With regard to academic staff development in higher education institutions, there are already promising studies which describe specific programs for teaching staff members in universities. These programs show diverse opportunities for new learning and teaching approaches that can lead to a deeper implementation of ESD in higher education institutions (Huisingh and Mebratu 2000; Barth and Rieckmann 2012).

Transfer Problems

Despite some progress there appear to be several transfer problems that make a so often proclaimed paradigm shift to more sustainability difficult. Scientists would agree that the state of the planet has worsened in the last 20 years, in environmental terms, but also in social terms regarding issues of inequity, marginalization and poverty (Jickling and Wals 2012). Universities are caught in a crossfire of influences, and so are sustainability science and ESD implementation processes. The advancements reported above contrast to other trends that can be observed in higher education.

From a macro level perspective:

- Universities orient their activities to more economic-driven directions, with a strong belief in the power of market mechanisms and competition (Raskin 2012; Schwarzin et al. 2012), based on a business-as-usual approach instead of sustainability principles. A new model of the *entrepreneurial university* can be identified that "utilizes relations with industry and government in order to

contribute to an innovation-driven regional or national economic growth strategy"(Yarime et al. 2012 p. 102). Other signs are technology parks, academic inventions (e.g. via spin-off firms or ventures), collaborative and commissioned research, consulting (ibid.). Quality assessment based on number of publications and student numbers decisive for the university ranking have become primary concerns of university leaders (O'Brien et al. 2013).
- Privatization of public education and increase of private universities as a response to the "knowledge economy." The UNESCO report *Trends in Global Higher Education* (Altbach et al. 2009, p. 69 et seq.) discusses the problematic issues of (in-)equity in accessing higher education and describes the trend of the marketization of education with rising tuition fees and decreasing scholarships as one of the biggest challenges for a sustainable higher education sector.

From a meso- and micro level perspective:

- Universities remain traditional and follow old mechanistic mental models (e.g. Newtonian and Cartesian paradigms) (Lozano et al. 2013a) with strong disciplinary structures that hinder inter- and transdisciplinary approaches.
- Even though a holistic approach in sustainability is often proclaimed, a narrow perception of sustainability prevails, focusing on the environmental and economic aspects of SD (Leal Filho 2009; Global University Network for Innovation (GUNI) 2012). As a consequence, sustainability initiatives at the campus run the risk of serving greenwashing purposes.
- According to the literature, some of the barriers within campus sustainability implementation include: (a) misconceptions of the concept of SD (e.g., sustainability is too broad, too abstract, too theoretical, too recent), (b) conservatism or unwillingness to change, (c) discipline-restricted organizational structures, (d) procrastination, (e) power-related aspects, (f) lack of support, (g) lack of relevant and complete SD information, (h) lack of SD awareness, (i) over-crowded curricula, and (j) fear of extra work (Leal Filho 2000; Dahle and Neumayer 2001; Lozano 2006; Leal Filho 2011).

Challenges

As a response to these problems, what can the role of sustainability science and ESD in higher education be? How can we achieve more effective knowledge transfer and broader engagement that indeed bridges the gap between science and society? Some reflections are outlined below:

- Sustainability science and ESD are value-driven, following normativity principles of sustainability, which put them in a special position, as their research approaches are not neutral. The economy-oriented trend in universities, which becomes especially problematic when the idea of contributing to *society* becomes synonymous with contributing to the *economy* (Yarime et al. 2012), is entering as well the sustainability discourse, e.g., through the concept of a Green

Economy.[1] Yarime et al. (2012) alert to several disadvantages for universities following this trend: (i) the entrepreneurial model and conventional technology transfer practices are not necessarily appropriate for promoting larger socio-technical innovation; (ii) this model is not focused on the sustainable development of local and regional communities; (iii) it follows a paradigm that incentivizes business-as-usual economic growth and does not compulsorily address pressing social or environmental issues; and (iv) negative effects of corporate-like competition may push aside the academic tradition of open sharing and collaboration. Here, a stronger debate about the concept of SD is required that puts into discussion strong vs. weak sustainability and stimulates visions of a more sustainable present and future encouraging alternatives to the business-as-usual model. From an educational point of view, the observed managerial approach favors educating people *to adapt to change* rather than building their capacity *to shape and create change* (O'Brien et al. 2013). Here, the already mentioned reorientation of curricula and learning needs to be led by ESD scholars.

- Social sustainability—which, e.g., focuses on equity of access to key services, including education, and on community responsibility in a long-term, intergenerational perspective—relates to institutional changes in the HEI governance model and changes in the curriculum, but these appear to be less central to the sustainability research agenda in universities. The most innovative and eco-efficient university would fail the sustainability principles of social justice if it addresses only a small group of elite students with sufficient financial capacities to attend their programs. Noam Chomsky's recent speech on "Public Education and The Common Good" (Cohen 2013) is a valuable source for rethinking financing higher education. These problems are still lacking in the research agenda for sustainability in higher education.
- Ranking/assessment tools and evaluation procedures focus on economic numbers instead of sustainably oriented governance models and future-oriented curricula/learning and teaching approaches. Here, sustainability research in universities can offer alternatives (see e.g., Lukman et al. (2010)). Sustainability assessment in higher education has become a growing study field (see "The University System and Fields of Action for Sustainability" for sustainability assessment tools applied in universities). However, it remains a challenge that assessment processes embrace sustainability holistically (Wals 2013), and more research and improvement is needed. According to Jones (2012), for example,

[1] The concept of green economy (GE) emerged primarily outside the context of the SD framework and is not built on sustainability principles (Baer et al. 2012). The Rio +20 summit in 2012 can be seen as an attempt to introduce the GE concept into the SD debate, and it was strongly promoted by some global players, whilst at the same time being received sceptically and rejected by others (Brand 2012; Bullard and Mueller 2012). GE is based on pillars like the environmental technology sector and green jobs, and strives for economic measurement beyond GDP. It still adheres basically to the concept of economic growth as a strategy for human well-being while reducing environmental risks and ecological shortages (Jones 2012).

> "ticking simple check boxes [in sustainability assessment procedures] does not encourage rethinking current doctrines of progress and modernity in order to develop new visions of the world," nor do these procedures foster a better human-nature relationship, but merely follow "aspects of managerial efficiency and the logic of markets." Here again, sustainability science should ask universities to reflect on what type of development they wish to pursue and which underlying educational objectives are at stake. The scope of universities' holistic sustainability understanding determines what categories and indicators they will consider when making sustainability assessments.

In order for the research shift noted in Table 3 to gain more momentum, other challenges such as the fragmentation of disciplines (Waas et al. 2010) and discipline-specific procedures of quality assessment and research funding need to be addressed (Barth and Michelsen 2013). However, there is a deep paradox in universities as institutions: Though directed toward teaching, they themselves learn very slowly and thereby delay changes from taking place (Stephens and Graham 2010).

Summing up, universities face tensions from strong economic and market forces, on national and global scales, and it is doubtful that any university can escape these influences. This discourse necessarily turns again to perceptions of sustainable development, to underlying divergent worldviews and to the question of whether the main objective is to follow a "strong" or "weak" sustainable development paradigm (Baker 2006; Neumayer 2010). Waas et al. (2010) consider it "imperative that one distinguishes between trivial or less useful conceptualizations and useful ones." Sustainability science and ESD are the scientific platforms to inform this choice.

Furthermore, they advance this ongoing debate by creating settings that permit the academic community to develop the new competencies, visions, and mental models necessary for a paradigm change. Such new settings are of central importance for the upcoming generation of scientists to experience inter- and transdisciplinary research approaches.

Jackson (2009) suggests a new paradigm without economic growth in which people "flourish as human beings—within the ecological limits of a finite planet" (p.16) and perceives as the most urgent task for society to create the conditions under which this flourishing is possible. The concept of degrowth emerged as an alternative to the neoliberal concept of infinite economic growth and has lately gained increasing attention in social media and research activities (Jackson 2009; Schneider et al. 2010; Research & Degrowth 2013b; The New York Times' Room for Debate 2013). This concept strives for downscaling of production and consumption, and at the same time, for increasing human well-being and enhancement of the ecological conditions, as well as equity on the planet. In order to achieve these goals, degrowth aims to develop strategies that help societies "to live within their ecological means, with open, localized economies and resources more equally distributed through new forms of democratic institutions" (Research & Degrowth 2013a). These strategies aim to substitute efficiency with sufficiency and promote innovation that "will no longer focus on technology for technology's sake but will concentrate on new social and technical arrangements that will enable us to live convivially and frugally" (ibid.). ESD and sustainability science as normative academic fields, action-oriented and close to society, together with universities as experimental areas, could include these strategies in their research agendas.

Concluding Remarks

The fields of ESD and sustainability science form the scientific basis for research on sustainability in higher education and can be seen as a way for transition.

Despite some progress, for example in shifting sustainability research in universities closer to society and following more transformative approaches, especially with regard to competencies development, both fields are still a niche in the research landscape. However, they play a crucial role in opening up university research to more inter- and transdisciplinarity and to develop more appropriate approaches to tackle the complex sustainability challenges our world is facing.

As old mental models and reductionist perceptions of SD still prevail, these fields are of utmost importance to correct misconceptions and to follow a strong sustainability paradigm that opposes the neoliberal trends taking place globally in higher education. By providing new platforms and approaches, sustainability science and ESD foster a more open dialog on visions and interpretations for SD and the development of new mental models. In this dialog, more inter- and transdisciplinarity as well as critical thinking, system-thinking, and anticipatory thinking are vital for the transition to sustainable universities and for enhancing the SD debate.

It is desirable that more disciplines than those related to environmental and educational science join this dialog, like for example humanities, to enrich, diversify, and enlarge the forms of communication that are urgently needed in the overall SD discourse.

ESD and sustainability science, along with universities as democratic institutions, constitute essential vehicles to investigate, test, and develop conditions for truly transformative change.

Acknowledgments The authors wish to thank Derek Moench for his valuable and constructive comments on this chapter.

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Being Scared is not Enough! Motivators for Education for Sustainable Development

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Abstract This chapter presents an overview of positive motivators for students, lecturers, and educational managers to prioritize Sustainable Development in education. Very often, we implicitly assume that students and colleagues should all be motivated by the great challenges that the world faces. And if they appear not to react sufficiently to these challenges, we sometimes tend to give these challenges an apocalyptic character. But is this the right motivator for students and colleagues to work on Sustainable Development? We all know that if you only use a stick and no carrot… So why don't we use more carrots? The bureaucracy that comes with tools for checking/auditing/evaluating the (SD content of) programs/curricula is not particularly a strong motivator for university lecturers. And building courses that add another subject to the erudition of the graduate might not be the right motivators for students that want to make a difference. We are often still in the process of convincing university managers to add SD to the curriculum, convincing colleagues to address SD, and convincing students to pick SD electives

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_2,

and address SD in their projects. How to motivate them to do this when this gives them no direct personal reward and even might increase their workload? The paper will explore options to develop motivating educating by reviewing case studies on educational renewal in four universities. It concludes that there are various options for more motivating education. However, to fully utilize these options, more priority should be given to education.

Keywords SD motivators · Humor · Curriculum development

Introduction

Although the need for Sustainable Development is widely accepted, and education is often addressed as the main driver of change for Sustainable Development, the results are still rather poor (Pandey 2003, p. 95). Many universities signed one of the SD charters (Copernicus, Talloires, Halifax, Barcelona….) but the vast majority of the 14,000 universities in the world did not sign any SD Charter (Lozano et al. 2013). Even the ones that did sign, sometimes forgot that fact or fell back after various promising efforts. Around the world sustainable development still appears as add-on modules in the curriculum (Desha et al. 2009). Rarely has Sustainable Development become the red line for the development of a whole program (Cf. Corcoran/Wals 2004). There are several examples of new M.Sc. programs that aim for SD, but hardly any pre-existing program achieved a transition to a sustainable curriculum. It is our impression that in the vast majority of higher education programs, SD is sometimes addressed in a specific course, and perhaps touched upon by motivated individual lecturers. But the step beyond, to restructure existing curricula, and make SD its leading principle, is rare (Cf., Thomas 2004). Curriculum renewal is generally an extremely slow process (Desha 2010).

A number of new M.Sc. curricula for SD have been developed (Salcedo-Rahola and Mulder 2008; Salcedo-Rahola and Mulder 2010). Of course the lecturers of these programs are teaching with great enthusiasm. But at the university management level, it is our impression that this is mainly a strategic reaction in regard to the uncertainties that the appeal for SD creates for universities: will SD programs really attract more students? And will the graduates be able to get jobs? In this way, higher education institutions seem to keep track of this "new development in the education market," i.e., they create options not to miss the boat. As a result, some universities are now training SD specialists, but the specialists (and generalists) of other disciplines still do not embrace the SD concept significantly.

This is a worrying development. SD is not an issue to be left to SD specialists. It should be a leading principle for managers, civil engineers, economists, chemists, architects, and sociologists… Why is there so much reluctance to restructure the curricula in order to contribute to Sustainable Development? It is our conviction that hardly anyone is opposed to Sustainable Development (Mulder 2010). Some are strongly motivated by it, others only marginally support it. But for many, this is insufficient to start restructuring education in order to educate graduates that are able to make a difference. *"The world has problems while universities have disciplines"* (Wilson 2009). This denotes that there is a strong force driving research into disciplines, and prohibiting taking up the real world challenges as subjects for scientific research.

Fear as Motivator

Fear is a strong motivator. During life threatening events, people can carry out actions that they are normally incapable of. But also when threats to life are less imminent, fear can be a strong motivator too. Marketers know that a threat or a fear which is solved by their product is a strong motivator for sales (cf. e.g., Moinpour 1972). In the case of Sustainable Development the sense of threat is less imminent, and generally there is no easy solution that leaves the customer nothing to worry about. If the customer does not want to worry continuously, denial of the threat is rather tempting: *a state of denial*. The cognitive dissonance theory provides a good explanation for this phenomenon (Cooper 2007).

There appear to be two conditions for threats leading to action:

- The credibility of the threat for specific persons is considered real.
- The options to do something about it are available.

The fact that threats will take a large number of victims does not automatically lead to (more) action if there is no clear option to do something about it. For instance, there are about 30,000 annual fatalities in EU road traffic (European Commission no date) but this does not create a sense of urgency. It leads to some investment in traffic safety though, but much smaller risks can create far more action as they are often more easily solvable.

The credibility of threats is related to their imminence: that our sun will die in a couple of billion years is no threat to anybody, a next ice age in 1,500 years[1] becomes some closer but is still not worrying. Even risks that become real in a couple of decades leave the subject ample cause for denial: this problem is *not real*, or it is *still not real*, or it might *never become real* because of some solution that will surely emerge. Al Gore's "Inconvenient Truth" did a lot to depict the realism of a climate crisis, although his arguments were sometimes rightfully criticized.[2] But it also became clear that although many people were willing to

[1] http://www.reuters.com/article/2012/01/09/us-ice-age-emissions-idUSTRE80814T20120109

[2] Wikipedia presents a thorough overview of the discussions that were triggered by this documentary: http://en.wikipedia.org/wiki/An_Inconvenient_Truth (February 11th, 2013).

take action regarding climate change, most of them were not willing to give up their lifestyles (Cf. Jacobsen 2011).

Lifestyle changes need positive choices: choices for a better life that gives more fulfillments (Hartig et al. 2001). In the consumption society, lifestyle choice often involves a choice for having a lifestyle that involves a higher level of consumption, provided that one can afford it. But positive choices for a richer life are possible without more consumption. Most middle class young kids make such a positive choice when they leave their parents' home: giving up wealth for having more autonomy. But it is not the 'giving up wealth' part that motivates; it is the "more autonomy" part that motivates.

Positive Motivators in Higher Education

Lifestyle changes that do not involve more consumption can frequently be observed. Besides having more autonomy, one can observe other motives like having more "quality" time to interact with each other, with nature, having time for learning, for creativity and self-growth or for contemplation. In educational psychology, the learner's autonomy or 'self-determination' has been identified as an important developmental goal and as an avenue to attaining outcomes such as creativity, cognitive flexibility, and self-esteem (Deci et al. 1991). Educational psychologists discern intrinsic and extrinsic motivation: the former arises from curiosity while the latter arises for the sake of the external rewards for achieving a result.

Given that autonomy is so important in the learning process, it is remarkable that the dominant system in higher education is based on a complete lack of autonomy. Students are supposed to spend their student lives in a largely pre-arranged way, in which the autonomy is generally limited to the coffee break. Lectures are supposed to be one-way traffic of information, and in training sessions the students are supposed to work in a pre-determined manner with pre-determined problems. Motivation is often supposed to be extrinsic; the reward of university graduation. But in general, SD courses are not key courses for graduation… So is there a way to stimulate intrinsic motivation?

Often, education is claimed to be most effective means that society possesses for confronting the challenges of the future (UNESCO 2002). However, educational approaches which focus on the development of scientific and technical skills in an isolated way, and ignore matters of moral sensitivity are rather dominant, with an extrinsic motivation structure. So there is a necessity to utilize intrinsic motivators optimally.

New pedagogies have virtually all been based on increasing the level of autonomy of the student. For example *Project*-Based Learning renders the student more options to order his own learning process while *Problem*-Based Learning offers more options for the student to determine which aspects he/she would like to study. Hence, the question is what these methods could achieve for SD education.

But it is not only a matter of motivating students. There is also an issue of motivating lecturers. University lecturers are normally building their careers on their research track records. Teaching is usually an obligation that "comes with the job." Copying last years' lectures is just the least time-consuming teaching method. Moreover, using the "classic lecture" as teaching style might also feel good for the lecturer, as the lecturer is at least during the lecture the focal point of a large audience. How to motivate him/her to implement more motivating learning experiences?

These are crucial questions for Sustainable Development education. The extrinsic motivation will not work at least not until SD is far more accepted in the university. The intrinsic motivation is hard to achieve, as most students do not pick a university program for that reason. Hence, it is crucial to utilize every option that can be identified to educate leaders for a sustainable future.

Motivating Teachers for SD

University lecturers are in general not particularly stimulated to make investments in their educational efforts. As long as their courses fulfill the minimum requirements, the lecturer does not have to fear any trouble. At least not as long as there are sufficient students participating in his course. But here could be the focal point for action. The market mechanism plays an increasing role in higher education. The Bachelor–Master division has created an additional choice option for students. Even within B.Sc and M.Sc programs, more options for electives and "study abroad" have emerged. This forces even the larger traditional university programs to offer various elective options to students. As long as student numbers do not show a problem, courses are safe, and so the lecturers are at liberty to prioritize their research. But numbers can easily drop very fast as the larger number of choice options creates more variety in student cohorts. What happens if falling numbers endanger the existence of a course or a whole program?

There is a remarkable dilemma in Western Europe: many natural science areas are seen as key areas for Europe's future, but only few young Europeans are interested in pursuing careers in these areas. In some research areas, the majority of the young researchers are non-EU nationals. This is not a sustainable situation. PhD student exchange is a good thing, but here there is something wrong: if a field that is determined to be so crucial is unable to attract sufficiently new students, something is not working properly. Especially in natural science and engineering, more attractive education should be offered to guarantee a next generation. Motivators for teachers to invest in their education should therefore be in "selling" their specialty to attract more students, especially those with strong interest and competences for the field.

But how to sell such a specialty? There is a strong tendency among science and engineering specialties, to show off, i.e., to show how bright they are. This might impress the audience and contribute to the fame of the discipline, but it does not bring more students. There is a growing tendency among students to aim at "making a difference." The way forward for lecturers to promote their scientific discipline is to show students how that discipline can contribute to important societal challenges (Peet et al. 2004). In fact one can argue that the efforts to integrate Sustainable Development into engineering education have contributed considerably to a more positive image for engineering.

Motivators for including SD in the courses of science and engineering lecturers could therefore be found in contributing to the societal legitimacy of the discipline and in creating student interest for that discipline. However, the disciplinary pride and culture might prohibit that these lecturers will implement these changes. ("Don't deal with these vague issues").

In general, we believe that the majority of lecturers are not opposed to deal with relevant SD topics in their courses. As we argued before, autonomy is important, also when dealing with lecturers. Autonomy in a course is a key issue for a lecturer. Attempts to interfere with that autonomy, for instance by introducing obligatory SD courses for lecturers, are bound to fail.

Therefore, instead of forcing a lecturer to adapt his course according to the will of what the lecturer regards as "non-experts," he/she should be triggered to move in that direction by him/herself. Quite a successful method has been developed, that aims at triggering the lecturers' disciplinary pride:

> Lecturers are interviewed regarding the issue what their discipline might contribute to SD. By putting the issue in this way, they are in control; it is their field of expertise that counts. They do not need to react to all kind of SD issues; they are responsible for raising the issues. This triggers their disciplinary pride, and might easily lead to long and extensive discussions (Peet et al. 2004).

However, experience shows that this is a slow process and it needs a lot of resources. Could we find easier and less resource-intensive strategies?

SD as Curriculum Integrator

Program directors are often faced with the problem that the curriculum is a collection of rather incoherent courses: the lecturers hardly know what their colleagues are teaching and students complain about gaps, overlaps, or even contradictions between courses. Especially in interdisciplinary programs, it often occurs that every lecturer is teaching his own disciplinary subject and the student is required to integrate them on his own. Such a fragmented curriculum, especially if aiming at interdisciplinarity, is hardly able to meet its learning objectives. SD is ideal for problem-based learning and could thereby have a profound role in integrating and strengthening such a curriculum.

A relevant—and maybe undervalued—reason for integrating SD into a curriculum is that it allows the student to develop innovation skills. The challenge of a sustainable society is so large that only radical and encompassing socio-technical innovation might help to fulfill the goal (Weaver et al. 2000). Situated in a transdisciplinary approach, the students see what it takes for their ideas to be realized. Cross-disciplinary interactions allow them to look at a problem with another perspective. More complex problems can be addressed. Taking SD as a red line for curriculum development allows the student to widen his perspective and the range of his skills, which is relevant for a wider range of situations. Communication and interaction with different publics for example, which is a relevant need for many graduates, and required by various accreditation frameworks (such as ABET, EUR-ACE or CDIO), can be developed through SD challenges.

Motivating Students for SD

How to motivate students for SD in a positive way? SD can be (and quite frequently is) taught in the traditional mode of the university: the traditional course based on lectures, a syllabus, and an exam. As was explained before, this is certainly not a positive motivator, but the institutional arrangements of the academy often leave no other option.

SD is seen as “a serious issue.” Hearing all the stories about the threats to our societies, and our moral obligations to do something about it, is not really a cheerful event. This only ‘resonates’ with the already interested students. And for the others, it creates quite a contrast with the bright prospects that some colleagues might paint for their students. In other words, SD can be quite depressing, and this will not help the field forward, as a depression mainly leads to a neglect of the issue: the students turn to something else.

We identify four main factors for motivating students through SD:

- Humor
- Autonomy
- Innovation and creativity
- Solving real-life problems.

Humor

Humor might help in motivating students. There is a clear relation between humor of a teacher and learning achievements of students. However, it should be well dosed, should not be overdone, and not be inappropriate (Chesebro and Wanzer 2006). SD problems often emerge from rather weird situations if you perceive them from another perspective. Mankind is in many respects behaving like the man cutting of the branch of the tree where he is sitting at (Fig. 1).

Fig. 1 Cartoon showing the dominant anthropogenic perception

But humor is not added to help SD teachers win a popularity contest among their students. Humor is a good motivator in classrooms. Complex—and often dramatic—issues can be treated with humor, which helps to develop lateral thinking and creativity, two fundamental skills for our students which are also required officially. And one can wonder where else they are developed in the curriculum. Applying humor in engineering can relativize the great global threats to a size that they can become a challenge for focusing action instead of being of completely apocalyptic dimensions. Naturally, humor should not lead to a trivialization of important topics.

With an understanding of basic humor theory and training, both psychological and medical research indicates people can increase their overall health and well-being as well **as improve lateral thinking skills and creativity**. Humor provides tools for developing resilience and maintaining a positive outlook, in times of rapid workplace change and debilitating stress. There is a large amount of scientific evidence which proves **humor** is a vital element of learning. (Wanzera and Bainbridge 1999).

Recently, we organized a workshop with experts in Engineering Education in Sustainable Development. The participants mentioned various effects of using humor to teach SD in class (Table 1).

Table 1 Results of the engineering education in sustainable development (Gothenburg 2010) workshop on humor and sustainability

Stimulates creativity and shift of perspective (needed for SD)
Changing paradigms/brings you into paradoxes
Open minds, challenges assumptions, disruptive thinking
Unsafe situations, stimulates doubt
Happiness makes easier to dream
Has proven useful for difficult times (Groucho Marx, C. Chaplin)
Simplifies complexity without reductionism (makes it accessible)
Reduces resistance to change, creates interest and positive attention
SD is too serious/Engineering is boring
Reduce pressure on serious topics
Have fun
Creates empathy
Team building, trust,
Creates energy!
Double edged sword
Cultural differences/politically incorrect/power structures (risks)
Breaks or creates barriers
Role modeling tool for the teacher
Shows you enjoy your vision
Keeps you "humble" with your knowledge

Answers to the question: Why humor can be a good tool for sustainability education?

Autonomy

Autonomy is also an important issue for students. Being able to organize your learning by yourself is a responsibility, but also an important motivator. An Individual Study System as a web of knowledge that the student could traverse by itself, at his own speed is attractive as it creates autonomy. Such a system might be enabled by modern software, and supported by web-based systems, recorded lectures and on line aid. The big advantage is that this system can easily be used for distance learning. It can also make the curriculum more flexible (as the students do not need to be in the lecture hall at fixed times). Curriculum flexibility allows special activities that require full working days or even a full-week program (Fig. 2).

A disadvantage of an individual study system is that it tends to individualize students; students hardly interact with each other, and with lecturers. Such electronic learning systems should therefore not dominate a curriculum, unless they are carefully designed to stimulate interaction. For lecturers, only communicating with students by exams and perhaps an e-mail question in preparing the exam can be quite alienating. For this reason, individual study systems should be accompanied by interactive forms of education (Fig. 3).

Fig. 2 Cartoon showing that human interference with the environment always has various negative and positive, long- and short-term effects

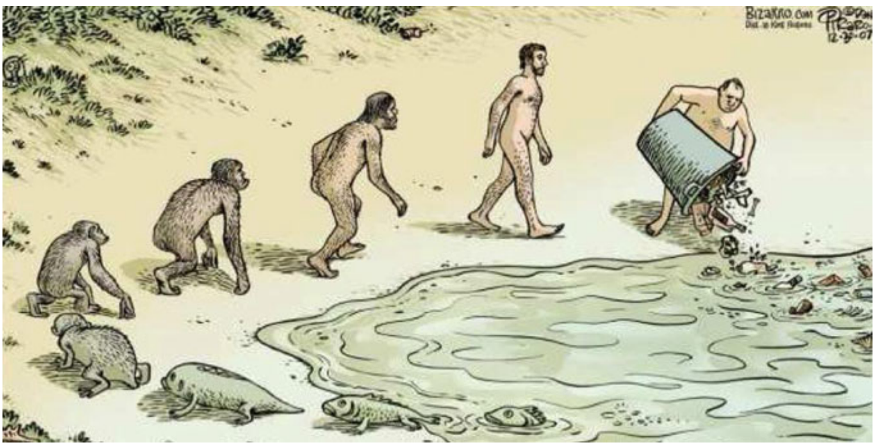

Fig. 3 Cartoon pointing toward long-term mankind-nature relation

Innovation and Creativity

The real challenges of SD will not be solved by optimizing our current system. Therefore, in an SD course, approaches related to innovation and creativity make total sense. Even, the combination creates synergy: much innovation education is done without the purpose of a grand goal and tends to pursue more consumption of a product, or solving a problem by creating a new need. Innovation oriented to SD supports societal grand challenges.

In addition, introducing innovation processes and creativity techniques and approaches in the curriculum connects education to a rising demand for entrepreneurship. With the current economic crisis, policymakers emphasize that students should acquire entrepreneurial skills. Giving them the capacity to create their own jobs, businesses, and opportunities, seems a clear motivation factor. More specifically oriented toward SD emerges the topic of social entrepreneurship or social innovation. The interest for that field is increasing rapidly and could attract more students to sustainability.

Solving Real Problems

Showing the students that they can participate in real challenges, local or global, helps to reduce the distance between theory and practice. This is frequently a criticism we hear from students. "The world has problems, the university has departments…". Significant learning tends to be much more effective in order to create interest because it shows the purpose of learning. The challenges of SD are rooted in the current development model that can be seen in almost any piece of reality we take. Naturally, not all real-life problems are suited for every part of the curriculum. Problem-based learning has often been analyzed as creating the ideal conditions for the learner (Segalas-Coral 2009).

How to Teach This?

Problem-based learning as group projects can have various motivating elements:

- It creates scope for students to determine their own path of addressing the problem.
- It creates a direct link between education and the societal application.
- If an unsolved real-life problem is the subject: it can create a sense of helping others.

In the remaining part of this paper, we will sketch some examples of motivating educational efforts.

UPC-Barcelona Tech: Bachelor Level—European Project Semester

The School of Engineering of Vilanova i la Geltrú at UPC Barcelona Tech (EPSEVG) has designed and coordinated the European Project Semester (EPS), an innovative learning program which responds to the challenges of society and the European Higher Education Area.

The EPS trains engineering students by applying Project-Based Learning in intercultural and multidisciplinary groups. The working language is English, and the program is designed for Bachelor degree students. The EPS program offered at EPSEVG emphasizes the introduction of competences in sustainability and human technology (Segalàs et al. 2011).

The main objective of the EPS is to improve the learning outcomes and competences of engineering students in relation to sustainability, communication and teamwork skills, the ability to work in intercultural settings, and the ability to work in real multidisciplinary projects with students from different backgrounds.

The EPS is divided into seminars (worth 10 ECTS) and a project (worth 20 ECTS). The seminars include courses in Sustainable Technologies, Business and Sustainability and Human Technology, among others. The projects are proposed by local companies and research groups. Since 2008 the number of participants has increased from 9 in 2008 to 30 in 2011. The students, who have participated in 15 projects, have come from 16 different European and North American universities and from over 18 different academic disciplines (http://www.epsevg.upc.edu/eps/).

UPC-Barcelona Tech: International Seminar on Sustainable Technology Innovation

The International Seminar on Sustainable Technology Innovation is a course offered within the framework of the Master of Sustainability of UPC-Barcelona Tech.

The main goals of the course are: to connect students with experts, futures researchers, and policymakers on real topics where long-term technological system renewal is needed in order to fulfill sustainability requirements:

- to increase the understanding of sustainable development in the long term and the role of technology embedded in systems;
- to increase the capability to apply foresighting, forecasting, and backcasting;
- to contribute to the development of the scientific work competences of students;
- to increase the ability of teachers to teach the approach of future imaging, foresighting, forecasting, and backcasting;
- to become an experts' meeting point;
- and to create networking activities among different groups and institutions (Segalàs and Tejedor 2012).

The course introduces the methodology of backcasting in real sustainability problems. The learning environment is international, transdisciplinary, intergenerational, and intercultural. It includes stakeholder dialogs and discussions. It is organized around current sustainability-relevant topics, which are analyzed in case studies based on different contexts: going from developed to developing countries and from local to global cases. Students apply scenario methodologies to the case studies in order to create the most contextualized sustainability strategies. Since 2012, the course is organized within the Erasmus Intensive Program framework financed by the EU. Students and lecturers from six European universities and with different backgrounds are participating in the course. The course is divided into four phases:

1. Local situation analysis. From March to May students analyze the topic in their own countries/regions.
2. Case study analysis. In May, students are grouped into international, multidisciplinary teams and define the current state of the case studies, as well as the questions and challenges that they pose.
3. Seminar at UPC. In June, students, lecturers, and stakeholders meet in Barcelona, where the two-week course takes place.
4. Evaluation of the course. Students analyze their learning experience in terms of acquisition of new competences.

So far more than 170 students, 30 lecturers, and 50 stakeholders have participated in the course.

The topics analyzed in the course vary each year and are related to relevant sustainability challenges; the topics elaborated so far have been: urban solid waste management; food and drinks packaging waste; overfishing and marine ecosystem degradation; sustainable mobility, agro-ecology, and community energy systems. (https://is.upc.edu/seminaris-i-jornades/seminaris/std-2013).

UPC-BarcelonaTech: SolarDecathlon

At UPC-BarcelonaTech, the recent experience of the SolarDecathlon contest has been very valuable.[3] In the first European edition (2010), a group of 20 architecture students coordinated by a lecturer worked during 16 months in order to design and build a passive sustainable house (LOW3). The experience was unique for the students who, apart from learning sustainable architecture, learned teamwork, project management, interdisciplinarity, fund-raising… so a wide range of

[3] http://www.youtube.com/watch?v=-2JXsONKlUU, http://www.youtube.com/watch?v=GeHMGAha1eY

interpersonal and entrepreneurial skills. In the following edition (2012), no teacher wanted to accept the heavy task of coordinating the project. Instead of abandoning the project, the students took the responsibility of carrying it out, and conducted successfully all project phases, acquiring not only all the competences mentioned earlier, but also the full responsibility of their project and learning activity. Fundamental in these experiences was the level of freedom and autonomy they had been conferred by the school, which triggered their responsibility and innovative solutions. As an example for the second edition, where funding was really a problem, they organized a crowd-funding project in a social innovation platform,[4] which would have been unimaginable if the school had provided the funding. This is today a key skill and experience for social entrepreneurship (http://www.low3.upc.edu/).

Delft University of Technology: The "Boat Week" Course

Since 2000, Delft University of Technology provides an option to all students to specialize in SD, within the context of their normal engineering curriculum. Students have to participate in a number of optional SD courses, carry out a graduation project that is SD relevant, and participate in the "boat week" course to obtain a special SD annotation with their engineering master's degree.

The "boat week" course aims at preparing students for an SD graduation project. The first week of the course is at a boat. The boat sails the inland waterways of the West part of The Netherlands. The students do not know each other before. They sleep, eat, and work on the boat. During the week, various sites are visited such as urban projects, landscape sites, waste or energy companies, special buildings, or infrastructures that are interesting for SD. During transport, presentations and discussions take place on board (De Werk/Kamp 2008). The students get a wide overview of the variety of SD challenges and solutions. After the week on the boat, the students do a backcasting exercise in groups:

- They should analyze the sustainability of a sector/function and the demands of all stakeholders.
- They should analyze trends in society that are relevant for that sector/function
- Based on that, consensus with stakeholders should be sought on an attractive future vision (long term, 10–50 years)
- The vision should be widely discussed with stakeholders and translated into pathways and milestones

Initially, the students took only long-term SD challenges (50 years). Nowadays, the students work on more short-term challenges (10–20 years) as that fits better to the time frame of partners (companies, municipalities, etc.). Working with these

[4] http://www.verkami.com/projects/2758-lleva-e-co-a-madrid

partners is extra motivating for students (http://www.tbm.tudelft.nl/en/about-faculty/departments/values-and-technology/tdsd-section/education/annotation-tisd/boatweek/).

Kyiv Polytechnic Institute: Summer School by Student Science Association

The annual Summer School was introduced at Kiev Polytechnic Institute (KPI) by its Student Science Association in 2006. The aim of this project is to facilitate internationalization at KPI and to provide students from all over the world with an opportunity to learn contemporary subjects in a friendly and motivating atmosphere during 2 weeks in summer. Every year the Summer School program focuses on several topics chosen by students-volunteer organizers of the project. These topics are organized into several separate streams which consist of lectures, workshops, discussions, group work, and study visits to companies and research institutions.

Sustainable Development has been integrated in the Summer School's program since 2008, after a group of students from the organizing committee took part in a course on Sustainable Development conducted at KPI in the framework of the Erasmus-Mundus SDPROMO project. Teachers from KTH, TU Delft, UPC Barcelona-Tech and KPI designed the first course in Sustainable Development for students, teachers, and researchers at KPI using active learning methods, including role plays, case studies, project work, films, and debates during 2 weeks in February 2007. An active group of students from the Student Science Association became inspired by the course. Therefore, they introduced SD as an important part of the Summer School program: from a block of lectures in 2008 and 2009, to a separate stream in 2010, a main topic of Science of Global Challenges stream in 2011 and a baseline of Advanced Energy stream in 2012. As a result, SD is playing the role of interdisciplinary pillar connecting different topics of the Summer School at KPI, where students motivate their fellows and guest speakers to reflect on how subjects of their study and research shall add to the progress toward SD (http://summerschool.ssa.org.ua/).

Conclusion

In order to successfully implement SD in education, the university should leave the established ways of teaching. Such a change might not only motivate students and lecturers, it might also serve the quality of education in general. This paper has presented a number of options that can achieve this educational reform. The main motivators are:

- Strengthening the autonomy of students in their own learning process;
- Connecting learning to real-life problems to strengthen self-confidence and transdisciplinary skills;
- Using humor to stimulate relativism and critical thinking;
- Invite colleagues to join, do not force them to change by new regulation.

Although sometimes such education can take place without much extra costs, it will probably be hard to get the new options accepted. One of the main problems is that although education might become more effective and efficient, as we have shown in the cases, changes take time and resources, and resources are scarce. Moreover, the university culture prioritizes investments in research, and careers are built on research achievements. Sometimes, good education can even be "undesired," as it clearly exposes low performance in education due to the research prioritization of most universities. For this reason, all the examples in this paper sometimes suffered from internal criticism, mainly not by a lack of success in educational performance, but more or less by too much educational performance…. Even if courses took no more resources than average courses, sometimes the large student efforts for the course (voluntarily by their high motivation) could lead to criticism. Hence, it takes convinced and committed lecturers to create some change.

Change is required, and the options are there: attractive SD education that motivates students is a viable option. Let us start the effort to implement it!

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Time and Sustainability Metrics in Higher Education

Stephen Derrick

Abstract The purpose of this article is to highlight the importance of considering time in the assessment and measurement of sustainability. The article combines a sociological perspective on time with a qualitative assessment of the representation of time in higher education sector sustainability reporting. Data from a sample of 30 institutions in 11 countries for the period 2005–2011 on greenhouse gas emissions, water consumption, and waste sent to landfill are examined. This chapter highlights the importance of considering past and future perspectives when assessing or measuring sustainability. The higher education sector has the capacity to take a longer term perspective on sustainability than the business sector as it is not subject to market and short-term pressures in the same ways. Combined with the sector's capacity to act as agents of change, there is significant potential to influence behaviors and attitudes in business, government, and the community toward sustainability. This chapter reports on research in progress and findings should be considered preliminary. The analysis of representations of time and sustainability in higher education institutions documents is indicative and is based on a purposive sample, deliberately chosen in order to explore perspectives on time. The chapter highlights how the higher education sector is uniquely placed to influence the ways in which sustainability is assessed and measured.

Keywords Time · Universities · Higher education · Sustainability · Measurement · Australia · United Kingdom · United States of America

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_3,

Introduction

Higher education institutions provide a useful case study for examining the ways in which sustainability is understood and represented. The higher education sector has become active in collecting and publishing data about energy use and performance against 'sustainability' targets. Rauch and Newman (2009, p. 107) refer to the 'vast international effort… across campuses and other institutions to collect quantitative data on sustainability'. While well-intentioned, this effort requires critical examination. Within higher education, sustainability targets are set in relation to and in comparison with peer and associated institutions, which, as Rauch and Newman point out, 'does not directly address the underlying, fundamental question of "what is sustainable"' (2009, p. 108). Sustainability reports from the higher education sector tend to focus on doing more with less; for example, energy saving and water and waste reduction. While this may be admirable, it only represents a move toward sustainability. This article introduces the perspective of time, which enables an assessment of current actions in comparison to the past. More importantly, such a perspective enables the development of time frames for the monitoring and the achievement of consumption and production goals.

There is a large literature about the term sustainability which emerged during the 1970s 'in something like its modern form' (Dresner 2002). Sustainability is commonly understood as maintaining or continuing something in a particular state. This framing of sustainability raises a number of questions including: What exactly is it that is to be sustained? For how long is it to be sustained? Should it be sustained? The related term 'sustainable development' emerged in 1980. Like sustainability, it is a contested term, with some environmentalists referring to 'deep-seated contradictions' (Dovers and Handmer 1993, p. 221), or an oxymoron (Redclift 2005, p. 212). The reference to deep-seated contradictions and the oxymoronic nature of the term relate to a conflict between a desire to sustain something in the long term, but also to develop and make use of it. A simple example of this conflict is the development of fossil fuel resources. In the short to medium term, this may provide benefits through generating employment and income, but in the long term, the use of a nonrenewable resource and the pollution it causes will have negative impacts on sustainability. Dovers and Handmer discuss eight (8) possible forms of contradiction. The terms sustainability and sustainable development are often used interchangeably. Sustainability reports and websites of universities reflect this diverse use of the terms sustainability, and sustainable development. For example, Leal Filho discusses sustainability at universities in terms of the 'implementation of the principles of sustainability' and 'the important role of sustainable development' (Leal Filho 2009, p. 319). A better definition of the term is needed and greater clarity about that which is to be sustained is required.

This article uses the higher education sector as a case study to argue that time is a vital, but often overlooked element of sustainability frameworks. Data for a sample of higher education institutions in Australia, the United Kingdom (UK), and the United States of America (USA) are used to illustrate the issues raised. Further, this article argues that the missing element of time is central to how sustainability is represented and assessed. Unless time frames, including an end point, are specified, it is difficult to establish either a process or path by which to move towards sustainability.

Around the world, higher education institutions continue to experience profound changes, which are driven by globalization. Yang (2003, p. 272) observes that globalization is shaped by market forces rather than policy imperatives, with the focus on expansion and growth of markets. In a globalized environment, increasingly universities are seeking to expand both domestic and international markets with the emphasis on the number rather than the caliber of students Chan (2007), Guri-Rosenblit et al. (2007), Marginson (2008) and Yonezawa (2007). One effect of this process, as Olssen and Peters (2005, p. 313) observe, is that the 'traditional professional culture of open intellectual inquiry and debate has been replaced with an institutional stress on performativity'. An audit culture has developed with a focus on measuring performance, target setting and forms of metrics as measures of academic quality. It is in this context that the increased emphasis on sustainability indicators has occurred. Many associations and groups of higher education institutions with a focus on sustainability issues have developed over the past 30 years. Some of the more significant and larger groups are discussed briefly below. The earliest is the Talloires Declaration, initially signed by 12 founding members in 1990. Signatories to the Declaration must commit their institutions to 'support sustainability as a critical focus of teaching, research, operations, and outreach in higher education through publications, research, and assessment'. There are over 400 signatories to the declaration as at the beginning of 2013 (See http://www.ulsf.org/index.html). In 2001, the European Universities Association (EUA) was formed and it currently has approximately 850 members in 47 countries (See http://www.eua.be/eua-membership-and-services/Home.aspx). Although EUA has a much broader focus than sustainability, their 2012 Annual Conference 'The Sustainability of European Universities' demonstrates the level of member interest in this (See http://www.eua.be/warwick.aspx). The American College and University Presidents' Climate Commitment (ACUPCC) was formed in 2006 and lists 665 signatories to date (See http://www.presidentsclimatecommitment.org/). The Association for the Advancement of Sustainability in Higher Education (AASHE) was established in 2006 and had 858 campus members, including international education institutions by the end of 2011 (See http://www.aashe.org/files/2011_annualreport_aashe.pdf). In 2007, UK student action group People and Planet, established the People & Planet Green League to measure the environmental and ethical performance of every UK university (See http://peopleandplanet.org/greenleague). The International Sustainable Campus Network has 41 members, each of which have committed to a Sustainable Campus Charter (See http://www.international-sustainable-campus-network.org/). The Environmental Association for Universities and Colleges (EAUC) is a not for profit organization with ‘a membership of over 300 universities and colleges, supporting sustainability within the UK tertiary education sector’ (See http://www.eauc.org.uk/home).

While the membership and focus of all of the above groups and many others varies significantly, there is a uniform interest in assessing and measuring environmental performance. While some groups also include assessments of economic and social performance, the treatment is neither uniform, nor always completed by the member institutions.

Perhaps because of the types of developments in measuring sustainability outlined above, there is an increasing tendency to try to compare the environmental or sustainability performance of higher education institutions. Making comparisons between individual institutions across different countries and climates is inherently difficult. For example, an institution located in a relatively hot and dry region of Australia, will have quite different demands on the environment than one located in northern England. Partly because of this difficulty, there has been considerable effort to develop systems of measuring sustainability that are based on a rating or star system. EAUC based in the UK has recently developed the ‘LiFE’ (Learning in Future Environments) Index which aims to ‘help colleges and universities to manage, measure, improve, and promote their social responsibility and sustainability performance’ (See http://www.thelifeindex.org.uk/). AASHE in the USA developed ‘STARS’ (Sustainability Tracking, Assessment and Rating System as ‘a transparent, self-reporting framework for colleges and universities to measure their sustainability performance’ (See https://stars.aashe.org/). While these developments may facilitate comparisons across institutions and countries, they generally do not specify the precise form of measures or timeframes that should be used in generating the basic measures that make up the rating. Both the LiFE index and STARS emphasize the potential marketing advantages of their systems. The LiFE index can ‘help you to publicly promote your achievements and benchmark your success both nationally and internationally’ and STARS can help the institution ‘earn recognition for sustainability leadership’. This is a part of a broader movement of ranking and rating of higher education institutions such as The Times Higher Education rankings (See http://www.timeshighereducation.co.uk/world-university-rankings/) that are regularly used by institutions around the world as a part of their marketing. While sustainability ratings may serve a useful purpose in drawing attention to a broader range of performance measures, the focus on a single rating or number of stars tends to obscure the actual data. In this way, globalization in higher education institutions is reinforced by the existence of a rating system. While there is a perceived need for an institution to participate in such ranking systems, there is a risk that this becomes just another part of institutional performativity. The sustainability ranking system becomes part of the managerialism of higher education, with data and systems driving the calculation of the rating or number of stars. It is not clear that such processes will advance the cause of understanding what sustainability means.

Despite the extensive discussions about sustainability in all of the above examples, there are only general references to time in the context of the perceived need to take action. Thus, time is a critical perspective that needs to be addressed. If something is to be made sustainable in the next 10 years, as opposed to over the next 100 years or more, this implies different levels of activity and larger changes in shorter time frames.

Time and Sustainability

There is limited literature on sustainability and time, with some notable exceptions, including, Stephen Morse who examines time and sustainability in terms of biology and the environment and argues for a special emphasis on biological science. He observes that 'Sustainability is all about people and time; the past, present and the future' (2010, p. 1). In a similar way, UK sociologist Adam (2004a, b, 2008) emphasizes the importance of past, present, and future perspectives. She suggests that a past orientation sheds light on patterns of inequality and the unintended consequences of technologies. A present orientation measures what we have, which is largely a result of past actions. A future orientation raises questions such as: How do we understand and measure future sustainability and by what factors? Whose sustainability? And, what is a reasonable level of consumption at an individual and a national level in order to achieve or maintain sustainability?

Adam's concepts of perspectives on the future are useful in planning for the future. She points out that future generations have no say in how we use resources now and they cannot charge us for this, or have any say or hold us to account. In other words, we are effectively borrowing from the future. She proposes that the 'standpoint of the future present' (Adam 2008, p. 2) is useful in highlighting the link between the future effects of current actions. For Adam, this approach to the future is directly applicable to sustainability. We are taking the 'standpoint of the present' when we ask how we sustain what we currently have. By contrast when we ask how our current consumption affects the future, we are taking the 'standpoint of the future present' (2008, p. 2).

Human actions extend across both time and space. Over time, human population has increased substantially and human built infrastructure has been greatly extended. After reaching 1 billion in about the year 1800, the world's population has recently passed 7 billion and is expected to exceed 9 billion by 2050 (United Nations Department of Economic and Social Affairs Population Division 2011). The growth in population and associated consumption and waste must be accommodated within a finite planet. For this reason, space must be considered along with time. Indeed, Adam argues that humans should be responsible not only for our environmental footprint, but also for what she calls our 'timeprint'—the effects of our past and present actions across time (2008, p. 8). This approach is quite different from mainstream economic understandings of time. In economics, time tends to be associated with the practice of discounting. Over the past 20 years, the techniques of discounting have been used by economists in an attempt to develop market based mechanisms to deal with the costs and risks associated with climate change. (see for example Stern 2008; Garnaut 2011). As Adam observes, this approach is based on the assumption that 'the future is less valuable to us than the present' (2008, p. 1).

Incorporating Time in Sustainability Assessments

Different sustainability frameworks suggest different timeframes. For example, if the focus is financial sustainability it is likely that the time horizon will be relatively short. For example, financial performance and funding issues are often prescribed in very short-term agreements and arrangements as the following two examples demonstrate. Higher education institutions in Australia and the UK receive substantial government funding, which is usually tied into an annual funding agreement (See http://www.innovation.gov.au/HigherEducation/Funding/CommonwealthGrantScheme/Pages/default.aspx and http://www.hefce.ac.uk/whatwedo/invest/institns/annallocns/). For institutions that are tied into such annual agreements, longer term planning and decision making is difficult. There are exceptions to this and for example, many education institutions in the USA have substantial private endowments that allow them to plan longer term. For example, Pomona College in Claremont, California in the United States is a small institution with only around 1,500 students, but it had an endowment of almost USD 1.5 billion as at end 2010 (See http://www.pomona.edu/about/facts-and-figures/index.aspx). While Pomona College uses the income from this endowment to help fund student fees, the College also has a major commitment to sustainability and is able to take a longer term perspective because of the strength of its financial position. In Australia and the UK, many long-established universities have substantial portfolios of fixed assets in the form of buildings and land and this can allow a longer term perspective to be taken also. For social sustainability indicators, timeframes could extend to generations, but probably not very long term as in thousands of years. A generation is usually considered to be between 20 and 30 years. This is not a long time frame considering many higher education institutions have existed for hundreds of years. For environmental indicators, the time frames can be very long, or very short. Debate about responsibility for nuclear waste is an example of a very long time frame where regulatory horizons have been extended to 10,000 years or more (see Viscusi 2007).

One way to address the complexity of economic, social, and environmental timeframes is to use a dynamic framework involving a range of time horizons. Rauch and Newman (2009) have attempted to do this for assessing sustainability in tertiary institutions. Their view is that the development of sustainability indicators should be set at short, medium, and long-term time scales so as to provide information on development of a path to achieve them. They define 'short' as up to 15–20 years; 'medium' as up to 50 years and 'long' as up to 100 years. Each timeframe is given a descriptive title also, so short is 'Institutional'; medium is 'Generational' and long is 'Visionary' (Rauch and Newman 2009, 109). In environmental terms, their long term of up to 100 years would be considered very short, but in economic or financial terms, 100 years is almost unthinkable in terms of how financial institutions think about return on investment. Graedel (2002) observes that while very long-term time frames may be important 'none of our political or social systems, even universities, can be counted on to operate on anything like those time scales' (2002; 348). He considers 'actions that can be taken within the 20–100 year range', but eventually settles on 'a target time of perhaps two generations (50 years or thereabouts)', which he suggests 'seems as good as any'(2002; 348). Approaches such as these simply reflect both the diversity of practice and the lack of rigour in setting timeframes and relating this to the importance and scale of the issues being addressed.

To better understand how time is represented in higher education sustainability reports, an analysis of sustainability and related reports from 30 institutions in 11 countries was undertaken for the period 2005–2011. The institutions were selected on the basis that they have information available on their websites in the form of annual sustainability reports, strategy documents, and other information about their plans to reduce their environmental impacts. As discussed earlier, the growth of interest in sustainability reporting by higher education institutions has been mainly focused on environmental concerns, so measures of environmental impacts such as use of energy and water and production of waste are most common. More recently, there is an increasing trend for institutions to consider and report on social and economic aspects of sustainability, but this is by no means a uniform feature of sustainability reports. The principal documentation examined was annual sustainability reports, for example, Denby (2011), Princeton University (2011) and University of Gothenburg (2011). In addition, annual reports, sustainability, and environmental strategy documents and various institutional Web pages devoted to sustainability matters were reviewed. A list of each of the 30 institutions and the relevant sustainability Web pages is provided at the end of this article. In some cases, such as the University of Tokyo, the most comprehensive source of information on sustainability reporting for a particular institution can be found through other organizations such as the International Sustainable Campus Network. This research and analysis is continuing, and the following findings are preliminary.

Data in relation to targets for greenhouse gas emissions, water consumption, and waste sent to landfill were examined. Measures relating to water, energy, and waste tend to be shown in terms of year to year changes, with reductions being represented as a move toward sustainability. In general, these data do not address overall timeframes or what is needed to reach or maintain sustainability. Occasionally, targets are set and published and then progress toward these, is reported. Timeframes are more often specified in the area of greenhouse gases; in many cases this is shaped by government policies or regulatory requirements. For example, the directive by the UK Government through the Higher Education Funding Council for England (Denham 2008) requires higher education institutions to adopt target reductions in greenhouse gas emissions by 2020 and 2050 in line with government commitments for country wide reductions. Nonetheless, there is a diversity of timeframes used, with different starting and end points and different ways of representing targets.

Table 1 illustrates timeframes for a selection of 22 higher education institutions—chosen for the breadth and range of timeframes.

Some of the timeframes relate to targets the institution has set for a number of environmental measures, for example, energy and water usage, while in other cases the target relates only to a reduction in greenhouse gases. Only one institution—University of North Carolina at Chapel Hill—could be said to have a longer term target at 50 years. Most are relatively short term as can be seen in Table 1. It might be expected that larger institutions would have more resources to devote to sustainability measurement activities and/or that older institutions might have more of an interest in promoting their sustainability. However, the analysis suggests that there is no discernible relationship between time frames and the age of the institution, or its size as measured by student load. The diversity of timeframes and targets may be a reflection of the difficulties inherent in setting base years and target dates. Many institutions do not have historical data for these types of measures—at least not for long periods—it is therefore difficult to construct accurate data for the past. Further, in the absence of past data and without useful benchmarks, it is difficult to set meaningful targets for changes in the measures and timeframes to achieve them.

Timeframes need to be considered carefully. For example, Rauch and Newman define an 'institutional' timeframe as quite short-term, yet some higher education institutions, such as the University of Cambridge and University of Oxford have existed for more than 800 years. Should generational issues be limited to thinking about one, ten, or one hundred or more generations? Is 100 years really visionary, or as Graedel suggested, should we be thinking on a millennial scale? There is no single answer to the question of what an appropriate time scale should be. Rauch's and Newman's suggestion of a 100 year timeframe as 'visionary' might be the practical limit that institutions and society can manage, at least initially.

Measuring Sustainability

Because there has been a growing focus on measuring sustainability (see earlier discussion), it is useful to examine how important higher education institutions are in the overall country and global environmental perspective. One way of attempting to estimate this importance is to compare the size of greenhouse gas emissions from higher education institutions with the total emissions by the country in question. A preliminary review of available data indicated that such estimates could be constructed for Australia, the UK, and the USA as greenhouse gas emissions had been estimated for the higher education sector as a whole. Similar, aggregate-level data could not be found for the European higher education sector and very few institutions in Asia provide such information. The aim of the analysis was to have data that as near as possible represented all of the higher

Table 1 Time frames for sustainability measures for selected higher education institutions

Institution	Year institution established	Country	Year of report analysed	No. of students (FTSL)	Base year	Target year
Australian National University	1946	Australia	2009	12,821	2006	2015
Charles Sturt University	1989	Australia	2010	18,803	2006	2015
EPFL Lausanne	1853	Switzerland	2011	7,762	2009	2022
ETH Zurich	1855	Switzerland	2011	16,342	2008	2015
Latrobe University	1967	Australia	2010	25,135	2010	2020
London School of Economics	1895	United Kingdom	2011	9,000	2010	2015
Macquarie University	1964	Australia	2010	26,661	2010	2020
Monash University	1958	Australia	2011	48,553	2010	2020
National University of Singapore	1962	Singapore	2011	36,000	2009	2015
Pomona College	1887	United States	2011	1,560	2009	2020
Princeton University	1746	United States	2010	7,494	1990	2020
Sydney Institute of TAFE	1891	Australia	2010	30,766	2006	2015
The Chinese University of Hong Kong	1963	Hong Kong	2009	19,852	2000	2025
University of Toronto	1827	Canada	2008	47,066	2007	2010; 2015 and 2020+
University of Cambridge	1209	United Kingdom	2011	17,398	2005	2020
University of Gothenburg	1907	Sweden	2010	26,370	2009	2015
University of Manchester	2004	United Kingdom	2011	39,438	2008	2021
University of Melbourne	1853	Australia	2011	36,639	2006	2015
University of North Carolina at Chapel Hill	1795	United States	2009	26,369	2000	2050
University of Oxford	1167	United Kingdom	2011	21,050	2006	2021
University of Tokyo	1877	Japan	2011	29,000	2006	2030
Yale University	1701	United States	2008	11,660	1990	2020

Sources Sustainability Reports; Annual Reports and web sites of the institutions as listed in the table at the end of this article

Note Eight of the 30 institutions for which reports and data were reviewed, either did not publish clear targets, or adequate information to include here education institutions in each country. In this way, it is hoped that the average data may be more likely to be representative than if a small number of selected institutions had been used. Looking at greenhouse gas emissions is only a proxy for an institution's environmental impact and ideally, it would be best to also look at other factors, such as water consumed; waste produced and land area utilized for example. However, data for these other factors was not readily available on an aggregate basis, so this analysis is confined to greenhouse gas emissions. While it would be useful to expand this analysis to a greater number of institutions and countries, data limitations mean that this analysis could only be completed for higher education institutions in Australia, UK, and USA.

In Australia, the higher education sector is relatively large for a country with a population of approximately 22 million. There are about 100 institutions, comprising universities and tertiary and further education institutes (The Australian Education Network University and College Guide 2012). It is important to note that some institutions operate as both universities and TAFE colleges in Australia and operate in more than one State. The figure of 100 is obtained by a simple count from this website. In 2009, the sector comprised around 107,000 staff and over 1.1 million students (Department of Education Employment and Workplace Relations 2011, p. 9). The sector accounts for large expenditures and has a large asset base of land, buildings and equipment. So there is a relatively high potential to influence students, staff and members of the community who use buildings and facilities, as well as through expenditures on goods and services. The higher education sector in the UK has more than two times as many students on an equivalent full time (EFT) basis as Australia. The US higher education sector has more than 21 times as many students as Australia, so it is much larger again. Actual equivalent full time student data are included in Table 2. Note that these are not all for the same year, so it is strictly speaking not possible to compare the exact sizes of the sector. However, the figures provide a good indicator of the relative sizes of the sector in each country based on student load.

Table 2 shows estimates of the environmental footprint (greenhouse gases) of the sector for Australia, the UK, and the USA While there is a great deal of activity in the sector on measuring and reporting on sustainability, how justified is this? Is the sector a significant contributor to emissions? The estimates in Table 2 indicate that it is not.

In both Australia and the UK, overall greenhouse gas emissions are relatively minor, both in absolute terms and as a percentage of the country's total emissions as shown in Table 2. For the USA, the annual emissions by the sector of over 120 million tons per year are substantial, which reflects the large number of institutions and students. The estimates in the tables should be treated as first order from a statistical point of view as a great deal more work would be required to increase confidence in the measures. However, the estimates provide a good guide to the overall emissions profile of the sector.

As discussed earlier, it would be desirable to extend this type of analysis to other forms of environmental impacts, for example, water and waste. It was not possible to easily draw together aggregate estimates for water and waste for either

Table 2 Selected emissions data for Australia, United Kingdom and USA

Country and year	Full time student load (FTSL)	Higher education total GHG (m tonnes)	GHG/ FTSL (tonnes)	Country total GHG (m tonnes)	Higher education as percentage of total country (%)
Australia (2009)[1]	813,049	1.45	1.78	599.8	0.24
UK (2006)[2]	1,957,000	3.18	1.62	649.4	0.49
USA (2005)[3]	17,487,475	121.1	6.92	7,166.9	1.69

Notes and sources

[1] (a) Australia FTSL is from Department of Education Employment and Workplace Relations (2009) database

(b) Higher Education GHG = (GHG/FTSL) * FTSL. Calculation of GHG/FTSL is derived from data in Sustainable Campus Group (2011). GHG emissions are from p. 13 and FTSL from p. 29

(c) Australia total GHG is from Department of Climate Change and Energy Efficiency (2011: page x, vol. 1)

(d) Higher Education % = Higher education GHG/Total GHG

[2] (a) UK FTSL is from SQWenergy and SQWconsulting (2009), Appendix Table B9

(b) Higher education GHG is from SQW report (2009) as above, Appendix Table B16, updated September 2010

(c) UK total GHG from Department of Energy and Climate Change (2011)

[3] (a) US FTSL is from Sinha et al. (2010, p. 572)

(b) Higher Education GHG is from Sinha et al. (2010, p. 572)

(c) US GHG/FTSL is = Higher Education GHG/FTSL. Note that Sinha et al. give a figure of 7.67 (p. 568), but it is not clear how this was calculated

(d) US total GHG is from United States Environment Protection Agency (2011: p. ES-6)

(e) Higher Education % = Higher education GHG/Total GHG

the UK or the USA as only a relatively small proportion of institutions reported this publicly. However, data on waste and water is available for higher education institutions in Australia and this is presented in Table 3 which shows water use and waste sent to landfill.

For both water use and waste sent to landfill, the higher education sector in Australia has a very small footprint. This is not surprising, since higher education institutions are not the source of major industrial activity, or bathing, laundry, and food preparation such as that which takes place on a daily basis in households. A large environmental footprint would provide the rationale for extensive effort to analyse and quantify levels of consumption in order to determine how best to make reductions. Which raises the question: given that the environmental footprint of the sector is relatively low, why does the sector spend so much effort trying to measure, analyse and report on its own sustainability? One response is that higher education institutions are in the position to demonstrate how to have a light environmental footprint.

Table 3 Selected environmental performance data for Australian higher education sector 2009

Environmental parameter	Higher education sector		Australia		Higher education sector GHG as percentage of total Australia[5] (%)
	(Units/FTSL)[1]	(Volume)[2]	(Units/head)[3]	(Volume)[4]	
GHG emissions	1.78 tonnes/ FTSL	1.45 million tonnes	27.32 tonnes/ head	599.8 million tonnes	0.24
Water used	5.4 kL/FTSL	4,390 megalitres	642 kL/head	14,101,000 megalitres	0.03
Waste to landfill	57.2 kg/FTSL	46,506 tonnes	1,010.8 kg/head	21,300,000 tonnes	0.22

Notes and sources

[1] Units/FTSL for GHG emissions is taken from Table 2. Figures for water and waste are taken from Sustainable Campus Group (2011, pp. 33–34) and recalculated by the author to be for average usage by FTSL, excluding staff

[2] Volumes are the result of multiplying the unit/FTSL by the FTSL

[3] GHG/capita is calculated by dividing the total Australian GHG by population of 21,951,700 for 2008–2009 from Australian Bureau of Statistics (2011, p. 11)

[4] Water/capita is from Australian Bureau of Statistics (2010a, p. 5) and is for the 2008–2009 year. Total volume of waste to landfill for 2007 and is from Australian Bureau of Statistics (2010b, p. 57)

[5] Waste/capita is calculated by dividing waste to landfill for 2006–2007 as shown by population of 21,072,500 from Australian Bureau of Statistics (2011, p. 11)

List of institutions

Institution	Relevant web page
Australian National University	http://www.anu.edu.au/anugreen/index.php?pid=82
Brown University	http://brown.edu/about/brown-is-green/
Charles Sturt University	http://www.csu.edu.au/csugreen/csu-green-home
Deakin University	http://www.deakin.edu.au/about/environment/index.php
EPFL Lausanne	http://developpement-durable.epfl.ch/files/content/sites/developpementdurable/files/ISCN-GULF%20Sustainable%20Campus%20Charter%20Report%202010.pdf
ETH Zurich	http://www.ethz.ch/about/sustainability/index_EN
Harvard University	http://green.harvard.edu/
James Cook University	http://sustainability.jcu.edu.au/
Latrobe University	http://www.latrobe.edu.au/sustainability
London School of Economics	http://www2.lse.ac.uk/intranet/LSEServices/estatesDivision/sustainableLSE/home.aspx
Macquarie University	http://mq.edu.au/sustainability/sustainabilityreporting.html
Monash University	http://fsd.monash.edu.au/environmental-sustainability
National University of Singapore	http://www.nus.edu.sg/oes/
New York University	http://www.nyu.edu/sustainability/
Pomona College	http://www.pomona.edu/administration/sustainability/
Princeton University	http://www.princeton.edu/sustainability/
Sydney Institute of TAFE	http://www.sit.nsw.edu.au/corporate/?Media_Index_ID=1179&area=corporate
The Chinese University of Hong Kong	http://www.cuhk.edu.hk/emo/v2/eng/energy/energy.html
The University of Melbourne	http://sustainablecampus.unimelb.edu.au/campus_sustainability/index.html
University of Ballarat	http://guerin.ballarat.edu.au/vfed/sustainability/sustainability.shtml
University of California Berkeley	http://sustainability.berkeley.edu/
University of Cambridge	http://www.cei.cam.ac.uk/university-sustainability
University of Gothenburg	http://www.mls.adm.gu.se/digitalAssets/1331/1331760_sustainability_report_2010.pdf
University of Manchester	http://www.sustainability.manchester.ac.uk/
University of Maryland	http://www.sustainability.umd.edu/
University of North Carolina at Chapel Hill	http://sustainability.unc.edu/
University of Oxford	http://www.admin.ox.ac.uk/estates/environment/
University of Tokyo	http://www.international-sustainable-campus-network.org/index.php?option=com_docman&Itemid=34
University of Toronto	http://www.sustainability.utoronto.ca/Page4.aspx
Yale University	http://sustainability.yale.edu/

Discussion and Some Conclusions

Higher education institutions have long taken a role as agents of change in society. This role gained new momentum in 1990 with the negotiation and signing of the Talloires Declaration at an international conference in France. Over 400 universities and colleges have now signed the declaration which commits them to ‘a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations, and outreach’ (Association of University Leaders for a Sustainable Future 2012). The Talloires Declaration is perhaps an antecedent of much of the sustainability dialogue in higher education over the past 20 years. Many of the key elements of the declaration have been built on and further developed by various authors. For example, Robinson et al. (Robinson et al. 2011), build on multilevel theory to argue a case for universities acting as agents of change for sustainability. They define this change agent capacity in three ways: ‘agency to change structures’; ‘agency to pursue novel practices’, and agency to link novel practices to structures’ (2004, p. 3). By this, the authors mean that higher education institutions are often in a position to change their physical structures and institutions because they are both owners and operators of their facilities. There is also a mandate to teach and undertake research which is closely meshed with both the students and researchers and an expectation that higher education institutions will undertake research and contribute to solving societal problems. With multiple roles as owners and operators of facilities and producers of educational and research output, higher education institutions must consider the full range of economic, environmental, and social perspectives of their operations.

Robinson et al. then go on to observe that higher education institutions have an important role to play in demonstrating sustainability, through measuring sustainability and benchmarking. Based on the research in this chapter and building on the work of Robinson et al., there are at least three practical ways in which higher education institutions could act to influence sustainability and the way it is assessed and measured. First, they could work together to set an agreed base year against which to measure and benchmark. Second, they could set agreed timeframes over which to assess sustainability. These timeframes should provide leadership and perspective and a period of 100 years is suggested as a good starting point. Third, they could ensure that there is a balanced discourse about sustainability, wherein social and environmental factors are given equal weighting alongside economic considerations. Finally, this role as agents of change could be developed further to communicate the benefits of a more considered approach to sustainability to other sectors, particularly business and government. By taking a longer term perspective; setting benchmarks and measuring over agreed timeframes, business and government could contribute to a better understanding of what sustainability means. This better understanding could arise in at least three ways. First, if data are collected on a comparable basis, it means that comparisons across different sectors of the economy could be made. Different sectors will have different impacts on sustainability, but there needs to be a common basis for measuring this. Second, I argue that the timeframe for measuring sustainability of a sector such as higher education should be longer than for, say, extractive industries as the benefits of education and research are more likely to be distributed country wide, if not globally. By contrast, the environmental impacts of extractive industries such as oil, gas and coal are both significant globally and may have negative impacts for many generations to come through the results of pollution and global warming on humans and other species. For these reasons, it is more important to understand the potential impacts on sustainability in a shorter timeframe, so that alternative actions can be taken in a timely manner. Finally, the choice of timeframe and the indicators of sustainability that are to be used must be a matter of public debate and discussion. At the very least, there needs to a common set of indicators that will be meaningful in terms of stopping or slowing activities deemed unsustainable and emphasising others that are likely to improve sustainability.

However, it is important to note that the higher education sector is experiencing extraordinary pressures through the processes of, globalization, massification, and managerialism. These processes may limit the ability of higher education institutions to act as change agents. Furthermore, the desire to demonstrate sustainability may carry with it the danger of increasing regulation and reporting requirements as a function of managerialism rather than as a true agent of change.

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Integrating Sustainability into the University: Past, Present, and Future

Filomena Amador and Carla Padrel Oliveira

Abstract The idea of evolution is deeply rooted in Western culture as since the eighteenth century the concept of continual development. Indeed, the latter commenced with the Industrial Revolution with the intent of improving the standard of living and thus quality of life. Higher education is necessarily part of this requirement and has been enacted by Universities that provide graduate whom typically become active and responsible citizens often internationally and usually supported by Government. To an extent, Universities control education, research, and training and thus provide a pivotal role in the dissemination of any concept. In this chapter, we examine the concept of sustainability and, based on an analysis, demonstrate the historical significance of sustainability and outline the significant contribution made by Universities with regard to the elucidation of sustainability. Indeed, it is our perception that Universities should use the concepts of both sustainable development and sustainability to reinforce their mission and improve the quality of the learning process. Although the University is seen as the most traditional of all institutions, it has of late become the major instrument of change in social, economic, and political systems, by adopting a new educational paradigm based on multidisciplinary education concerning environmental issues, stressing the values of equity, justice, cultural, and environmental sustainability, and viewing the learning process itself as lifelong.

Keywords Higher education · Sustainability · Sustainable development · Historically view · Future

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_4,

Introduction

A discussion concerning sustainable development frequently proves to be confusing owing to the different concerns of each and every stakeholder as well as the differing opinions, after all that is all that they are, over the method to be adopted to achieve sustainable development. The current meaning of the word sustainability and, more specifically, the expression sustainable development, became part of our daily vocabulary in the late 1980s with the publication of the report entitled Our Common Future (WCED 1987). It is accepted that the concept of sustainable development commenced in about 1969 with the National Environmental Policy Act (NEPA 1969, pp. 91–190), which was according to the text of the act to "foster and promote general welfare, to create and maintain conditions under which man and nature can exist in productive harmony and fulfill the social, economic and other requirements of present and future generations." However, sustainability can be traced to the eighteenth century and arose owing to the potential scarcity of resources, in particular energy (a scenario familiar to us today), for a growing population entering an industrial revolution that was made possible by fossil fuels in particular coal (Mebratu 1998). Thomas Malthus (1766–1834) is considered to be the first economist to foresee the limits of growth based on limited resources. According to Malthus, the land was the limiting factor and he argued that as the population grew, the standard of living would necessarily decrease toward a subsistence level, and eventually the population would reach a plateau. Although this philosophy is neither universally obeyed nor the consensus of all it is considered the first statement of what is now called sustainable development (Jackson 2009).

The most common definition of sustainable development refers to the use of resources to meet our needs without compromising the availability of those resources for future generation (paraphrased from the Brundtland report, WCED 1987). The current debate concerning a sustainable future was developed for the concept of renewable energy with an emphasis on the more efficient use of the known resources that included increasing the efficiency of automobiles. The majority of people would acknowledge these are matters that must ultimately change but when asked to do so would not wish to do so if those proposed changes would impact their own personal lifestyle. The same attitude is invoked with arguments concerning climate change which is in general regarded as a "problem that will be solved" through the use of some "innovative technological solution" (Cohen et al. 1998).

Similarly, sustainability and sustainable development are concepts that cannot be defined in a scientifically precise manner. Nevertheless, descriptions of these concepts are required to both establish and broaden their adoption and it is to the definition of both sustainability and sustainable development that we now turn.

Sustainability and Sustainable Development

Sustainability can, and in this contribution we will argue with some vigor, must be considered the goal of a process that is known as sustainable development. Thus, a sustainable society is one that has reached sustainability through sustainable development, which is a concept different from *sustainability* because change is required within society to do so; this does not, as often assumed, become synonymous with zero growth and this need not be the case. It is clear, we hope to all, that world requires sustainable development to prevent further the environmental matters that have arisen from rapid development. For example, the Industrial Revolution was certainly responsible for the degradation of the planet's ecosystems because the number of species has declined and the average global temperature has increased; the latter is otherwise known as global warming. It is our conjecture that neither of these matters are in contention. To reduce and even mitigate the environmental damage that has arisen from human development requires that humans adopt the concept of sustainability.

The current framework for sustainable development has evolved between 1972 and 1992 through a series of international conferences and initiatives initiated by the UN Conference on the Human Environment held in Stockholm (1972). The recommendations that arose from this meeting were further elaborated in the 1980 World Conservation Strategy, which aimed to advance sustainable development by identifying and prioritizing conservation and also suggested the plausible policy options that would require adoption to do so. The first important use of sustainable development can be traced to the 1980 World Conservation Strategy (IUCN et al. 1980) while the process of combining environmental and socio-economic matters was eloquently expressed within the so called Brundtland Report that states a definition for sustainable development as follows: 'the needs of the present without compromising the ability of future generations to meet their needs' (WCED 1987, p. 43). This philosophy requires a balance between human activities and the ecological processes that sustain all life both now and in the future.

Since 1987 sustainable development has been continually expanded to encompass other principles with the intent of clarifying the otherwise rather vague term. The additional principles to be included are as follows: intra- and intergenerational equity, the precautionary principle, and triple-bottom line. These items are either explicitly or implicitly part of any definition of sustainable development. It is to an understanding of these terms that we now turn.

Intra- and intergenerational equity refers to the sharing of resources among a generation and between current and future generations. The term considers the distribution of economic, social, and environmental capital in a fair and just manner between all generations.

The precautionary principle, which was defined in 1992 by the Rio Declaration (United Nations 1992), promotes the consideration of the impact of an action on the environment particularly when the action results in a negative environmental impact. This principle requires decision-makers to anticipate potential harm before it occurs and ensure adequate measures are taken whenever scientific uncertainty exists to reduce and preclude any plausible impact on the environment.

Triple-bottom line theory considers environmental, social, and economic factors in the decision process taken by stakeholders (Norman and MacDonald 2004). The inclusion of these principles, elucidated above, have assisted in the clarification of the concept of sustainable development, and permitted implementation within a number of different applications. Of course, attaining sustainable development is still a matter that requires further research and analysis. However, governments, businesses, and individuals around the globe are embracing sustainability and thus ultimately will permit its achievement.

Sustainability permits humans to exist almost indefinitely by operating within the finite natural resources offered by the world within the natural cycles. Clearly, a central concern of sustainability is the dynamic that occurs between the need for economic activity and the resultant impact of this on the natural environment. Considerations of both the philosophical and ethical aspects of the definition of sustainable development have resulted in concepts of sustainability that give priority to either economic or environmental objectives: these concepts are often referred to as “weak” and “strong” sustainability (Hediger 2006). Within the economic concept, capital is anything that has the capacity to generate benefits valued by humans. We can then further subcategorize capital as:

- Natural capital incorporates both nonrenewable and renewable resources, that includes the atmosphere, sources of raw materials and sinks used to either store or recycle waste products, and other ecological resources and ecosystem services;
- Physical capital which is based on manufacturing as well as other related economic activities including the use of machinery, buildings, houses, roads, railways, and infrastructure; and
- Human capital that is knowledge, technical know-how, and health.

This is a simplified model and the three types of capital are commonly called environment, economy, and society. Figure 1 depicts, through a Venn-type diagram, the interlinkages of the three dimensions of sustainability.

Figure 1a depicts economy, society, and environment that are completely unconnected and thus, corresponds to a time in our history when the focus was solely with economic development utilizing unlimited natural resources and neither environmental impact of any action nor the plausible limits of natural resources were known. In this scenario, economics prevail over considerations arising from both environmental and societal matters. The link between economy, society, and environment is shown in Fig. 1b where matters of economy are viewed as partially independent of both social and environmental matters. The three components are considered during development but, as shown, the majority of the area of each circle remains unconnected. Therefore, this representation does not yet reflect the environmental impact of human activity; this factor has become increasingly apparent over the past two decades.

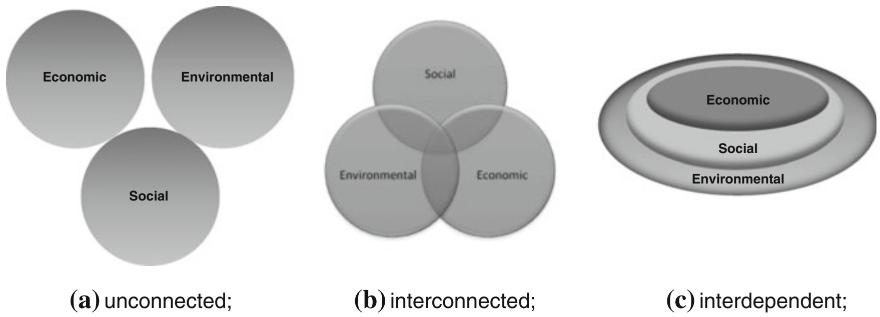

Fig. 1 Evolving views of the connections between environmental, economic, and social dimensions of sustainability (Adapted from http://www.sustainablemeasures.com)

Figure 1c, which differs from both Fig. 1a, b shows that each circle is within each other and illustrates the concept of sustainability (Deller et al. 2006). In particular, Fig. 1c shows economic activity which lies *within* society, and together they exist and function within a finite environment and are all totally dependent on each other.

The difference shown between Fig. 1b, c is an illustration of the concepts of weak and strong sustainability, respectively. It is the definition of both the relative terms of weak and strong that we now turn. In the case of weak sustainability, this term refers to the balancing of economic activity with social and environmental responsibility. The proponents of weak sustainability (given the acronym WS) maintain that natural and built capital, in the long term, be interchanged or substituted one for the other so that the overall ecosystem relies on the ability of technological to compensate for environmental degradation and a decreasing stock of natural capital. On the other hand, strong sustainability (given the acronym SS) implies that human activity must acknowledge the interdependence of economic, social, and environmental aspects of life (Dietz and Neumayer 2007). In doing so, the claims are that certain functions performed by the ecosystems and the environment cannot be duplicated by humans as built capital, and that the existing stock of natural capital must be maintained and enhanced. The health of the worldwide economy is totally reliant on the existence of a healthy society, which is totally reliant on the existence of a healthy environment.

Thus, development must be reconsidered and ultimately transformed in light of sustainability and this ultimately means utilizing new approaches and models. Edwards (2005) commented that sustainability is indeed a revolutionary movement rather than a scientific revolution and, as such, represents a paradigm shift. In this regard, traditional science, which focuses on individual parts of broader systems, is being replaced by systems thinking (as has been applied to chemical plants), which expands the focus to include the interactions and relationships between the parts of these complex systems. Understanding the relationships between nature and society, which is between the biosphere and the human enterprise is fundamental to this shift.

Sustainability is often considered to be synonymous with *environmentalism* that is perhaps better termed environmental sustainability. Accepting this definition leads to a rather limited scope and neglects that sustainability must be considered to be a system of numerous interdependent factors and that a change in one factor will most certainly result in an unpredictable change in one or more of the others. Pappas (2012) suggests the oil spill resulting from an explosion on the Deep Horizon drilling platform operated for the lease owner British Petroleum, that occurred in 2010, provides an example of how sustainability might be applied in reality. The spill has created an *environmental* disaster that inevitably affected the local fishing industry and has generated a local economic crisis and these matters have combined to create further *social and cultural changes* within the communities. Thus, the approach required to solve the complex problems resulting from this disaster necessarily requires individuals across different disciplines with quite disparate skills.

In this regard, it is the task of higher education to undertake the education of students in the appropriate definition of sustainability and the application of the theory of systems to the problem of sustainability. In our opinion, environmental sustainability is an excellent point with which to start the study of sustainability, albeit from a rather limited perspective concerned with nature.

Universities Contributions to a More Sustainable Future

In the past two decades much has been written about sustainability and in particular the contribution of Universities and the process approaches adopted to do so (Leal Filho et al. 1996; Leal Filho 2002, 2005; Weber and Duderstadt 2012). A definition of a "sustainable University" has been provided by Scoulos (2010) with a "University which contributes to Sustainable Development (SD), is a University which is able to deliver the message of integration and progress in all aspects of SD, to promote socially just, economically prosperous and environmentally benign development, through the concepts, principles and methods of Education for Sustainable Development (ESD)." According to Scoulos (2010) it is possible to envisage three levels of analysis: (i), curriculum and programs; (ii), governance, processes, and "culture"; and (iii), infrastructure. Referring to Weber (2012) Universities are now a key driver of the knowledge society and are expected to do more and better research as well as to engage in public debate, serving the needs of the economy, the society, and their community. On the other hand, Tilbury (2010) referred to the "need to embed sustainability in the DNA of academic institutions, to ensure that policy, decision-making and practice are aligned with commitments towards sustainability" and in doing so, cites work conducted at the University of Gloucestershire. We can continue to quote different authors but at this point our goal is to show the existence of a great level of concordance, although we can envisage in some of them a more intensive focus in some issues.

A temporal dimension is essential in any analysis of both the present and future role of Universities in sustainable development. Indeed, if we limit ourselves to the present the risk will exist that the formulation so obtained was distorted. However, the need for major change is widely acknowledged and accepted, and discussions occur regarding the problems and their solutions albeit hampered by the rate at which changes occur. It is clear the complexity of globalization hinder a proper understanding of the phenomena.

To provide some context to the role of universities in society it is evident that they are required to provide expectations and a goal indicating the potential paths to achieve them.

Revisit History of Universities in a Sustainable Education View

The aim of this section is to provide a historical background to the debate concerning the relationships between Universities and society. It is of course imperative that Universities are open to change and integrate the concepts of sustainability into their courses and systems.

The first Universities in Europe were founded in the year of about 1088 and were preceded by episcopal and monastic schools as well as professional guilds Sheffler (2010). At about that time, Christian monastic schools had adopted as a method of learning placed a strong emphasis on dialectical reasoning to extend knowledge by inference, and to resolve contradictions. The same scholastic approach was introduced within Universities. The scholastic instruction—*quastio*, *disputatio,* and *quodlibet*—was intended to develop argumentative skills and promote knowledge and application within various disciplines (Mattoso 1997). The critical spirit fostered by the Franciscan priests Duns Scotus (1265–1308) and William of Ockham (1295–1347) began to undermine confidence in the scholastic methods synthesizing the philosophical and religious traditions in a comprehensive system of thought. In particular, Ockham advocated a reform of both method and content with the aim simplification. Ochkam is also known for the simplicity principle or Ockham's razor that states entities should not be multiplied unnecessarily. This principle of parsimony or simplicity can be interpreted as the simpler theory is more likely to be the correct one. This approach seems adequate for sustainability, which necessarily involves a complex world, requires deeper analyzes that will enable the problems to be defined but not by an exact formulation.

It is our opinion that the value of argument has been lost over time. Indeed, other authors have claimed University teaching methods that should be replaced by assigning value to the development of the skills of cognitive argument. This approach is particularly relevant for the education of sustainable development. Recently, Nussbaum (2010) appealed to a Socratic pedagogy as a reaction against passive learning. Students must be stimulated "to think and argue for themselves, rather than defer to tradition and authority." To better understand the current situation, we must analyze the changes that have occurred in both society and Universities.

Universities were found with a structure to provide the intellectual renewal of society. The mission of Universities was hampered, particularly in Europe, in their early years by wars, epidemics and social upheavals. The remarkable expansion of education came with the Renaissance that preceded the late Middle Ages. New urban schools provided for the needs of an increasingly powerful merchant elite and monarchs, princes, bishops, and towns supported the foundation of new Universities from Scandinavia to the Iberian Peninsula. Although substantial barriers to education remained, there was an increase in literacy across a broad spectrum of society. The result was the creation of a substantial literate public whose skills served both to challenge and reinforce existing political and religious institutions.

If we take a different approach based on the analysis of curriculum development in Universities it is possible, from an historical point of view, to identify three major epistemological traditions: classicism, pragmatism, and encyclopedic. The classicism prevailed in the early European universities where access to university was preceded by the completion of the *Trivium*—preparatory arts of grammar, rhetoric, and dialectic or logic—and of the *Quadrivium*—arithmetic, geometry, music, and astronomy. If classicism marked the curriculum of the first universities, it was the encyclopedic tradition from eighteenth century that indelibly influenced the programs of educational institutions. The pragmatic tradition was consolidated in North America in the late eighteenth century. This approach broke from traditional academic subjects that were included in *curricula*, by emphasizing, in particular, the active participation of individuals in the development of their communities. It is worth noting that pragmatism did not have great influence in European institutions.

In the encyclopedic model, that was markedly adopted within Europe, knowledge is acquired solely for its intrinsic value. This approach resulted in the enhancement of certain disciplines to the detriment of others. In this context, it is important to underline the implications that took place in university *curricula* publication as a result of this approach that were documented in the *Système figuré des connaisances humaines*, developed by Denis Diderot (1713–1784) and Jean d'Alembert (1717–1783). Indeed, this classification of knowledge that the *Dictionnaire raisonné des sciences, des arts et des métiers* "imposed" to the educated elite, resulted in repercussions for Universities that included the selection of subjects as basic knowledge domains, and was ultimately concerned with the transmission exhaustive knowledge.

At this juncture, it is also important to emphasize the concepts utilized by the Humboldt Universities as founded by Wilhelm von Humboldt (1767–1835) whom was one of founders of University of Berlin in the XIX century. In these institutions, the methodology adopted included the concepts of autonomy and academic freedom, and avoided the possibility of influence from politics, economic or religion. The economic arguments were, however, adopted by Wilhelm von Humboldt, along with a belief in the power of Universities in the development of states (Habermas and Blazek 1987).

Meanwhile, in France Napoleon created a proto-network system of state controlled education which is known as the Imperial University (Neave 2002).

The rational that guided the creation of the first universities and the development of them within the eighteenth and nineteenth centuries neither targeted a specific identify nor autonomy. The latter was influenced by both European and International developments rather than solely within a nation or institute. Universities were subjected to external demands that required radical reforms. These were achieved by the adoption of general guiding principles rather than a clarification of the Universities mission statement.

Today, when we consider the relationship between University and society some of the inevitable questions that arise are as follows: “What kind of University is required for what society?”, “What expectations does a University have of society and vice versa?” (Olsen 2005), or, “What role can Universities perform in the construction of a sustainable future?”

Reflect on the Present to Rethink the Future

Universities worldwide have two core missions and these are teaching and research. Teaching has been provided since the Middle Ages with a mission that included both undergraduate and graduate education. Research first emerged as a topic in the pre-industrial German territories and in the German (Humboldtian) where it was integrated into classroom teaching.

The role of Universities in society is as important in the twenty-first century as it was in the middle ages and the question that always requires consideration is” what type of skills should students acquire while at university?”. In general, Universities are research centers from the expectation are significant contributions to the progress of society are achieved. However, it is clear that new roles are emerging for Universities that necessarily require changes in both the academy and the relationships between stakeholders and decision-makers.

In this regard, a literature review concerning sustainability within higher education brings to light the difficulties that Universities face transforming a set of general statements into specific and concrete activities. It is evident that there exists a gap between ideological principles and the practicalities of their adoption and dissemination. All too frequently Universities appear to avoid assuming a greater commitment to this process and prefer to be seen “providing a neutral platform for open debate” (Katechi 2012, p. 120), when in fact neither Universities nor science itself can be considered as neutral. Lotz-Sisitka (2004) has concluded that deeper changes within Universities are not occurring because of the modernist dichotomy between theory and practice.

There are, according to Neave (2002), essentially two models adopted by Universities and the origin of these can be traced to the beginning of the nineteenth century in both France and Germany. In the French Napoleonic system, the system was controlled by the state by a hierarchy imbedded within the so-called Civil Service rather than by an autonomous entity established solely for the pursuit of knowledge. In Germany, the Humboldtian University model was adopted and is now viewed as opposed to the Napoleonic system. The Humboldtian approach had three defining principles: (i) academic freedom and the autonomy of Universities; (ii) the pursuit of knowledge as a basis of culture and civilization; and (iii) the unity of teaching and research. The Napoleonic and Humboldt models provided the basis for a wide range of diversified educational systems both nationally and internationally. For instance, the German model contributed to the foundation of the research University in the United States that in turn had a big influence on the rise of the entrepreneurial university. Today most European Universities are national institutions, in sharp contrast with the United States where colleges or universities are either private or state controlled albeit with indirect Federal funding.

Recent studies of these systems by both Martin (2012) and Hemlin et al. (2008) conclude because we are moving toward a more knowledge-intensive society that requires knowledge-based innovation that ultimately provides economic value Government is increasingly involved in the education process. Indeed, Martin (2012) states "This has been characterized as a fundamental change in the 'social contract' between universities and the state, with the latter now having more specific expectations regarding the outputs sought from the former."

The "knowledge society" presents complex issues for the research mission of universities and requiring a balance between teaching and research, and for the latter a compromise between basic and applied research that is ultimately linked to the economic activity and through taxation the availability of other social programs and the overall public service mission of Government. The research, particularly applied form funded by both Government and Industry, function of Universities also requires attention given to intellectual property, technology transfer, the formation of companies, and competition within and between nations. According to Smith (2001) these changes require new collaborative arrangements in the natural and social sciences and in turn these challenge existing policies and institutional autonomy. The research mission of Universities is significant because they ultimately provide improvement within society and stability that arises from a skilled workforce that permits economic growth and thus, for example, improved healthcare.

The concept of Universities as drivers of economies necessarily requires the adoption of a set of principles that are intended to maximize the economic value of the two University missions of research and education that was described by Thorp and Goldstein (2010) as the concept of so-called entrepreneurial universities. However, Universities follow the scientific logic that requires operation with the "traditional" principles of curiosity and freedom to select topics for research. Scientific logic obtains results with which society can ultimately benefit but does not necessarily do so in the time scale required for commerce that requires measurable financial results on a quarterly basis. There are thus two competing modes of operation one is the academic desire for a thorough scientific understanding of the other commercial benefit that coincide when the academic requires funding to perform the science and in some instances might permit the market to dominate the science. These principles are particularly prevalent in the funding available for innovation research projects as it is the case in the research related to bio and energy technologies where the potential commercial benefit may override the basic research when decisions are made with regard to funding.

This new paradigm requires changes to the University system so that these institutions are capable of tackling in a coherent manner teaching and performing research that also solves real-world problems of value to society. Many US Universities have operated these principles for several decades and done so successfully. For most other Universities, this will certainly, as Nielsen (2012) describes, require severe changes to the practices previously adopted by university. Some of changes are as follows: (i) more interdisciplinary research; (ii) more open and transparent science; (iii) close collaboration with different stakeholders; and (iv) larger scale of problems worthy of solution.

Within this paradigm, changes to the operational mode of Universities are required to incorporate the concept of sustainability into the University system. In this case, McDonald (2011) reports Universities across the world are incorporating sustainability into their curricula and engaging in activities to promote sustainability. Indeed, a strong curriculum in the sustainability paradigm both attracts students and recruiters alike. Indeed, many corporations require students with degrees in business have a background that includes sustainability and thus a far greater number of students are seeking business degrees that emphasis sustainability (Bunch 2009).

In the educational context, it must be noted that sustainability must be treated as a cyclical process of implementation, evaluation, and readjustment. Courses that include sustainability can now be found within many different academic disciplines and they all require these three elements. Of equally importance in education is the removal of interdisciplinary boundaries following the so-called trans and interdisciplinary approaches. This has an additional benefit in that the students are more likely to succeed in multiple future career paths. We expect, within the next few decades that higher education institutions worldwide will have to prepare their students with the mental flexibility that permits a smooth transition between disciplines. The goal of higher education and necessarily the structure of the academic disciplines must necessarily evolve continuously. In view of the challenges of the twenty-first century, it is therefore necessary that Universities adopt both interdisciplinary research and the metadisciplinary approaches of education.

In view of these changes, it is inevitable and indeed a requirement that Universities contribute to the process, rather than sit on the sidelines, because it is that clear higher education is intertwined in the complex system. As an example, we consider the comments of Jackson (2011) concerning the economic transformation that is crucial to sustainable development. In this regard, Jackson states "to rely on heroic beliefs about technological or behavioral change without exploring these questions is to default to a kind of magical thinking about the future." Brand

(2012) has stated that strategies to sustainable development have been failing owing to the absence of relevant socio-economic proponents that are interested in pushing this agenda and formulating appropriate strategies. This debate highlights the necessity of engaging professors and students to resolve the disputes. In the beginning of this chapter, we stated that the terms "sustainability" and "sustainable development" are ill defined and in some regard unstable and it is the purpose of this article to prompt further discussion.

In the definition of these terms, there are at present conflicting interests and it is our view that Universities have an emancipatory and privileged position that permits the definition of these terms (Wals and Jickling 2002). Indeed, Lozano et al. (2013) has stated with immense clarity that Universities must become the leaders in sustainability and change the paradigm within the context of education, research, campus operation, community outreach, assessment, and reporting. In this regard, Schratz and Walker (1995) were the first to suggest that the concept should be "research as social change" that is research that is undertaken 'with people' rather than 'on people'.

Final Remarks

History has clearly shown that education is the most appropriate way to promote critical thinking that ultimately empowers people to address matters of both local and global concern ultimately developing solutions for sustainable development. Higher education empowers people for their role in society and therefore of vital importance to promote the concepts of sustainable development within education so that it benefits the global community. History also shows, albeit with regard to other matters, that education shapes future generations and provides the means by which they are able to address the complexities of globalization. Universities are thus required to teach the skills students require to enter and advance in the labor market, as well as to cultivate in their students, faculty, and staff a positive attitude toward cultural diversity and to help them to understand how people can contribute to a better life in a safer sustainable world.

In Europe, the so-called Bologna Process requires Universities to rethink their strategy and to meet the challenges of a sustainable society: Which innovative approaches in teaching and learning are needed? The Bologna Declaration stated that a 'Europe of Knowledge' is an important factor for social and human growth. Universities have been important partners in the building of transnational understanding and cooperation, thus also in contributing to the European dimension of higher education.

All these challenges and opportunities require universities to rethink their position in society in order to meet expectations as well as to take full advantage of emerging opportunities.

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Part II
Researching Sustainability Assessment

Sustainability Assessment: The Role of Indicators

Tomás Ramos and Sara Moreno Pires

Abstract There are many ways to assess sustainable development, each of which provides potentially useful, though different, insights for distinct audiences. Despite the abundance, specific features and diversity of methods and tools for assessing sustainability, indicators are one of the most used approaches. In fact, sustainability indicators, have been at the forefront of many political, academic, scientific, and community debates for the past decades. Nevertheless, there is a dearth of research on synthesizing indicator approaches, frameworks, trade-offs, advantages, and drawbacks, at different operational and strategic scales and contexts. Therefore, the aim of this chapter is first to develop an integrative analysis of existing sustainability indicator approaches, frameworks, and different initiatives in scope and scale. In the second place, it aims to present insights and critical dilemmas about how indicators could be adopted and tailored for higher education institutions that want to assess sustainability performance. The roles and potential values of sustainability indicators should be clarified; more than “empty” or “miraculous” assessment tools, they need to be considered as steering processes able to change organizational and cultural dimensions of higher education institutions, their education and research structures, and the way they relate to society.

Keywords Sustainability assessment · Indicators · Stakeholder’s engagement · Higher education

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_5,

Introduction

The concept of sustainable development is charged with complexities as it involves and balances several different goals, content types, approaches, aspirations, and desires (Ramos and Caeiro 2010). Assuming that it is to be defined and used to support decision making and policy processes, sustainability must be monitored, evaluated, and reported. Thus, improving the management of global, national, regional and local policies, plans, programs, projects, and actions is vital to achieve more sustainable outcomes with less negative effects on human and natural systems.

As a multifaceted concept, sustainability requires aggregate measures (Hanley et al. 1999), based on the integration of the different thematic dimensions, including the non-material ones (e.g., beliefs, perceptions, aspirations), that ultimately defines the sustainability level of human-natural systems. There are many ways to assess sustainable development, each of which provides potentially useful, though different, insights for distinct audiences. Despite the abundance, specific features and diversity of methods and tools for assessing sustainability, indicators are one of the most used approaches (Ramos 2009). Indicators are special "signs" that when properly designed and used could convey "value added messages" in a simplified and useful manner to different types of target audiences, including policy and decision-makers and general public. Though, indicators usage must keep intact the chance to explore further in detail and obtain in-depth evaluations.

Sustainability indicators can improve the dialog with stakeholders, engaging them in sustainability matters and providing key relevant information for their decisions and aspirations. As pointed out by Moldan and Dahl (2007), at a time where modern information technologies increase the amount of information but not the capacity to store, process, and understand it, we need tools to aggregate and easily communicate the most important information. Indicators will respond to these needs and challenges.

Despite the rise and importance of sustainability indicators at international, national, regional, and local levels, their development and use is not a recent issue. Some of the first important references on environmental indicator date from the 1970s, e.g., Thomas (1972), Inhaber (1976), Ott (1978). Currently, there has been a proliferation of sustainability indicators initiatives worldwide, ranging from local to global systems, and some authors (e.g., King et al. 2000; Hezri and Hasan 2004; Wilson et al. 2006) consider that they are part of an 'indicator industry.' However, there are still no clear answers about the effective impact of these indicator initiatives in society, showing who really adopt and use these tools and at the end how valuable or irrelevant they are in practice. Additionally, the area of indicator research is still rather confusing and non-consensual, as shown by Ramos et al. (2004). The term 'indicator' is sometimes used rather loosely to include almost any sort of quantitative information (RIVM 1994). Equally, statistics are often called indicators without being carefully selected or reworked.

At the organization level, in particular at company level, various authors explore the role of sustainability indicators to evaluate and report corporate performance of organizations (e.g., Tyteca 1996; Bennett et al. 1999; Jasch 2000; Johnston and Smith 2001; Olsthoorn et al. 2001; Perotto et al. 2008; Comoglio and Botta 2012; Hahn and Kühnen 2013). The private sector has moved faster than public sector adopting practices of environmental and sustainability performance evaluation and reporting, including corporate performance indicator systems (Lundberg et al. 2009; Ramos et al. 2007). Public organizations often neglect and/or omit their own environmental problems, excluding themselves from environment integration in their own activities. Nevertheless, some public institutions, in particular local public administration, are shifting their management toward the integration of sustainable development practices and related assessment tools.

As any other organization, higher education institutions should also evaluate their performance (Lozano 2011). Beyond the more traditional economic, financial, and human resources performance management and evaluation, the environmental and social-cultural dimensions should also be integrated and analyzed. Corporate sustainability assessment and reporting, as part of a performance management process, led efforts for developing integrated sustainability performance evaluation approaches and tools. Sustainability indicators could have a relevant role to accomplish this goal at university performance evaluation, as suggested by the research of Lozano (Lozano 2006a, b, 2011). Nonetheless, and as shown by this author, other sustainability assessment approaches, such as narrative assessment or accounts oriented are also used individually or combined.

Despite a number of works on sustainability indicators, including for higher education institutions, there is also a dearth of research on synthesizing indicator approaches, frameworks, trade-offs, advantages, and drawbacks of these major tools for assessing and reporting sustainability at different operational and strategic scales and contexts.

The aim of this chapter is first to develop an integrative analysis of existing sustainability indicator approaches, frameworks, and different initiatives in scope and scale. In the second place, it aims to present insights and dilemmas about how indicators could be adopted and tailored for higher education institutions that want to assess sustainability performance.

Sustainability Indicators Approaches and Frameworks

Approaches for Developing Indicators

It is possible to say that the current era of assessing development progress began in the 1920s in the United States, when economic indicators started to be developed to guide economic decision making (Hardi and Zdan 1997). Traditional indicator grouping, based on the main categories of economic, social, and environmental indicators, was discrete until the 1980s (Seasons 2003). They were developed and applied separately to assess trends of specific policy areas. What we can see, from this decade on, is the upcoming of multidisciplinary approaches, replacing monodisciplinary views on the design of indicators (Briassoulis 2001). This situation changed under the influence of three powerful integrative conceptual models born at the time: sustainable development, quality of life, and healthy cities (Seasons 2003). Since then, sustainability indicators have been at the forefront of extremely rich political, academic, scientific, and community debates. Innumerable proposals for specific indicators, conceptual frameworks, methodologies, development criteria and principles, presentation and communication methods, participative tools, among others, have been discussed to structure the process for indicator creation.

They have been interpreted through different angles, driven by different rationales, served multiple purposes, taken on multiple functions, objectives, and uses toward sustainable development (Moreno Pires 2013). The "sustainability indicators industry" has been generally categorized into two opposing groups: the 'technical' or 'expert-oriented' approach and the 'participative' or 'citizen-oriented' approach (see this categorization in Bell and Morse 2001; Pastille 2002, for instance). More recently, convergence between these two categorizations, in practice and in theory, has been argued by several researchers (see for example (Reed et al. 2005, 2006; MacAlpine and Birnie 2005). They account for the need to consider a new theoretical and practical structuring of the role of sustainability indicators in governance contexts. Following the argument put forward by Holman (2009), it is therefore possible to consider a third broad typology of approaches—what she calls "connecting the dots," that goes further in looking at the outcomes of sustainability indicators projects on governance contexts: the 'governance' approach (Moreno Pires 2011).

Within the more traditional 'technical' approach (e.g., Hammond et al. 1995; Gallopín 1997; Bossel 1999, 2000; Jesinghaus 1999; Schlossberg and Zimmerman 2003; Giovannini and Linster 2005; Niemeijer and de Groot 2008; Singh et al. 2012, among many others), several authors agree that today sustainability indicators are not only necessary but indispensable instruments to facilitate the collection of information for planning, decision making, implementation, and evaluation of sustainable development policies. They try to achieve scientific relevance and to devise "ideal" indicators that are able to conceptualize and measure sustainable development and challenge its uncertainty and complexity. The scientific robustness of indicators is a key concern, framed by the need for sound methodologies, technical progress, statistical innovation, improved measurement tools, better presentation, and communication methods or stronger conceptual frameworks (Holman 2009; Caeiro et al. 2012). This approach generally assumes that information from those indicators will "naturally facilitate and feed policy-making" by "virtue of their scientific validity," and therefore envisage "a linear input-driven policy process" (Holman 2009, p. 368).

As a criticism to this linearity, several authors started to question: have sustainability indicators been so helpful as this approach assumes? Are they being used by policy-makers at all? Do they effectively change policies? Do they reflect the conflicts around different goals and policies? Do they help to reinforce capabilities to deal with the complexities of sustainable development? Bell and Morse (2003) state that projects on sustainability indicators tend to become "myopically focused on technical issues" forgetting that they do not readily and automatically have an impact on decision making nor result in major concrete policy changes (see also Pinfield 1996; MacAlpine 2005; Reed et al. 2005, 2006; Fraser et al. 2006, just to name a few). "The assumption is that they do, but where is the proof?" (Bell and Morse 2003, p. 55). This is particularly true for "technically elegant images in journals and reports" of private companies or public organizations taking sustainable development as predetermined views of what "few individuals want" (Bell and Morse 2003, p. 28). We will discuss this aspect further on regarding the role of sustainability indicators in higher education institutions.

On the other side, the 'participative' approach (Innes and Booher 2000; Kline 2000; Rydin 2007; Coelho et al. 2010; Mascarenhas et al. 2010; Holden 2009, 2011) considers sustainability indicators as effective mechanisms for understanding people's values, needs, concerns, and expectations. They are considered a tool for community participation and empowerment and for opening new opportunities to learn about sustainable development and gain support for collective desired actions (Kline 2000; Gahin et al. 2003). The impacts of sustainability indicators in this approach are mostly analyzed at the community level, mainly at the local level, despite the existence of initiatives at regional and national scales. This approach tries to investigate the ability of sustainability indicators to produce "soft" impacts related to intangible or conceptual outcomes (Holman 2009). Questions of "who participates," "who decides," "who uses," "for whom are indicators meaningful," and "how to communicate," "what values shift" or deeper questions of power and knowledge are critical to this approach (Moreno Pires 2013). They argue for the usefulness and benefits of building participative processes toward the development of sustainability indicators and explore frameworks to structure and guide stakeholder discussion in a more effective way (Holden 2009).

Some authors have been put forward recommendations for the convergence of both 'technical' and 'participative' approaches to sustainability indicators and to address 'cross-fertilization' of ideas (Reed et al. 2005, 2006; Ramos and Caeiro 2010; Ramos 2009). Nevertheless, Holman (2009) underlines that both approaches miss an explicit and direct link to the effects of indicators on more comprehensive governing arrangements in a given context. The 'participative' approach on indicators does not "explicitly discuss the role that indicators can play in network integration (…) across spatial scales and policy sector (…), lacking a real engagement with notions of governance and the policy process" (Holman 2009, p. 370).

As such, the 'governance' approach (Pastille 2002; Gudmundsson 2003; Morel Journel et al. 2003; Astleithner et al. 2004; Hezri and Dovers 2006; Rosenström 2006; Terry 2008; Yli-Viikari 2009; Moreno Pires and Fidélis 2012, among others) goes further into detail in the study of the effects of indicators in governance for sustainable development. This approach seeks to understand and explain the way sustainability indicators change or steer institutional arrangements for sustainable development and how they are limited or facilitated by these arrangements. Indicators are considered as processes with potential to shape new networks, bring new stakeholders to sustainability debates, promote new institutional arrangements, or new communication channels that steer policy integration horizontally and vertically (Holman 2009; Moreno Pires 2011).

Taking Hezri and Dovers (2006, p. 88) words, sustainability indicators may "represent an important experiment in governance, beyond a mere technical fix or improvement in measurement protocols." This places a critical need to understand the role of sustainability indicators, not as mere assessment tools, but as steering processes within specific institutional contexts related to Higher Education Institutions.

Conceptual Frameworks for Indicator Organization and Application

To ensure that sustainability indicators serve the purpose for which they are intended and to control the way they are specifically selected and developed, it is important to organize/categorize them in a framework (Ramos et al. 2004). While cause-effect relationships are difficult to establish, environmental decision making commonly relies on assumptions about such linkages in order to determine appropriate management responses. Thus, indicator models and approaches, which show relationships among system components, generally have the most meaning for decision and policy-makers. However, many indicator initiatives carried out do not use a well-defined framework, with different categories to label and structure the different indicators, but rather just develop an ad-hoc list of indicators without any particular methodological procedure.

According to Ramos et al. (2004), which made an extensive review on indicator frameworks, one of the first and determinant indicator frameworks was the Stress model (Friend and Rapport 1979). This was mainly designed for environmental statistics and resource accounting purposes and it provides the physical basis for comprehensive environmental/resource accounts, which could be linked to the UN System of National Accounts. Unrealistically, it tried to make one-to-one linkages among particular stresses, environmental changes, and responses (USEPA 1995). "Stress" categories include natural as well as human influences and "responses" stands on ecosystems responses (RIVM 1994). The following indicator frameworks, such as the PSR (Pressure-State-Response) (OECD 1993), DSPIR (Driving Forces—Pressures—State—Impacts—Responses) (RIVM 1994; RIVM 1995) and many others, adapted or were inspired by the Stress model philosophy. They are mainly based on a concept of causality: human activities exert pressures on the environment, and these pressures modify the state of the environment, including socio-economic-related aspects. Undesirable impacts lead to response from the society. Despite the large variety of frameworks developed, many of them are quite similar in their methodological approaches and are mostly adaptations of the PSR model, based on causality chains.

In a synthesized way, Giovannini and Linster (2005) consider two broad categories of frameworks that are used to select indicators: *conceptual frameworks* and *statistical frameworks. Conceptual frameworks* reflect the integrated nature of sustainable development, while organizing the core indicators in a useful way to decision-makers and the public, and encouraging the use of combined sets of sustainability indicators in the overall policy debate (Giovannini and Linster 2005). According to APA (2007), five main groups of frameworks can be found in this category: (i) economic frameworks; (ii) pressure-state-response (PSR) frameworks, and its variations; (iii) capital frameworks; (iv) frameworks of human well-being or ecosystem well-being; (v) issue or theme-based frameworks. *Statistical frameworks* help to ensure continued systematic and long-term efforts to improve the availability and quality of the statistical basis from which the indicators can derive, and that can be used to support further in-depth analysis (Giovannini and Linster 2005). Capital-accounting based frameworks, centered on the economic and environmental pillar of sustainable development, are an example. They can act together with conceptual frameworks. The System of Integrated Environmental and Economic Accounting or *SEEA* is one of many attempts to adjust conventional systems of national accounts to include natural values (*greening* the national accounts) and was first published by the United Nations Statistical Office in 1993 (Hammond et al. 1995).

The proliferation of sustainability indicator frameworks are mainly implemented at the country/national level (Ramos and Caeiro 2010), and few of them include meta-evaluation procedures (an evaluation of an evaluation, as a critical assessment of the strengths and weaknesses of an evaluation). Lyytimäki and Rosenström (2007) analyze the effectiveness of different national conceptual frameworks for communicating sustainability indicators. They stress that it is important to pay more attention to the indicators as a set, more than on an individual basis, and that specifically tailored frameworks should be employed for specific uses.

Nevertheless, indicator conceptual frameworks could have several advantages, such as: guide overall data and information collection process; improve the communication to decision-makers and general public, summarizing key information; suggest logical grouping for related sets of information, promoting their interpretation and integration. Overall, they can help to spread reporting burdens, by structuring the information collection, analysis, and reporting process across the main issues and areas that pertain to sustainable development (UNEP/DPCSD 1995).

However, special attention must be paid when using causality chains not to suggest linear relations, to avoid obscuring the more complex relationships in the environment and the interactions among subsystems. Both environmental and human systems exhibit rich internal dynamics that result in effects (or outputs and outcomes) that are not simple direct functions of inputs. The risk of viewing the

PSR (or similar frameworks) as representing causal sequences in terms of policy making is that invalid inferences are likely to be drawn, leading to wrong policy recommendations (Gallopín 1997).

As broadly discussed by Ramos et al. (2004) and USEPA (1995), a variety of terms are used in different ways to cover similar categories and the same item can appear in different places in the same framework, depending on which target system we are focusing on (e.g., environment or overall sustainability system). The frameworks adopted for indicator use evolve mostly from the assessment of the environmental systems to, more recently, the sustainability performance of territories, organizations, and economic sectors evaluation. Therefore, the more recently initiatives take into account not only the environment, but also the society and economy, attempting to measure sustainability, which make much more complex the adoption of frameworks that were initially designed for environmental systems.

Interestingly, Reed et al. (2006) argue that most of the frameworks are applied according to the sustainability indicators approach they represent. As such, expert-led and 'technical' approaches tend to draw their attention to the aforementioned frameworks. On the other hand, 'participative' or 'governance' approaches tend to give more importance to process-related frameworks, aiming to improve the process of developing and using sustainability indicators. These concerns led, for instance, to the formulation of the well-known Bellagio principles. The Bellagio principles were designed in 1996 as guidelines for establishing sustainability indicators—from their selection and design to their interpretation and disclosure—at all territorial levels, from the community to the international level (Hardi and Zdan 1997). The ten principles reaffirm the importance of effective communication, broad participation, and institutional capability in the creation of sustainability indicator sets.

Overview of Initiatives from Global to Local Level: Different Scopes and Scales

As we can see, the massive literature and the uncoordinated and independent practice on sustainability indicators have brought no consensus around methodologies, not even agreement on frameworks or the distinct impacts and effectiveness on policy debates (Hammond et al. 1995; Giovannini and Linster 2005). According to Pintér et al. (2005), this continuous growth in the diversity of sustainability indicator frameworks and systems may allow growing inefficiencies in terms of our ability to develop and monitor progress towards goals, where cooperative action is required. This is why several different authors (Hammond et al. 1995; Pintér et al. 2005; Wong 2006; Coelho et al. 2010; Mascarenhas et al. 2010, just to name a few) insist that the way forward for sustainability indicators should be based on a stronger harmonization at different territorial levels and different stages.

But will the inherent tensions between global and local pressures in the process of developing sustainability indicators reduce, through harmonization, or increase, with no consensus around frameworks and methodologies? Can harmonization be 'capable of covering the full spectrum of interest from the 'super powers' to the small island developing states, from indigenous cultures to post-industrial communities, and from high-tech to no-tech situations?' (Dahl 1997 p. 78).

Bakkes (1997), Dahl (1997), Dhakal and Imura (2003), Miller (2007), among others, alert to the fact that if measures of sustainability are to be globally applicable, they must incorporate sufficient flexibility and they must be culturally and universally appropriate. For Bakkes (1997), for example, indicators must reflect their particular cultural and institutional context and therefore harmonization efforts should only exist where comparability is really needed. There is a need to channel diversity and at the same time standardize some concepts and methods. Dhakal and Imura (2003) argue in the same way when defending that although a single set of common indicators equally applicable to all nations, cities, or institutions is obviously not possible, the identification of a few common universal indicators (independent of the local situation) is recommended in order to provide useful international and interregional comparisons, with the possibility of adding extra particular indicators. These are questions that frame current debates on sustainability indicators together with concerns to understand their practical use and institutional challenges for sustainable development and the trade-offs between different rationales and approaches (Moreno Pires 2011). We will emphasize these and other dilemmas further on when devising sustainability indicators to assess performance of higher education institutions.

Not pretending to be exhaustive, a short consideration of different indicator developments at different territorial scales is also made. For further discussion on the development and progresses of sustainability indicators at different territorial levels see, for example, Hass et al. (2002), Pintér et al. (2005), Coelho et al. (2010), Singh et al. (2012). There also appealing internet tools, such as the International Institute for Sustainable Development (IISD)'s electronic Compendium of Sustainable Development Indicators (http://iisd.ca/measure/compindex.asp), the online list (http://www.ids.ac.uk/eldis/hot/indicator.htm) of the Institute of Development Studies, Sussex, or the Global City Indicators Program sponsored by the World Bank (http://www.cityindicators.org/), that try to systematize, publicize, and generate debate around indicator projects from the global to the local level.

From the global international perspective, the United Nations Commission on Sustainable Development (UNCSD) had an initial critical supportive role with the publication of *Indicators for Sustainable Development: Frameworks and Methodologies* in 1996. Currently, a number of other institutions—such as OECD or the EU, as well as non-governmental organizations—such as the World Resources Institute, the Worldwatch Institute or ICLEI—or research institutes and universities—such as the International Institute for Sustainable Development or Columbia University, among many others—have been working to define sustainability indicators for the planet as a whole or in a global dimension.

Particularly at this territorial level, attention has been directed to the development of one single sustainability index (an example of numerical integration generating one single value) instead of a list of indicators. Table 1 presents an overview of some of the most well-known projects on sustainability indexes. Different indexes offer different insights and different directions for a more sustainable development.

At the national or regional level, many countries worldwide have also established sustainability indicators, and most of them have been working close with the UN, OECD, the World Bank, the EU, or other organizations. Canada, the United States, the Netherlands, the UK, or Sweden are examples of countries with long efforts to devise national sustainability indicators. The 2002 Summit on Sustainable Development in Johannesburg was an important milestone, since it gave impetus to many countries to develop their own sustainable development strategies and related indicator systems. According to some studies (e.g., Hass et al. 2002; Coelho et al. 2010), general features of national and regional initiatives can be briefly summarized. Most of those experiences prefer to adopt a list of indicators (between 30 and 60 in average) and headline indicators.[1] instead of using solely a single index). Sophistication in national reporting is reported by Dahl (2012) where he stresses the trend to fewer pages, less frequency, less indicators, and more images in reports. A key feature of these experiences reveals that national-regional-local-scale interaction among indicators is present but it is still a challenge to be addressed (Coelho et al. 2010). They use causality-chain indicator frameworks but also other types of frameworks, generally grouping indicators along the main dimensions of sustainable development or the policy goals considered in sustainability strategies (ibid.). Finally, according to Coelho et al. (2010), there are in general three main groups of stakeholders involved in the participation process: the public administration, private groups (business and industry), and the general public (communities and non-governmental organizations). A fourth group of experts acts sometimes as an advisory group, where academia could have an important role to play, through its technical-scientific knowledge, independence, transparency, and facilitating behavior, in helping all stakeholders deal with sustainability issues, as highlighted by Ramos (2009).

At the local level, hundreds of towns, cities, and counties, have developed indicators to identify and assess particular aspects of sustainability in their community (e.g., Walter and Wilkerson 1998; Gahin et al. 2003; Miller 2007; Holden 2009). The "community indicators movement," named by Innes and Booher (2000), was boosted by 'Agenda 21' (Fidélis and Moreno Pires 2009) and calls for a participative and 'bottom-up' development of sustainability indicators to provide solid bases for local decision making (UNCED 1992, chapter 40). The experience of Sustainable Seattle's Indicators of Sustainable Community in the United States was one of the first attempts by a community to value and measure local quality of

[1] Headline indicators are special "key" relevant indicators in the context of overall sustainability assessment, which provide particularly useful information for the top decision-makers and the general public. Usually they are represented by a small subset within the main sustainability indicator set.

Table 1 Examples of sustainability indexes

Sustainability indexes	Authors	Date
Stressing the ecological dimension		
Ecological footprint (EF)	Wackernagel and Rees	1996
Environmental space	Friends of the earth, Wuppertal institute	1994
Environmental performance index (EPI)	Columbia University	2006
Environmental vulnerability index (EVI)	Jonathan Mitchell (SOPAC)	2004
The living planet index (LPI)	World wildlife fund (WWF)	1998
Sustainable process index (SPI)	Institute of chemical engineering, Graz university	1996
Stressing the economic dimension		
Eco-efficiency (EE)	World business council on sustainable develop.	1992
Index of sustainable economic welfare (ISEW)	Daly and Cobbs	1989
Measure of economic welfare (MEW)	Nordhaus and Tobina	1973
Genuine progress indicator (GPI)	Cobb et al.	1994
Sustainability performance index (SPI)	Krotscheck and Narodoslawsky	1994
Genuine savings	Pearce and Atkinson	1993
Down jones sustainability index	Down Jones & Company	1999
Stressing the social dimension		
Human development index (HDI)	UNDP	1990
Capability poverty measure (CPM)	UNDP	1995
Index of social progress (ISP)	Estes	1974
More Integrative approaches		
Barometer of sustainability (BS)	IUCN—Prescott—Allen	1995
Environmental sustainability index (ESI)	World Economic Forum, Yale Univ., Columbia Univ.	1999
Wellbeing of nations index	Prescott—Allen	2001
Dashboard of sustainability (DS)	International Institute for Sustainable Development	2000
Compass of sustainability	AtKisson Group	1992

life and sustainability and still remains as one of the best known practices at the international level (Holden 2006). Many of these community experiences in the U.S., Europe, and all over the world were developed by citizens themselves with their own procedures and generated indicator systems based on their particular needs and circumstances, considering the available resources and the perspectives of the people involved (Moreno Pires 2013). It involved a good deal of ‘trial and error, of learning by doing’ (Walter and Wilkerson 1998) and it was sometimes loaded with unrealistic expectations (Sawicki 2002).

Finally, endeavors have also been directed to develop sustainability indicators to assess particular policy sectors performance, such as agriculture, forestry, energy, biodiversity, water, transport, industry, among others, or to assess sustainability performance of private institutions or companies. As stressed by Myhre et al. (2013) and Ramos et al. (2007), public sector organizations are far from this reality. Despite the dearth of initiatives on sustainability indicators for public sector performance evaluation, it is acknowledged that local governments are part of a wider sustainability change trend, as they are often recognized as leaders of environmental sustainability related initiatives in public sector organizations, as pointed out by Strengers (2004).

In the private sector, the OECD's Guidelines for Multinational Enterprises, The World Business Council for Sustainable Development indicators, the International Organization for Standardization indicators, or the Global Reporting Initiative (GRI) framework are key examples. According to GRI (2013) in 2011, 95 % of the largest 250 companies worldwide were producing sustainability reports, mainly supported by indicators; but it took 12 years for this proportion to grow from 35 to 95 %. GRI stresses that although company reporters are growing and the quality of reporting is improving, the adoption of sustainability reporting is too slow and yet to achieve its full potential. In addition, Lozano (2011) concludes that sustainability reporting in universities is even still more ahead than sustainability reporting in corporations, both in numbers of institutions reporting and in level of reporting. What room for maneuver or what role can sustainability indicators play in steering these conditions? The next part will explore these challenges more deeply.

The Role of Sustainability Indicators for Performance Evaluation of Higher Education Institutions

The study on the role of sustainability indicators in higher education institutions has been receiving recent growing attention from scholars. The majority of the studies clearly reflect the 'traditional' approach to indicators mentioned before. They tend to focus on how to best assess sustainability through conceptual frameworks (Waheed et al. 2011), environmental management systems (e.g., Disterheft et al. 2012b, reporting guidelines (e.g., Lozano 2011), indexes such campuses ecological footprints (e.g., Conway et al. 2008), life cycle assessments (Ingwersen et al. 2012) auditing approaches (e.g., Roorda 2001; Glover et al. 2011; Mitchell 2011), comparative and ranking tools (e.g., Shriberg 2002; Lozano 2006a, b, 2011; AASHE 2012), among others (e.g., Disterhelft et al. 2012a). Fonseca et al. (2011) underline that these studies tend to highlight the relevance of sustainability indicators and reporting for higher education or discuss pioneering experiences.

Two major future dilemmas regarding this technical approach on the role of sustainability indicators in higher education institutions are put forward by the study of Shriberg (2002). First, he stresses the necessity, feasibility, or desirability of developing a 'universal assessment tool' versus the development of contextual indicators; and second, the need to develop mechanisms to rank colleges and universities on sustainability versus the need to provide a rationale for why ranking is not appropriate. Both dilemmas reveal some of the highly debated trade-offs analyzed before regarding the development of sustainability indicators in general.

A less explored approach has been devoting by other scholars that tend to focus on the participatory dimensions and effective communication strategies of sustainability indicators (e.g., Djordjevic and Cotton 2011) and how indicators or reporting can promote real change. Interestingly, Tilbury (2011) assumes that although universities and colleges have committed to multiple international declarations and agreements toward sustainability (such as the Bologna Charter, The Halifax Declaration, the Talloires Declaration, or the Copernicus Charter for Sustainable Development) practice shows that they are still failing to reach the core of staffs, students, and stakeholders or indeed influence the culture of institutions. In the same way argues the study of Fonseca et al. (2011) but regarding sustainability reporting, particularly in Canadian universities. They sustain that although practice of sustainability reporting is still uncommon, diverse in contents, rationales, frameworks, and indicators, with a restricted scope (emphasizing eco-efficiency and green architecture), the major problem remains in their scarce ability to inform sustainability-oriented decisions (Fonseca et al. 2011). Furthermore, it is argued that since those projects in Canada are mostly bottom-up processes (with the impetus of sustainability offices or student groups) they lack commitment and accountability from the top, they are not largely communicated, and their potential value has been weakened. This is why they sustain the need to explore research deeper into the way indicators can be effectively communicated and debated widely (Fonseca et al. 2011).

These challenges directly connect to other issues that remain unexplored, mostly regarding the governance approach and the ways indicators can change or steer organizational and cultural dimensions of higher education institutions, their education and research structures, and the way they relate to society. Miller et al. (2011) provide a critical contribute to these needed institutional changes, although focusing more generally on sustainability knowledge and not particularly on indicators.

Final Remarks

This chapter has briefly reviewed different sustainability indicator approaches, frameworks, and initiatives to bring to the fore insights on how these indicators could be adopted and tailored for higher education institutions.

Sustainability assessment initiatives, more than supporting policy and management issues, should be ready to integrate and well reflect the uncertainty values of nonlinear complex processes, where the limits are often unknown. In the near future sustainability indicators should be ready to include new challenges and deal with non-traditional aspects of sustainability, particularly those involving global changes and threats, goal and target/limit uncertainty, sustainability ethics, cultural, esthetics and general non-material values, collaborative learning, and voluntary monitoring. They should also be able to rethink the new and old limits of natural-human systems.

Higher education institutions have here a critical dual role. In one way, they are decisive stakeholders to influence and strengthen the development and use of sustainability indicators by society, at different scales and scope. In another way, they must be leading model institutions where sustainable development practices should be embedded and where sustainability indicators, more than empty assessment tools, need to be developed aiming to promote real change. Critical dilemmas emphasized in this chapter, such as the harmonization versus context-specific indicators, ranking and comparison versus specific and tailored indicator systems, or the frameworks and approaches to consider, will certainly frame future studies and debates. However, more than this is needed. Facing the development of sustainability indicators as processes that can deliver change, implies to consider them as framed by specific institutional contexts, where new communication channels, the inclusion of new stakeholders to sustainability debates or the need to strength decision making are critical issues to explore.

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A Strategy and a Toolkit to Realize System Integration of Sustainable Development (SISD)

Niko Roorda

Abstract A chain of action research programs on education for sustainable development (ESD) has delivered a coherent strategy to integrate SD into higher education. Based on the 'tree metaphor' for education, a range of tools was developed and applied, e.g., the ESD Checklist, RESFIA+D for SD competences, an introductory textbook, the SD Curriculum Scan, and the AISHE assessment tool plus the ESD Certificate. Together, they enable a university to realize 'SISD', i.e., 'System Integration of Sustainable Development.' The ESD strategy and its toolbox is described, and illustrated through a number of cases.

Keywords ESD · Tree model · Sustainable development · University mission · ESD checklist · Graduation profile · SD competences · RESFIA+D · Fundamentals of SD · Curriculum scan · Interdisciplinary · Transdisciplinary · Assessment · AISHE · Certification · System integration · SISD · Sustainably competent professionals · Pledge

Introduction: The Tree Model

In a series of action research experiments in the Netherlands between 1991 and 2012, a coherent strategy was designed to integrate sustainable development (SD) into higher education.

The present chapter offers a practical description of this 'Education for Sustainable Development' (ESD) strategy and of the 'toolbox' that it makes use of. It does not discuss the philosophy behind the ESD strategy or the validation of its tools. These backgrounds can be found in Roorda (2010).

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_6,

The strategy is expressed in a compact way with the aid of a metaphor, the 'Tree Model,' in which a bachelor or a master program in a university is compared to a tree, its parts and its environment, as is illustrated in Fig. 1.

For each of the elements of this 'tree,' tools and instruments have been designed, validated and applied. Together, these instruments form a toolkit which enables universities to integrate SD thoroughly in all of its activities, starting from modest starting steps, all the way toward *System Integration of SD* ('SISD'), a concept which is pivotal to the philosophy behind the ESD strategy. Table 1 offers an overview of the instruments.

The Tree Model is a tool in itself. It enables a university (department) to select priorities for organization development, and to define an ESD strategy based on those priorities. This is what the empty 4th column in Table 1 is meant for.

The *Genotype*: The University Mission

Ideally, the university mission is an expression of its identity, translating this into concrete goals and a strategy. An example is the strategy of Avans University in The Netherlands, which is an inspiring example of a university that has decided to become a truly sustainable institution. This is clear from its Mission Statement (Avans 2010):

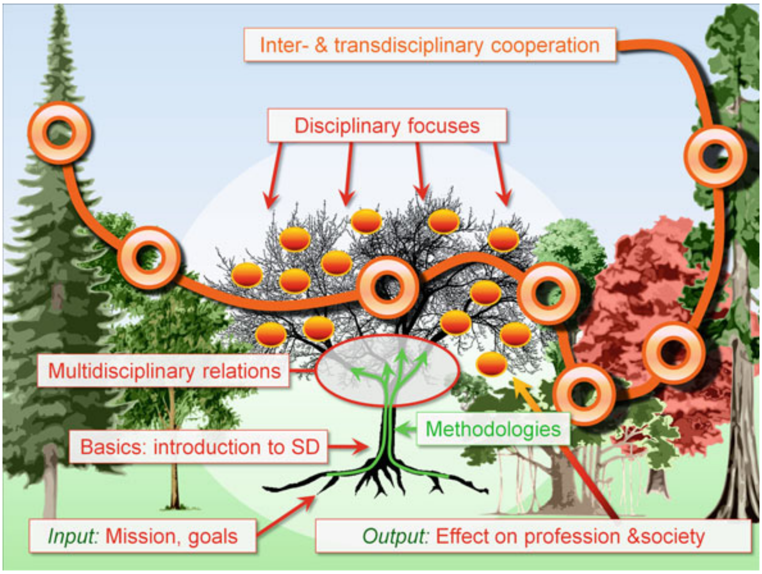

Fig. 1 The 'Tree Model,' a metaphor for a bachelor or master program in a university

Table 1 The tree model: defining the sustainability strategy

Tree aspect	Topic	Tool	Priority
The *genotype*	The university mission	Inspiring examples	
The *phenotype*	Characteristics of education for SD	The *ESD Checklist*	
The *roots*	The graduate profile	The *RESFIA+D Model*	
The *trunk*	The basics: what *every* student should learn	Textbook: *Fundamentals of SD*	
The *branches*	The disciplinary details of a curriculum	The *SD Curriculum Scan*	
The *biochemistry*	Methodologies for the learning process	*Two hundred exercises*	
The *ecosystem*	Inter- and transdisciplinary cooperation	Interdisciplinarity training	
Sprouting and growing	Strategy, assessment, and involvement	*AISHE 2.0*	
The *recognition*	Reward, benchmarking, ranking	The *ESD Certificate*	
Reaching maturity	System integration of sustainable development	*SISD*	
The *fruits*	Sustainably competent professionals	The *Pledge*	

> Avans University educates students to become highly qualified professionals, who continuously develop themselves and their profession, being aware of their societal responsibility. Avans wants to co-create social-cultural and economic developments by being a partner to companies, governments, and organizations for which contributing to sustainable development is pivotal. (…) Our graduates fulfil key positions for the realization of a sustainable society. This demands them to have a societal engagement and an entrepreneuring attitude. (…) From our expertise of, and involvement in the on-going societal developments Avans participates in the societal debate, thus contributing to finding solutions to societal issues.

In 2012, Avans University formally decided to appoint SD as one of its highest priorities. In a vision paper (Avans 2012a), it formulated a 'prospect':

> In 2016, Avans University has reached System Integration of Sustainable Development (SISD), which means that sustainability has been embedded in all of its operations, education, and research. By then, Avans will be a truly sustainable university.

In a legally binding contract with the Dutch Ministry of Education, Avans University decided to make ample use of the strategy and the various tools of the 'Tree Model' (Avans 2012b):

> Before 2015, all 19 academies and all service departments of Avans University have acquired the ESD Certificate at the level of two stars. Besides, all curricula will have integrated the SD competences described by RESFIA+D.

Other excellent examples of mission statements stressing the importance of SD can be found in Roorda (2010) and in various other sources.

The *Phenotype*: Characteristics of Education for Sustainable Development

Much has been written about the notion that higher education, in order to be able to contribute effectively to SD, will have to go through a significant change process. In his dissertation (Roorda 2010), the author of the present chapter presented an overview of the characteristics of ESD (education for SD), partly based on his experiments between 1991 and 2010, and partly on a list of literature sources. The overview is reprinted here as Table 2.

The table can be used as a checklist by those who are designing or redesigning study programs in higher education.

The *Roots*: The Graduate Profile (RESFIA+D)

Competence-based learning has entered higher education in many countries. Discussions are going on in many places: what kind of competences do our highly educated professionals need in order to be able to contribute effectively to SD? In other words: what typifies a *sustainably competent professional*?

To answer this question, a tool was developed and validated called 'RESFIA + D' (see: Roorda 2010 and 2012). RESFIA+D has also been dubbed 'The seven SD Competences,' as it consists of six generic competences, appropriate for each and every discipline or professional, plus a seventh group that varies according to the discipline involved. The six generic competences, each are divided into three sub-competences, as Table 3 shows.

Competence levels

For each of the 6 × 3 sub-competences, four levels of competence have been defined. The four ascending levels are *apply*, *integrate*, *improve,* and *innovate*. This makes it possible to use RESFIA+D as a tool for education design or improvement. As an example, the levels of sub-competence F1 are shown in Table 4.

When RESFIA+D is applied, a group is formed, delegated from: the education management, the teaching staff, the students, and the professional field. Together, they discuss three questions for each of the 18 sub-competences, aiming at reaching consensus:

1. Which competence level should every student of your study program *at least* have acquired at the moment of graduation?
2. Which level is demanded in the present competence profile of the study program?
3. Which level is actually realized for all students in the current curriculum?

Table 2 The ESD checklist: characteristics of education for sustainable development

Principles	Characteristics	Details
Connectivity, Complexity	Systems thinking	Connecting parts, subsystems or aspect systems. Connecting an analytic with a holistic approach; the small with the large; and the local with the global
	Multi-, inter- or transdisciplinary	Connecting disciplines and stakeholders. Balanced regarding Triple P; balanced with disciplinary aspects
	Life-cycle approach	Connecting phases in the lifecycle. Regarding lifecycles of people, products, companies, habitats, cultures, designs, paradigms, etc
	Intercultural, international	Connecting people (sub)cultures, regions, nations. Openness for values and perspectives of others
	Future orientation	Connecting the past, the present and the future. Concerns both long-term and short-term targets, based on visions of sustainable future developments
Innovativity	Openness to changing conditions	Flexibility of mind; capability of dealing with uncertainties
	Openness to new solutions	Creativity, non-linearity, out of the box thinking, acceptance of the unexpected
	Function orientation	Stimulating creative thought and design processes by zooming out from actual products or services to underlying functions or needs, aiming at finding alternative ways of fulfilling them
Action learning, social learning	Application of knowledge	Acquisition and application of knowledge, either sequentially or simultaneously (learning by doing). Aiming at finding useful solutions to real problems
	Multi-methods	E.g., just-in-time lectures, art, discussions, drama, games, etc
	Real-life situations	Context-embedded learning, either in simulated or actually existing situations
	Commitment	Personally engaged towards objectives of sustainable development
	Cooperation	Teamwork within student groups; cooperation with experts, professionals
Reflexivity	Learning to learn	Reflection on own learning process, aiming at continuous improvement. Lifelong learning
	Responsibility	Responsibility for own learning process, and for the definition of learning goals (up to a certain level). Also: responsibility for results of professional activities (stakeholder approach)
	Value-driven	Aware of the relevance and the relativity of embedded values and opinions
	Critical thinking	Critical attitude towards questions, tasks, methods, answers, own functioning
	Robustness of information	Awareness of level of certainty of knowledge, data, conclusions: subjective, intersubjective, objective (opinions, theories, facts)

First published in Roorda (2010). Main sources: Agenda 21 (UNCED, 1992), Orr (1992), De Haan and Harenberg (1999), De Haan (2002), Sterling (2004), UNESCO (2004, 2005), UNECE (2005), Martens (2006), Van Dam-Mieras (2007), Dyball, Brown and Keen (2007), Barth and Burandt (2008), Dieleman and Juárez-Nájera (2008).

Table 3 RESFIA+D : Professional competences for sustainable development *The section numbers refer to the sections of Roorda (2012), in which this table is printed as Table 8.4*

Competence R: Responsibility A sustainably competent professional bears responsibility for his or her own work *I.e., the sustainable professional can …*	*See*	**Competence E: Emotional intelligence** A sustainably competent professional empathizes with the values and emotions of others *I.e., the sustainable professional can …*	*See*
1. Create a stakeholder analysis on the basis of the consequence scope and the consequence period	*§5.5*	1. Recognise and respect his or her own values and those of other people and cultures	*§4.3*
2. Take personal responsibility	*§8.2*	2. Distinguish between facts, assumptions and opinions	*§8.5*
3. Be held personally accountable with respect to society (transparency)	*§8.2*	3. Cooperate on an interdisciplinary and transdisciplinary basis	*§1.3 §4.8*
Competence S: System orientation A sustainably competent professional thinks and acts from a systemic perspective *I.e., the sustainable professional can …*		**Competence T: Future orientation** A sustainably competent professional works and thinks on the basis of a perspective of the future *I.e., the sustainable professional can …*	
1. Think from systems: flexibly zoom in and out on issues, i.e. thinking analytically and holistically in turn	*§3.5*	1. Think on different time scales-flexibly zoom in and out on short and long-term approaches	*§5.5*
2. Recognise flaws in the fabric and sources of vigor in systems; have the ability to use the sources of vigor	*Ch 2-4*	2. Recognise and utilize non-linear processes	*§7.3*
3. Think integrally and chain oriented	*§8.3*	3. Think innovatively, creatively, out of the box	*§8.4*
Competence I: personal Involvement A sustainably competent professional has a personal involvement in sustainable development *I.e., the sustainable professional can …*		**Competence A: Action skills** A sustainably competent professional is decisive and capable of acting *I.e., the sustainable professional can …*	
1. Consistently involve sustainable development in the own work as a professional (sustainable attitude)	*§4.7*	1. Weigh up the unweighable and make decisions	*§8.5*
2. Passionately work towards dreams and ideals	*§4.2*	2. Deal with uncertainties	*§6.3*
3. Employ his or her conscience as the ultimate yardstick	*§8.2*	3. Act when the time is right, and not go against the current: 'action without action'	*§4.2*
Plus: **Disciplinary competences** for sustainable development (differing for each course, discipline or profession)			

This consensus meeting usually leads to remarkable differences between the answers to the three questions, and thus the team of the study program gives itself evident goals for improvement.

Table 4 Example of a competence card

F: Future orientation			
A sustainably competent professional works and thinks on the basis of a perspective of the future			
Level 1: Apply	Level 2: Integrate	Level 3: Improve	Level 4: Innovate
F1. Think on different time scales–flexibly zoom in and out on short and long-term approaches			
• In concrete working situations, you recognize and describe operational methods for the performance and improvement of your work	• In the case of concrete work related problems, you recognize and describe the differences between short-term methods aiming at reducing the symptoms and long-term methods aiming at eliminating causes	• In the case of work related problems, you contribute to the design of a solution strategy based on a carefully selected combination of short- and long-term methods	• You contribute to the (re)definition and the application of the mission and of the strategic policy of the organization you belong to
• You contribute to the application of these methods, and thus contribute to short-term improvements	• You contribute to the application of symptom reducing methods based on the operational policy of the organization or team you belong to	• You contribute to the design of symptom reducing methods based on the tactical policy of the organization or team you belong to	• You involve present and expected future trends in your working field and in society

The *Trunk*: Fundamentals of Sustainable Development (a Textbook)

As the basis for the SD education, the 'trunk of the tree,' a tool was developed consisting of a textbook called 'Fundamentals of Sustainable Development' (Roorda 2012), and a series of online accessories, which can be retrieved from www.routledge.com/cw/roorda-9781849713863.

The textbook is intended for *all* disciplines, e.g., for technical, economic, social, environmental, agricultural, educational, and art courses. The book offers a broad introduction to the concept of SD.

Consequently, the book does not go into the details of specific disciplines. It is not intended for those who want to become high-level experts on sustainability. For them, many other books exist. The philosophy behind this approach is that, as all of society needs to become more and more sustainable, it is essential that not just some, but *all* professionals with a high level of power and responsibility in every company, government department, ngo, etc., are able to think and act in a sustainable way. So, an introduction to sustainable development at a basic level should be a necessary element in the study programs of each discipline in every university, all over the world.

The online accessories consist of, e.g., a glossary, a set of about 200 student exercises, 40 video clips, and for each chapter: additional texts, a description of the learning goals, a summary, and a powerpoint presentation.

The *Branches*: The SD Curriculum Scan

The above mentioned RESFIA+D model is a tool for education development, starting from the roots; the competence profile. The opposite approach is offered by the SD Curriculum Scan. This tool enables to draw a map of a curriculum, showing which aspects or topics of SD have been realized in which part of the curriculum.

In order to describe the curriculum in such a way, 16 categories of topics have been defined, grouped into four groups: basics, people, planet, and profit, as Fig. 2 illustrates.

For each of the 16 categories, a series of topics was selected. This was not intended as an exact or forcing checklist for the curricula, but just as a source of inspiration for education developers, to give them some impression of how the themes might be interpreted. As an example, for the 'Participation' category, the following topics were selected:

- Participation versus exclusion
- Social cohesion versus segregation
- Freedom versus solidarity
- Civil society
- Cultural values and differences
- Democracy

Period	Basics		People		Planet		Profit	
First Year								
Sem.1	Triple P		Education		Agriculture and food		Economy	
	Place		Health		Climate		Enterpre-neurship	
	Time		Participation		Environment		International cooperation	
	Ethics		Welfare and poverty		Nature		Technology	
Sem.2	Triple P		Education		Agriculture and food		Economy	
	Place		Health		Climate		Enterpre-neurship	
	Time		Participation		Environment		International cooperation	
	Ethics		Welfare and poverty		Nature		Technology	
Second Year								
Sem.1	Triple P		Education		Agriculture and food		Economy	
	Place		Health		Climate		Enterpre-	

Fig. 2 A (still empty) example of an SD curriculum map

- Equal opportunities
- Gender issues
- Human rights
- Minorities
- Fugitives
- Immigration, integration
- Unemployment.

A practical tool was designed in the shape of a spreadsheet in which spaces are available (the white boxes in Fig. 2) to fill in all kinds of curriculum elements that exist in an actual study program. When filled with the details of a curriculum, the result is an 'SD Curriculum Map.' After a series of practical tests in 2008 and 2009, the Curriculum Scan is now being applied. These applications make it possible to develop the Scan further, from a generic tool to a more specified instrument that can be applied in a variety of disciplines.

The application of the SD Curriculum Scan takes quite some time, as the scan consists of investigating all study materials (e.g., textbooks, lecture notes, exam regulations) and interviewing a selection of professors, lecturers and students, followed by feedback loops and checks. This is why the scan is usually performed by students in educational sciences, performing the scan as a graduation project.

The *Biochemistry*: Methodologies for the Learning Process

Nowadays, there are many didactic approaches that can be used. Examples are: Analysis tasks, numerical exercises (such as calculations, simulations), research tasks, serious games, TED talks, MOOCs, debates & discussions, problem-based learning (PBL), projects, and creative tasks (e.g., movie clips, paintings, events).

An example of how a seemingly traditional exercise can be transformed into an innovative task, demanding creativity and societal involvement from the students, is shown here. Preferably, this exercise is performed by a group of students.

> Exercise 8.6. The accidental discharge
> A PVC factory has a permit to discharge wastewater into a nearby river. Full use is made of this permit, and on a given summer's day they discharge wastewater at a rate of 4,000 l a minute.The wastewater quality is regularly measured, which is why alarm bells quickly rang out when, at 12:31, it was noticed that a dissolved substance was present in the water, which was highly poisonous and should under no circumstances be released into the surface waters. The substance is called *methyl mercury*—its scientific name is *hydroxyl (1-methylethyl)mercury(II)*, for short: C_3OHgH_8 (Fig. 3)—and its concentration levels in the discharge pipeline stood at three ppm (parts per million).

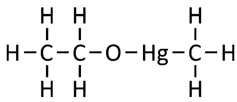

Fig. 3 The molecular structure of methylmercury

The chemical has a notorious recent history and is highly toxic, with an LD50 value of 1 ppm (LD50 stands for 'Lethal Dose 50 %', the concentration level at which 50 % of sufferers die). Some decades ago methylmercury was discharged into the surface waters of the town of Minamata in Japan, with the locals consuming the fish caught in these waters. What came to be known as Minamata disease claimed many human lives.

Immediately after the alarm was sounded, employees attempted to shut the valve. This is not a small and simple tap but rather a large and very heavy gate valve. At 12:38, the closing disc started moving, initially moved slowly as it is so heavy. The large part of the shut-off operation after that went relatively quickly, although toward the end work slowed as the wastepipe could burst open if the disc was forced shut too fast. By 12:43, it was completely sealed.

The form of the outflow that occurred while staff was busy closing the valve resembles a section of a sine graph; see the graph (Fig. 4).

(a) What is the minimum amount, in grams, of the poisonous chemical that was discharged into the environment?
(b) And what is the maximum amount?
(c) What actions might have been undertaken between 12:31 and 13:38?
(d) If you were the company manager, what would you have instructed the company's press secretary to say?

Question (a) in this exercise is straightforward and traditional. Students capable of performing basic mathematic calculations can find the answer easily.

Question (b) appears to be comparable, but it is not, as the proper data to perform the calculation are missing. Consequently, the correct answer is: 'We don't know'. For many students, this is a shocking experience.

Question (c) encourages a wide range of activities, if you allow the students to use sufficient time. Practical experiences showed that some students approached environmental or operational managers of chemical factories, while others phoned

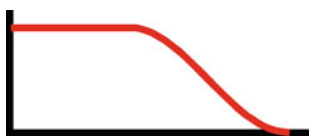

Fig. 4 The outflow of wastewater as a function of time

the local government to get information about regional disaster plans. Still others studied internet sources or consulted lawyers. When these students came together again after their investigations, they combined all those new kinds of information in order to formulate their best answer.

Question (d) evidently raises all kinds of discussions of an ethical, management, or philosophical nature. It's not the exact answer that the students arrive at that matters, but rather the discussion itself.

Another example is illustrated in Fig. 5. Both examples belong to the 200 exercises that are a part of the accessories of 'Fundamentals of Sustainable Development,' the textbook described above. All of them can be downloaded freely.

The second exercise makes use of a serious game called PopSim. This computer application simulates the growth of a population on an isolated island.

Exercise 6.11. PopSim simulation: global scenarios
For this exercise use the program *PopSim*, which can be downloaded from the website of the book.

(a) Launch the program and press the 'Start' button, which will set the simulation running using the 'simple' scenario. Examine the results-what type of growth do you observe?

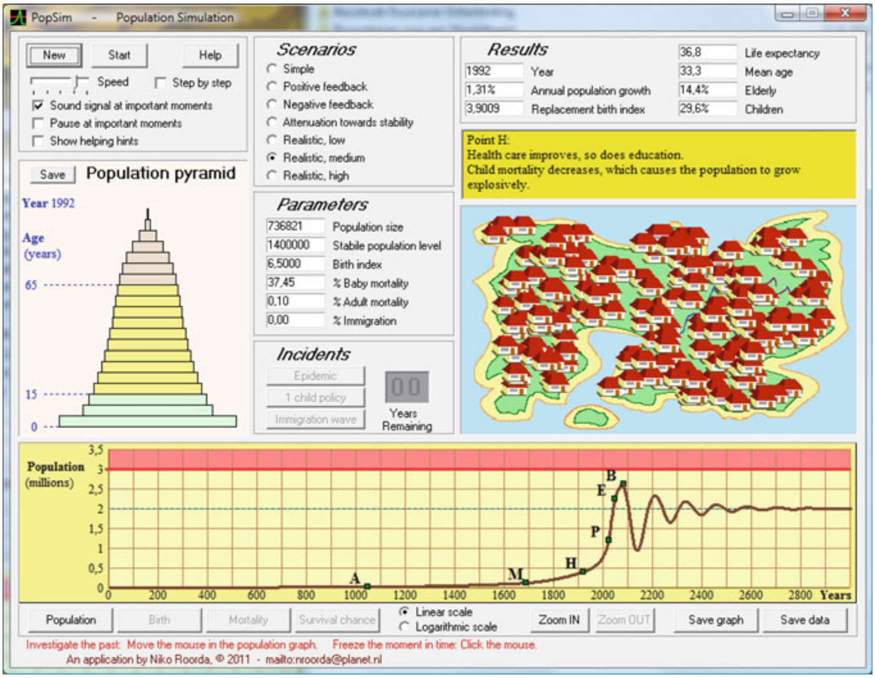

Fig. 5 The World scenario simulation program popSim

(b) Press the ‘Help’ button and read the program guide.
(c) Select the scenario ‘Attenuation towards stability’. What type of growth do you observe?
(d) Experiment with the ‘simple’ and ‘Attenuation towards stability’ scenarios by changing the values of the variables. You can invoke one-off events and study the results.
(e) Turn on the ‘Pause at important moments’ option. Use the three ‘Realistic’ options-low, medium, and high. Detail your findings.
(f) Which of the three ‘realistic’ scenarios do you believe most closely resembles the real world, and why?
(g) In your report, also focus on the question of whether a model such as this one can, in spite of the fact that it is a simplified representation of the real world, teaches us something about that real world. If this is the case, what might it teach us? If that is not the case, why not?

The *Ecosystem*: Inter- and Transdisciplinary Cooperation

In *multidisciplinary* education, issues or methods from various disciplines are combined into one curriculum. In other words, multidisciplinary approaches can be performed by one or more students within just one study program. In *interdisciplinary* education, students from various disciplines (e.g., engineering, management, law, social studies) are joined to perform a complicated task as a team in a real-life context (Pohl and Hirsch Hadorn 2007).

In initial experiments around 2000, participating students were hardly prepared for such a task, and their lack of ability to work beyond the borders of their own discipline caused serious struggles and misunderstandings.

For this reason, training and coaching program was developed. This program appeared to be relevant, not only for the students, but certainly also for their lecturers. In the first week of the internship, the involved students and lecturers met with each other, explained their varying views on SD, on the involved company, on professionalism, etc. Exercises were made, e.g., role playing games, to transform the individuals into a team. In the course of some years, this approach was improved and utilized repeatedly. Tools are based, e.g., on the Belbin Test for team roles (Belbin 1981), the Tuckman group development model (Tuckman 1965), and elements from Six Sigma (George 2003).

A next step was taken when a *transdisciplinary* approach was selected. In this case, not just students from various disciplines functioned as a team, but also others were added. In one case, where a planned home for the elderly was redesigned, en number of them, future inhabitants, joined the project; not just as incidental stakeholders or interviewees, but as true members of the project team. Initial problems were solved by adding them to the first week training program and permanent coaching.

These projects have proved to render excellent results, which would have been impossible within a mono- or just multidisciplinary approach.

Sprouting and *Growing*: Strategy, Assessment, and Involvement (AISHE 2.0)

Assessment of SD in a university or school can have a number of reasons or benefits (see Table 5). It can be used for the development of a strategy to implement SD into the education, the operations, the research, the community outreach, and even into the identity of the university itself. AISHE, the 'Assessment Instrument for Sustainability in Higher Education,' was developed for all of these reasons.

The first version of AISHE was developed and validated in 2000–2001 (Roorda 2001). Since then, the tool has been applied in 11 countries. Case studies are available in, e.g., Roorda (2004) and Roorda and Martens (2008).

A second, expanded version has been developed by an international group (Roorda et al. 2009). This 'AISHE 2.0′ consists of five modules, each with six indicators (Fig. 6).

AISHE was derived from a tool for general quality management in higher education (HBO Expert Group 1999). It makes use of a five-point ordinal scale, describing the natural development of an organization, as Fig. 7 shows.

Characteristics of those five stages are descried for each of the indicators. A group of participants, together representing the professional field, the management, the educators, the non-teaching staff and the students, discusses the indicators, reaching consensus on the present stage within the assessed organization (e.g., a

Table 5 Nine reasons for the assessment of ESD

1.	Assessment = tool for strategy and policy development
2.	Assessment = tool for evaluation of policy results
3.	Assessment strengthens awareness and involvement for ESD among management, staff, and students
4.	Integration of ESD in quality management is necessary to get ESD in mainstream of education
5.	Reporting offers transparency toward stakeholders (financiers, potential students, etc.)
6.	Reporting strengthens feeling of responsibility among management and staff
7.	ESD certification works as an incentive
8.	Benchmarking and ranking raise feeling of competition
9.	Standardized assessment enables universities to learn from each other and cooperate on ESD

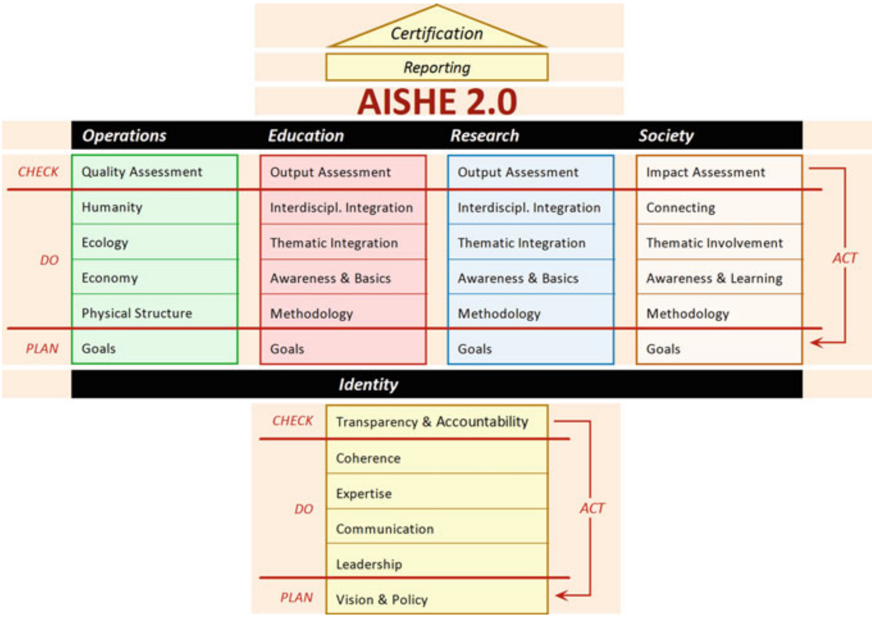

Fig. 6 The five modules of AISHE 2.0

faculty or a campus), and also on the ambitions that are to be realized within a next strategy period. Thus, AISHE has proved to be a successful strategic ESD instrument (Roorda 2010).

The *Recognition*: Reward, Benchmarking, Ranking (The ESD Certificate)

Based on the results of AISHE, assessments, a Certificate for Sustainable Development in Higher Education was defined by the Dutch ESD organization DHO. The certificate has been awarded to universities about 100 times. It is a 'star system,' corresponding to the five stages of AISHE. The certificate has been formally recognized by the Dutch and Flemish Accreditation Organization for Higher Education (NVAO).

Case studies (Roorda 2010) show that the certificate is an effective incentive for continued efforts to implement ESD more and more thoroughly, eventually leading to *SISD*.

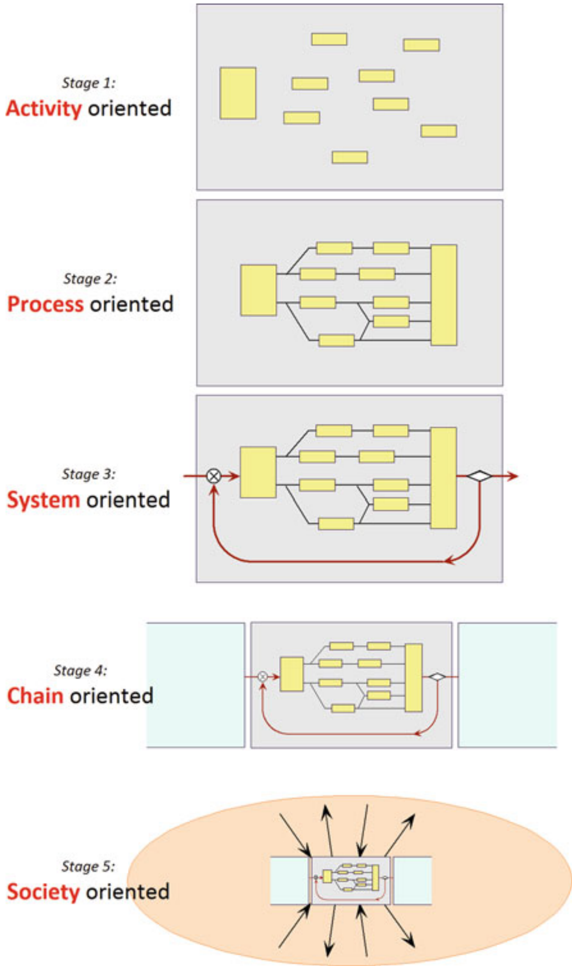

Fig. 7 The five stages of AISHE

Reaching *Maturity*: System Integration of Sustainable Development (SISD)

When a university or a department takes its first steps concerning the integration of SD into its education or its organization, this is described by the stages 1 and 2 of AISHE. If this process is continued and ESD becomes systematically integrated, the three-star certificate may be reached, establishing a state called 'System Integration of Sustainable Development,' 'SISD.' This concept is defined as follows (Roorda 2010, p. 138):

> SISD not only refers to a systematic integration of sustainable development into an educational organization (or a functional unit within it, e.g., a faculty, a school, or a study program), but also, and even primarily, at integration at a systems level. This implies that

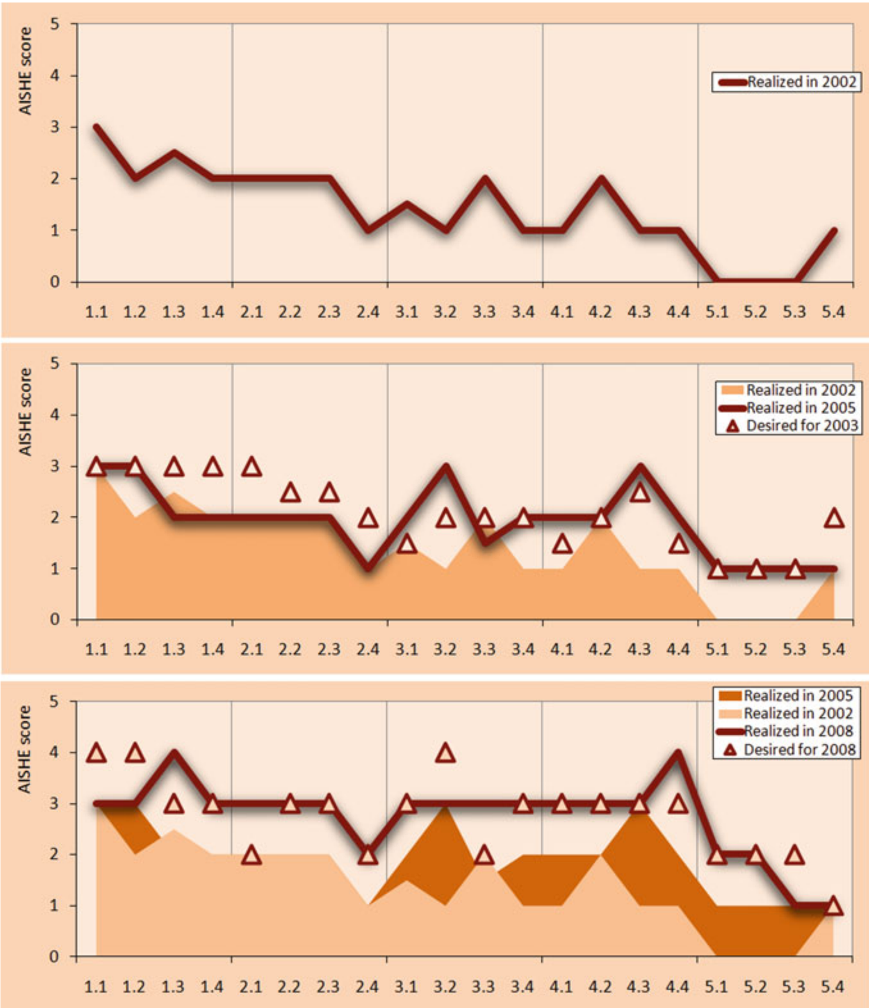

Fig. 8 A case study: the development of a faculty toward SISD

sustainable development has become a part of the fundamental characteristics of the organization, of its very identity. If this is the case, it will be observed that sustainability has become a part of all or most activities, or at least of the thoughts and philosophies behind those activities.

Figure 8 shows the case of a faculty (Fontys School of Applied Sciences, Eindhoven, Netherlands) in which SISD was realized in 2008 as the result of a six-year process.

The SISD concept is an appropriate final goal for an SD strategy of a university, as it is both assessable and realistic, as several cases on the faculty level have proved. An example of a SISD ambition at the full university level is Avans

University. Its mission statement was quoted above, containing the SISD concept as its prospect, to be reached around 2016. Avans University designed a detailed ESD strategy, applying the entire ESD toolbox described in this chapter, to realize its ambition.

The *Fruits*: The Effects on Profession and Society

If the process toward SISD is followed through consistently, making use of AISHE to design and evaluate the strategy, and making use of RESFIA+D to define the educational goals, the effect will be that the graduates will all be sustainably competent professionals. The final indicators for success will naturally be the dissertations by the students, and later their efforts and successes concerning SD in the course of their careers.

The final element in the toolbox of the ESD strategy, described in this chapter, is a pledge that students may make at the moment of their graduation. The pledge is introduced in Roorda (2012):

The Pledge

I promise that in my work I will consistently consider the consequences of my actions for society and for the environment, both today and in the future. I shall, before making decisions and while making them, conscientiously assess issues. I shall not undertake any actions geared toward harming people or the natural environment. I shall use my education, talents, and experiences in order to make a contribution to a better world through sustainable development.

I accept that I am personally responsible for my choices and actions, and I promise that I will be held publically accountable for my work by everyone for whom that work holds consequences. I shall not appeal to the fact that I acted on the instructions of others.

I promise that in my work I will not only make an effort for my own interests and my career, but also for my dreams and my ideals. In this I shall respect the values and the interests of others.

I understand that there will be times in the course of my career when it will be difficult to do what I am now promising to do. I will adhere to this pledge, even in those times.

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Assessing Sustainability and Social Responsibility in Higher Education Assessment Frameworks Explained

Pieternel Boer

Abstract In this article two different assessment tools for sustainability in higher education are being described. The first, AISHE 2012, is a framework that assesses sustainable development in higher education learning programs. Developed in 2001 and continuously developed since this assessment tool is being used by learning programs in the Netherlands and Flanders to assess their educational organization, including the curriculum, research program, management, and organization. In a practical manner, the author shares experiences from the application of this AISHE 2012 framework. Second, an overview of the developing process of the ARISE framework is given. ARISE is an assessment framework at the institutional level, based on the ISO26000 guideline, that assesses social responsibility in higher education.

Keywords Assessment tools · Sustainable development · Social responsibility · Higher education · Evaluation system · ISO 26000 · AISHE 2012 · ARISE

Introduction

In society, awareness and action for sustainable development (SD) is growing. Higher Education Institutions (HEI's) play a significant role in society's drive toward sustainability through both education and research. The knowledge gained at university should enable graduates to become responsible leaders who consider social, economic, and environmental factors in making decisions (Locke et al. 2009, p. 27). The involvement of higher education institution in the transition toward a sustainable society is reflected in different declarations, signed by

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_7,

university leaders. Examples are the Talloires Declaration (1990), Copernicus Charter (1994), the Handvest Duurzaamheid HBO[1] (1999), Agenda 21 (1992), The UN Decade for Education for Sustainable Development (2005–2014), and Rio + 20 Higher Education Sustainability Initiative (2012). Apart from these declarations and charters, several universities and universities of applied science in the Netherlands have started to take action and integrate sustainability in the organization: in its education, research, service to society, and operations. One aspect of incorporating sustainability in the management and continuous improvement of the organization is to assess the performance.

Sustainable Development and Social Responsibility in Higher Education

The most quoted definition of SD is the one as formulated in the Brundtland report 'Our Common Future':

> *"Sustainable development: development that meets the needs of the present without compromising the ability of future generations to meet their own needs."* (World Commission on Environment and Development 1987).

There is a huge amount of literature on SD available and the concept is much debated. Critical authors, like Anthony Giddens, or Riley Dunlap, for example criticize the ideal of 'development,' interpreted as growth and high consumption life-style in Western societies and that 'developing' countries have to catch up. Also the term 'sustainability' is much contested, as it is not specified what it is that has to be sustained.

Just as 'SD' is widely disputed, also the idea of 'education for SD' (ESD) is a much debated concept of which the merits are being questioned. In his article *'Why I don't want my children to be educated for SD'* Bob Jickling (1992) questions the relationship between education and SD, especially where it is described as 'education *for* SD' (1992, p. 5). Educating *for* suggests that education should aim to advance a particular end, in this case SD, and that it's the job of education to make people behave in a particular way. A suggestion that is highly questionable according to the author, mainly because there is no overall goal for SD. For that reason: *"[…] it seems[…] improbable that we can accept any educational prescription in the absence of an adequate conceptualization of SD."* (1992, p. 7)

According to Jickling, education is about the acquisition of knowledge, understanding, and the ability to think for oneself. (1992, p. 6) Education for SD (or education for anything else in that matter) is inconsistent with that criterion. Jickling concludes his article with stating that although *"[…] we should not educate for SD, it is quite a different matter to teach students about this concept."*

[1] Charter for Sustainability in Universities of Applied Science in the Netherlands.

(1992, p. 8) This means that students learn about the arguments that support it, but also learn that SD is being criticized. *"[…] we must enable students to debate, evaluate, and judge for themselves the relative merits of contesting positions."* (1992, p. 8)

Against this risk of SD becoming *"indoctrination, a mindless and autocratic repetition of official definitions and limiting standards"* (in Kopnina 2011, p. 3) there is a call for *"pluralistic, emancipatory or transactional forms of education that encourage co-creation of knowledge […] and encourage multiple perspectives and critical dialogue on the very concept of SD and ESD*" (in: Kopnina 2011, p. 3) Kopnina (2011) however, questions this call for multiple perspectives stating that *"encouraging plural interpretations of ESD may in fact lead ecologically ill-informed teachers and students acculturated by the dominant neo-liberal ideology to underprivilege ecocentric perspective."* (2011, p. 1) Kopnina's concern is mainly on the dominance of an anthropocentric perspective in ESD as opposed to an ecocentric perspective. (2011, p. 6) The author stresses the importance of environmental ethics for ESD as well as highlighting paradoxes of SD and the difference between anthropocentric and ecocentric perspectives.

The scope of this article doesn't allow us to elaborate extensively on these debates and the complexity of the field. The content and approach as outlined in this article, is in that sense very practical aiming to share our experience from the Netherlands and Flanders. Instead of 'education for SD' we rather talk about 'SD in higher education' or 'sustainable education', focusing on an integral and holistic approach of integrating SD in the learning- and research programs as well as in the management and operations of an educational organization. We do stress the importance of a multi-perspective approach of ecological, economical, and social dimensions, added with the perspectives of 'time', in terms of a long-term perspective, and 'place', in terms of inclusiveness, and always stressing the importance of critical thinking.

Assessing Sustainability and Social Responsibility in Higher Education

Worldwide several evaluation- and assessment tools for SD in (higher) education exist. They range from a holistic approach, like the STARS[2] method, assessing sustainability in the curricula and the management and operations, to mere focus on awareness raising, support and inspiration, like MEERA.[3] For an overview of

[2] STARS; The Sustainability Tracking, Assessment & Rating System. (a self-reporting framework for colleges and universities to measure their sustainability performance, mainly used in the United States) (https://stars.aashe.org/).

[3] MEERA: My Environmental Education Evaluation Resource Assistant. http://meera.snre.umich.edu/

existing assessment tools for sustainability in higher education we refer to an article by Shriberg.[4] In the underlying article two assessment tools will be discussed, the AISHE[5] 2012 framework and the ARISE[6] framework. This article is written on the basis of the experience in the Netherlands and Flanders with assessing study programs with the AISHE 2012 framework and the developing process of the ARISE framework, assessing the social responsibility of higher education institutions using ISO 26000 as reference point.

AISHE 2012

Auditing Instrument for Sustainability in Higher Education (AISHE) is an assessment tool for sustainability in higher education. It was originally developed by the Dutch Committee on Sustainable Higher education (CDHO) and Niko Roorda in 2001. The AISHE framework assesses a study program[7] on the development stage regarding SD. The past decade different study programs of higher education institutions have been assessed with the AISHE framework, approximately 120 study programs in total, and a substantial part of them were granted a certificate.

In 2012 this AISHE framework was reviewed by Hobéon[8] and resulted in a framework called 'AISHE 2012.' The review had mainly two objectives. The first was to make it less prescriptive, not prescribing *how* the organization should integrate sustainability in the study program. Second, the objective was to adapt the framework to the current educational context and in that way make it more up-to-date and accessible. Some issues disappeared completely from the framework, other issues were added and often the descriptions of the issues changed and/or the required level shifted. For example, integrated problem-solving and competence-based learning were less common 13 years ago than they are now. For these didactical requirements for education for SD the required level was raised. The purpose and function of the framework has remained the same: assessing sustainability in higher educational study programs.

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[4] Shriberg M.'Institutional Assessment Tools for Sustainability in Higher Education. Strenghts, Weaknesses, and Implications for Practice and Theory. University of Michigan, USA.

[5] AISHE: Auditing Instrument for Sustainability in Higher education.

[6] ARISE: Assessing Responsibility in Sustainable Education.

[7] Study program refers to the study program as organizational unit, including managerial, primary processes and secondary processes.

[8] Hobéon is a consultancy and certification organization for higher education institutions.

ARISE

AISHE 2012 is assessing sustainability at the level of the study program. Institutions of higher education in the Netherlands and Flanders felt the need for an assessment tool at the level of an institution. By raising the aggregation level, more and different aspects of sustainability can be assessed, like the institutional governance and environmental management of the campus.

Because of this request from institutions, Hobéon developed a new framework for assessing social responsibility in higher education institutions, named ARISE: Assessing Responsibility In Sustainable Education. A higher education institution in this case can be the institution as a whole, a faculty or a service department, depending on the context and size of the specific institution and the objective of the assessment. The framework was developed together with stakeholders from the field and an expert committee on social responsibility.

The ARISE framework is based on ISO 26000 (2010), the international guideline for social responsibility of organizations. With ISO 26000 the focus of corporate social responsibility (CSR) changed and broadened by moving from the terminology '*corporate* social responsibility,' suggesting it only applies to corporations and business organization, to 'social responsibility of organizations.' With this shift the approach is applicable to all organizations, big or small, profit or non-profit and in that sense also includes institutions of (higher) education. Instead of just providing goods and services to society, organizations in general are now seen as contributing to the welfare of society.

Following the approach in ISO26000 we see social responsibility as the contribution of organizations to SD. Assessing organizations on their social responsibility is a manner to make an organizations performance visible and encourage organizations to increase their effort. "*An organization's performance in relation to the society in which it operates and to its impact on the environment has become a critical part of measuring its overall performance and its ability to continue operating effectively.*" (ISO 2010) This citation also shows the link with quality management in higher education, linking the social responsibility of organizations with their overall performance.

In this paper, both the AISHE 2012 (Chap. 2) and ARISE (Chap. 3) frameworks are being described. The objective is to share our experience in developing the frameworks and applying it in higher education institutions.

AISHE 2012

The Framework

The AISHE 2012 framework contains a set of issues to assess. These issues are divided in 4 categories: 1. Objectives; 2. People and Resources; 3. Education; 4. Results. These categories are based on a quality assurance approach referring to

Table 1 AISHE 2012 Issues

	Issues AISHE 2012	General description
1.	*Objectives*	
1.1	Vision	The vision on sustainable development in relation to the specific discipline of the study program
1.2	Policy	The policy that reflects the vision on concrete actions, planning, and responsible persons
1.3	Intended learning outcomes	The intended learning outcomes of students, reflecting the study programs vision on sustainable development
2	*People and resources*	
2.1	Staff	Competencies of staff to carry out the objectives on sustainable development
2.2	Network	Network of the study program in the field of sustainable development
2.3	Operations	Environmental management of the study program and contribution of the study program to the environmental management of the institution
2.4	Communication	Internal and external communication on sustainable development issues
3.	*Education*	
3.1	Content study program	Integration of sustainable development in the body of knowledge
3.2	Learning on the job	Integration of sustainable development in practical assignments
3.3	Didactics	Integration of sustainable development in didactical model
3.4	Research	Research topics and approach to sustainable development
4	*Results*	
4.1	Alumni	Contribution to sustainable development of alumni
4.2	Innovation	Innovation contributing to sustainable development

the following questions: what the study program wants to achieve? (Objectives) How does the study program aim to achieve its objectives? (People & Resources and Education) Is the study program achieving its objectives? (Results). In Table 1 an overview of the AISHE 2012 issues are being outlined.

The issues in table I are assessed on five development stages of sustainability, based on the original version of AISHE.[9] The development stages refer to the orientation of sustainability initiatives of the study program. The stages range from 'activity orientated' (stage one) to 'process orientated' (stage two), to 'system orientated' (stage three), to 'chain orientated' (stage four), to 'society orientated' (stage five). A general description of the meaning of these five stages is being presented in Table 2 below. Table 3 shows an example of issue 1.1 'Vision' with a description of the five development stages.

[9] AISHE (2001) was based on a model for quality management developed by the European Foundation for Quality Management (EFQM) and enhanced by the Dutch Institute for Quality Management (INK).

Table 2 General descriptions of the five development stages from AISHE 2012

Stage 1: Activity-oriented	Stage 2: Process-oriented	Stage 3: System-oriented	Stage 4: Chain-oriented	Stage 5: Society-oriented
General features of the stages				
• Objectives and results relate to parts of the organization	• Objectives and results relate to the whole of the organization	• Objectives are formulated clearly and results are measured. The PDCA cycle is complete	• Objectives and results relate to the role of study program in the chain	• Objectives and results relate to the role of study program in society
• The processes are based on actions of individual staff members	• Relevant parts of the study program are involved	• Stakeholder management is integral part of the cycle	• External stakeholders are actively involved in the processes in the study program	• A broad range of relevant social partners are actively involved in the study program
• Decisions are made on an ad hoc basis	• Decisions have a short-term horizon	• Decisions are made on the basis of a medium-term educational policy	• Decisions are taken in consultation with the partners	• The study program takes a leading role in society
				• The study program has a long-term strategy

Using this framework the study program is being assessed on these development stages for all 13 issues, resulting in an integral judgment of what development stage the study program is situated in.

The Audit Method

Generally, an AISHE audit consists of two parts: a self-evaluation of the study program and an analysis of relevant documents. The self-evaluation is formed during a consensus meeting led by two AISHE auditors. This consensus meeting takes one full day and is conducted with a representative group of people from the study program, including management, staff, students, support staff, and the professional field. This group evaluates the performance of the study program and determines a relevant development stage for each issue. This decision process is based on consensus, meaning that people should convince each other with arguments and examples. Meanwhile the auditors are asking questions and facilitate

Table 3 Stage description of issue 1.1 'Vision' (AISHE 2012)

Objectives				
Vision				
Stage 1: Activity-oriented	Stage 2: Process-oriented	Stage 3: System-oriented	Stage 4: Chain-oriented	Stage 5: Society-oriented
• The study program has an implicit vision on sustainable development and education.	• The learning study program has explicitly formulated a vision on sustainable development and education	• The vision on sustainable development and education is shown in the profile of the learning study program	• The vision on sustainable development is related to the role of the study program in the chain	• The vision on sustainable development and education is based on long-term developments in society and the position of the study program within society
• The vision can be seen in the activities carried out by different parts of the study program	• The vision is supported by a large extent of the study program	• Education and supporting processes are lead by the vision	• The professional field and other educational institutions are active partners in developing the vision on sustainable development	• A broad range of societal actors are participating in developing the vision of the study program

the process of consensus. All participants are equal. The opinion of management has the same weight as the one of a student. This is to emphasize that sustainability in education is something that needs to be seen, felt, and supported in all parts of an organization. The discussion that takes place offers the auditors relevant information and insight in the actual incorporation of sustainability into the study program.

Figure 1 shows an example of a self-evaluation outcome developed during a consensus meeting, demonstrating the current status with the arrows showing the ambition level of the study program.

By scoring not only the current situation, but also formulating an ambition and respective timeline, the assessment also provides input for further integration of sustainability into the study program.

After this consensus meeting, the audit team will scrutinize several documents to check if the consensus meeting outcome can be verified by the documents. It is our experience that a consensus meeting gives a very realistic view on the integration of sustainability into the study program as participants not only have to convince the auditors but also each other. As a result of the way the meeting is facilitated by the auditors, an open atmosphere of discussion and dialog is stimulated.

Fig. 1 Graphical overview of an outcome of a consensus meeting

Certification

Certification is based on a 'star system,' ranging from one to five stars, corresponding with the respective five development stages. Figure 2 shows an example of a three-star-certificate. Based on the documents and discussions the audit team gives an integral judgment of the development stage of the study program as a whole. This could also imply that the study program is offered a redress period for a certain period of time.

At the level of a three-star-certificate, meaning the program is system-oriented with regard to SD, the study program can apply for an accreditation in 'distinctive features'[10] by the NVAO.[11] Study programs use this distinctive feature as a way to externally profile the organization as sustainable.

[10] Bijzonder Kenmerk Duurzaam Hoger Onderwijs (Distinctive feature Sustainable Higher Education).

[11] Nederlands-Vlaamse Accreditatie Organisatie (*Dutch-Flemish Accreditation Organization).*

Fig. 2 A certificate with three stars, meaning the study program is 'system orientated' with respect to the integration of sustainable development

Baseline Assessment

AISHE 2012 is multifunctional in use. Besides using the assessment framework for certification, it is often used to do a baseline assessment. Because of the consensus method, this tool is very suitable for raising awareness, create enthusiasm among staff and students, concretize the terms 'SD' and 'social responsibility', and provide these terms with a study program specific elaboration, concrete results of current situation, ambition, and activities that are needed to achieve this ambition. "*AISHE is an excellent example of a process-oriented approach to sustainability assessment. The consensus building approach […] creates a flexible platform upon which to stimulate and operationalize sustainability in higher education*" (Shriberg 2004, p. 79).

ARISE: Assessing Responsibility In Sustainable Education

Introduction

AISHE (2001) has been analyzed into strengths and weaknesses (Lambrechts and Ceulemans 2013; Shriberg 2004). Some of the shortcomings that were mentioned are the fact that research, service to society, and operations are underexposed in the framework and it can only be used in small groups on the level of single study programs. (2011, p. 6)

ARISE, *Assessing Responsibility In Sustainable Education*, is a newly developed framework to assess sustainability and social responsibility at a higher aggregation level of educational institutions. This framework was developed on the request of educational institutions and addresses the management of an educational institution regarding its social responsibility and its incorporation and results in the organization, using a quality assurance approach.

The ARISE Framework

The framework consists of eleven subjects that are based on the core issues and principles of ISO 26000, the international guideline for social responsibility of organizations (2010). Before elaborating on the content and approach, the ARISE framework will be presented in Table 4.

Development of ARISE

For the developing process of the ARISE framework we made use of the core issues and principles of ISO 26000. The ISO 26000 guideline helps to clarify what social responsibility is and helps businesses and organizations to translate relevant issues and principles into effective actions. ISO 26000 was developed for all types of organizations regardless of their activity, size, or location by many different stakeholders across the world. Representatives from government, NGOs, industry, consumer groups, labor organizations, and educational institutions around the world were involved in its development, which provided an international consensus. For this reason, we chose to use ISO 26000 as the reference point for the content of the ARISE framework.

For assessing these issues we use a general approach of quality assurance and consider social responsibility of organizations as an aspect of quality assurance. The ARISE framework consists of different issues, divided into quality assurance approach, as used by the Dutch institutional accreditation of quality management[12]: objectives, processes, results, and context. Using this approach means that by looking at the social responsibility of educational organizations we use a quality assurance framework as a reference point. In that sense the framework is based on assessing the PDCA cycle of social responsibility policy of educational institutions. Table 5 shows how the ARISE issues are related to the general aspects of quality assurance.

The core issues of ISO 26000 are: organizational governance, human rights, labor practices, the environment, fair operating systems, consumer issues and community involvement and development. (NEN-ISO 26000 2010, p. 21) These

[12] NVAO Beoordelingskaders accreditatiestelsel Hoger Onderwijs *Instellingstoets Kwaliteitszorg* (2011).

Table 4 ARISE Framework (2012)

Subject	Issue
What it is about	*The state we want to see*
Vision and mission	• The management of the organization has formulated a clear mission and vision on social responsibility. These are publicly supported in a broad and provable way • The profile of the organization has been designed in collaboration with different stakeholders • The organization has a clear vision on its intended added value for the users of its services in education, research, and service to society.
Policy	• The organization has translated the mission and vision into concrete policy • The management of the organization is explicitly responsible for the policy on social responsibility • The responsibility for implementing the policy is clearly and provably delegated in the organization
Education	• In developing its educational portfolio the management takes into account its objectives of social responsibility • The organization stimulates the study programs to integrate relevant aspects of social responsibility into the content of the study programs. • The organization has an explicit SR policy for its internationalization activities
Research	• In developing research portfolio the management takes into account its objectives of social responsibility • The organization stimulates the research entities to integrate social responsibility issues into their research study programs and activities
Service to society	• In developing its services the organization takes on a perspective of social responsibility • The organization has an active dialog with its clients/partners on social responsibility
Operations/ Planet	• The organization has a clear view on its sphere of influence on the planet side of its operations • The organization has a policy and concrete targets comprising a neutral or positive impact on its physical environment • The approach leads to tangible results
Operations/ People	• The organization has a clear view on its sphere of influence on the people side of its operations • The organization has policy and concrete targets regarding the social quality of the organization • The approach leads to tangible results
Operations/ Prosperity	• The organization has a clear image of its sphere of influence on the financial side of its operations • The organization has policy and concrete targets comprising a responsible financial continuity • The approach leads to tangible results
Students	• The organization communicates clearly to (potential) students the level, status, content, and names of study programs • The organization deals with its students in a provable responsible manner • The organization explicitly pays attention to students with a particular background, like international students or students from minority groups

(continued)

Table 4 (continued)

Subject	Issue
Professional field	• The organization communicates to future and current employers regarding level, status, content, and names of study programs • The organization has relations with educational institutions, organizations, and businesses in the region, focused on strengthening the societal meaning of education, research, and service to the community
Culture	• The social responsibility of the organization is supported and shared by the majority of employees in the organization • The organization communicates its targets and results with respect to the social responsibility of the organization systematically, within and outside the organization

Table 5 Issues ARISE framework

Quality assurance	Issues ARISE framework
Objectives	• Vision/mission • Policy
Processes	• Education • Research • Service to society • Operations regarding people planet and prosperity
Results	• Students • Professional field
Context	• Culture

core issues were translated into the educational practices. This was done in such a way that the terminology and focus would be recognizable for Dutch higher education institutions. Table 6 illustrates the relation between the core issues of ISO 26000 and the issues of ARISE.

The primary processes of education and research are not directly or explicitly linked with a core issue of ISO 26000, but of course these are relevant issues in the ARISE framework and therefore present in the framework.

ISO 26000 not only contains core issues, but also *principles*, being: accountability, transparency, ethical behavior, respect for stakeholder interests, respect for the rule of law, respect for international norms of behavior, and respect for human rights. (NEN-ISO 26000 2010, pp. 11–15) We view these principles as important and relevant for all issues in the ARISE framework and so they will be taken into account during the audit process. Two fundamental practices of social responsibility, according to ISO 26000, are that organizations recognize their social responsibility within their sphere of influence, and identify and engage with their stakeholders. These practices, as well as the principles, are always taken into consideration.

The assessment tool has been developed in collaboration with different stakeholders, being a group of relevant people from the field and an expert committee on social responsibility, consisting of people from different (higher) education institutions in the Netherlands and Flanders and the professional field.

Table 6 Reference table ISO 26000 core issues—ARISE issues

Core issue ISO 26000	Issue ARISE	Explanation
Organizational governance	Vision and mission Policy	Organizational governance is translated in a vision, mission, and policy and is a key issue in the ARISE framework. The focus is on the managerial leadership and the incorporation of the vision and policy in the organization
Human rights	Operations/ people	Focus is on policy regarding operations that influence the 'people aspect,' including human rights. This concerns a diverse range of issues, e.g., sustainable procurement, diversity, or internationalization policy
	Students	Focuses amongst other things on policy regarding students with particular background
Labor practices	Operations/ people	This issues deals a.o. with the organizations' HRM policy, also internationally
	Operations/ prosperity	In this issue the focus is on responsible financial management, which directly influences the labor practices
The environment	Operations/ environment	This issue addresses the impact on the environment and the organizational policy
Fair operating systems	Culture	Culture is the basis of fair operating systems and a boundary condition for social responsibility of the organization
	Students	This issue focuses a.o. on fair and transparent communication with students
	Professional field	This issue focuses a.o. on fair and transparent association and communication toward the professional field
Consumer issues	Students	Students are considered the consumers of education and in that respect their interests are priority
	Professional field	In a broader sense the professional field is also consumer and its interests are being taken care of as well
Community involvement and development	Service to society	This issue focuses a.o. on an active dialog and involvement with the community

Audit Method

The assessment tool has an organizational scope. This can be the institution, but also a faculty or service department. It depends on the size, context, and current state of the organization. In 2013, a pilot will start that will assess two organizational units from a higher education institution: the service department (responsible for all service-related activities of the school, like energy, catering, building, procurement, et cetera) and the faculty of engineering.

The assessment procedure starts with a scrutiny of relevant documents by the secretary of the audit panel. Depending of the focus of the audit, an audit panel will be formed, in coordination with the institute. After the analysis, a site visit takes place, varying between 1 and 3 days depending on the scope of the audit. During this site visiting the audit panel will interview relevant representatives of the organization to analyze how the quality assurance mechanisms are working with respect to the issues in the ARISE framework.

For each issue the audit panel determines whether the organization is 'committed' to sustainability and social responsibility, 'recognized' for its social responsibility or 'excellent' in this respect. This judgment is based on the findings of the initial scrutiny of documents to the knowledge and experience of the panel, and on the conversations with the organizational representatives and external stakeholders. This terminology of 'committed', 'recognized' and 'excellent' is based on the EFQM Excellence Model, a quality tool for improving organizations performance (www.efqm.org). This terminology emphasizes the focus on growth regarding SD and social responsibility and stimulates and encourages institutes to commit themselves and start the journey of transforming educational and organizational practice.

Committed

An educational organization is 'committed' when it has a clear vision on its social responsibility with tangible outputs, communicates this ambition in the organization and plays an active role in adjusting policies and processes to this perspective of SR. It's not yet required to show results on all relevant topics but it is required to have started on essential areas. This certificate is valid for two years.

Recognized

An organization will be judged 'recognized' when it has concretized its vision on social responsibility for all relevant areas. The organization achieves tangible results and communicates in a bidirectional way with its environment. This certificate is valid for 3 years.

Excellent

An organization is 'excellent' when it has preserved its certificate 'recognized' for several years and is perceived as opinion leader in the field of social responsibility and SD by its environment. This certificate is valid for 3 years.

Future Perspectives

According to Shriberg (2002) sustainability initiatives are most successful when driven by diver by different stakeholders, with the support of top leaders, acting in a coordinated manner. This needs to happen on the individual and organizational level. Change agents (individual level) are most effective "by appealing to personal ethics at low levels in the organizational hierarchy while appealing to institutional strategic positioning (e.g. reputational end recruitment benefits) at higher levels."(2002, p. 3) We believe that the ARISE framework will support this institutional strategic positioning of sustainability and facilitate the road toward a coordinated and systematic approach. In the Netherlands higher education institutions are required to 'profile' the organization on specific themes. Sustainability could be such a theme and several educational organizations have indeed opted for 'sustainability' as a profiling characteristic. One institution in the Netherlands with 'sustainability' as a focal point, has decided to assess all of its study programs with an explicit ambition to acquire a two-star-certificate for all study programs in 2015.

At this moment a shorter version of AISHE 2012 framework is being developed. This framework will be used by study programs that are part of an institution that is rewarded with an ARISE certificate 'recognized' or 'excellent'. As some issues have then already been checked, these do not need to be assessed at the individual study program anymore. However, at this moment in time, the ARISE framework is still quite ambitious for higher education institutions. It's a serious objective for institutions that offer study programs in which sustainability is integrated and apply a social responsibility approach in their general operations. On the way to achieve this objective institutions are stimulated to undertake steps, among others through certification.

In the future we will adapt AISHE 2012 and the ARISE framework to different school types[13] as it is important to involve different level and types of (professional) education to guarantee continuity of education for SD in the chain.

One of the books that inspires us in our work is 'The Three Levels of Sustainability' (Cavagnaro and Curiel 2012). In their book they state that the ultimate goal of SD is securing a better quality of life for all, both now and for future generations, by pursuing responsible economic growth, equitable social progress, and effective environmental protection. These three dimensions refer to a sustainable society. To achieve this higher level of consciousness, governments, institutions, and organizations need individuals who can steer the process toward this superordinate goal: a higher quality of life for all. This process of change toward sustainability depends on the choices made by people. It is therefore essential that not only societies and organizations choose sustainability, but also individuals. This book departs from the premise that the journey toward sustainability is by its very nature a process that has to involve all three levels mentioned

[13] In the Netherlands that would be mainly schools for vocational training (*mbo scholen*).

above and each one with their respective dimensions. This reminds us that assessment and certification of sustainability in higher education institutions is explicitly seen as a means to an end, not an end in itself.

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Alternative University Appraisal (AUA): Reconstructing Universities' Ranking and Rating Toward a Sustainable Future

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Abstract The ranking of higher education institutions (HEIs) has become increasingly common in recent years. Oftentimes however, the criteria used in these rankings appear to be Eurocentricly defined. Consequently, universities in developing countries often find themselves marginalized and at a disadvantage in such ranking systems. To address this matter, there is a vital need for the reconstruction of criteria used in these ranking systems. The Alternative University Appraisal (AUA) is one of a number of projects emerging from a network of universities known as ProSPER.Net (the Promotion of Sustainability in Postgraduate Education and Research) which offers a possible solution to this issue. The primary objective of the AUA is to facilitate and encourage Higher Education Institutes to engage in education and research activities for sustainable development and to raise the quality and impact of these activities by providing benchmarking tools that support diversity of mission, as well as a framework for sharing good practices, and supporting dialogue and self-reflection. Three integral steps were taken to achieve the ultimate project goal of creating a dynamic community which would enable the reorientation of higher education toward sustainable development. The first

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_8,

involved the development of the AUA Model. To this end, an AUA Peer Consultation Model was developed as the second step. The final step saw the development of a Peer Consultation System which provides HEIs with the perspective needed to enable reorientation toward sustainability and assist them in identifying specific areas that need to be addressed and improved. By utilizing the AUA model, universities can aspire to attain better sustainability ratings through conventional and Education for Sustainable Development (ESD) measures.

Keywords Higher education assessment · University rating system · Education for sustainable development · Peer consultation · Sustainability assessment tools and methodology

Introduction

Sustainable development is now widely considered the ideal model for development through which economic, environmental, and societal equity is to be attained in any plan aimed at inclusive and balanced national development. Governments and institutions around the world are growing increasingly aware of the need for sustainability implementation in all areas of public and private mechanisms—and institutions of higher education are not exempt of this phenomenon. This path to a better future that serves the interests of all global citizens brings with it a need not just for a revamp in the manner in which education—specifically tertiary education, is carried out at universities in the country, but also for a new and more inclusive instrument through which to gauge the transformations that are bound to occur in the nation's public universities in line with the values and tenets of sustainable development.

Universities have conventionally been defined as centers for teaching and research. Through their teaching activities, universities tend to offer specialized training for different sectors of society, as well as the education essential for personality development. Additionally, university education also boosts theoretical knowledge among the different divisions in society while offering practical solutions to deal with societies' dilemmas. The traditional framework of a university often consists of a close circle of students and lecturers—frequently referred to as the "ivory tower". As an elite component within mainstream society, this circle has, throughout history, had the privilege of influencing societal agendas in order to meet its own goals. However, in light of the changes brought about by the new millennium, universities all over the world are beginning to realize that their roles are also rapidly changing in a globalizing world. As Komiyama (2011, p. 322) argues; "sustainability demands a realignment of existing academic disciplines. Whereas academia has moved inexorably toward fields of in-depth specialization, sustainability seeks comprehensive, integrated solutions to complex problems. It therefore requires a restructuring of education and research that spans multiple disciplines."

The understanding that a university's full benefits can only be obtained when the university and society are organically linked together is increasingly commonplace. In other words, the needs of the society must be at the center of a university's activities, and the university must be willing to undergo flexible adjustments in order to accommodate society's changing needs. In an era of globalization, universities and colleges also have an impact through their global procurement, offshore partnerships as well as through the education of national and international students. Their potential influence on economic development, poverty alleviation but also health and community building should not be overlooked (Boks and Diehl 2006; Galang 2010; Lotz-Sisikta 2011, Tilbury 2012).

Recognizing the role which education can play in the development of societies that are more equitable and sustainable, the United Nations launched the Decade of Education for Sustainable Development (DESD) in 2005. As mentioned in Sect. "AUA Methodology" of the 2009 Bonn Declaration, "Education for sustainable development is setting a new direction for education and learning for all. It promotes quality education, and is inclusive of all people. It is based on values, principles, and practices necessary to respond effectively to current and future challenges."

Higher education Institutions have been in constant struggle for their sustainability programs to be recognized. Assessing universities has been an object of study for a long period of time, however, there has been little agreement on the evaluation methods, frameworks and indicators that would be appropriate for the assessment of ESD performance in HEIs. The AUA project addresses that gap. The AUA is aiming to (Kansal et al. 2013, p. 63):

1. Evaluate and assess an institution's ESD activities by using the new assessment tool;
2. Enable the institution to consult with the AUA dialogue committee on ideas, concerns, problems, and solutions based on the results of the new assessment; and
3. Invite the institution to an ESD learning community where they can provide, receive and share best practices with other institutions and partner organizations.

Universities for Sustainability

With regard to the connection between the definition of sustainable development and the concept of education, Agenda 21—the international action plan drawn up at the United Nations Conference on Environment and Development (UNCED, Rio 1992) identifies education as a crucial component in bridging the divide. It clearly states that "education is critical for promoting sustainable development' and that 'countries should stimulate educational establishments in all sectors, especially the tertiary sector, to contribute more to awareness building." (Agenda 21 1993), Chapter 36.3/36.10.d).

Although sustainable development may appear to be a relatively new concept in higher education, it is important to note that many sustainability-related activities and elements are already in place in the existing curricular structures of many universities around the world. Therefore, it is necessary to bear in mind that sustainability in higher education is not so much a revolution as it is an *evolution* of currently existing platforms. On the other hand, it is also important to note that in many instances, the current framework of higher education is unable to accommodate sustainability on its own and therefore a fundamental change is needed if it is to be made compatible with the sustainability agenda. According to Sterling (2003), p. 42, "Sustainability does not simply require an 'add-on' to existing structures and curricula, but implies a change of fundamental paradigm in our culture and hence also in our educational thinking and practice. Seen in this light, sustainability is not just another issue to be added to an overcrowded curriculum, but a gateway to a different view of curriculum, of pedagogy, of organizational change, of policy and particularly of ethos."

In a (Carlson 2006) article on sustainable campuses in the Chronicle of Higher Education, Carlson argues that university initiatives on sustainability are only minor steps that aim to project the appearance of sustainability—in other words, a form of "greenwashing." Echoing this sentiment are criticisms by certain groups who point out that universities are taking a very slow approach with regard to sustainability integration in comparison to corporate entities.

In light of such criticisms, Cortese's (2001), p. 12 definition of a sustainable university may prove invaluable in assisting us in our understanding of the fundamental elements of a sustainable university—"A sustainable university can be considered as an institute of higher education as a whole or as a part, that addresses, involves and promotes, on regional or global level, the minimization of environmental, economics, societal, and health negative effects in the use of their resources in order to fulfill its main functions in teaching, research, outreach and partnership, and stewardship among others as a way in helping the society make the transition to sustainable lifestyles.

Monitoring, Evaluation, and Ranking of Institutions of Higher Education

Monitoring and Evaluation (M&E) are an integral part of any Higher Education Institution's management. The auditing tool used in the measuring process fully depends on the purpose of the measuring being carried out. For this matter, the objectives and scope of the measurement should be well defined before the audit takes place. Certain elements such as financial limitations are deciding factors on how deep or detailed the audit should be. The expertise of those conducting the audit should also be a matter of high consideration as well—on the other hand, there should also be an approximate expectation of how cooperative the audited entity will be with the auditors. Since the auditing process requires massive date collection, bilateral cooperation is of vital importance. Therefore, the parameters for this measurement should be relevant to the condition and setting of each HEI. For the purpose of ranking, various parameters may be considered such as: research excellence and/or influence, student choices, eventual success and/or demographics, on surveys, and others. However, as Rocki (2005) argues; "The variety of methodologies, and thus of criteria used, suggest that any single objective ranking could not exist."

Ranking exercises among universities—especially through the assessment of the quality of HEIs is gaining worldwide momentum. As Huang (2003) explains, university evaluation encompasses both academic performance (often discipline-based) and administrative performance. There are several elements involved in expanding this demand. As described by Stella (2006), these elements involve "shrinking resource allocation for higher education from public funds, increasing competition among HEIs and growing awareness about value for money among the public." Therefore, universities that are able to obtain higher standings in ranking lists are also more likely to receive funding and other relevant resources.

As argued by Huang (2011); "Ranking shows a university's relative strength and weakness as compared to its peer institutions in the areas represented by the indicators." There are a number of mainstream higher education ranking systems around the world whose indicators are utilized by HEIs for self-appraisal, namely; the Times Higher Education (THE) World University Rankings, and the Shanghai Jiao Tong University Ranking. Interestingly, the use of such ranking systems results in several implications on the universities that utilize them, i.e., they stimulate competition among these universities, provide some of the rationale for allocations of funds; and they help to differentiate among different types of institutions as well as different programs and disciplines (Sadlak and Liu 2007). However, as with any other assessment system, the framework and parameters used are always debatable, and this in turn fuels the continuous search for an alternative system.

In Search of Alternative Ranking/Rating Systems

As Tyehimba (2004) argues, "The education system reflects the norms, values, biases, assumptions, and socio-economic priorities of the ruling elite. From kindergarten, children are indoctrinated according to the dominant values of the mainstream." For many centuries, the mainstream formal education systems in many countries have heavily borrowed or been influenced by colonial Eurocentric values and regulations; additionally, the Eurocentric ideology has also invaded the sphere of higher education in many developing countries. The drawback of this phenomenon is that the Eurocentric ideology ignores the contributions made by developing nations with regard to the global body of science and knowledge as the Eurocentric perspective is often considered to be "superior" to those of other cultures. Blaut (2000) argues that Eurocentrism as a phenomenon are “false claims by Europeans that their society or region is, or was in the past, or always has been and always will be, superior to other societies or regions.” Eurocentric perspectives are often based on a number of belief systems—some of which include that Europe is a continuously developing and progressing entity as opposed to the stagnant conditions of non-European states/communities, that Europe’s progress is due to an inherent intellectual/spiritual superiority; “the belief that the only manner in which non-Europe may develop is by handouts given to them by Western civilizations such as new ideas, commodities, settlers, etc., which in turn are paid for by non-Europe via raw materials, plantation products, labor, art objects, etc. (Chilcote 2000).”

The full benefits of a university can only be made to manifest when both the university and the society it is located in are organically linked together. In other words, a university’s activities must be flexible enough to factor in the needs of its society—given society’s rapidly changing needs and trends. This directly rejects the Eurocentric ideology of homogenizing knowledge and science in favor of the countries of the North.

With large pools of disciplinary experts, high quality research facilities, state-of-the-art infrastructures, and a cohort of students with varied academic interests, universities have considerable comparative advantages in promoting prosperity within the communities they serve. For this reason, the universities of the developing nations have the opportunity and advantage to refer to their rich traditions and history, which have played a pivotal role in the creation and dissemination of knowledge throughout history. That being said, it is also important to understand that a single solution such as Eurocentrism cannot be devised as a global gold standard.

An aspect of higher education specifically affected by Eurocentrism is the ranking system of universities, which generally focuses not only on the university as a whole but also on various activities such as teaching, research, and/or trainings. However, the criteria used in these rankings are often Eurocentricly defined. Therefore, universities from developing countries often find themselves marginalized in such ranking systems. In order to overcome this matter, a number of nations from around the world have proposed certain initiatives geared toward reforming the current ranking systems of HEIs.

The Birth of Alternative University Appraisal (AUA)

Although they have been in existence for decades, conventional ranking systems utilize a rigid and rather inflexible approach toward their grading of tertiary institutions. It is quite plain to see that such guidelines are counterproductive to the well-being of institutions that wish to pursue alternate forms of educational development such as sustainability integration or in the case of HEIs in developing nations, face a lack of financial means by which to fund such research and grants.

In the long run, these criteria serve to inhibit creativity and stunt the growth of universities that would otherwise be open to new, creative development ideas, and only function in further strengthening the position of HEIs that comply with the now increasingly irrelevant and archaic ranking criteria.

In light of this dilemma, the AUA initiative was developed as a mean by which to create a learning community among universities that are engaged in Education for Sustainable Development (ESD) in the Asia–Pacific region. The AUA is one of a number of projects that has emerged from a network of universities called ProSPER.Net—the Promotion of Sustainability in Postgraduate Education and Research, which has a membership of approximately 20 universities and academic institutions from around the region.

AUA Methodology

In order to create the AUA assessment tool, several existing ESD assessment tools were carefully analyzed and evaluated: the College Sustainability Report Card, the Earth Charter (EC)-Assess, Monitoring and Assessing Progress during the UN Decade of Education for Sustainable Development (UNDESD) in the Asia–Pacific Region, and the Sustainability Tracking, Assessment, and Rating System (STARS). Several meetings in Japan, Malaysia, and India were held and extensive tours undertaken to collect feedback and promote the new model. Dialogue with a variety of stakeholders at local and international conferences, meetings, and other events helped shape the system, as did dialogue within sustainability-related networks such as the International Association of Universities (IAU), Association for Advancement of Sustainability in Higher Education (AASHE), International Conference on Sustainability Science (ICSS), and Higher Education for Sustainable Development (HESD) Forum in Japan. As a result of these efforts, the AUA Project was recognized by more than 150 institutions. AUA core member meetings also helped shape the design of the system.

Alternative University Appraisal (AUA)

The endeavor was initiated in 2009 through the conception of the AUA Model which sought to appraise universities via an alternative set of perspectives while completely doing away with conventional ranking systems. The Mission Statement of the AUA is also unambiguous in its developmental objective, i.e., the AUA seeks to "facilitate and encourage institutions of higher education to engage in education and research for sustainable development and to raise the quality and impact of these activities by providing benchmarking tools that support diversity of mission, as well as a framework for sharing good practices and supporting dialogue and self-reflection (Senaha 2010)." A fundamental goal of the AUA undertaking is to bring about an Alternative University Peer Consultation System that focuses less on the ranking of universities and instead places a greater emphasis on the rating of universities.

In addition to the above-mentioned constructive qualities of the AUA Model, the initiative also functions as a tool for self-reflection between partnering institutions thus enabling HEIs to assess their individual ESD involvements. It is believed that through this process, HEIs can specifically identify areas of ESD which need to be addressed in the future with a vision of protecting and enhancing the diversity of tertiary education and also recognize the contextual strength of individual universities—contrary to the "one-size-fits-all" approach of conventional mainstream assessment systems. In line with this ambition, the AUA Model is expected to function as the first step in AUA peer consultancy among universities and ESD experts in addressing ESD in diverse ways with the aim of sharing good practices and strengthening their respective initiatives. The aim of the project is not to propose an appraisal system for a small subset of universities that reject mainstream ranking systems and wish to choose an alternative path, but instead to advocate the empowerment of a Higher Education Institution to decide for itself the development strategy of its own establishment. In addition to this, "the AUA system does not only recognize the good practices of participating universities that consciously espouse the principles of ESD, but also aims to shape the ways in which universities operate for a more sustainable future in accordance with the AUA's system of recognizing diversity, innovation, and change toward sustainable development thus functioning along the vein of other alternative appraisal systems such as the Association for the Advancement of Sustainability in Higher Education (AASHE), the International Council for Higher Education (ICHE) Observatory Project and the University Rating System for ASEAN/Southeast Asia which is currently being developed (Ubukata 2010)."

At the outset, the AUA Model acts as a form of self-review for such universities and encourage self-awareness of their own strengths/weaknesses in the field of ESD in order to further deepen and promote their activities (AUA Website, 2012). There are also two rationales for the AUA in mind; first to enhance the value and attractiveness of universities engaging in ESD and second, to create a learning and supporting community to improve their practices. The reason for these rationales is clear; as we embrace Education for Sustainable Development to serve the educational needs of the twenty-first century and to accomplish the goal of the UNDESD in regard to sustainable development incorporation into the academia, the goal should no longer be to create a ranking system that places an emphasis on which educational institution is surpassing others, but instead to develop a rating system that will encourage and foster universities within the network to attain a level of academic and sustainability excellence and by so doing, create a conducive environment for mutual cooperation between partnering academic institutions of higher learning.

The Alternative University Appraisal system also seeks to facilitate and encourage institutions of higher education to engage in education and research for sustainable development, and to raise the quality and impact of such activities by providing benchmarking tools that support the diversity of missions as well as offering a framework for sharing good practices and facilitating dialogue and self-reflection. The core members of this endeavor come from a multifaceted background, comprising a number of institutions that are focused on the sustainability agenda and acting as agents of change in their respective capacities. The core members comprise of Hokkaido University, Teri University, Yonsei University, Universiti Sains Malaysia, the United Nations University—Institute of Advanced Studies (UNU-IAS) and the Asian Institute of Technologies.

Hokkaido University (HU), the secretariat of the AUA Project, is strategically committed to contribute to the creation of a sustainable society through its educational activities. HU developed an international initiative utilizing its strength as a global research university in 2005 in response to a call from the international community to realize a sustainable society and promotes "Education for Sustainable Development (ESD)" for citizens from all over the world.

Teri University recognizes that quality human resource is the biggest asset for a society to progress on the path of sustainable development and has been engaged in offering higher education through programs related to sustainable development for the past 10 years. In addition to this, the university also acknowledges that institutions of higher learning play a major role within the broader context of social, scientific, political, and cultural reforms which drive the economic progress of a society. Furthermore, its programs emphasize the theory–practice connection by including stakeholder interaction as part of the curriculum in all its programs.

Yonsei University acknowledges the importance advancing international cooperating research institutes such as ProSPER.Net and plans to host the UN Center for Sustainable Development while also establishing the School of Asian Studies in order to carry out various education and research program especially with regard to sustainable development. Yonsei has pledged to continue to support efforts for mutual growth through great research opportunities such as the AUA.

The UNU-IAS is part of the United Nations University (UNU) system, comprising of a network of Research and Training Centers and Programs (RTC/Ps) which are assisted by associated and cooperating institutions and scholars from around the globe. The Institute applies a strong policy-oriented research program designed to promote strategic approaches to sustainable development. Research consists of advanced and multidisciplinary methodologies accompanied by postgraduate education and capacity development activities, particularly for developing countries while engaging experts from many disciplines in the natural, social, and life sciences for the development of informed policymaking that meets sustainable development challenges.

Universiti Sains Malaysia (USM) has embraced the vision of becoming a sustainability-led university of world-class standing and has embarked on a range of missions through which specific objectives and activities are expected to contribute to the achievement of the overall sustainability vision. One such mission of great significance is the decision to establish the Center for Global Sustainability Studies (CGSS@USM) which functions to mainstream sustainability into the entire fabric and rubric of the university while working with all other relevant sections of the University, regional and international sustainability organizations, national and regional governments, private sector, civil society groups, and NGOs to promote sustainable development, paying particular attention to the disempowered *bottom billion*.

Asian Institute of Technology (AIT) has, for more than four decades, acted as a bridge between the developed countries and the developing and less developed countries in the region. With its multinational community of students, faculty, staff, and alumni, AIT offers a unique multicultural context for the exchange of ideas, the development and transfer of advanced technologies, and innovative approaches to shared problems. AIT's future orientation is based on education and research toward the sustainable development of the region, strengthening the knowledge, development, and business capacity of the region, and supporting communities and their economic development and integration into the global economy.

The AUA Functioning Mechanism

As an integral part of achieving the ultimate goal toward creating a dynamic community of practice for reorienting higher education toward sustainable development, the AUA Model was created, which includes self-awareness questions designed to help interested HEIs enhance their related activities (AASHE 2010). The model was developed in consultation with a variety of stakeholders through international/local conferences, meetings, and consultations. It is not intended to intensify competition among HEIs or to impose a uniform, predetermined ideal university model upon them; rather, it aims to provide perspective to enable consideration in their efforts to reorient themselves toward a sustainable future and help them identify specific areas to be addressed and improved.

The AUA system consists of three components: Self-Awareness Questions (SAQs); Benchmarking Indicators Questions (BIQs); and Dialogue. SAQs and BIQs serve as a data source and make up the foundation for dialogue among universities. Dialogue is the component through which the institutions share concerns, best practices, and generally foster an ESD learning community. In addition to these three components, the AUA project also created an ESD Archive, which is a repository of ESD activities conducted by HEIs (ProSPER.Net 2012).

The characteristic of the AUA Self-Awareness Questions include; Facilitation of universities' selection of ESD focus areas to be assessed, Provision of a mixture of quantitative (objective) and qualitative (subjective) questions—some of which require narrative responses, and Encouragement of universities' self-awareness regarding their own strengths and weaknesses through question responses (The AUA Model 2011). The AUA Self-Awareness Questions consist of four main sections namely; *Governance, Education, Research and Outreach*. This assessment is for overall SD or any specific SD area for which the IHE would like to be assessed. Answers to the questions should only include the data that is relevant to

SD or SD sub-themes which are chosen by the HEI. The assessment sub-themes are chosen according to the United Nations Decade of Education for Sustainable Development (UNDESD) which includes gender equality, health promotion, the environment, cultural diversity, rural development, peace, human security, sustainable development, sustainable consumption, or sustainable urbanization.

(A) Governance

In terms of Governance, the section is designed to assess the overarching administrative structure and policy directions of the HEI. "Governance" in this section refers to a basic framework to promote ESD which is capable of impacting ESD-related research and education most advantageously. This section is developed to assess the institution's understanding of, and commitment to, the chosen assessment sub-theme as well as to check if the assessment sub-theme is incorporated in its management strategy.

This section consists of five questions. Each question is accompanied by a "purpose" and the instructions toward answering the purpose. Figure 1 shows an example of a question in the Governance section:

(B) Education

Indicators/questions in this section are designed to assess curriculum, teaching, capacity development, and other learning opportunities your institution offers to its students, faculty members, staff, and communities. Consisting of nine questions, this section aims to assess mechanisms of delivering an understanding of sustainable development to students. Each question is accompanied by a purpose and its accompanying instructions. Figure 2 shows an example of a question in the Education section:

(C) Research

Consisting of four questions, this section is designed to assess the institution's efforts and commitment to ESD and SD research and consultancy. Each question is accompanied by the purpose and its accompanying instructions. Figure 3 shows an example of a question in the Research section:

Question 2. What action plans and policies are in place for the implementation of [*assessment area*] strategies? How is progress monitored and assessed?

Purpose

To assess if the progress of [*assessment area*] in your institution is self-monitored.

Instructions

Please include information on the level(s) at which [*assessment area*] is planned, e.g. at board level or at departmental level, and whether there is a separate committee for planning.

Fig. 1 An example of a question in the governance section (*Source* The AUA Model 2011)

Question 8. Does your institution employ any particular pedagogical or learning approaches that best represent your teaching in[*assessment area*] ? If so, please provide examples.

Purpose

To assess the institutional efforts for educational transformation.

Instructions

Please include a description of the approaches of such efforts as those in participatory learning, problem solving, community, engagement, transdisciplinary studies.

Fig. 2 An example of a question in the education section (*Source* The AUA Model 2011)

Question 17. Please describe incentives to encourage and foster innovation as well as multidisciplinary collaboration for the research in [*assessment area*].

Purpose

To assess the institutional systems to advance research for [*assessment area*].

Instructions

Please indicate incentive types, such as financial remuneration, appraisal mechanisms, infrastructure support, etc.

Fig. 3 An example of a question in the research section (*Source* The AUA Model 2011)

Question 20. Does your institution provide [*assessment area*]-related training and learning opportunities for society? If so, please explain. If not, please outline the reasons why.

Purpose

To assess the institutional efforts regarding the advancement of [*assessment area*] for the community at various levels.

Instructions

This may include information on non-credit short training courses or programs for continued learning in the community.

Fig. 4 An example of a question in the research section (*Source* The AUA Model 2011)

(D) Outreach

This section helps to assess the extent of transformation that the institution has undergone toward ESD and to understand the institution's outreach. Consisting of four questions, the purpose of this section is to mainly gauge the institution's involvement in the assessment sub-theme with the local community or with broader networks. Each question is accompanied by the purpose and its accompanying instructions. Figure 4 shows an example of a question in the Outreach section:

Intended Users and Timing

The AUA Model works efficiently when used by a committee consisting of multiple stakeholders of a university, as it reflects diverse opinions and encourages the parties involved to work together to reach a consensus on the ESD field under assessment. Committees may consist of university representatives such as management executives, faculty members, staff, and students as well as individuals from alumni associations, non-governmental organizations and/or non-profit organizations in related communities.

The model can be used at any time of the year, but the user should bear in mind that many of the questions require information based on annual data for fiscal years since 2005—a year considered to represent an appropriate benchmark as it witnessed the United Nations' declaration of the Decade of Education for Sustainable Development, to which we hope to contribute. It may therefore take a while for first-time users to collect information encompassing at least the last 5 years, but the burden on subsequent occasions will be lighter.

The AUA Model is an important tool not only in encouraging self-reflection on the part of the user but also for subsequent AUA peer consultations between users and groups of ESD experts. Accordingly, the user is requested to provide responses and descriptions as candidly as possible, especially when unified opinions are not reached.

In brief, the steps for Usage of the AUA model include (The AUA Model 2011):

i. Accessing the AUA website and downloading the latest version of the AUA model.
ii. Forming a group consisting of university representatives such as management executives, faculty members, staff, and students as well as individuals from alumni associations, non-governmental organizations and/or non-profit organizations of related communities to answer the AUA self-awareness questions.

iii. Setting the ESD field to be assessed, such as (according to the United Nations Decade of Education for Sustainable Development) gender equality, health promotion, the environment, cultural diversity, rural development, peace, human security, sustainable development, sustainable consumption, or sustainable urbanization. You may of course create your own field of ESD to be assessed.
iv. Filling out the institutional profile.
v. Answering the self-awareness questions.
vi. Submitting the results to the AUA Secretariat at Hokkaido University.
vii. Letting the secretariat know of any requests for specific individuals/institutions/organizations to be included as part of the AUA Peer Consultation Committee. This may be taken into consideration in the organizational process as the committee includes both AUA Core Member institutions and specialists in users' ESD assessment fields.
viii. Be prepared to hear from the secretariat regarding the peer consultation schedule.

The AUA Peer Consultation system works as follow:

i. The AUA Secretariat calls for participation by any university, especially in the Asia–Pacific region.
ii. The AUA Secretariat accepts applications from interested universities (to be made in the name of the head of the institution).
iii. Participating universities partake in orientation with the AUA Secretariat to share goals and plan the consultation process.
iv. Participating universities answer the self-awareness questions and submit the results to the AUA Secretariat.
v. The AUA Secretariat selects experts to sit on the AUA Peer Consultation Committee based on the results submitted by individual universities.
vi. Peer consultation is held between each participating university and the AUA Peer Consultation Committee for advice and to set ultimate goals.

Conclusion

Undeniably, quality assurance is an important need for university performance. However, it is equally important to consider the end-goal of such performance as well as the parameters in which this performance is framed. These considerations form the basis of this paper, which argues that ranking/rating systems are beneficial as long as they uphold the following major principles—Inclusiveness, Effectiveness, Responsiveness, and most importantly Contextualization. Although comparing findings from such systems may prove to be challenging, it is nonetheless important to note that universities in this era have attained such a degree of globalization and diversity that good practices can now only be shared through the strong underpinning of contextual parameters. This is precisely the goal of AUA's attempts to mainstream rating among universities, whereby in a worst-case scenario, ranking/rating or appraisal initiatives ultimately benefit all and not just a particular segment of society. Ultimately, the entire measuring and evaluation process becomes a systemic educational learning process benefitting all individuals and entities involved.

To date, AUA project members have reported satisfaction with the overall self-assessment process. The AUA system has afforded them an opportunity for critical self-reflection, helped them reconsider their ESD practices, and helped pinpoint various strengths and weaknesses. There have been several concerns raised throughout the project regarding quantitative data. Feedback suggested that it was not possible or too labor-intensive to collect information dating back to 2005 and that some terms and expressions, such as "ESD courses", "full time positions", and "ESD-related jobs after graduation", were poorly defined and understood across countries, institutions, and even individuals. Those questions have since been revised and the latest version is more focused on narrative and qualitative questions that can be used as a gateway to dialogue by a growing number of institutions.

The objective is to transform the AUA system from a project to a service in 2012. The new service would be known as SUSTAIN (SUSTainability Appraisal for Academic Institutions) and would continue to expand the ESD learning community, raising the quality and impact of sustainability-related activities. Greater discussion is required in order to better define this new direction. In addition, the Dialogue component requires further financial support and greater assistance from external ESD specialists. The ESD Archive continues to operate well and will remain available for basic and comprehensive ESD references.

As AUA members recognize diversity, innovation, and change toward sustainable development, the project will continue to be refined. This continual improvement can help the AUA system become a guiding force that shapes the universities of today and tomorrow.

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Part III
Sustainability Assessment in Practice: Case Studies from Europe to Australia

Sustainability Assessment in Higher Education: Evaluating the use of the Auditing Instrument for Sustainability in Higher Education (AISHE) in Belgium

Wim Lambrechts and Kim Ceulemans

Abstract Assessing the integration of sustainability in higher education can be a powerful lever for organisational change in higher education institutions. When comparing the available tools and instruments for assessment of sustainability in higher education, the Auditing Instrument for Sustainability in Higher Education (AISHE) has proven to be a reliable tool, providing a qualitative approach to sustainability assessment. This article presents the AISHE tool and discusses its use in two higher education institutions in Belgium. Included in this work is an analysis of the audits in several study programs, and an independent evaluation of the instrument based on literature and Belgian good practices. The experiences of the Belgian institutions with sustainability assessment tools can motivate other higher education institutions around the world to start up sustainability assessment in their institution.

Keywords Sustainability assessment · AISHE instrument · Sustainability in higher education

Introduction

Since the 1990s, many higher education institutions (HEIs) worldwide signed sustainability charters and declarations—of which the Copernicus Charter (1994) is one of the most cited—thus accepting an active role in promoting sustainable

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_9,

lifestyles (Lozano et al. 2013; Wright 2004). Throughout the years, the societal appeal to contribute to the transition process towards sustainability became more urgent, and HEIs were blamed for responding too slowly to this appeal. An analysis of 11 main declarations, charters, and partnerships for higher education by Lozano et al. (2013) pointed out that the majority of them addressed initiatives for the integration of sustainable development (SD) in higher education in all four major functions of HEIs—i.e., education, research, community outreach, and university operation, as defined by Cortese (2003). Nevertheless, this does not imply nor insure that the signatories actually integrate SD in their institutions (Lozano et al. 2013).

Although many examples exist of concrete actions for SD integration within the four functions of HEIs, ranging from the development of SD courses, teacher trainings on SD, or student competency schemes for SD—all of them being "curriculum" initiatives—to typical "operations" initiatives, e.g. energy and waste management programs or staff/student diversity policies, it is clear that the integration of sustainability in higher education still deals with a broad range of fundamental barriers (Ceulemans et al. 2011a; Lozano 2006a; Thomas 2004; Velazquez et al. 2006), preventing or holding HEIs back from implementing sustainability initiatives in their institution. These barriers are, amongst others, related to the lack of awareness among university leaders, teachers and researchers, the disciplinary structure of higher education, and the lack of funding. Furthermore, there is a conceptual problem we have to deal with: SD is often perceived as a vague and complex concept, thus making it difficult to implement and integrate in specific courses (Lambrechts et al. 2008, 2009). Finally, the lack of suitable indicators and instruments to monitor and assess the efforts undertaken by HEIs complicates the assessment process, resulting in the lack of a clear view on the current situation of sustainability integration in higher education worldwide (Lambrechts et al. 2009; Lozano et al. 2013).

Many tools for SD management, assessment, and reporting have been developed throughout the years—e.g., Sustainability Balanced Scorecard (Figge et al. 2002), Global Reporting Initiative (GRI) guidelines (GRI 2011), ISO 14000 Series (ISO 2004), ISO 26000 (ISO 2010). However, most of these tools are defined on a general level, and are not (fully) suitable to use in the context of HEIs, as there are hardly any specific indicators for education, research, and outreach within these existing tools (Lozano 2006b). Specific instruments have also been developed for the analysis of SD in the core activities of higher education, and some of them have been reviewed in the past (Cole 2003; Glasser and Nixon 2002; Glover et al. 2011; Lozano 2006b; Shriberg 2002, 2004; Siemer et al. 2006). Focused on the validity and comparability of results, some of these tests and reviews concluded with a demand for the development of a more comprehensive tool, addressing some of the downsides and limitations of the use of the current assessment tools (Ceulemans et al. 2011a; Glover et al. 2011). Furthermore, the reviews have limited attention towards empirical data on the practical use of SD assessment instruments in HEIs, the perspective of audit participants and the possibilities for organisational change and development (Lambrechts et al. 2009).

Looking at the reviews found in the literature, the Auditing Instrument for Sustainability in Higher Education (AISHE) was evaluated as an innovative European example (Shriberg 2004; Siemer et al. 2006), and it continues to be applied in more institutions (Glover et al. 2011). This paper tackles the need for empirical data on SD assessment instruments in HEIs, and therefore discusses the experiences with the AISHE instrument in two Belgian HEIs. The research presents the results of the assessments in various study programs of these institutions, and focuses on the evaluation of the AISHE instrument and its assessment process. The structure of the chapter is as follows: first, the "Reasons to Assess Sustainability in Higher Education" will be addressed, and the "Materials and Methods" will be presented. Afterwards, the "Results" and "Discussion: Evaluation of AISHE" will be provided. The chapter ends with a general "Conclusion".

Reasons to Assess Sustainability in Higher Education

Although SD assessment tools can be powerful levers for organisational change in higher education, little research has been done to investigate the current situation of sustainability integration in HEIs (Ceulemans et al. 2011a; Desha et al. 2009; Lambrechts et al. 2013; Shriberg 2002). SD assessment in higher education can be performed for various reasons, which can be clustered in three core groups: (1) policy development, (2) mainstreaming sustainable higher education, and (3) transparency and communication (Ceulemans et al. 2011a; Lambrechts et al. 2008; Roorda 2007; Shriberg 2004).

A first reason for SD assessment in higher education is policy development. Since the beginning of the 1990s, various HEIs around the world signed a number of charters and declarations, specifically fostering the integration of sustainability in higher education (Lozano et al. 2013). However, the integration of SD in higher education is a slow process. Many projects were launched, focusing on education, competences, curriculum, research, outreach, assessment, reporting and training, but a thorough and structured approach seems to be missing (Lambrechts et al. 2013; Lozano et al. 2013). Assessment instruments for SD could guide a translation from the theoretical charters and declarations to a practical approach in HEIs. Moreover, these instruments identify strengths and weaknesses, provide policy makers with qualitative and quantitative information about the integration process, and suggest priorities for future policy (Roorda 2007; Shriberg 2004). Additionally, using assessment instruments could lead to the integration of SD in the general quality management system of the HEI (Roorda 2010).

Secondly, the assessment of SD integration in higher education could lead to the mainstreaming of sustainability in the institution. Management and staff are often unaware of the sustainability projects and efforts in their institution.

Although Ceulemans et al. (2011a) stress that "a combined top-down/bottom-up approach seems to be the most beneficial for sustained sustainability integration efforts", the use of sustainability assessment instruments is clearly a top and middle management affair. Nevertheless, assessment on the organisational scale could also raise awareness and create a sense of responsibility among all internal stakeholders, i.e. management, staff, and students (Siemer et al. 2006), and thereby facilitate mainstreaming of sustainability in the institution.

A third group of reasons to assess SD in higher education are more communicative reasons. Assessment instruments provide the management with clear data, useful to report about the efforts of their HEI to integrate SD. In (larger) companies, an annual sustainability report has become a way to communicate to all stakeholders, and creates awareness and trust among various stakeholders. However, in higher education, SD reporting is not widely spread (Lozano et al. 2013; Roorda 2010). The assessment of SD in higher education could be an incentive for the management, because it can lead to a special certificate, and provides opportunities to compare their results, benchmark their efforts and learn from each other (Shriberg 2004).

Materials and Methods

A number of tools and instruments have been developed or modified to help assess SD in HEIs. Siemer et al. (2006) note that worldwide more than 220 projects for assessing SD integration are present, most of which originated in America and England, and sometimes presenting specific guidelines and tools. Without giving a comprehensive overview, some examples are given to express the variety of the available tools: AISHE (Roorda 2001), the Graphical Assessment for Sustainability in Universities (GASU) tool, combining some of the GRI indicators with additional indicators for the core business of HEIs (Lozano 2006b), the Sustainability Tool for Assessing UNiversities' Curricula Holistically (STAUNCH) (Lozano 2010), the Sustainability Tracking, Assessment and Rating System (STARS) (AASHE 2012), the revised version AISHE 2.0 (Roorda et al. 2009); and Waheed et al.'s (2011) uncertainty-based DPSEEA-Sustainability index Model (uD-SiM).

Shriberg (2002, 2004) compared existing assessment instruments for SD in higher education, and concluded that most of the tools did not provide mechanisms for comparing campus efforts against other institutions, and that the reasons for undertaking the SD initiatives were often neglected in these tools. Despite the number of available tools and instruments, Velazquez et al. (2006) still report the lack of effective indicators and call for the development of a control instrument as a major priority for HEIs.

Within the reviews of the tools and instruments, AISHE is often seen as a good example because of its process-oriented approach (Shriberg 2004), and because of the innovative nature and methodology (Siemer et al. 2006). These strengths of the instrument, and the structure based on a quality management model (Roorda 2001) were the reasons for two Belgian HEIs to start using AISHE within their study programs. This section presents the AISHE instrument, with a focus on the structure, criteria and assessment process.

The AISHE Instrument

AISHE is an instrument designed to assess the level of integration of sustainability in HEIs. The instrument can be downloaded for free and is available in Dutch, English and Swedish. AISHE is based on a model for quality management developed by the European Foundation for Quality Management (EFQM), enhanced by the Dutch Institute for Quality Management (INK) for commercial use in companies, and consequently adapted by a higher education expert group on quality management for application in HEIs (Roorda 2002). The EFQM-INK model starts from the idea that, based on a set of criteria, an organisation is situated in a certain development stage: (1) activity oriented, (2) process oriented, (3) system oriented, (4) chain oriented or (5) society oriented. The stages of AISHE are cumulative, and the institution moves towards a holistic integration, striving to achieve the status of "sustainable higher education". AISHE consists of twenty criteria defined and structured using the Deming cycle of Plan-Do-Check-Act.

The criteria of AISHE are formulated according to three fundamental principles: they are process oriented (rather than content oriented); qualitative, presented on an ordinal scale (rather than quantitative); and descriptive (rather than prescriptive) (Roorda 2001). Table 1 provides an overview of the twenty criteria of AISHE 1.2. Each criterion is described thoroughly in the AISHE manual, with short characteristic descriptions for each of the five stages (Roorda 2001).

The AISHE instrument is developed to be used on the level of a single education program, or—in case of several comparable programs within one university—on the level of a faculty or department. Although AISHE includes some criteria assessing sustainability integration on the institutional level—mainly within the "vision and policy" subset—it is impossible to conduct an AISHE audit for a university as a whole (Roorda 2007). An AISHE audit gathers a group of 15–20 stakeholders from the university: one or more manager(s), several lecturers, some other staff members, some students and if possible some external stakeholders. Each participant has to be in some way involved in the specific education program that is being assessed. After an introduction to the topic of sustainability and to the auditing instrument, each participant individually reads the criteria and decides—to his or her personal opinion—which stage seems the most appropriate for every single criterion. After that, the stakeholders participate in a consensus meeting, where the results are presented and discussed. Each criterion is discussed in this meeting, and consensus has to be reached about the stage in which the criterion is situated. It is important to mention that the arguments used in the consensus discussion to choose the current phase of the criterion must be

Table 1 The criteria of AISHE 1.2 (Roorda 2001) and scores for different certificate levels (Roorda and Martens 2008)

	Certificate level (# stars)	1	2	3	4
Plan	*1. Vision and policy*				
	1.1. Vision	1	2	3	4
	1.2. Policy	1	2	3	4
	1.3. Communication	1	2	3	4
	1.4. Internal environmental management	1	2	3	4
	2. Expertise				
	2.1. Network	–	1	2	3
	2.2. Expert group	–	1	2	3
	2.3. Staff development plan	1	2	3	4
	2.4. Research and external services	–	–	1	2
Do	*3. Educational goals and methodology*				
	3.1. Profile of the graduate	1	2	3	4
	3.2. Educational methodology	1	2	3	4
	3.3. Role of the teacher	–	1	2	3
	3.4. Student examination	1	2	3	4
	4. Educational context				
	4.1. Curriculum	1	2	3	4
	4.2. Integrated problem handling	1	2	3	4
	4.3. Traineeship, graduation	1	–	3	4
	4.4. Speciality	–	2	1	2
Check	*5. Result assessment*				
	5.1. Staff	–	1	2	3
	5.2. Students	–	1	2	3
	5.3. Professional field	–	1	2	3
	5.4. Society	–	1	2	3

verifiable, meaning that each argument can be proven by evidence or documents if asked for. Preferably, for each criterion, a desired situation is also described. For a detailed description of the different steps within AISHE, we refer to the AISHE manual (Roorda 2001).

The outcome of the audit is a written report and a diagram, showing the results, desired situation and priorities. When the AISHE audit is led by an official AISHE auditor, the education program can afterwards request a certificate issued by the Dutch Committee. In the Netherlands, several universities (mainly universities of applied science) have used AISHE and received a certificate. Certificates can be issued on four levels (ranging from one star to four stars), depending of the extent of SD integration in the education program, e.g. for a one star certificate, a study program needs to reach level 1 for 11 criteria, as shown in Table 1. Also, some HEIs performed several subsequent audits in time. Figure 1 shows the result of

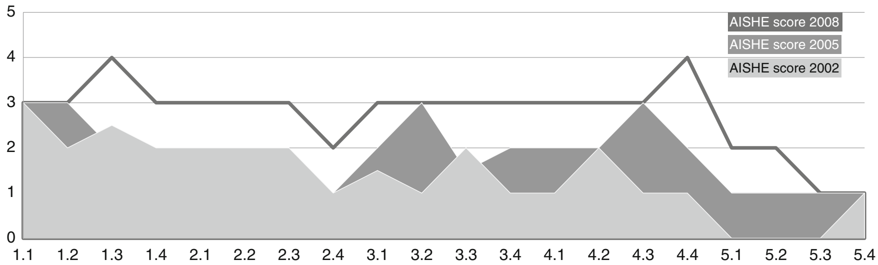

Fig. 1 Results of the AISHE audits in Fontys University (*Source* based on Roorda 2010: 147)

three subsequent AISHE-audits in Fontys University in The Netherlands, as reported by Roorda (2010).

Methods

The use of AISHE in several Belgian study programs has led to a considerable output of data, both on the results and outcomes of these assessments, as on the practical experiences within the HEIs in undergoing the assessment process. The evaluation of the instrument can be broken down into the following questions:

1. What are the results of the use of AISHE in various study programs?
2. What are the experiences of participants regarding the assessment process?
3. What are the strengths and weaknesses of the instrument?

The information provided in the results and discussion section is based on several data sources:

– Literature study on previous reports on the validity of the instrument;
– Reports on the results of the various assessments in the study programs in both HEIs (as shown in Table 2);
– Internal reports on the use of AISHE in both HEIs;
– Two focus groups organised by both HEIs, with 30 participants from a variety of internal and external stakeholders (in November 2008 and March 2011).

Results

In Belgium, two HEIs have officially used AISHE with the guidance of an AISHE auditor, while some other universities also used it without guidance of an external auditor (i.e. a self-evaluation). Both Leuven University College (KHLeuven) and

Table 2 AISHE audits in KHLeuven and HUB

KHLeuven	Date	Department	Study Program(s)	Type
A	September 2003	Business Studies	Business Management Office Management	External
B	September 2004	Business Studies	Business Management Office Management	External
C	October 2005	Teacher Education (Campus Leuven)	Secondary Education	External
D	October 2005	Social Work	Social Work	External
E	October 2005	Health and Technology	Nursing Midwifery	External
F	October 2005	Health and Technology	Chemistry Biomedical Laboratory Technology Nutrition and Dietetics	External
G	December 2005	Teacher Education (Campus Leuven)	Pre-primary Education Primary Education	External
H	February 2006	Health and Technology	Medical Management Assistant Applied Information Technology	External
I	December 2006	Teacher Education (Campus Diest)	Pre-primary Education Primary Education	External
J	March 2009	Business Studies	Business Management Office Management	Self-evaluation
K	March 2010	Business Studies	Business Management *Office Management*	External
HUB	*Date*	*Faculty*	*Study Program(s)*	*Type*
L	November 2005	Economics and Management	Bachelor/Master Environment, Health and Safety Management	Self-evaluation
M	August 2006	Economics and Management	Business Management Office Management	External
N	March 2010	Economics and Management	Bachelor/Master Environment, Health and Safety Management	External
O	March 2010	Economics and Management	Bachelor/Master Business Engineering	External

Hogeschool-Universiteit Brussel (HUB) have done several AISHE audits in the past years, resulting in one star and two star certificates for several study programs.

The initial driver for KHLeuven to start with the AISHE audits was the start of a research project on sustainability integration in higher education, which provided funding to prepare and perform the audits in all study programs. Another internal driver was the interest of individual staff members and policy development within the organisation (Verhulst and Lambrechts 2013). KHLeuven received the one star certificate for all its study programs, ranging from business management, teacher training, health care, technology, and social work, based on the AISHE audits between 2003 and 2006. In 2010, KHLeuven obtained a two star certificate for its study programs in business management (Ceulemans et al. 2011b). For HUB, policy development was the main driver to start with AISHE audits. In 2005, there was a growing interest within HUB to take up a more systemic approach towards SD integration. HUB's Faculty of Economics and Management decided to start using AISHE as a tool for continuous improvement of SD efforts within one academic program, and to consequently use these audit results to guide further SD integration within the organisation. HUB achieved a two star certificate for its Environment, Health and Safety Management Master Program in 2006, while in 2010 this certificate was renewed for another three-year period. Simultaneously, the Master in Business Engineering received the two star certificate after being subjected to its first AISHE audit in 2010. An overview of the audits in both institutions can be found in Table 2. The results of the 11 audits in KHLeuven and four audits in HUB are shown in Table 3.

Moreover, both KHLeuven and HUB performed some subsequent AISHE audits. The results of these subsequent audits are interesting to analyse, in order to find out if and to what extent the SD integration is actually improving throughout the years. Figure 2 shows the results of the four AISHE audits within the Bachelor program in Business Management at KHLeuven. Figure 3 shows the results of HUB's subsequent AISHE audits for the Bachelor/Master in Environment, Health and Safety Management. Both graphs show an overall improvement of SD integration in the study programs throughout the years. Nevertheless, the level of some criteria can also decrease from one audit to the next: the result and achieved level for a certain criterion does not assure that this level can be attained in later stages without particular attention. Also, results show that participants are actually grading the criteria lower in self-evaluations (without guidance of an auditor, see KHLeuven audit in 2009 and HUB audit in 2005) than in the following audits with an external auditor.

Discussion: Evaluation of AISHE

The use of AISHE was evaluated based on the audit experiences of KHLeuven and HUB (as shown in "Materials and Methods"), on information gathered from the literature (as shown in "Reasons to Assess Sustainability in Higher Education"

Table 3 Overview of the results of the AISHE audits in KHLeuven and HUB (based on: Lambrechts et al. 2009 and internal AISHE reports)

Criterion			KHLeuven											HUB			
			A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1. Vision and policy	1.1.	Vision	1	3	2	1	1/2	1	0	1/2	2/3	3	3/4	1	3	3/4	3/4
	1.2.	Policy	2	3	2	1	1/2	1	0	1/2	2	3	3/4	1	3	3/4	3/4
	1.3.	Communication	1	2	1	1	1	1	1	1	2	3	4/5	1	3	2/3	2/3
	1.4.	Internal environmental management	1	1	1	1	1/2	2	1	1/2	3/4	2	2/3	1	2	2/3	2/3
2. Expertise	2.1.	Network	1/2	2	1	2	2	1/2	1	0	2	2	4/5	1	3	4	4
	2.2.	Expert group	1/2	2/3	2	2	1	1	1	1	3	3	3/4	3	4	4	4
	2.3.	Staff development plan	1	2	1	1	1/2	1	1	1	1/2	2	3	1	3/4	3	3
	2.4.	Research and external services	1	2	1	1	1	1	1	1	2	4	4	1	3/4	3	3
3. Educational goals and methodology	3.1.	Profile of the graduate	1	2/3	1	1	1/2	1/2	1	1	1	3/4	3/4	2	4	4	4
	3.2.	Educational methodology	2	2	3	3	4	3	3	3	3	3/4	3	3	3	4	3
	3.3.	Role of the teacher	1	1/2	1	1	1	1	1	1	2	3	3/4	1	2	1/2	1/2
	3.4.	Student examination	1	1	1	1	1/2	1	1	1	1	2	2/3	1	2/3	3	3
4. Educational context	4.1.	Curriculum	1	1/2	1	1	1	1	1	1	1	2	2/3	2	3/4	4	2/3
	4.2.	Integrated problem handling	1	2	2	2	3	1/2	2/3	2/3	3	3	3	4	3	3	3
	4.3.	Traineeship, graduation	1	2	2	1	1	1	1	1/2	2/3	3	3	3	3	5	4/5
	4.4.	Speciality	0	0	0	0	0	0/2	1	0	1/2	2	2/3	4	3	3	2
5. Result assessment	5.1.	Staff	0	0	0	0	0	0	0	1	1	2	3	0	1	1	1
	5.2.	Students	0	0	0	0	0	0	0	1	1	2	3	0	1	1	1
	5.3.	Professional field	1	1	0	0	0	0	0	0	0	1	3	0	1	1	1
	5.4.	Society	0	0	0	0	0	0	0	0	1	1	2	0	1	1	1

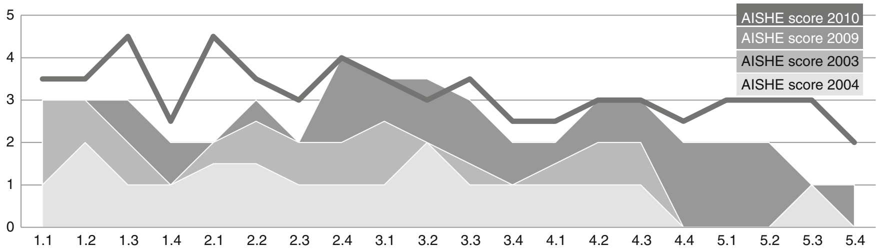

Fig. 2 Results of the AISHE audits in KHLeuven, Bachelor Business Management (based on Lambrechts et al. 2009; Ceulemans et al. 2011b)

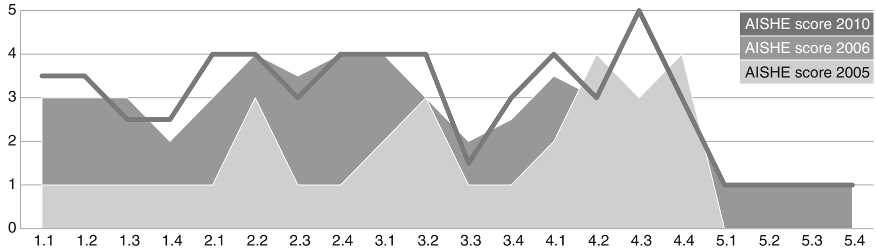

Fig. 3 Results of the AISHE audits in HUB, Bachelor/Master Environment, Health and Safety Management (based on Ceulemans et al. 2011b and internal audit reports)

and "Materials and Methods"), and from two focus groups with internal and external stakeholders. Both focus groups were organised by KHLeuven and HUB, in collaboration with the Flemish government, Department of Environment, Nature and Energy. Thirty stakeholders who participated in the focus groups represented other Flemish HEIs (teachers, students, policy makers), governmental organisations, civil society organisations and NGO's. The first focus group (November 2008) discussed three issues: (1) results of an assessment for organisational development, (2) creating awareness for SD, (3) SD certification and accreditation (Lambrechts and De Prins 2008). The second focus group (March 2011) focused on the results of the recent AISHE audits in KHLeuven and HUB, and discussed strengths, weaknesses and possibilities for organisational development (Ceulemans et al. 2011b).

Based on the literature, the AISHE reports of KHLeuven and HUB, and the outcomes of the focus groups, Table 4 shows an analysis of the strengths, weaknesses, opportunities and threats of the AISHE instrument, regarding (1) the structure of AISHE, (2) the process of the audits and (3) the results of the audits.

Table 4 SWOT analysis of AISHE 1.2

	Strengths	Weaknesses	Opportunities	Threats
Structure	EFQM	High level of complexity and abstraction	Add elements of operations, research, outreach	Complexity of the instrument
	Process oriented	Focus on single study programs	Modular system	Risk of fragmentation in modular structure
	Flexible framework to use on an institutional level	Operations, research and outreach are underexposed	Link with quality system	Difficult to compare between programs/ institutions
Process	Interactive	Only usable in small groups	Enlarge scale (to be used with a larger group of participants)	Might become too time consuming
	Involvement of different stakeholders	Motivation not always included	Present the concept of an audit in a clear way to prevent difficulties in the consensus meeting	Risk of wrong interpretation of criteria
	Raise awareness, "aha-erlebnis"	Emphasis on communicative aspects		Might become too complex for participants
	Formulate desired situation	"Light-initiatives" are not included		
Results	Define objectives and priorities	Results depend on subjective experiences of stakeholders	Offers opportunities for capacity building	Define indicators is a difficult exercise
	Easy to understand and interpret the results	Results depend on the auditor competence	Define (quantitative) indicators	Risk of overkill and wrong interpretation of results
	Attractive and useful for decision makers	No real indicators	Possibilities for accreditation and benchmarking	Risk of forcing results in a certain direction

Structure of AISHE

Regarding the structure of AISHE, one of the main strengths seems to be the quality management approach, offering a structural framework for the entity initiating the auditing process. The evaluation pointed out that the EFQM model provides a good methodological basis for the tool and offers opportunities to connect with quality management of a study program. Defining the criteria according to the Deming cycle of "Plan-Do-Check-Act" gives the instrument a clear structure. AISHE's format ensures the continued work on integrating SD, but allows for flexibility of the methods or of the criteria to focus on for a certain period. This flexibility is actually also a downside of the instrument, because the quality circle is not closed. Continual improvement is possible when the achievement of desired outcomes and priorities of a previous audit would be assessed within the subsequent audit. Without this connection between two audits, or conditionality attached to the criteria, HEIs are being allowed to lag behind on certain criteria, depending on their choice or preference at a certain moment.

The AISHE tool is intended to assess the integration of SD into specific study programs. On the one hand, this is a weakness of the instrument, since one and the same HEI can be a SD integration leader for a certain educational program, while completely ignoring SD issues within the curriculum of another program. On the other hand, this could also be seen in a more positive way: AISHE's flexibility allows for the discussion of sustainability integration to begin in one place within an institution and then grow outward.

Nevertheless, an important weakness is that it does not provide any guarantees for extension to other programs or faculties. It might also be the case that implementation in a single study program does not offer any incentive for other programs to integrate SD issues. Whether or not the study programs are in a way related, by mutual lecturers or mutual research topics, or interest of management staff in further integrating might be determining for the levering capacity of AISHE when only initially applied in one program of the institution.

However, even though the AISHE method can only be applied to a selected study program, some criteria force an evaluation of the performance of the entire institution. Criteria such as vision, policy, and environmental management are usually established on an institutional level. Therefore, even though one study program may excel in integrating SD in curriculum, if the institution is not taking steps to ensure the sustainability of operations, it is not possible to achieve a high AISHE rating. Nevertheless, stakeholders often state that certain aspects of SD integration on the institutional level (e.g. operations, research) are underexposed in the instrument.

Process of AISHE

In the literature, AISHE is often seen as "an excellent example of a process-oriented approach to sustainability assessment" (Shriberg 2004). Furthermore, the experiences of both KHLeuven and HUB, and feedback gathered during the focus groups, showed that regarding the process, awareness-raising seems to be a clearly positive consequence of AISHE. An audit invokes involvement, and broadens the reach of active people within the organisation, since different types of stakeholders are actively involved. The process of the audit is evaluated very positively, especially the interactivity, dialogue and consensus meeting. Taking part in an audit starts an awareness-raising process with the participants, because (1) SD is a new concept for them and/or (2) they were not aware of certain sustainability initiatives in their study program. This calls for a thorough introduction into SD on the one hand, and a good communication and recognition of sustainability initiatives on the other hand.

It is very important for all participants to be on the same level when it comes to the definition of SD, in order to avoid different interpretations and discussions during the consensus meeting of the audit. Therefore, special attention should be given towards the scope and questions in the instrument: sometimes they appear to be too vague, leading to very broad interpretations and confusion between different participants.

Regarding the role of participants in the audit, students provide valuable input for the audit: often they have a strong vision and come up with arguments to demonstrate their opinions. However, for some of the criteria in the instrument they do not feel confident, e.g. for the criterion "staff development plan". A possible weakness of the instrument's process is that the quality of the audit depends largely on the auditor, who has to be an expert both in the field of sustainable higher education and of the particular study program that is performing the audit.

Results of an Audit

Regarding the results of the audits, a major strength is that the reports and graphs are attractive, useful and easy to understand and interpret. The translation into concrete actions is also considered to be a valuable outcome of the consensus meeting, which can be used to further integrate SD in the study program. Furthermore, a very positive result of the audits is that it tends to create a new dynamic in the study program, giving formerly isolated initiatives the opportunity to become more known and even widespread within the study program or university.

Moreover, there are a lot of initiatives within the courses and departments that highlight a particular aspect of SD (e.g. social initiatives), and thus contribute to a further integration of (aspects of) SD. These so-called "light" initiatives are often excluded because they do not embrace the three "P's"—i.e. people, planet, and profit—of sustainability. On the other hand, internal environmental care is considered as an example of SD. It is important to pay attention to these aspects, in order to prevent for this change of scope to create confusion and to bias the results of the audit. Another key point, emerging in all audits, is the strong emphasis on communication aspects. Not only is communication a criterion on its own in the instrument, in the other criteria communication aspects are also largely emphasized. Although this is a particularly important factor, it may cause bias in the results of an audit.

Considerable attention needs to be paid towards the objectives aiming to achieve a certain level or "star" in the audit. If not properly introduced to the policy level, aiming for a star might be a barrier to achieving certain criteria, perceived as valuable for SD integration in general, but not crucial for the achievement of a star. These criteria might be neglected in the results and following actions, because they do not contribute to achieving the desired star level.

Conclusion

When comparing the available tools and instruments for assessment of sustainability in higher education, AISHE 1.2 has proven to be a reliable tool, providing a qualitative approach to sustainability assessment. Nevertheless, the AISHE tool has certain strengths as well as weaknesses, emerging from its use, assessment, and evaluation within several (research) projects. The description, practical experiences and evaluation of the tool might stimulate other HEIs to start using SD assessment tools within their institution, and could indicate whether the use of AISHE and its qualitative approach would be an added value for a particular educational program.

Regarding the structure of the instrument, a major strength is that the instrument is based on the EFQM model, thus providing opportunities to connect with quality management in universities. Also, the fact that the instrument is process oriented is seen as a strength.

Regarding the auditing process, a positive element is the involvement of different (internal and external) stakeholders, and the fact that it raises awareness among the participants, providing a real *aha-erlebnis*, or eye-opener for those who are not familiar with the concept of sustainable higher education. Major strengths regarding the results are the ease in understanding and interpreting of the results, as well as the definition of a desired situation, towards which the involved stakeholders can strive in the next period.

The instrument also has some shortcomings. Research, community outreach and operations are underexposed in the AISHE tool, although equally important roles of HEIs as education. The instrument can only be used in small groups on the level of single study programs, and the results may be biased by the subjective experiences of participants or the auditor's competences.

The use and evaluation of AISHE version 1.2 has led to the development of new versions of the instrument, i.e. AISHE 2.0 (Roorda et al. 2009), AISHE 2012 (Hobéon 2012a), and ARISE (Hobéon 2012b). AISHE 2.0 was developed by an international expert group (Roorda et al. 2009). It is a modular tool, applying the same approach as AISHE 1.2, and working with a set of different criteria, but focusing in a more balanced way on each of the four roles of a university: education, research, outreach and operations. In order to achieve a holistic view, a fifth module was developed, i.e. the identity module (Roorda et al. 2009), covering vision and policy criteria at the level of the institution. AISHE 2012 and ARISE were developed in 2012 by the Dutch consultancy firm Hobéon, with the cooperation of a Dutch-Belgian expert team. AISHE 2012 (Hobéon 2012a) is also based on the AISHE 1.2 tool, but the criteria and the approach have been revised and are more adapted to current tendencies in the higher education sector. Besides the AISHE 2012 instrument, Hobéon also developed a new instrument, called "Assessing Responsibility In Sustainable Education", or ARISE (Hobéon 2012b). This instrument is based on the ISO 26000 principles, and mainly covers organisational aspects (the "operational side" of HEIs), or focuses on the HEI's corporate social responsibility.

The use and evaluation of these newly developed instruments in the near future should be encouraged, since this will indicate whether these instruments can counter some of the described weaknesses of the original AISHE instrument, and whether they are able to take into account some of its opportunities and threats and therefore offer a clear added value to their predecessor, AISHE 1.2.

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Perspectives on Sustainability Governance from Universities in the USA, UK, and Germany: How do Change Agents Employ Different Tools to Alter Organizational Cultures and Structures?

Felix Spira, Valentin Tappeser and Arian Meyer

Abstract Previous studies on organizational change processes toward sustainability at universities have mainly focused on which structures—sustainability visions, policies, or governance mechanisms—should be altered to advance these processes. Relatively few studies however, have focused on how this structural transformation is promoted by different change agents, as well as which tools they employ. Understanding this process is important to understand the underlying mechanisms of organizational transformations toward sustainability. This research tries to contribute to the existing literature and models, by examining how change agents utilize different tools—policies, missions, visions, etc.,—to alter existing organizational structures and cultures. Qualitative data from three case studies in the US (University of California Santa Cruz), the UK (University of Greenwich) and Germany (Lüneburg University) has been collected and analyzed to this end. The findings suggest that different groups of change agents are responsible to advance the changes at each of the three institutions under scrutiny, including researchers, operational staff, higher management, and students. These actors mobilized different tools to advance sustainability. The choice of tools is mainly determined by their position within the organization and personal background. Moreover, the promotion of certain tools is facilitated through outside actors. However, the interaction between these outside actors and the change agents needs to be further examined.

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_10,

Introduction

In recent years, several studies have been dedicated to the analysis of organizational change processes toward sustainability at institutions of higher education around the world. This essay builds on this knowledge foundation and tries to expand it. Our approach is based on the central assumption, that processes of organizational change should be studied by analyzing the complex and dialectical interaction between change agents on the one hand, and organizational structure and culture on the other hand. Those change agents employ a variety of mediating tools—such as sustainability missions, visions, policies, or proposals for new sustainability management systems—to shape and reorganize organizational culture and structure.

Previous studies of organizational change processes at universities have mainly focused on which structures—policies, missions, or finance mechanisms, etc.—should be changed within the organization. Relatively few studies have focused on how this structural transformation is promoted through different change agents. This research tries to contribute to the existing literature on the sustainability transformation of universities, by examining how change agents utilize different tools—policies, missions, visions, etc.—to alter existing organizational cultures and structures. Qualitative data from three case studies in the USA (University of California Santa Cruz), the UK (University of Greenwich), and Germany (Lüneburg University) was collected and analyzed.

The remainder of this essay is organized as follows. The first section provides an overview and synthesis of existing models to describe organizational change toward sustainability at universities. The section presents the theoretical foundation for the later analysis of the three case studies. The second section shortly outlines the methodology used to gather and analyse the data. The third and fourth sections present and discuss the findings. They describe the different actors involved in the process of organizational transformation in the three case studies, the tools they used, as well as the way in which those tools shaped and reconstructed organizational culture and structure.

Literature Review

Organizational change can be understood through the interaction of change agents and structures (Reed 1997). Change agents are defined as individuals, groups or networks within or outside the organization that engage in an active and conscious effort to change organizational structures. In the broadest sense, structures represent organizational rules such as written policies, physical infrastructures such as buildings, as well as more informal processes such as organizational cultures and worldviews.

Previous studies on organizational change toward sustainability at universities can be situated within this agency-structure framing. The majority of studies concentrate on the structures that need to be altered or put in place to advance sustainability. Based on the review of 80 campus sustainability transitions, Velazquez et al. (2006) proposed a four-step process. These four-steps include the creation of a sustainability vision, mission, committee, targets and objectives, as well as strategies. Lukman and Glavic (2007) also developed a four step process—policy, operations, evaluation, and optimization—with several subsections. Alshuwaikat and Abukabar (2008) propose three strategies to promote sustainability on campus. Those include the implementation of an environmental management system (EMS), public participation to promote engagement, and initiatives to integrate sustainability in teaching and research.

These three studies focus on the structures that should be put in place to achieve the end goal of a sustainable university. Their lowest common denominator of a sustainable university is an institution that integrates sustainability into educational, research, operational, and community activities. The difference between these studies lies in the extent of steps that are involved in the process—three or four major steps with different subactivities. Those steps function as good guidelines for actors interested in learning where to start when they want to transform their university. However, they fail to illustrate the deeper mechanisms involved in advancing these structural changes through the work of change agents.

Apart from this primary focus on structure, several studies exist with a stronger emphasis on the interaction between change agents and structures. Shriberg (2002) found that change agents tend to be successful if they wrap their arguments in different discourses: For instance, when talking to higher management, change agents should appeal to the strategic benefits of sustainability for the university. However, when engaging with lower levels in the organizational hierarchy they should appeal to promoting sustainability out of personal ethics. Change agents should consider these findings when engaging with actors who adhere to a certain organizational culture.

Disterheft et al. (2012) analyze the success factors in the implementation of EMSs. Participatory implementation of an EMS features as an important success factor in their model. This quantitative study does not provide a detailed analysis of the change agents behind the promotion of the EMS. Nonetheless, it illustrates the importance of gaining legitimacy and input of actors in the design of an organizational structure.

Finally, Sharp (2011) presents a three-stage model to explain organizational change. According to Sharp, the organization first experiences a process of awakening, in which few sustainability change agents generate small victories. Then, the scale of the sustainability ambitions and the amount of actors involved in the transformation grows in a process called pioneering. Through further successes, design of organizational structures and changing organizational culture, the university enters the phase of transformation. In this phase, sustainability has become a core principle of the institution. Compared to Shriberg (2002) and

Disterheft et al. (2012), the strength of Sharp's analysis lies in her explicit emphasis on the agency—structure interaction, in which a growing alliance of change agents infuses organizational culture and structures.

Theoretical Framework: Actor Dynamics in Change Processes

The literature review illustrated that existing studies on change processes toward sustainability in higher education place different emphasis on the role of actors or structures. Based on these existing studies and models, as well as the engagement of the authors with sustainability governance through the Maastricht University Green Office, the following model was developed to better capture the agency—structure dynamic (cf. Fig. 1). This model is later used to analyze the three case studies.

On the first level, actors are subdivided into supporters, change agents and decision makers. Change agents are defined as individuals groups or networks that engage in the active and conscious effort to change organizational structures.

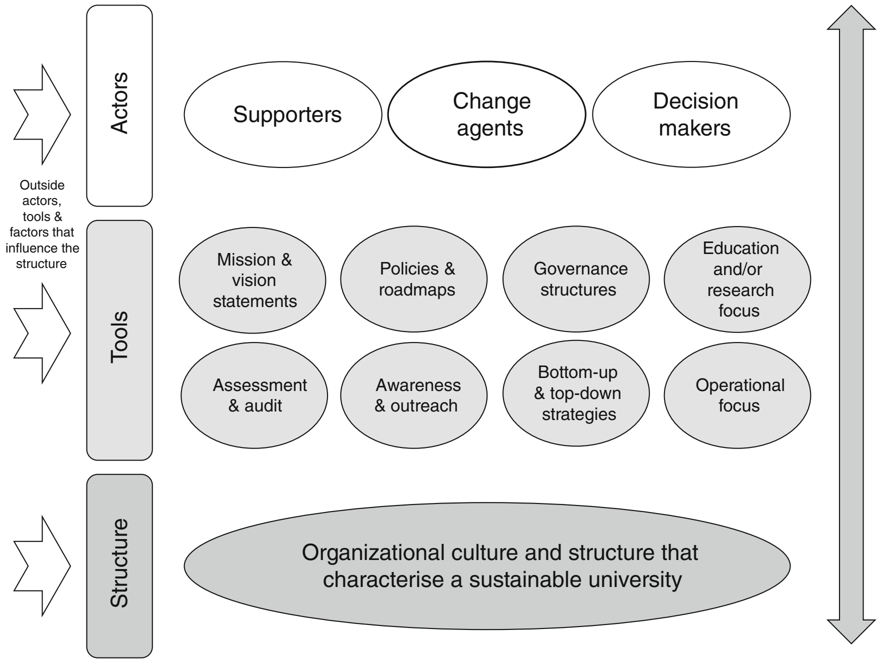

Fig 1 Structure-actor dynamics in change processes (developed based on models by Shriberg (2002), Velazquez et al. (2006), Lukman & Glavic (2007), Alshuwaikat & Abukabar (2008), Sharp (2011), Disterheft et. al. (2012) and the personal experience of the authors through their work at Maastricht University Green Office

Supporters constitute all other actors that the change makers can mobilize for their quest. Change agents and supporters can also come from outside the organization. Decision makers constitute the actors within the organization that can decide about the adaptation or implementation of sustainability projects or policies.

The second level constitutes the tools that the change agents use to advance their sustainability agenda. This vast array of tools accounts for the diversity that can be found in sustainability initiatives across universities. Some change agents might focus more on bottom-up strategies to advance educational changes. Other change agents might focus more on promoting operational changes, e.g., through energy projects and policies. Change agents can also rely on tools that are provided by outsiders, such as NGOs, national governments or companies. The division between the tools and the structure is fluent. Tools can be understood as the building blocks of a sustainable university. In this sense, tools that the change agents promote become part of the structure if they are successfully implemented.

The interaction between change agents, tools, and structure is complex and dynamic. Change agents are products of the organizational culture and structure. They are constrained by their formal positions and powers, and shaped by years of working within the organization. However, the change agents also try to expand the structural constraints. Due to this dual causality, a neat distinction into independent—change agents—and dependent—structure-variables cannot be made. Moreover, the choice of tools change agents employ to alter the structure is shaped by their personal preference and ability, as well as their position within the organizational structure. In this sense, not all tools are equally available to all change agents.

Methodology

A purposive sample of three case studies was chosen. Those three cases were chosen, because they dispose over a long and rich history of organizational change. Sustainability initiatives at the respective universities also unfolded differently from each other so that they provide a diverse and thick web of data. Since the study only contains three cases, the specific results should not be expected to be generalizable across all universities, but rather provide illustrations of different sustainability change processes in higher education (Ghauri 2004).

First, five interviews with the founder of the sustainability office, the interim sustainability director, sustainability office staff, and an operational director were conducted at the University of California Santa Cruz in the United States. Second, the sustainability manager at the University of Greenwich in the United Kingdom was interviewed. Finally, three interviews were conducted at the Leuphana University Lüneburg in Germany. Among the interviewees were the Environmental coordinator and two professors that have been involved in the sustainability transition of the university from the beginning. All nine interviewees for this research possess considerable experience with and influence on the sustainability transformation of their respective universities. The aim of the interviews was to map the historical development of the change processes, the different actors involved, challenges encountered, and future directions. The interview accounts are verified, supplemented, and enriched through content analysis of sustainability reports, websites, policies, and strategies from the respective universities and the University of California.

Results

University of Greenwich

Concentrated sustainability efforts at the University of Greenwich are the most recent among the three case studies. In 2008, the university was still on place 109 (out of 119) in the People and Planet Green League of UK universities (People & Planet 2008). However within 4 years, Greenwich rose in this ranking from place 109 onto the first place (People & Planet 2012).

Sustainability efforts have mainly been driven by staff members from operations and higher management. In 2009, a Sustainability Manager was hired after lobbying from staff members and an environmental society. Since then, the engagement of students has been relatively low, mainly involving student representatives on committees and volunteers working in the university garden. Despite this limited participation from students, the involvement of staff member is high. The sustainability team just comprises three people, but many staff members are involved in the implementation of sustainability policies, as the change agents managed to spread responsibilities for sustainability throughout the organization. Nonetheless, the wide-spread engagement of researchers, as well as students, still appears to be a major issue.

This has been achieved through the use of several tools: The participation of staff members in the Sustainability Champions Program is approved by their supervisors, so that they can officially dedicate a certain amount of hours per month to sustainability issues and participate in monthly trainings. Then, Greenwich participates in the behavior change project Green Impact run through the National Union of Students (2011), which empowers staff members to implement small sustainability projects in their department. Sustainability was also integrated in all new job descriptions so that also staff members who are not sustainability champions are encouraged and have a justification to dedicate working time to sustainability issues. Through this mobilization of existing personnel, only three new sustainability staff needed to be hired since 2008.

The use of existing governance structures and the creation of specialized committees further contributed to the spreading of responsibilities throughout the organization. Rather than having created a new sustainability committee, the Sustainability Manager joins the resources subcommittee to discuss strategic sustainability issues. This high level committee includes the deputy vice chancellor, directors of offices and deans of schools who meet on a monthly basis. Moreover, sustainability issues are reported twice a year to the university court. Next, five highly specialized committees on biodiversity, fair-trade, sustainable food, education for sustainable development and carbon management directly deal with issues that have been approved in the sustainability policy on an operational level. Those committees comprise higher management such as the director of facilities, students, researchers, and facility staff.

Sustainability efforts started with and still maintain a strong operational focus, while educational initiatives are still nascent. This could be explained by the fact that the majority of change agents have a strong operational focus and are staff members, rather than students who might primarily focus on outreach issues. Then, certain tools are adopted—carbon management plan, Green Impact Program, and ISO14001—, because they are promoted or made compulsory by outside organizations. For instance, Greenwich developed the carbon management plan, because the funding council for higher education in the UK partly links funding to the achievement of CO2 objectives (University of Greenwich 2011).

The change agents managed to alter the organizational structure and culture through the specific choice of these tools. The broad mobilization of staff members through different programs, policies, and committees increases staff involvement and spreads responsibility for sustainability issues. The first sustainability policy and action plan was launched in 2010 and subsequently extended through sustainable food, procurement, biodiversity, and fair-trade policies in 2011. In 2012, sustainability was integrated into long-term planning documents such as the Strategic Plan, as well as the Teaching and Learning Strategy. In this sense, sustainability objectives diversified from a narrow operational focus to also include educational and strategic elements. By aligning sustainability with the core principles of the organization, University of Greenwich can thus be seen as reaching the transformation stage as defined by Sharp (2011).

University of California Santa Cruz

Different from Greenwich, students at UCSC play a central role in the university's sustainability transformation. In 2003, students from the University of California Santa Cruz UCSC and the other eight campuses in the University of California system lobbied for a system-wide sustainability policy. This Policy on Sustainable Practices was then adopted by the University of California System (University of California 2009), which gave further legitimacy and upwind for sustainability change agents to advance UCSC's commitment. A student and staff-driven Council for Sustainability and Stewardship was established in 2006.

A former student leader was also hired as Sustainability Coordinator to run the first sustainability office alongside two student interns. UCSC students then provided further finance to the office and other climate change initiatives by passing an additional fee levied on top of tuition. The sustainability office grew its team over time, now including four full-time staff members, and dozens of student employees and interns involved in specific projects. Staff members are further engaged through several committees and working groups with a major emphasis on sustainable operations management. Similar to Greenwich, the major challenge has been the engagement of researchers in the sustainability transformation.

The tools employed by the change agents were heavily influenced by outside organizations. The framework for sustainability activities was set by the UC Policy on Sustainable Practices in 2004. Also, in 2006, the chancellor signed the Climate Action Compact and the American College and University Presidents Climate Commitment (ACUPCC). The first is a student-initiated, system-wide policy on green building and clean energy (University of California 2009). The latter is a major commitment of over 650 US-American institutions of higher education to assess and reduce their greenhouse-gas emissions (ACUPCC 2013).

The nature of these commitments can explain the strong climate change and operational focus of sustainability management at UCSC. Areas of education or research for sustainable development are not addressed by existing policies or commitments, despite a strong environmental studies focus of UCSC. In addition to these climate change agreements, a major step after the establishment of the sustainability office was the compilation of a campus wide sustainability assessment, published in 2007 (UCSC 2007). This assessment—which has again a strong operational focus and only includes one chapter on curriculum—provided the basis for the first Campus Sustainability Plan published in 2010 (UCSC 2011).

Sustainability policies and commitments are implemented and monitored by a complex system of governance mechanisms. Different from the University of Greenwich, UCSC established a new Committee on Sustainability and Stewardship (CSS), which reports to the Advisory Committee for Facilities. Interviewees mentioned dissatisfaction with the CSS, because its role was sometimes unclear and members felt dissatisfied that they could not directly report to the executive committee. Attempts are now made to restructure the governance system, so that the CSS directly reports to the executive committee and is better aligned with the sustainability office's work, by setting concrete targets and benchmarks. In addition to the CSS and the Sustainability Office, nine working groups— with a focus e.g. on buildings, energy, water, transport, etc.,— as well as several student initiatives are involved in the sustainability transformation of UCSC.

The sustainability efforts at UCSC were a product of student activism, and they strengthened student engagement in return. Change agents from within the student body convinced the university management to make regional or national sustainability commitments. Those commitments were then used to drive sustainability issues into the organization. The focus of these commitments established a strong historical trajectory to alter the operational structure and culture of UCSC, while education and research in the area, though existing remains somewhat disconnected. Change agents also established a complex mixture of governance mechanisms, which are currently restructured to place sustainability at a higher level in the organization.

Leuphana University Lüneburg

Leuphana University is at the forefront of the sustainable university movement in Germany. In contrast to the two other case studies, a small group of professors and students were the pioneers of the university's sustainability transformation starting in the 1990s. Given the fact that the first change agents comprised professors, they utilized a strong set of research and educational focused tools to advance sustainability. As a first milestone, these change agents guaranteed government funding for a research project. From 1999 until 2001, they investigated the meaning of the Agenda 21 for Leuphana University.

As part and parcel of this first research project, several changes in operations, e.g., the introduction of an EMS, education, e.g., the establishment of sustainability courses and art projects, and research, e.g., the fostering of collaboration between researchers of various fields. The project also laid the foundation for the comprehensive sustainability definition the university employs. The focus is on six areas, namely inter- and transdisciplinary research, education, the university as a societal actor, campus development, operational efficiency, and the university as a space to live (Leuphana Universität Lüneburg 2011). This definition of sustainability that also strongly emphasizes well-being, interestingly lead to the implementation of a steering group and policies on health in 2003—representative of the holistic approach to sustainability the Leuphana employs.

Following the first research project and the implementation of the EMS, the change agents achieved the commitment necessary for the university management to publicize the first sustainability guidelines in 2000. Hence, different from models presented in the literature review, the development of sustainability guidelines did not represent one of the first steps. It could be assumed that the change agents first needed to create successes to convince the university management to commit to sustainability issues university-wide. Following the publication of the guidelines, the change agents—drawing on an increasing support basis—launched a second research project entitled "Sustainable University," which ran from 2004 until 2007. This laid the ground for the creation of an UNESCO chair on Higher Education for Sustainable Development in 2005, the integration of sustainability as one of the core research principles in 2008 and the creation of the first German faculty of sustainability in 2010. This trajectory illustrates that research and teaching remained driving forces behind the slow infusion of sustainability into the core principles and organizational structure.

The position of an environmental coordinator was created following the first research project, but no central sustainability office exists. Only two working groups have been formed on the environment and health. Their members are drawn from student, staff and faculty and include the environmental coordinator. One reason for the creation of this rather small governance structure could be that the faculty for sustainability and its teaching and research output are key actors in the transformation process. The President and his office also exhibit strong leadership on sustainability issues.

At Leuphana, change agents initiated a systemic restructuring of the organization's research, education and operational principles. Change agents advanced this structural transformation primarily through a research-driven agenda. The findings of the research were then directly implemented to improve Leuphana's sustainability. The holistic definition of sustainability also enabled the change agents to include other discourses in their agenda, such as health improvements. Overall, students are engaged in global or campus related sustainability issues through their classes, student organizations and the two working groups. However, the process itself is primarily driven by researchers and higher management.

Discussion

Table 1 provides an overview of the main findings. The type of actor involved in the respective institutions' sustainability transformations is different in each case. Greenwich started with a change agenda that was primarily driven by operational staff and middle-line managers. UCSC exhibits an important influence of student leadership, while researchers were the main drivers at Leuphana University. Interestingly, in all of the cases, change agents have not yet managed to significantly involve other groups of actors that have been previously underrepresented, despite attempts to do so. Early involvement of sustainability champions in the student community, higher management, education and research at a very early stage of the process that avoids such path dependencies may thus be a key for a holistic transformation to occur. The University of Greenwich successfully illustrates how responsibilities for operational sustainability can be diffused throughout the organization, by using tools that engage staff members.

Next, the choice of tools was determined by different factors. On the one hand, the University of Greenwich and Leuphana illustrate that the change agents mainly employed tools, which correspond to their position and background within the university. On the other hand, the direction of the sustainability agenda at UCSC was strongly influenced through regional or national commitments that the university signed. Those commitments laid the basis for a strong operational and climate change focused discourse. Prioritizing areas to pioneer change is important, as this can create successes to convince decision makers to further commit to a sustainability agenda. Nonetheless, the initial emphasis on one area, such as operations can again create trajectories of change that are difficult to alter. Leuphana University presents a successful case study in which the research, education and operational areas are linked to create powerful synergy effects to advance change in each area.

Moreover, the degree of formalized governance structures varies between the cases. Greenwich managed to diffuse responsibility for operational sustainability throughout the organization, and Leuphana draws on its faculty of sustainability and environmental committee. Change agents at UCSC created a complex web of governance mechanisms involving staff, students, and higher management. Hence,

Table 1 Overview findings

	University of Greenwich	UCSC	Leuphana university
Actors	Pressure from middle-managers and students to employ sustainability manager	Lobby work of dedicated students to approve sustainability policy in the University of California system	Professors and students as early change agents
	Primarily staff-driven sustainability efforts, with student input on some committees		Main actors remain professors and other research staff, as well as higher management.
	Wide-spread mobilization of existing personnel and integration into existing governance structures and establishment of five specialized committees	One student leader starts the sustainability office	One environmental manager, environment and health committees drawn from student, staff and faculty
		Complex mixture of student and staff initiatives and governance structures	
Tools	Started off with sustainability policy, then development of specialized policies (food, biodiversity, fairtrade, etc.) until final integration into strategic program	First sustainability assessment of UCSC laid foundation for further actions	Research project laid conceptual and strategic foundation
			Holistic sustainability concept
	Strong operational focus, but beginning spread into educational policies	Significant influence of outside actors through commitments that created path dependency of operational focus	Integration in the university's principle, reorganization of research and education toward sustainability focus. Operational efficiency just one component
	External actors promoted or made some tools compulsory		
Organizational Culture and Structure	Increased staff engagement in sustainability issues	Culture of student and staff engagement, however challenges to involve researchers	Strengthening of sustainability research and educational structure, whereas operational efficiency is just one component
	Diffusion of sustainability agenda from operational focus into strategic plans of university	Principles of sustainability mainly implemented in operations	Significant realignment of the university's principles with sustainability

rather than following a broad three or four-step approach, the sustainability transformation was advanced through change agents who lobbied for change in different areas. Models that frame campus transformations as large scale designs following a three or four step process—such as Lukman and Glavic (2007) and Velazquez et al. (2006)—should be downscaled to also account for these incremental achievements.

Nonetheless, despite these differences in the change processes, similar patterns exist across the three cases: In each case, a small group of change agents started to build alliances with powerful actors. This is similar to Leenders (2009) observation that transition processes start with small teams and then draw on a larger coalition of change agents. Moreover, all change agents in the three cases worked on a strategic dimension—through policy tools—and a specific dimension through tangible sustainability projects. The projects generated the successes to show the benefits and potential of sustainability, which helped to commit the university through sustainability policies and guidelines. In return, the strategic commitments further legitimized and enabled small-scale projects. Hence, the choice of specific tools varies across the three cases, whereas some general and broad patterns persist.

Conclusion

The findings of this research emphasize the diversity of approaches to advance sustainability at a university. Change agents can come from students, research, operational staff, or higher management. They have multiple tools at their disposal to alter organizational structures and cultures. Among others, change agents can try to kick-start the process through an assessment, vision, research project, carbon management plan or lobby work to influence higher education policies in general. Rather than following a broad three- or four-step process as recommended by some models in the literature review, change agents should become aware of the multiple options they have to approach sustainability at their university and review them carefully.

University of Greenwich illustrates that tools which succeed in mobilizing existing resources and personnel to diffuse the sustainability agenda into the DNA of the university appear could be successful. Leuphana University shows that powerful synergies can be created between the research, educational, and operational actors at a university to advance changes in each area. Nonetheless, change agents should also be aware of the path-dependencies they create with the initial choice of tools. For instance, Greenwich and UCSC developed a strong operational focus and experience difficulties to diffuse their message into research and education.

The case studies also illustrate the importance of outside organizations to provide valuable tools that change agents can use. On the one hand, those tools can constitute certifications for EMSs or behavior change programmes. On the other hand, they can represent legislation from the university system, which helps change agents to justify their sustainability agenda toward local decision makers. However, the complex interactions between the change agents within the organization and outside actors need to be further examined.

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Developing a University Sustainability Report: Experiences from the University of Leeds

Rodrigo Lozano, Jordi Llobet and Gary Tideswell

Abstract During the last decade, an increasing number of higher education institutions (HEIs) have engaged in incorporating and institutionalizing sustainability into the university system, which includes curricula, research, operations, outreach, and assessment and reporting. This paper focuses on the assessment and reporting element, where a number of tools and guidelines have been devised. One of the best options available is the global reporting initiative (GRI) sustainability guidelines. However, the GRI guidelines were not developed for universities. To address this, the Graphical Assessment of Sustainability in Universities (GASU) tool was developed, which can also help to produce a more holistic report. This chapter presents the process undertaken to develop the first draft of the University of Leeds sustainability report. The purpose of this report was to: (1) to compile the required information, (2) to create the first draft of the sustainability report, and (3) to analyze the performance values from the information collected. The data was analyzed with an updated version of GASU. The results show that the University of Leeds out performs other universities that have published sustainability reports, in all of the dimensions and their averages. The report exercise revealed that when preparing a sustainability report it is important to have a holistic perspective, addressing the different interrelations between indicators, categories, and dimensions, as well as throughout the university system. In the process of preparing a report is it is important to have sufficient time and access for data collection, as well as engaging with stakeholders. A tool, such as GASU, allows the data

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_11,

collection and analysis to be more systematic. The results can be used to tackle those areas where the university could improve, with respect to sustainability, across its entire system, including curricular, research, operations, and outreach.

Keywords Sustainability reporting · Global reporting initiative (GRI) guidelines · Graphical Assessment of Sustainability in Universities (GASU) · University of Leeds

Introduction

During the last decade, an increasing number of higher education institutions (HEIs) have engaged in incorporating and institutionalizing sustainability into their curricula, research, operations, outreach, and assessment and reporting (Cortese 2003; Lozano 2006a), as well as collaborating with other universities; fostering transdisciplinarity; making SD an integral part of the institutional framework; creating on-campus life experiences; and 'Educating-the-Educators'(Lozano et al. 2013). This chapter focuses on the assessment and reporting element.

From the different tools and guidelines developed for sustainability reporting (see the comprehensive lists by Dalal-Clayton and Bass (2002) and Cole (2003)), the most widely used guidelines include: the ISO 14000 series; the social accountability 8,000 standard (SAI 2007); and the GRI Sustainability Guidelines (GRI 2006). In the particular case of universities Shriberg (2002), offers a comparison of the different guidelines developed, with examples such as the National Wildlife Federation's State of the Campus Environment, the Sustainability Assessment Questionnaire, Higher Education 21's Sustainability Indicators, and the Auditing Instrument for Sustainable Higher Education (AISHE).

Among the different guidelines, the global reporting initiative (GRI) sustainability guidelines offer one of the best options (Lozano 2006b; Morhardt et al. 2002). Over the last 10 years, or so, there has been an increase in published company sustainability reports based on the GRI (GRI 2009; Morhardt et al. 2002). However, the GRI guidelines were not developed for universities (Cole 2003; Lozano 2006b), and the number of universities publishing sustainability reports is still limited when compared to companies (see Lozano 2011).

This chapter provides an overview of the Graphical Assessment of Sustainability in Universities (GASU) tool, and the exercise of developing and analyzing (through indicator coverage and performance) the first draft of the sustainability report of the University of Leeds.

The Graphical Assessment of Sustainability in Universities (GASU) Tool

Lozano (2006b) modified the GRI Guidelines to include the core competence of universities, the Educational Dimension, to develop the graphical assessment of sustainability in universities (GASU) (Lozano 2006b). GASU provides a systemic and systematic way of assessing the available indicators, and their performance, which can then be used to prepare a sustainability report.

GASU has been used to analyze 12 universities (see Table 1) that have published GRI Sustainability Reports (Lozano 2011).

GASU 2006 was updated in 2011 to align it with the GRI G3 (2011), as well as adding Inter-linking issues and dimensions (Lozano and Huisingh 2011) to provide a more holistic coverage of sustainability issues and their interactions. Table 2 shows the GASU 2011 dimensions, with their categories and aspects.

The Inter-linking issues and dimensions include the following categories and indicators:

- Relations within the same dimension
  - Relations within the Economic Dimension
- RS1. Tuition fees and Income
  - Relations within the Environmental Dimension
- RS2. GHG emissions and Energy
- RS6. Transport and Emissions
  - Relations within the Social Dimension
- RS3. Employee training and development with Health and safety
- RS4. Volunteering and philanthropy and Communities
  - Relations within the Educational Dimension
- RS5. SD Research-led Teaching
- Relations to issues in another dimension
  - Relations between the Economic and Environmental dimensions
- RA1. Eco-efficiency and Earning
- RA2. Six Sigma and the Environment (This indicator does not apply in the university context.)
- RA9. Environmental accidents and Fines
- RA10. Purchasing and Environment
  - Relations between the Educational and Social dimensions
- RA11. Training and education and SD curriculum
- RA12. Training and education and SD research
- RA13. Training and education and SD administrative support

Table 1 Universities that have published full sustainability reports

Institution	Date of publication	Number of pages	Reference
University of Birmingham, UK	2008	18	University of Birmingham (2009)
University of Natural Resources and Applied Life Sciences (BOKU), Vienna, Austria[a]	2005	194	BOKU (2005)
University of British Columbia (UBC), Canada	2007	74	UBC (2007)
Florida University, USA	2009	63	Florida Universitària (2009)
Gothenburg University, Sweden	2009	34	Göteborgs universitet (2009)
University of Hong Kong, China	2007	24	Leuphana University (2007)
University of Leuphana, Lüneburg, Germany	2007	60	Rodriguez et al. (2002)
University of Michigan, USA	2002	415	University of Hong Kong (2007)
Pontífica Universidad Católica del Perú (PUCP), Perú[b]	2007	58	PUCP (2007)
University of Santiago de Compostela (USC), Spain[c]	2006	220	USC (2007)
Singapore Polytechnic, Singapore	2008	87	Singapore Polytechnic (2007)
Turku Polytechnic, Finland	2008	52	Turku Polytechnic (2008)

Source (Lozano 2011)

[a] BOKU published sustainability reports from 2005 to 2007 (GRI 2009)

[b] The PUCP report is only for the Science and Engineering Faculty

[c] USC published sustainability reports from 2004 to 2006 (GRI 2009)

- Relations between the Environmental and Social dimensions

- RA3. Communities and the Environment
- RA4. Communities and Biodiversity
- RA5. Employee training and Eco-efficiency
- RA6. Environment and Health and Safety
- RA7. Products (This indicator does not apply in the university context.)
- RA8. Water and Communities
- Relations among all dimensions
  - RT1. Accidents and remediation
  - RT2. Green buildings and Social Dimension

Table 2 Graphical assessment of sustainability in Universities (GASU 2011) dimensions and categories

	Category		Category
Profile	Strategy and analysis Organizational profile Report parameters Governance, commitments, and engagement Management approach and performance indicators	Social	Labor practices and decent work Human rights Society Product responsibility
Economic	Economic performance Market presence Indirect economic impacts	Educational	Curriculum Research Service
Environmental	Materials Energy Water Biodiversity Emissions, effluents, and waste Products and services Compliance Transport Overall	Interlinked issues and dimensions	Relations with same dimension Relations to issues in another dimension Relations among all dimensions

– RT3. Supply chain (This indicator does not apply to the University of Leeds context.
– RT4. Time dimension (The report provides the bases to explore past and current activities, and those planed for the future that are contributing to the Economic, Environmental, and Social dimensions, as well as how to connect them to the core competencies of the University: Education and Research.

The numbers of performance indicators in GASU 2011 are: 43 for the profile; 9 for the economic; 30 for the environmental 40; for the social part; 29 for the educational; and 23 for the Inter-linking issues and dimensions. The large number of indicators demands a large amount of resources to create a full report, and for its analysis.

The indicators are analyzed using the following GASU 2006 criteria codes (Lozano 2006b):

0. There is a total lack of information for the indicator, it is nonexistent, or the information was not found;
1. The information presented is of poor performance. This is given when there is some information, but it is too general or it has little detail or coverage;
2. The information presented is of regular or fair performance. This is assigned when the data covers around half of the issues in the indicator, or when there is good detail but it only covers some areas (for example for the curriculum category);
3. The information presented is considered to indicate good performance. This is given when there is not full detail, the information or coverage is not thorough, or a particular issue has not been addressed; and

4. The information indicates excellent performance. This is assigned when there is complete and detailed information for that particular indicator. It is also assigned for indicators that do not apply to the University or to the context.

GASU provides information about the percentage of indicators where information is available against the total number of indicators in each aspect, category and dimension, as well as for the entire report. GASU results are presented in 22 charts (with 2 divisions: indicator coverage; and indicator performance) in the following dimensions:

- **General chart** (performance with respect to Profile, Economic Dimension, Environmental Dimension, Social Dimension, Educational Dimensions, and Inter-linking issues and dimensions);
- **Profile**;
- **Economic Dimension**;
- **Environmental Dimension**;
- **Social Dimension (5 charts):** Overall, Labor Practices and Decent Work, Human Rights, Society, and Product Responsibility;
- **Educational Dimension**; and
- **Inter-linked issues and dimensions**.

GASU can help universities on the road to sustainability by making recommendations as to where the University should effect the changes needed to make its system more sustainability orientated. GASU can also facilitate comparisons of the University's efforts and achievements toward sustainability in different years, as well as benchmarking against other universities.

Developing the First Draft Sustainability Report for the University of Leeds Exercise

The University of Leeds has 33,002 students from over 142 countries—29,015 full time students, and 3,987 part time students. Of the 33,000 total, 25,000 are undergraduates and 8,000 are postgraduates. It offers 560 undergraduate degrees and 300 postgraduate degrees. The University has 7,645 staff from 97 different nationalities.

The University has a total income of £517.7 million, with a total expenditure of £505 million (University of Leeds 2010).

The first draft sustainability report was commissioned by this paper's third author and produced by Organisational Sustainability Ltd.

Data Collection

The paper's second author collected the information between March and July 2011, under the supervision of the first author. Most of the information gathered was for the academic year 2009–2010, although some information was only available from 2005 to 2006.

The first step in the data collection was to review the university's web pages to try to obtain as much available information as possible, as well as to understand the university's structure. Some information was obtained from statistical calculation from available databases, such as the SAP system and the Higher Education Statistics Agency (HESA 2011).

The second step was to locate the owner or person responsible for the information not available on the web pages, and to carry out face-to-face or phone interviews to acquire the data. Table 3 shows where the information for the different dimensions and categories was obtained from, whether through secondary or primary sources. The Profile and Economic Dimension data was collated mainly from secondary sources, such as the University's Annual Report and Accounts (University of Leeds 2010) and web pages. The indicators for the Environmental Dimension were mainly obtained through the Estate and Campus Support Services, with additional input for the Biodiversity indicators. The indicator for the Labor Practices and Decent Work category were acquired from people in different departments and schools. The information for the Society category was provided by Legal affairs. The Product Responsibility's information was obtained from University web pages. No information was found for the Human Rights category.

The Educational Dimension indicators were obtained through the Sustainability Tool for Assessing UNiversities' Curricula Holistically (STAUNCH®) (for details on STAUNCH® refer to Lozano 2010; Lozano and Peattie 2011) assessment the Faculty of Business, and the Faculty of Environment (Lozano and Young 2013). The assessment was done for 2,761 Bachelor and Postgraduate taught degrees during the academic year 2010–2011.

Once all the information was collated, it was triangulated to check for consistency and reliability; whenever there was a doubt, the individuals involved were contacted again.

The next step was to integrate the indicators to populate those for the Interlinking issues and dimensions, followed by the assessment of all the indicators.

Once these steps had been undertaken, a 102-page report was created, providing details for each GASU 2011 indicator, as well as a discussion on each dimension and the 22 graphs generated by GASU.

Table 3 Information location or provider for the indicators in each GASU (2011) dimension and category

Dimension	Category	Information location or provider for this report
Profile		University web pages
Economic		Annual account report and University web pages
Environment		Sustainability Development office (e.g., Environmental policy, Sustainable purchasing policy, Fair trade policy, Environmental co-ordinators, Environmental management systems (EMS), Energy management, and Transport policies)
Social	Labor practices and decent work	*Employment category:* Human Resources department, and Well-being and health and safety office *Labor/Management relations category:* Well-being and health and safety office and CUU web pages *Occupational Health and Safety category:* Health and Safety department, Human Resources department, and Occupational Health and Safety office *Training and Education category:* Staff and departmental development unit (SDDU), Health and Safety office *Diversity and Equal opportunities category:* Caroline in the Human Resources department, and University web pages
	Human rights	Currently not available
	Society	Legal advisor office
	Product responsibility	University web pages
Educational		STAUNCH® assessment
Inter-linking		Collated and developed by organizational sustainability

Methodology Caveats

One of the first challenges was to become familiar with the university's structure. Although universities tend to have similar systems, each has its own peculiarities of structure.

Some of the limitations in the data collection or analysis included: the information from the SAP software was input by different individuals with possibly different criteria and priorities. The information for the Product responsibility category was obtained from the National Student Survey (NSS), this might not be totally representative of the numbers per faculty, since some of the subject names are slightly different from those offered in the University faculties. Another limitation in the data collection was the limited time assigned to locate the data. Some of the information was not publicly available, or was not explicit in respect of the GASU indicators. This was particularly prevalent for indicators within the Human Rights and Society categories in the Social dimension. These two dimensions are covered by the U.K.'s laws and regulations, which apply to all types of organizations, including universities.

Two issues were particularly challenging: the information was scattered across different offices, departments, and centers; and there seemed to be no shared understanding within the University of sustainability, or how it could have been implemented more holistically throughout the university.

The sustainability report exercise was facilitated by their experience in sustainability reporting by this paper's first two authors, and the access provided by this paper's third author. Thus, having researchers who knew exactly which information they were looking for, and enabled by having the right access to it, this, despite the limited time and resources, permitted timely completion of the report.

Sustainability Report Exercise Results

This section presents the results for each of the dimensions in regards to indicator coverage and indicator performance. Illustrative graphs are provided for the Overall results, the Educational dimension, and the Inter-linking issues and dimensions.

Table 4 and Fig. 1 show that the indicators in the Profile were easily available (almost 80 % obtained), followed by those in the Economic, and Environmental dimensions (over 60 %). The ones in the Social and Educational dimensions were more difficult to obtain (less than 50 %). Those in the Inter-linking issues and dimensions were collated from other indicators.

Table 4 and Fig. 2 show that the performances of the Profile and Economic indicators are relatively high (around 60 %). The ones for the Environment and Inter-linking issues and dimensions are medium (around 40 %), those for the Social Dimension are low (almost 30 %), mainly due to the information from Human Rights and Society not being made explicit. The Educational Dimension tends to be quite low (less than 20 %), mainly due to the difficulty of obtaining information for the Research category. The SD incorporation in the curriculum category tends to be good (50 %) due to the STAUNCH® curriculum assessment exercise.

Table 4 Percentage of GASU 2011 indicators collated and their performance

Sustainability reporting dimension	Percentage of indicators collated (%)	Performance of the indicators collated (%)
Profile	76.74	61.05
Economic	66.67	57.41
Environment	63.33	40.67
Social	45.00	29.53
Educational	35.48	17.44
Inter-linking issues and dimensions	56.52	40.00
Total	**57.47**	**42.06**

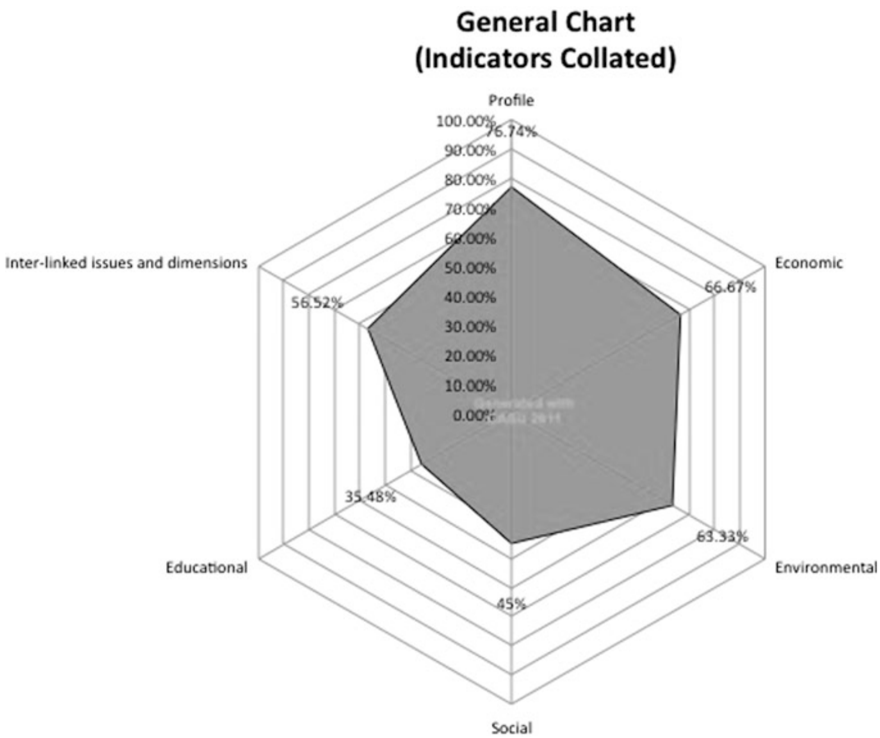

Fig. 1 Indicators collated analysis of all the dimensions of the sustainability report using GASU 2011

Discussion

The indicators for the Profile section were easy to obtain, and they had a relatively good performance. There seemed to be a need for improved co-ordination between the plans for operations (e.g., Environmental policy, Sustainable purchasing policy, Fair trade policy, Environmental co-ordinators, Environmental Management Systems (EMS), Energy management, and transport), and the Educational Dimension (more specifically a link to curriculum and research).

In general, Economic Dimension information was found in the Annual Report and Accounts (University of Leeds 2010), which resulted in the good performance of the Economic performance category.

There was considerable information for the Environmental Dimension. The information for the Transport category was excellent due to a transport survey. The data for the Biodiversity category performance could be better if the draft plans were implemented. Only direct energy (scope 1 and 2) is being considered, where the information was generally good. In the water category, the quantity of water used, discharged, and recycled should be calculated and specified. Within the

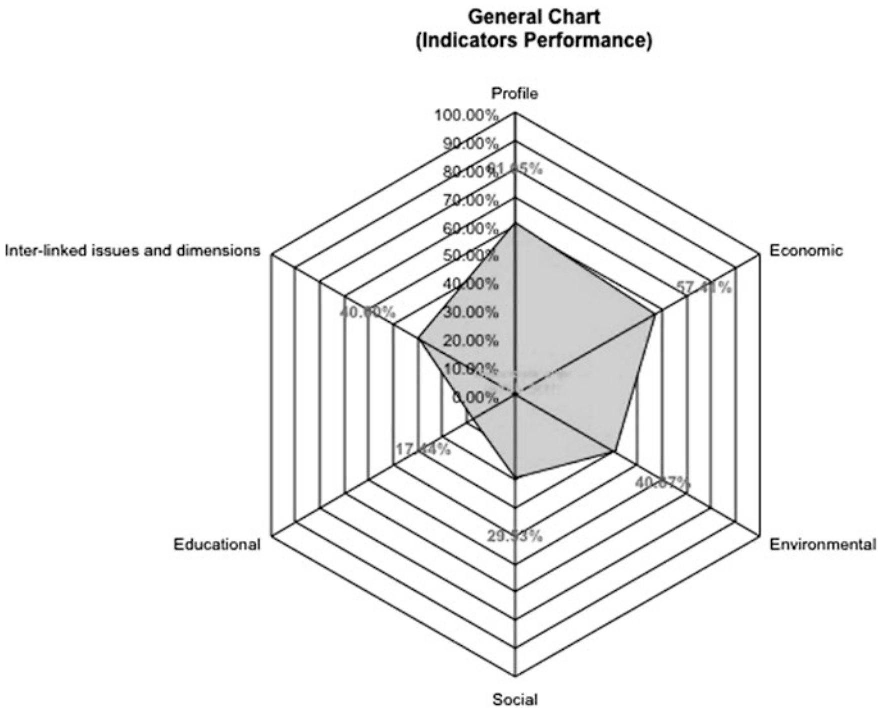

Fig. 2 Performance analysis of all the dimensions of the sustainability report using GASU 2011

emissions, effluents, and waste, the carbon management plan provides good information; however, it was still in the process of being executed. There was no information about emissions and effluents other than carbon, e.g., ozone depleting substances, NO_x, and SO_x. There was no current information available for the materials category, or for the total environmental protection expenditures and investment (in the Overall category). These data should be compiled.

The information for the Social Dimension was quite varied in its categories—for some categories it was easy to obtain, e.g., for the Labor Practices and Decent Work category. It should also be noted that there was no central co-ordination or management for information in this dimension. The Human Rights and Society categories tend to score low because the issues are not made explicit although this should not be a problem for a Western European University. The Product responsibility category was analyzed with the perspective that the University has a responsibility of service to its students. There seemed to be some information (e.g., for Customer health and safety, and for customer satisfaction); however, more explicit data on how incidents are dealt with could improve the category's performance.

Curricula assessment using the Sustainability Tool for Assessing UNiversities' Curricula Holistically (STAUNCH®) provided detailed information about SD incorporation into the curricula for two faculties (Business and Environment), if the assessment would have been done for the entire University, the performance would have been much better.

The fairly good percentage for the indicators collated and their performance in the Inter-linking issues and dimensions categories showed that the University was already tackling some issues holistically. These efforts should be recognized and encouraged, so that there is a better connection between the different dimensions, and improved interactions between operations, education, research, outreach, and assessment and reporting.

It was not possible to find information for some indicators; this was due to reasons such as the short time allocated for the project, information not being made explicit, difficulties finding or accessing data, compartmentalisation of information, and not having a common understanding of sustainability throughout the University.

Table 5 shows the comparison of the University of Leeds' report with the sustainability reports of 12 other universities that have published Sustainability Reports. It shows that the University of Leeds draft sustainability report had better performance values than the other universities in all the dimensions and their averages, except for the Educational Dimension, where UBC had the best performance.

The University of Leeds sustainability report was being used internally. If the sustainability report is to be made publicly available, a process of stakeholder identification has to take place, as well as the removal of any sensitive and/or confidential information.

Table 5 Results from the GASU analysis: the four higher education for sustainable development (HESD)'s dimensions

Institution	Economic (%)	Env. (%)	Social (%)	Educational (%)	Inter-linking (%)
Birmingham	7.95	7.22	3.54	3.92	NA[a]
BOKU	11.93	28.89	10.63	3.92	NA[a]
UBC	13.07	32.78	5.78	22.29	NA[a]
Florida	27.84	5.00	7.46	0.00	NA[a]
Gothenburg	11.93	10.00	12.69	3.01	NA[a]
Hong Kong	9.09	28.89	2.99	0.00	NA[a]
Leuphana	15.90	10.00	8.02	6.63	NA[a]
Michigan	25.00	20.50	11.75	17.47	NA[a]
PUCP	4.55	6.67	1.49	0.00	NA[a]
USC	15.91	30.00	22.57	11.75	NA[a]
Singapore	0.00	17.78	8.40	13.25	NA[a]
Turku	26.14	26.67	18.66	8.73	NA[a]
Leeds	57.41	40.67	29.31	17.44	40.00
Averages	17.44	20.39	11.02	8.40	–

The maximum score attainable in each dimension is 100 %

[a] *NA* Not available, since these indicators are not explicitly considered in the reports source; adapted from (Lozano 2011)

Conclusions

Universities are increasingly recognizing their role in helping societies become more sustainable. Sustainability reporting can help to assess and communicate the university's efforts more systematically to its stakeholders. Although some universities have engaged in this process, the number of universities worldwide publishing sustainability reports is still small compared to the number of company reports.

This chapter presents the process of developing the first draft sustainability report for the University of Leeds, where the key challenges faced were the limited amount of time allocated for data collection, the compartmentalisation of the data, and the lack of a common understanding of the sustainability concept (although it is being used in different university policies).

The results in the Educational dimension can be highly improved by performing an assessment of all the curricula throughout the university. The results from the Inter-linking issues and dimensions show that even if the information is compartmentalized, it is possible to find indicators that relate to others in other dimensions. Thus, confirming that sustainability is holistic and integrative, i.e., it is as much about the issues as it is about indicators, categories, and dimensions.

Using a tool such as GASU allows the data collection and analysis to be more systemic and systematic. The tool can help universities on the road toward sustainability by making recommendations as to where the University should effect the changes needed to make its system more sustainability orientated. GASU can also facilitate comparisons of the University's efforts and achievements toward sustainability in different years, as well as benchmarking against other universities. It can also help practitioners in preparing a sustainability report.

In the process of preparing the report it is important to have sufficient time and access for data collection, as well as engaging with stakeholders (such as support staff, managers, academics, and students). The exercise should be done and updated periodically, for example, through an interactive webpage where the information can be made available at any and all times.

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A Whole Sector Approach: Education for Sustainable Development and Global Citizenship in Wales

Alison Glover and Carl Peters

Abstract The Welsh Government aims to ensure sustainable development as a central organizing principle for organizations. Strategies from the Welsh Government provide Welsh higher education institutions with support and structure to embed education for sustainable development and global citizenship across all activities. The Welsh Government has funded a sector wide review of environmental management systems and energy efficiency improvements at Welsh higher education institutions. Following an audit of all higher education curricula for education for sustainable development and global citizenship content a potential baselining tool has been developed and piloted. In order to assist implementation of this tool a Sustainability Maturity Model has been created based on a capability maturity model project management tool. The Sustainability Maturity Model illustrates the processes which are vital in the maturing of sustainability at an institutional level. The model uses commitment and leadership, teaching and learning, institutional management, partnerships, and research and monitoring to structure the elements that need to be considered and addressed within an institution to initiate and mobilize change in education for sustainable development and global citizenship. Offering a strategic overview for managers in higher education institutions this is a practically useful tool for higher education internationally.

Keywords Baselining · Education for sustainable development · Global citizenship · Maturity model

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_12,

Introduction

Higher education performs a vital role in preparing the leaders, designers, and teachers of tomorrow to fully participate in society and future decision making at the local and global level. There is opportunity for universities to lead the way in modeling sustainability as institutions ‘are significant leverage points which both reflect and inform social mindsets’ (Cortese 1999, p. 6). Many have emphasized the importance of higher education delivering the sustainability agenda (Orr 1994; Alabaster and Blair 1996; Moore 2005; Gough and Scott 2007). However, criticism that higher education is ‘failing society by producing leaders incapable of addressing our most pressing problems’ has also been suggested (Martin and Jucker 2003, p. 3). It is vital higher education provides ‘graduates with the attitude, knowledge and skills to lead this process (sustainable development), while also developing and delivering the knowledge to support research on sustainable development’ (Jansen 2009, p. 55). The World Commission on Environment and Development provided a widely applied definition of sustainable development as ‘development that meets the needs of the present without compromising the ability of future generations to meet their own needs’ (WCED 1987, p. 43). The Welsh Government promotes the ‘goal of sustainable development is to “enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations”.’ (Welsh Assembly Government 2009a, p. 8). The United Nations drives the sustainability agenda endorsing the vital role of universities. ‘They can model sustainable practices as they engage in research and teaching. They cannot afford to be disinterested, detached observers, but must bring their resources to bear on the search for sustainable development solutions’ (UNESCO 2008, p. 33).

However, if sustainable development is to be addressed successfully across higher education relevant ‘structural programmes’ such as campus greening and sustainability research need to exist (Leal Filho 2011, p. 437). It has also been argued that drive from government has little influence on change with more awareness generated via increased ‘public interest in the environmental agenda’ (Sterling and Scott 2008, p. 389). However, others have stated that lack of government policies referring to formalization of rules to reinforce sustainable attitudes and behavior could be of hindrance to effective sustainability actions (Kurland 2011, p. 417).

The devolved Government for Wales has been responsible for education and training policies since 1999. A result of this has been strategies addressing Education for Sustainable Development and Global Citizenship across all education sectors. The Welsh Government adopts the terminology ‘Education for Sustainable Development and Global Citizenship’ (ESDGC) highlighting citizenship alongside environmental issues, focusing on the development of ‘people’s skills to take action that improves our quality of life now and for future generations’, (Welsh Government 2012a). Figure 1 presents important dates for ESDGC in Wales.

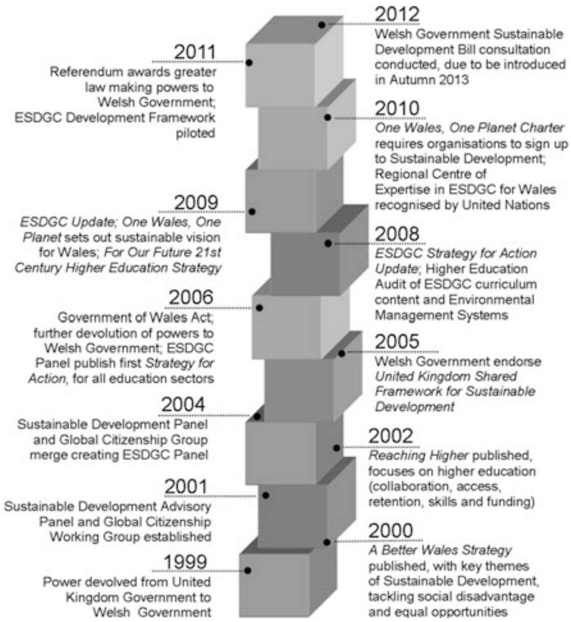

Fig. 1 Important dates for the Welsh ESDGC agenda (updated from Diniz and Glover 2010, p. 65)

A major proposition from the Welsh Government has been for all organizations in Wales to incorporate sustainability as a central organizing principle (Welsh Assembly Government 2009a). The significant role of students and staff in implementing effective sustainability actions has been recognized and the sharing of progress and achievements viewed as important (Clugston 1999; Leal Filho 2000; Locke et al. 2009). Nevertheless successful implementation of sustainability actions needs 'support, vision, and involvement throughout the top, middle, and bottom' (Brinkhurst et al. 2011, p. 351). In Wales the drive from the government level has initiated progress. This research aimed to establish the impact of such government drive and resulted in the development of the Sustainability Maturity Model to support the maturing of sustainability in higher education. A maturity model is relevant as it involves 'step change' processes conducted by an organization moving through levels of maturity. Versions of 'sustainability maturity models' have been developed for business (Baumgartner and Ebner 2010; Cagnin et al. 2011; Fair Ridge Group 2011). These models utilize five levels, however, content needs interpreting for it to 'fit' the higher education sector. For example Fair Ridge Group apply six 'dimensions'; strategy, organization, process, measurement, people, and marketing (Fair Ridge Group 2011). Therefore, generating a model specific to the higher education sector was deemed worthwhile.

Methods

The Welsh Government and Higher Education Funding Council for Wales expect strategic plans and updates to outline clear priorities and strategy. The strategic plans are submitted annually and aim to allow institutions to include their direction and progress towards Welsh Government social and environmental priorities. Document analysis of strategic plans from all Welsh higher education institutions offered a means of identifying areas of interest and changes over time, including the significance of ESDGC at institutions. Three years of strategic plans from the ten higher education institutions in Wales were coded using Computer-Assisted Qualitative Data Analysis Software to manage the large quantities of text. Literature and Government documents also provided detail regarding education for sustainable development in higher education; this is expanded upon later. Interviews and good practice studies also complemented data collection. This qualitative methodology provided a systemic and deeper investigation, culminating in 'valuable explanations of processes' (Marshall and Rossman 2010, p. 11) and captured the process of interpretation (Maykut and Morehouse 1995, p. 18). The Capability Maturity Model developed for the software industry (Paulk et al. 1993) was adapted to provide specific guidance for higher education. A partial grounded theory approach supported the generation of new knowledge, informing elements of the Sustainability Maturity Model. Existing priorities identified during the document analysis provided justification and content for processes to be incorporated within the Sustainability Maturity Model as this is believed to result in a more effective adoption of ideas and better progress rather than introducing something totally new (Collins and Porras 1996). Guidelines from the Capability Maturity Model (Paulk et al. 1993) were modified to target the ESDGC agenda.

Welsh Universities and ESDGC

Some of the actions identified in *ESDGC Strategy for Action* (Welsh Assembly Government 2006) included the allocation of government funds to analyze good practice (SQW Consulting 2009), implement environmental management systems and an audit of the curricula for sustainability content. The Higher Education Funding Council for Wales allocated £3.8 million across the sector to install integrated systems of sub-metering to enable monitoring and targeting of 90 % of the energy and water consumption (Higher Education Funding Council for Wales 2007). Some of the funding was also used to finance improvements to energy and water efficiency. Each of the ten higher education institutions in Wales was also allocated £22 500 to audit their environmental management system and curricula (Higher Education Funding Council for Wales 2008).

The 2008 audit of the curricula utilized the STAUNCH© (Sustainability Tool for Auditing University Curricula in Higher Education) software, developed by

Rodrigo Lozano. Lozano (2009) agreed with others (Clugston and Calder 1999; Scott and Gough 2004; Tilbury 2004; Locke et al. 2009) that many higher education institutions worldwide were incorporating sustainability into research, buildings, operations, and outreach activities. However, many struggled to integrate sustainability into curricula. The data required for the curricula audit was collected from the aims and descriptions of modules (Lozano 2008; Glover et al. 2011). STAUNCH© acknowledged the balance of environmental, social, and economic elements which a holistic sustainability curricula demands. In order to grade modules for ESDGC content 36 criteria were used to evaluate the balance and strength of course content, examples of criteria include diversity, health, biodiversity, resource use, holistic thinking, human rights and long-term thinking. Scores of left blank, one, two, or three were inputted for each criterion for each module with the software providing a summary of the ESDGC balance and strength of content for each program of study (Lozano and Peattie 2011).

An audit of curricula at the University of Gävle, Sweden raised the profile of sustainability (Sammalisto and Lindhqvist 2008). This reinforced Wright's comments that monitoring is essential (Wright 2004, p. 17). Therefore, in instigating an audit of curricula content for ESDGC across Welsh universities the Welsh Government, via the funding council, was driving the agenda, raising its profile and also aiming to possibly develop a baseline for future progress. Outcomes from the audit have been summarized by the Higher Education Academy (2009), with Glover et al. (2011) and Lozano and Peattie (2011) recounting institutional experiences of the process. The Higher Education Academy also supports the profile of ESDGC in Welsh universities. It convenes an ESDGC group with representatives from each institution along with other interested stakeholders. The group supported the environmental management systems initiative, the curricula audit, successful UNESCO recognition of a Regional Center of Expertise in ESDGC for Wales, shares good practice initiatives and has published a *Common Understanding of ESDGC* (Higher Education Academy 2010) for the higher education sector.

Following the potential of the curricula audit to provide a baseline for universities the Higher Education Funding Council for Wales commissioned two Welsh higher education institutions to develop and pilot a baselining tool to aid the process of measuring ESDGC. The intention was to provide a comprehensive picture of ESDGC within institutions, determine how progress in mainstreaming ESDGC could be measured, identify potential difficulties, and whether the proposed approach could be integrated into existing reporting (Higher Education Funding Council for Wales 2012). As the Welsh Government had already initiated the *ESDGC Strategy for Action* (2006), along with its updates (2008 and 2009b), to ensure consistency, existing terminology, and structure were applied. The structure for the baselining tool used the five 'common institutional areas' from the *ESDGC Strategy for Action* (Welsh Assembly Government 2006, p. 3);

- **Commitment and leadership—**guiding strategic planning, managing capital programs, and leading institutions' interactions with external partners and stakeholders.
- **Teaching and learning—**curricula, pedagogy and experience, and continuing professional development for practitioners.
- **Institutional management—**whole institution approach, ensuring day-to-day activity and long-term sustainability are integrated.
- **Partnerships—**developments need to build on existing partnerships and share with others the range of skills, values, and attitudes for ESDGC.
- **Research and monitoring—**support for basic and applied research with information integrated across disciplines.

The outcome was an EXCEL spreadsheet to record evidence within each of the common institutional areas, with support provided to guide the collection of evidence and questions offering possibilities for continuous improvement and future progress (Glover et al. 2013). The adoption of this approach validated the exercise as 'several authoritative documents recognize that sustainable development is a journey and not just a destination' (Mulà and Tilbury 2011, p. 8). Throughout the process of conducting the curricula audit and piloting the base-lining tool it became apparent that staff and students were keen to address the ESDGC agenda but support was required (Glover et al. 2013). It was decided that 'small steps' toward achievement are more realistic and adapting the Capability Maturity Model project management tool should be explored.

The Capability Maturity Model

The Role of Change Management

If the transition to sustainability in higher education institutions is to be effective successful change management is required as universities sustainably develop, while simultaneously adjusting assumptions and paradigms upon which they are established (Van Weenen 2000). Doppelt (2003) comments that two core steering mechanisms require change; the governance system and skilled leadership if an organization's culture is to be transformed.

The role of project management has gained momentum over the past 25 years, shifting from solely acceptable within engineering and information technology, businesses that were deemed prime to employ the tools of project management, to becoming accepted across all organizations (Kerzner 2009, p. 51). Kerzner (2009) provides an outline of the evolution of project management over the years, with systems such as 'Life-Cycle Costing' (1994), 'Capacity Planning Models' (2004), and 'Lean Project Teams' (2007) demonstrating additions to the field (Kerzner 2009, p. 52). Harold Kerzner also qualifies his position in concluding that all organizations would appreciate the role of such systems and those that achieve excellence are aware of the importance of 'successful implementation and execution of processes and methodologies' (Kerzner 2009, p. 54).

Others also explore the change process within organizations, acknowledging the importance of diagnosing where an organization is positioned, developing strategies and policies to move toward aspired goals and managing the implementation of these into real change (Hayes 2007, p. 82). Kotter's eight steps focus on actions required to drive the change transforming an organization (Kotter 1998, p. 7). Some specifically target change agents for sustainability with recommendations promoting collaboration, transdisciplinarity, and integrating planning and decision making (Moore 2005). Others focus specifically on addressing the curriculum challenge for sustainability, for example Rusinko (2009) proposes adopting a generic strategy to integrate sustainability.

Overview of the Capability Maturity Model

The Capability Maturity Model (Paulk et al. 1993) is a process management tool from software production and applied in many business and industrial sectors. The model consists of five levels of capability for organizations to work through as they strive to become more mature, with each level demonstrating organizational achievements, as highlighted in Fig. 2.

The characteristics of each level are:

Level 1 Initial, ad hoc, maybe chaotic operations with few defined processes performed and reliant on individual effort.

Level 2 Repeatable, basic management established to track resources and costs, earlier successful operations are repeated and failures discarded.

Level 3 Defined, more documentation and standardization of activities adhering to the organization's procedures and guidelines.

Level 4 Managed, quantitative controls established.

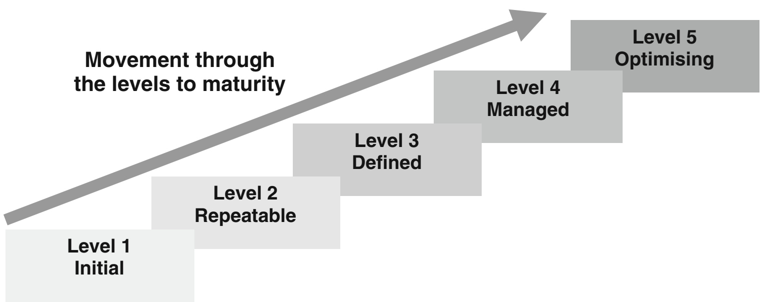

Fig. 2 The five levels of the capability maturity model (Glover 2012)

Level 5 Optimizing, quantitative feedback allows for continuous improvement and ongoing piloting of new initiatives.

(Adapted from Ginsberg and Quinn 1995, p. 46)

In order to advance through the five levels 'process areas' requires 'specific' and 'generic' 'goals' and 'practices' to be successfully achieved. Ultimately risk reduces as predictability increases.

Although goals form part of the structure of the maturity model, it is processes that drive management and institutionalization in an organization and this is believed key to embedding initiatives effectively. While change management, via the application of project management tools is important it is the management of the processes that can lead to more significant behavioral change (Crawford 2010). This approach is supported by research that maintains a move away from a focus on the product created, and instead adds value and develops reflective practitioners (Winter et al. 2006). With the Capability Maturity Model based on 'many small steps rather than earth shattering innovations' achieving progress through the different levels of maturity is more likely to be accomplished (Parrish 2003, p. 3).

To adapt the Capability Maturity Model to ESDGC in higher education appropriate information informed the processes, Fig. 3 illustrates this. Information was derived from strategic plans from all Welsh higher education institutions, government and funding council documentation, research literature and the higher education context, reflecting the appropriateness of adapting existing practices rather than introducing new ones (Collins and Porras 1996). The Capability Maturity Model has been modified many times to address specific business models or industry contexts (Brookes and Clark 2009), demonstrating adaptability and flexibility in application. This reflects the emergence of a broader application of

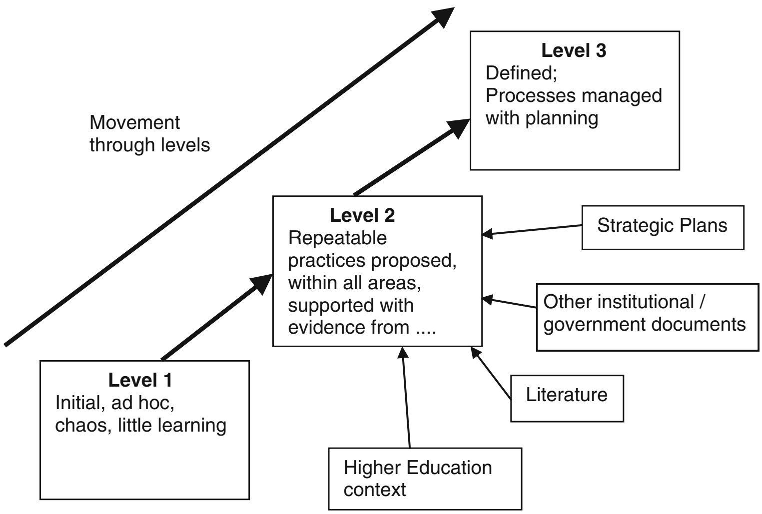

Fig. 3 Inputs that informed the sustainability maturity model for higher education

such tools, as other disciplines realize their potential (Söderlund 2004). Easy modification of a model to enable a clear understanding by people in an institution is vital (Adomssent et al. 2007). Therefore, by taking a tool from a specific arena and modifying it to fit a new role can prove successful.

Some perceive the Capability Maturity Model as lengthy, complicated, and with ‘dense’ guidelines (Bamberger 1997, p. 112). Bamberger recognized the significance of successful application of the Capability Maturity Model, being its flexibility in being ‘interpreted, tailored, and applied within the culture and context of each unique organization’ (Bamberger 1997, p. 113). It is this assumption that allowed adaptation of the model, with some degree of freedom in interpretation, supported by the acknowledgement that it is the ‘essence’ of the Capability Maturity Model and the benefits it can bring that are important.

The provision of ‘guidelines’ as opposed to ‘requirements’ provides flexibility in implementation and the stability and visibility that results from repeating and defining processes means more personnel are involved and success is more likely (Bamberger 1997, p. 113). Parrish also comments that tailoring the model to fit an organization as opposed to tailoring the organization to fit the model results in success, and this provides confidence to adapt the Capability Maturity Model to the higher education arena (Parrish 2003, p. 8). As the Welsh higher education sector was the focus existing Welsh Government terminology was used to structure the model; commitment and leadership, teaching and learning, institutional management, partnerships, and research and monitoring as personnel required to implement change would be familiar with the language.

Innovating the Sustainability Maturity Model

To ensure a manageable and focused outcome to stimulate change in higher education, goals and process requirements for Levels 2 and 3 for Welsh universities have been developed. In creating guidance for processes required for these levels it is anticipated that the majority of the Welsh higher education sector is catered for as it has been suggested this is where most organizations are positioned (Grant and Pennypacker 2006). Conceptualizing requirements and expectations for Levels 4 and 5 was also attempted (Glover 2012). Level 2 begins to manage processes and some institutions would be driving to perform at the defined Level 3, important in establishing effective mainstreaming of ESDGC.

As discussed previously the language and structure of the existing Welsh Government ESDGC agenda has been adopted. Other initiatives helped to inform its content, including the People and Planet (a student action group) Green League Table criteria and Green Gown Awards categories (The Environmental Association for Universities and Colleges recognition of sustainability initiatives). However, due to the high profile of the Welsh Government’s approach to ESDGC the ‘common institutional areas’ (Welsh Assembly Government 2006, p. 3) informed the Key Process Areas for the model. These provided the first level of organization

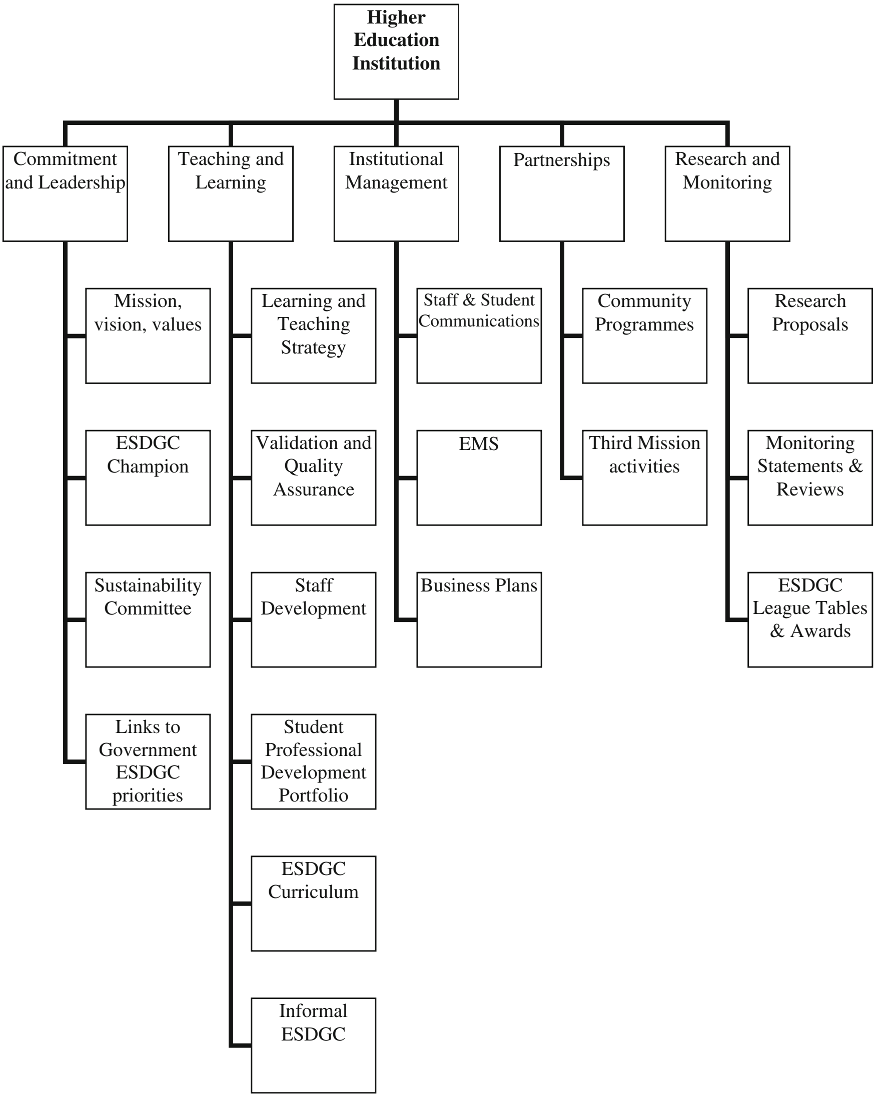

Fig. 4 Structure of the sustainability maturity model for higher education

for the ESDGC Development Framework, created for baselining ESDGC across Welsh universities. Therefore, consistency exists in advancing effective ESDGC in Welsh higher education. Figure 4 presents the five common institutional areas (Key Process Areas) with the second level of organization added (specific practices).

To construct the content of the Sustainability Maturity Model document analysis of three years of strategic plans from the ten Welsh higher education institutions was undertaken. Welsh Government documentation and related literature were also explored identifying key priorities and practices relevant to progressing sustainability (Glover 2012). The necessary steps were identified for the Sustainability Maturity Model, identifying actions needed by institutions to mature, adapting the Capability Maturity Model specifications (CMMI Production Team 2001) to sustainability. Thus, the model aims to be of practical use as actions to increase a higher education institution's level of maturity are identified (Brookes and Clark 2009).

The practices proposed within each Key Process Area lead toward the achievement of goals. Following processes (subpractices) is vital to any movement toward maturity and institutionalization of the specific practices. For Level 2, for instance, supporting policies and training are engrained within the structure of the institution, which means processes come into force even during a crisis. For Level 3 the institutionalization of the processes results in demonstrating a commitment and ability to perform the activities and they can be measured, analyzed, and verified while being implemented. Although there are quantifiable indicators required to measure success, this does not always need to be the case and the underlying ethos in developing the Sustainability Maturity Model was to facilitate the processes/practices that could assist effective ESDGC performance. Figure 5 focuses on the Institutional Management Key Process Area, listing sub-practices contained within each specific practice. Table 1 expands the sub-practices for staff and student communications, similar guidelines have been generated for all sub-practices (Glover 2012).

Discussion

There were several reasons behind the instigation of this project, from the importance of the United Nations Decade of Education for Sustainable Development and ongoing Climate Change Conferences driving intentions on the world stage, to the high profile of sustainable development within the Welsh Government. The vital role higher education has to perform in providing future leaders, teachers and entrepreneurs is substantial and has long been advocated (Orr 1994; Alabaster and Blair 1996; Cortese 2003). As previously discussed the maturity models existing for business lacked specific focus for the higher education sector. Others have proposed models to reflect the process of effective sustainability within higher education. For example Sterling (2004) suggested institutions would go through four levels of change when reacting to education for sustainable development; no change, accommodation (adapting and maintaining), reformation (critically reflecting and adapting), and transformation (creative revisioning) (Sterling 2004, p. 78). The Higher Education Funding Council for England also proposed that institutions could be located at one of four stages; grass roots enthusiasts, early adopters, getting really serious or full commitment (Higher Education Funding Council for England 2008, p. 61). Jabbour also proposed 'evolutionary stages of greening' directed at business schools but transferable to

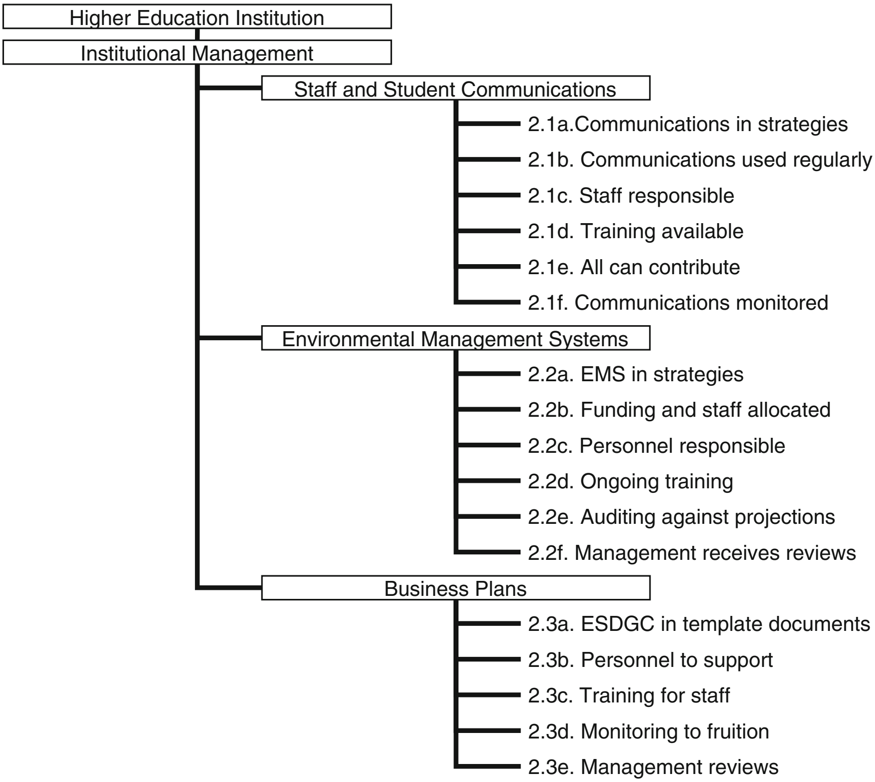

Fig. 5 Sub-practices for each specific practice in institutional management (key process area) for the sustainability maturity model

Table 1 Specific practice 2.1, staff and student communications sub-practices, guidelines expanded from Fig. 5 text

2.1	Effective staff and student communications for ESDGC are managed
a	Approaches and methods of staff and student communications included within organizational strategies
b	Appropriate methods of communications utilized regularly
c	Identified personnel have direct responsibility to communicate ESDGC information to staff, students, and wider community
d	Appropriate training available for website dissemination of information or newsletter publication, clear links with marketing department exist
e	Opportunity exists for all to contribute to the ESDGC information communicated
f	Monitoring of communications used to ensure engagement with ESDGC and higher level management informed of methods and uptake

whole institutions; counterproductive, fragile contributor stage, potential contributor stage and effective contributor stage (Jabbour 2010, p. 57). Suggesting an integrated model for the creation, diffusion and adoption of environmental management knowledge Jabbour dissects the complexity within a business school (Jabbour 2010, p. 53).

Several others have focused on evaluating existing assessment tools that provide an indication of the effectiveness of sustainability actions for higher education institutions (Shriberg 2004; Lozano 2006; Yarime and Tanaka 2012). Recent recommendations following extensive research at the University of Michigan promoted the development of indicators to assess and monitor 'a campus culture of sustainability' (Levy and Marans 2012, p. 373). However, as Gardiner and Lacy highlight monitoring of social responsibility within organizations must be appropriate to the specific organization, ask the right questions and motivate continual reflection (Gardiner and Lacy 2005, p. 183). The successful adaptation of the capability maturity model to other business and industry contexts demonstrates its suitability for further applications (Bamberger 1997; Brooks and Clark 2009). Although several useful models have been identified above, the small step changes to processes undertaken within an organization proposed by the structure of the Sustainability Maturity Model aims to provide clear guidance for all personnel resulting in the embedding of ESDGC effectively.

Conclusions

This research analyzed themes and priorities for Welsh higher education institutions, as presented in their strategic plans. The influence of the Welsh Government and Higher Education Funding Council for Wales were dominant in the configuration of the plans. This illustrates the importance of the 'small nation' and the sense of cultural identity, contributing to cohesion within the citizenship agenda. This supported opinion that promoted the value of addressing sustainability issues within a coherent arena (SQW Consulting 2009, p. 45; Welsh Assembly Government 2009a, p. 4). Although some have criticized lack of investment in this area (Tilbury 2004; Brown 2010), in this instance investment from the Welsh Government is supporting progress. It is accepted that effective ESDGC can be instigated from the 'top-down' or the 'bottom-up'. Although there is a place for all types of initiatives to address ESDGC issues, it is recognized that drive from the top is required to support possible success (Doppelt 2003; Dawe et al. 2005; Brinkhurst et al. 2011).

With clear constitutional requirements for sustainable development from the Welsh Government (Office of Public Sector Information 2006) and the drive for higher education to be at the forefront of reaffirming its role in contributing to a sustainable future (Cullingford 2004; NEF 2008), this research aimed to provide insight and outcomes to inform not only the higher education sector but the wider community. Adherence to Welsh Government priorities in strategic plans aligned with the significance of strong leadership. However, there is the risk that if such drive is withdrawn the lack of support from government and senior management could result in a slowing or even a halt in embedding ESDGC. It is acknowledged that as the Welsh Government prioritises economic development, in a drive to create jobs along with amended directives regarding the higher education sector, resources, and drive are still required to assist higher education to mainstream ESDGC. The Welsh Government is currently drafting a Sustainable Development Bill, aiming to place a duty on Welsh public bodies to embed sustainable development (Welsh Government 2012b).

A preference from Welsh universities to promote successful and not so successful league tables, rankings, or prestigious accolades emerged from the document analysis and demonstrated an aspiration to promote achievements and an acceptance of measures to indicate progress. This supports the adoption and application of the Sustainability Maturity Model. Nevertheless, it is recognized that the ESDGC agenda in higher education is competing for priority alongside issues such as fees, recruitment, employability, funding applications, financial sustainability, and the merging of institutions. A major challenge in driving the ESDGC agenda is embedding the idea these issues facing universities are encompassed within ESDGC.

Challenges to arise while conducting this research included incorporating priority changes from the Welsh Government as they emerged to keep research as up to date as possible and defining a cut-off point for the analysis of documentation, as new strategies and policies continue to be published. The capacity and effectiveness of utilizing Computer-Assisted Qualitative Data Analysis Software proved invaluable ensuring efficient management and retrieval of text as and when required, with the software also providing useful summaries for required themes allowing for thorough examination of documents. An underpinning ethos throughout the generation of the Sustainability Maturity Model was to provide an accessible format for staff, not necessarily familiar with the ESDGC agenda, so that 'step change' would be manageable and assisted via processes in place which continue to evolve and embed within the fabric of the university. The generation of the Sustainability Maturity Model was informed by existing practices, meaning it contains familiar terms and expectations. Continuity with existing Welsh Government terminology means a more holistic systemic approach is ensured across Wales. The implications of this are very much dependent upon further progress if the 'small nation' is to demonstrate methods of mainstreaming ESDGC not only across higher education but throughout the nation, and at this stage continual drive from the Welsh Government is vital.

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Integration of Operational and Academic Efforts in Sustainability at the University of British Columbia

Alberto Cayuela, John B. Robinson, Ann Campbell, Nicholas Coops and Alison Munro

Abstract Sustainability is a growing priority for higher education institutions around the world. Many universities are responding to global imperatives by committing to strong operational sustainability goals and targets. Similarly, many universities are realigning their resources and redefining their academic priorities to respond to the need to prepare students to understand and address sustainability challenges. Yet few post-secondary institutions have identified the need to deeply integrate academic and operational sustainability as a prerequisite for permanent positive change toward sustainability on campuses and beyond. At the University

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_13,

of British Columbia (UBC), the integration of operational and academic sustainability has catalyzed the development of an aggressive portfolio of programs and activities that aim to transform the University into a test-bed for sustainability and an agent of change in the wider community. However, while the specific actions and projects described herein represent a tangible manifestation of UBC's intent, the most important change taking place at UBC lies at the level of institutional culture around sustainability. From this perspective, the cross-fertilization of academic and operational cultures becomes an indispensable armature on which the more specific actions rest. This chapter reviews the UBC Sustainability Academic Strategy (SAS) process that led to the creation of the UBC Sustainability Initiative (USI), with a mandate to integrate academic and operational sustainability campus-wide and to act as a clearinghouse for sustainability programs and activities. Special emphasis is placed on a critical review of the USI's most ambitious sustainability implementation strategies deployed and the resulting challenges. Potential solutions to these challenges are hypothesized before concluding remarks concerning the process of institutionalizing deep and lasting transformative change. The general intent is that this synthesis be of value to higher education institutions considering how they might deepen their commitment to sustainability.

Sustainability and the Role of the University

At UBC, sustainability is viewed as a societal imperative and a topic of growing interest to students, faculty, staff, and partners in the community. UBC has adopted a view of sustainability that sees it not as a prescribed set of outcomes but, rather, as the emergent property of a societal conversation about what kind of world people want to live in, informed by some understanding of the ecological, social, and economic consequences of different courses of action. It is thus a highly normative and political concept, though deeply informed by scholarship on, and scientific understanding of, the interaction of human societies and the environment around them.

Universities can be a major locus for discussion and debate on all aspects of sustainability (Cortese 2003), including resource conservation, habitat preservation, climate change, social equity and justice, livelihoods and community, and economic viability, and resiliency. Universities are also strongly connected locally and globally to civil society, business, and government and can thus become brokers for sustainability within and beyond the communities to which they belong (Lozano et al. 2013; Thomas 2009).

Sustainability Academic Strategy Context

Over the past 15 years, four significant factors have been critical for UBC to build the stock of authoritative and material resources that support the idea of pursuing sustainability practices at the campus scale, thus setting the groundwork for advancing UBC's discourse on both academic and operational sustainability.

The first factor is UBC's track record in both operational and academic sustainability. In 1997, UBC was the first university in Canada to adopt a sustainable development policy and, a year later, to open a campus sustainability office. UBC was also a pioneer in the development of green buildings, starting with the Choi Center in 1996, and most recently in 2011, the Center for Interactive Research on Sustainability. In 2003, UBC completed EcoTREK, the largest energy and water retrofit program on a Canadian university campus. Through EcoTREK, UBC achieved a 27 % reduction of non-renewable energy consumption in institutional buildings from 2000 levels, and a 48 % reduction in potable water use. In the mid-1990s, UBC developed a teaching-based Greening the Campus program that linked students, faculty, and staff on sustainability projects and in 2008, UBC implemented an external review of its core research and teaching programs which concluded that sustainability research and teaching is a major area of strength and key academic priority for UBC. Reflecting this operational and academic track record, in August 2011, UBC received a gold rating through STARS (Sustainability Tracking, Assessment, and Rating System), a sustainability evaluation tool developed by the Association for the Advancement of Sustainability in Higher Education (AASHE).

The second critical factor is the provincial policy context. In 2008, the Province of British Columbia became the first North American jurisdiction to enact comprehensive climate action legislation. In addition to an escalating carbon tax regime (currently valued at \$30 Canadian dollars per ton of CO_2 emitted), the Province mandated that all publicly funded institutions in the province must become carbon neutral by 2010, and required that all scope 1 and 2 emissions must be offset by buying offsets from the province at \$25 ton^{-1}. To that effect it founded the Pacific Carbon Trust, designed to collect funds generated through these mandatory carbon offsets with the purpose of reinvesting them in green projects and initiatives in BC. As a public institution in BC, UBC is required to maintain an inventory of its greenhouse gas (GHG) emissions, pay the carbon tax, demonstrate how emissions are being reduced, and offset any remaining GHG emissions. UBC's Vancouver campus is responsible for roughly 60,000 tons of CO_2 per year (scope 1 and 2 emissions), 90 % of which come from UBC's district energy system based on medium-pressure steam generated by natural-gas-fired boilers. UBC's annual carbon tax and mandatory offset liabilities amount to \$3 million Canadian dollars per year, a strong financial incentive to wean UBC off fossil fuels and invest in greener and more efficient technologies.

The third critical factor is leadership. In 2009, UBC developed a new strategic plan, entitled Place and Promise, which expresses a commitment to create "an exceptional learning environment" that "advances a civil and sustainable society" (University of British Columbia 2009). Place and Promise has nine mid-level strategies of which sustainability is one. UBC's current President, Professor Stephen Toope, and his executive team are fully invested in sustainability, to the point that it is now a consideration in every key campus infrastructure and operational decision made on campus.

The fourth and final contextual factor is the existence of a strong societal and cultural interest in sustainability in British Columbia. For example, over the past decade, UBC recruiters testify that prospective students spontaneously mention sustainability when asked what they are interested in studying at UBC. These four factors contributed to creating an institutional climate supportive of strong action on sustainability and cemented the credibility UBC needed to develop a comprehensive Sustainability Academic Strategy (SAS), which is described in detail below.

An Academic Strategy for Sustainability at UBC

In the fall of 2009 and in support of UBC's new strategic plan, Place, and Promise, UBC launched a comprehensive process to develop an academic strategy for sustainability. The Sustainability Academic Strategy (SAS) process provided a framework to guide planning and decision-making for sustainability and created a consultation and engagement process through which the UBC community could demonstrate its shared interest in working toward a sustainable future. A working group charged with leading the SAS process was established under the President's Advisory Council—Sustainability. The group was chaired by Professor John Robinson and included members representing staff, faculty, students, and external community partners.

Given sustainability is both a critically important topic for ongoing research and teaching, and a practical imperative for society, the SAS process focused on two overarching principles for UBC. The first principle: That UBC should *explore* the various dimensions of sustainability through research, teaching, and learning. The challenges of sustainability range across disciplines and fields in the humanities, social sciences, natural and applied science, and the medical and health fields, and thus the exploration of sustainability transcends traditional academic boundaries. Society needs to contribute in disparate ways to the ongoing conversation about why it cares about sustainability, what the constraints and options are, and how best to achieve more sustainable practices at many scales and in many contexts. The second principle: That UBC should *exemplify* sustainability in its operations and related activities both on and off campus. As an institution, UBC should demonstrate best practices in achieving operational sustainability.

These two principles reflect, respectively, the academic and operational dimensions of sustainability at UBC. An explicit part of the SAS mandate was to consider ways to better integrate academic and operational efforts in sustainability.

To that end, two cross-cutting goals were established that bring together teaching and learning, research and partnerships, and operational and administrative activities and functions. The first goal is to transform the UBC campus into a living laboratory for sustainability so as to demonstrate—at a scale that is useful for replication beyond the campus boundaries—sustainable practices and technologies that engage faculty, students, staff and community partners and leverage operational innovations. The second goal is to cement UBC's role as an agent of change for sustainability beyond its campus. In this role, UBC facilitates dialogue and fosters partnerships between UBC, government, industry and civil society in a search for sustainability ideas and solutions that are instrumental in reinforcing the fabric of global society.

SAS Recommendations

The SAS process resulted in a series of recommendations organized in three activity areas: teaching and learning; research and partnerships; and operations and administration. In order to implement the SAS recommendations, in January 2010, UBC President Stephen Toope announced the establishment of the UBC Sustainability Initiative (USI). The goal of the USI is to integrate operational and academic sustainability deeply across UBC and make the UBC campus available as a kind of societal test-bed, where UBC can work with partners from the private, public, and non-governmental organization (NGO) sectors to prove out the technical, economic, and behavioral aspects of sustainability in the simpler institutional environment of a single campus.

The USI consists of a central management group; a teaching and learning team; a research and partnerships team; and an operational management group composed of representatives from operational units on campus including, Infrastructure Development, Building Operations, Campus and Community Planning, Student Housing and Hospitality Services, and UBC Properties Trust. The USI reports to a steering committee composed of three UBC vice presidents (VP Academic and Provost; VP Research and International; and VP Finance, Resources and Operations), two Deans (currently Arts and Science, with the intention that this rotates among faculties), the Associate Provost for Interdisciplinarity and Special Projects, and a student representative.

The USI is neither an operational nor an academic unit. It does not have direct teaching or research responsibilities, nor does it manage any campus operational activities (a separate campus sustainability office delivers many operational programs and reports to a member of the USI operational management group). The USI is a horizontal entity that cuts across the vertical UBC functional structures—faculties, departments, and operating units—that occupy the institutional landscape of UBC. It is essentially a voice, a clearinghouse, and an enabler for sustainability at UBC. USI's long-term success depends on the degree to which it can support, facilitate and mobilize activities within UBC's various structures.

The following sections present the most significant SAS recommendations being implemented, the main challenges that have emerged and some potential solutions to these challenges. A final section provides general observations on how UBC might maintain momentum toward transformative change in both operational and academic terms beyond the current, positive situation in which the University's leadership and community are highly supportive of efforts. Deep and lasting change is the goal.

Teaching and Learning

Teaching and learning is a key focus area for the USI. The mandate of the Teaching and Learning Office is to coordinate, support, and enhance undergraduate and graduate level sustainability education at UBC. It acts as an integrator and provides a focus for UBC's sustainability education resources and activities and communicates this information to UBC and the wider community. The office provides a point of contact for external groups and works with existing sustainability engagement and outreach initiatives, aspiring to fill gaps where needed.

A major activity of the Teaching and Learning Office was the creation of Teaching and Learning Fellows. These six fellows are UBC faculty members who are selected to work with the office in developing strategies around curriculum reform and working to articulate and implement these strategies. Fellows receive a stipend (which cannot be used for course buy-outs) for 1–2 years of involvement with the Teaching and Learning Office.

The main SAS recommendation pertaining to teaching and learning involves improved access to sustainability learning opportunities for every student who desires them. This process includes the development of concept papers around pathways that propose that UBC provide every student, regardless of their degree program, with the option to study sustainability via a learning pathway (up to a minor). A pathway implies meaningfully connected courses and learning experiences that provide a progression of learning due to thoughtful curriculum design.

To facilitate the delivery of pathways, the office worked with the Teaching and Learning Fellows to develop the document, "Transforming Sustainability Education at UBC: Desired Student Attributes and Pathways for Implementation" (University of British Columbia 2011). The document's student-centric framework expresses four high-level sustainability attributes, or skills and knowledge, that students who complete a sustainability pathway should be able to demonstrate:

(1) Holistic systems thinking;
(2) Sustainability knowledge;
(3) Awareness and integration; and
(4) Acting for positive change.

The document is intentionally high-level as it targets all curriculum developers across campus, and is designed to aid them in developing program-level learning outcomes for existing and new sustainability learning pathways. It is expected that the attributes will be interpreted and applied differently by different disciplines, as the relevance and meaning of the sustainability attributes will vary with disciplinary perspectives. The document proposes flexible models for building sustainability learning pathways, advocating that students begin their pathway with an introductory sustainability course or experience, and complete their pathway with an interdisciplinary leadership and/or capstone course. Students may tailor the rest of their pathway toward their personal sustainability interests, which may be discipline-specific, theme-based, or focused on an immersive experience beyond the classroom.

In addition, since the creation of the USI, the Teaching and Learning Office has developed a suite of programs to support their mission. Highlights include:

- Development of a framework to categorize sustainability courses offered at all levels at UBC and an inventory of sustainability-oriented courses and programs at UBC. The original inventory included more than 300 courses. The list is updated each year with courses that instructors identify for inclusion; at this writing (June 2013) the list sits at 580 courses. Most of these are upper level courses distributed within and across programs without explicit connections (exceptions exist, e.g., in the Faculties of Land and Food Systems and Forestry) and without a shared understanding of what sustainability curricula means.
- Management of the fellowship program in which cohorts of respected faculty leaders in sustainability teaching and learning are brought together to work collectively on sustainability curriculum issues and provide an interdisciplinary forum for development and promotion of sustainability across academia. The first cohort of fellows developed the “Transforming Sustainability Education” document described above.
- Development of innovative curriculum including piloting an introductory sustainability course for first-year students. This course was open to all first-year students of any discipline and built on the significant benefits of an interdisciplinary teaching team, diversity in student backgrounds and action-oriented, hands-on learning. Subsequent work has focused on the development of an introductory course at the second-year level in two faculties.

The development of sustainability pathways across UBC is a strategic priority. The main challenges to implementing this recommendation revolve around institutional philosophies, processes, and procedures that favor the status quo. This will require UBC to address the notion of an institutional home for such courses, working with UBC faculties to coordinate institutional support in the form of, for example, course evaluation, academic discipline, and teaching assistance funding. Also important in the future will be an emphasis on integrating teaching with the operational sustainability activities at UBC. Although there have been some successes in integrating teaching with operational sustainability at UBC—for example UBC's SEEDS program which connects students to staff directly and an innovative course that focused on the Campus as Living Laboratory concept—a more focused approach will be necessary to increase the frequency of these connections.

Additionally, the USI needs to embark on a much more consultative and collaborative process with the different faculties and think through the questions of how the new academic sustainability programming would be embedded in existing institutional structures and what changes to those structures would be needed for this to work. For example, achieving the transformational changes required to embed sustainability deeply in the curriculum means that change must be pervasive and occur in all corners of UBC. In effect, each teaching unit at UBC must see the value of such changes if the changes are to be successfully implemented in those teaching units.

Research and Partnerships

The main SAS recommendation regarding research and partnerships involves the development and coordination of interdisciplinary research initiatives that support the technological, behavioral, economic, and social sustainability dimensions of UBC's operational projects. In parallel with teaching and learning, the USI has created a Research and Partnerships Office and created Research and Partnerships Fellows (three at present) who work with the office in articulating and implementing its mandate.

To respond to the need for better integration of operational activity, partnerships interests and research, UBC has developed the Campus as Living Laboratory for Sustainability (CLL) initiative. Through this process UBC aims to develop interdisciplinary research projects that leverage operational requirements and that, in addition to leading to substantive partnership opportunities with industry and other community partners, provide teaching, learning and research opportunities for students, faculty, and staff.

Under the CLL initiative, the whole 400-ha, 400-building campus (containing about 1.5 million square meters of floor-space) is seen as a living laboratory for sustainability, a test-bed in which to demonstrate at scale and in partnership with other organizations, operational innovations that catalyze the development of new knowledge and new applications, systems and technologies, for the purpose of advancing the sustainability goals of UBC and its partners.

Many universities have characteristics similar to UBC that make them uniquely qualified to serve society in this role:

- They are single decision-makers (and often owner-occupiers) with respect to a significant capital stock, consisting of multiple buildings and energy, water and waste systems;

- They are public institutions, or have a public mandate, that can be more forgiving on pay-backs, and long-sighted on returns;
- They educate; and
- They conduct research.

UBC assembled a CLL Steering Committee and a CLL Working Group to meet regularly to discuss and review current and future CLL opportunities. These groups are composed of representatives from Building Operations, Infrastructure Development, Campus and Community Planning, the UBC Sustainability Initiative, Information Technology, faculty, students, the University Neighborhoods Association, and BC Hydro.

As part of the SAS process and as a direct result of the positive response to the CLL idea by industry and other community partners, the CLL group implemented a pipeline process to provide certainty and a fair and predictable evaluative process for solicited and unsolicited proposals from industry and other community partners. A series of strategic partnerships with industry resulted in several research projects, including:

- The Center for Interactive Research on Sustainability (CIRS), designed to be North America's most sustainable building and a demonstration of the concept of "regenerative" sustainability that seeks to achieve net-positive performance in both environmental integrity and human well-being terms (Reed 2007).
- A Bioenergy Research and Demonstration Facility that provides power and heat to the campus and hosts research projects associated with biomass gasification and cogeneration intended to leverage federal and provincial research funding for the benefit of undergraduate and graduate UBC students.
- A smart electromechanical systems demonstration project, intended to pilot and evaluate opportunities to create an interconnected, smart electromechanical grid on the UBC campus.
- An electrochemical energy storage system that will reduce UBC's reliance on diesel backup generators and conventional UPS technologies. Researchers from Electrical Engineering, the Clean Energy Research Center and Materials Engineering have full access to the technologies deployed to study their performance and energy savings as well as financial and environmental impact implications.

Led by the strong interest in the CLL process exhibited by current and potential private sector partners, UBC moved this component of the USI Research and Partnerships Office into a separate campus-wide Strategic Partnerships Office. This office has responsibility for developing living lab partnerships. All projects, sustainability-focused or not, must meet minimum sustainability goals and standards.

Because of UBC's aggressive GHG emission reduction commitments (33 % below 2007 levels by 2015, 67 % by 2020, and 100 % by 2050), one of the key challenges of the CLL initiative has been to counter a natural tendency to gravitate toward energy and emissions projects and to have an almost singular focus on engineering and technology. These areas do not fully cover the spectrum of sustainability challenges and opportunities on campus. Social sustainability, as represented by social justice, equity, and intercultural understanding imperatives, among others, needs to be equally represented and addressed (Vallance et al. 2011). To that end, USI is currently consulting with a number of relevant groups on campus to articulate a coherent conception of social sustainability that will serve as the basis for strategic programming in this area.

Another significant challenge associated with the CLL initiative is how to evaluate the net sustainability benefits and potential trade-offs of CLL projects. At present, minimum sustainability standards for CLL projects do not exist at UBC; the evaluation of proposed projects is based on alternative but incomplete analyses such as those supported by lifecycle assessment and lifecycle costing methodologies. These types of assessments leave out critical social and community sustainability issues and do not explicitly incorporate externalities (Curran 2013).

As part of a process of refining and expanding its successful CLL program, UBC is working to implement a sustainability assessment framework or “lens” to support UBC’s infrastructure and campus development decision-making process. The development of a sustainability evaluative framework for CLL projects, building projects, and campus infrastructure initiatives is intended to support UBC’s efforts to assess the environmental and social impacts of the projects it undertakes.

In support of all of these activities, UBC has implemented strategic alliance partnerships with BC Hydro, the City of Vancouver and the University Neighborhoods Association. These organizations share UBC’s sustainability vision and are committed to working on the living lab projects and taking the lessons learned off campus in order to accelerate the adoption of more sustainable practices across their entire portfolios.

It is intended that through the CLL process UBC is able to treat its whole campus as a kind of societal test-bed for sustainability where private, public, and NGO sector partners can work with UBC to test solutions at an urban neighborhood scale, and then take those ideas out to the world.

Operations and Administration

The main SAS recommendation regarding operations and administration was to foster the integration of sustainability decision-making and practices into all aspects of campus life and business. The intent was for this effort to be guided by a comprehensive UBC Campus Sustainability Plan that, underpinned by a campus-wide behavioral and organizational change program, would set targets that meet or exceed the highest level of external standards and benchmarks. The initial focus of this effort was on climate change-related goals and targets that involved the active participation of students and faculty through research and teaching activities.

The main challenge associated with this strategy, as was the case with the previous UBC Campus Sustainability Plan, Inspirations, and Aspirations, was that, by necessity, it focused on tracking UBC's commitment to the integration of sustainability values into the University's operations and programs and on celebrating the important contributions of individuals and units across campus. While this resulted in general engagement by the campus community and brought stakeholders together across campus to create ambitious targets and track sustainability performance over time, it did not address the issue of sustainability performance and reporting ownership and accountability.

The willingness of leadership in UBC's operational units to engage with the CLL initiative appears to be critical to its early successes. This engagement has included welcoming academic representation on operational committees and being open to meeting operational needs (for example, for new energy sources) through innovative, research-driven projects such as the Bioenergy Research and Demonstration Facility.

As UBC continues the development and refinement of its campus sustainability strategies, such as the Climate Action Plan, the Water Action Plan, the Waste Action Plan, and the Engagement and Social Marketing Strategy to foster a culture of sustainability and resource conservation on campus, it needs to ensure that:

- Operational sustainability targets are embedded into operational and academic unit work plans;
- Enough resources are allocated to sustaining ongoing monitoring and communication with UBC departments and units;
- Tracking and quality management systems are in place to manage and report performance data consistently over time; and
- Frequent and regular contact with units is maintained to be updated about staffing changes or changes in unit strategic direction.

Discussion and Conclusion

Looking forward, UBC must maintain and build agency and momentum. Like other large academic institutions, UBC is subject to a myriad of internal and external pressures, a number of which are highlighted below.

One of the key challenges across the University as a whole is timing cycles. Course development and the delivery of programming to students is inherently a long-term process, with curriculum developed by individual faculty members approved within their corresponding faculty and then provided to Senate and other university-wide units for approval. Course curriculum is then prepared and delivered to students with changes occurring slowly. As a result, curriculum is a slow moving target. In contrast, research and partnerships within a university are often much more dynamic, with grants and research projects extending from 1 to

5 years resulting in marked graduate student and staff turnover. Operational projects are a mix of timescales with some units at the university working at a fast pace implementing logistical decisions weekly, making a myriad of campus-wide decisions on real-time economic and social imperatives. Others, however, within the operational portfolio involve longer term planning such as transportation and residential and building construction that operate within extended time cycles. This range of timing cycles presents challenges for integrating sustainability within a living laboratory concept across all aspects of UBC. It can be difficult to develop curriculum which links directly into ongoing research projects, and likewise for research projects to be developed and implemented that address real-time operational needs.

Solutions to these challenges exist. For example, UBC has the SEEDS program, which is an operation-driven program of small research projects that bring together an operations staff member, a faculty member, and small group of undergraduate students to address pressing needs over a semester. At a higher level, it is crucial to develop forums through which operations staff can present current and future plans and encourage input from sustainability-oriented faculty and staff. The CLL groups described above are an example of this approach.

From a teaching and learning perspective, the modularization of curriculum, with a move toward shorter, more intensive online flexible learning course components is an attractive option, especially when dealing with topics such as sustainability. For example, a first-year module based on the connections between chemistry and sustainability could be developed in which the production, distribution, and use of key chemicals (for example, sulfuric acid, phosphorous) could be discussed and debated. This module could then be used by a variety of courses across UBC, including first-year chemistry, but more interestingly could also form a component of applied science, agriculture and resource-based economics. Initial experience at UBC suggests that these modules can be more easily developed, fine-tuned, and packaged to provide more flexible and responsive courses that respond to students' needs for sustainability curriculum. However, despite the potential relief from the traditional lengthy processes of course development offered through this approach in the short term, the longer term goal of developing sustainability pathways is still crucial, particularly to safeguard against an inclination for sustainability to be taught superficially and repetitively.

Another issue associated with integrating sustainability across the curriculum is full engagement of faculty members into the operations and research sustainability structure at UBC. As is well known, faculty promotion and tenure is heavily weighed to the production of high quality, peer reviewed output, the successful attraction of research grants, and education of graduate-level students. The faculty members' peers, often at other national or international universities or academic institutions, then assess these indicators. As a result, there is often no clear benefit within the tenure and promotion system for faculty members to become involved in university-focused sustainability initiatives. This is especially the case for new and young faculty, who feel significant pressure to meet the conventional indicators of scientific and teaching excellence.

The issue of changing university requirements for promotion and tenure to allow these types of locally focused sustainability engagement priorities to be recognized is vexed and will not be completely solved in any academic institution for years to come. Some of the easier solutions in the shorter term could include mentoring of young new faculty by established faculty around sustainability-related projects. Likewise UBC could provide internal incentives for faculty to become involved in sustainability projects through competitive small research or curriculum grants, or specific initiatives focused on campus-wide activities, for example a funding program offering support for sustainability-focused flexible learning projects.

Collaboration across structures and a shared commitment to sustainability is also crucial. At UBC, the USI and associated activities cut horizontally across the strongly vertical governance structure of UBC, which presents both a challenge and one of the keys to the USI's future success. The authors contend that such a non-traditional and unanchored approach to sustainability governance—one that does not rely solely on authoritative power or resource allocation capability—can mobilize existing activities in new and exciting ways. Only by enlisting the ongoing support and involvement of the staff, faculty and students already engaged in sustainability operations, research, teaching, and learning can UBC build on those activities in order to meet its sustainability goals.

UBC is beginning to see a level of engagement between operational staff, faculty, and students that is unprecedented and that has led to many unexpected outcomes. For example, treating the physical campus of UBC as part of its academic agenda (instead of just required services and infrastructure), changes the nature of operational decisions and the role of operational staff. Similarly, involving students and faculty in such operational activities not only provides a rich new field for teaching and research, but also changes the way all players see their roles and their campus.

UBC and many other post-secondary education institutions possess the characteristics required to be at the forefront of the sustainability transition; to practice sustainability operationally at a scale of great interest to cities; to do research on the technical, economic, social, and institutional challenges involved in achieving operational sustainability; and to provide students with sustainability skills they can take out into the world.

On this quest, UBC will inevitably encounter roadblocks and experience failures. But that is one of the reasons why universities are natural homes for such experiments. There exists a significant opportunity for the post-secondary sector to act on the opportunity to become a societal test-bed for sustainability, and in that way contribute directly to the significant transitions required to reach a sustainable future.

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An Indicator-Based Approach to Sustainability Monitoring and Mainstreaming at Universiti Sains Malaysia

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Abstract This chapter presents the results of the research we have been doing to develop a new methodology to monitor and mainstream sustainability throughout Universiti Sains Malaysia, in keeping with our new vision of "Transforming Higher Education for a Sustainable Tomorrow." We have focused both on global sustainability challenges and on campus sustainability. In the first part of our research we developed a new tool, a *Sustainability Assessment Methodology* (SAM), to assess the sustainability content of courses and projects. This method involves a *screening* step, consisting of three generic questions; an *identification* step, with 24 more specific questions; and a *classification* step, in which the results of steps 1 and 2 are used to classify courses and projects as either Green (High), Yellow (Medium), or Red (Low) in terms of sustainability. When we used SAM to do a USM Sustainability Audit, out of 2671 courses examined, 44 % were found to have elements of at least one pillar of the "Triple Bottom Line" sustainability model, 27 % had elements of two pillars, and 9 % had elements of all three pillars. In the second part of our research, we developed a *Framework with Four Worksheets* that presented targets, tasks, and timelines for sustainability infusion at all

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_14,

levels of USM's activities. The outcomes of this part of our research provide feedback and guidance to all practitioners to build sustainability content in their mission activities. This may include reorienting existing courses or designing and managing new research and community-oriented projects. Together, the results may be used either for *rating* or *ranking* sustainability performance, though we have used them only for *rating* at this stage.

Keywords Sustainability indicator (SI) · Sustainability assessment methodology (SAM) · Education for sustainable development (ESD) · Higher education · USM-APEX (Universiti Sains Malaysia accelerated program for excellence)

Introduction

This chapter presents the results of a recently concluded project to develop methodology and approaches to help Universiti Sains Malaysia (USM) achieve its vision of "Transforming Higher Education for a Sustainable Tomorrow". USM has been given an award to pursue this vision from the Accelerated Program for Excellence (APEX) under the auspices of the Ministry of Higher Education's prestigious Critical Agenda Program. APEX was created to enable a selected number of universities in Malaysia to gain global recognition through excellence in teaching, innovation in research, and creativity in community engagement. USM is the only recipient of an APEX award so far (Razak et al. 2010). In recognition of the critical role that universities play in promoting sustainability (Fonseca et al. 2010), USM has identified the integration of sustainability into all of its activities as the main pathway towards achieving its APEX vision.

In Part 1 of our project, we developed a *Sustainability Assessment Methodology* (SAM), using a set of *Sustainability Indicators* (SI) that we identified, to assess the sustainability content of existing courses and subjects, research projects and community initiatives. In Part 2, an Indicator Framework[1] and a set of four Indicator Worksheets,[2] both aligned to the USM-APEX sustainability roadmap (CGSS@USM 2009),[3] were developed to assist in the successful evaluation, design, and implementation of sustainability mainstreaming throughout the university—in teaching, research, community engagement and institutional

[1] Indicator framework and worksheets are accessible at: http://cgss.usm.my/images/sustainability_indicators%20version%20for%20reprint%20250110.pdf (All the six (6) links in this paper can be viewed by 'Ctrl + left-clicking' the hyperlinks in the text or in the footnote and following prompts (click OK) on the screen.).

[2] Indicator worksheets are available at: http://cgss.usm.my/images/sustainability_indicators%20version%20for%20reprint%20250110.pdf.

[3] USM-APEX Sustainability Roadmap is accessible at: http://cgss.usm.my/images/sustainability_rm%20version%20for%20reprint%20120110.pdf.

arrangement. Such a holistic set of sustainability indicators is of crucial importance as USM adopts the standpoint that sustainability integration is a process which has to occur within all levels of an organization's activities and is in sync with its own objectives, targets and processes (Asif et al. 2011).

Logical Framework Analysis (LFA) approaches (Ortengren 2004) were used to plan this project—setting goals, targets, and activities. The activities needed to achieve the targets were decided by developing a Problem Tree and a corresponding Objective Tree, following LFA guidelines. The major assumption here is that sustainability components as outlined in the university APEX strategy and its Roadmap will be progressively integrated into the work of all sections of the university. While it is true that different sections of USM will progress through this process at different pace, all are involved in it as it is the new direction of the university. In addition, there is also full institutional support for this transformation, including budgetary allocations.

The problems involved in mainstreaming sustainability at USM were identified during an initial stakeholder discussion. The results were refined by our sustainability team into a 'cause-effect' hierarchy, shown in the Problem Tree at the left in Fig. 1.

The Objective Tree shown at the right in Fig. 1 was created from the Problem Tree by restating all the negative statements as positive ones and by representing them as objectives to be attained. Based on this approach, the *goal* or the *overall objective* of the project was to solve the deepest-level problem in the Problem Tree, that is, to integrate sustainability fully into USM's core mission activities by

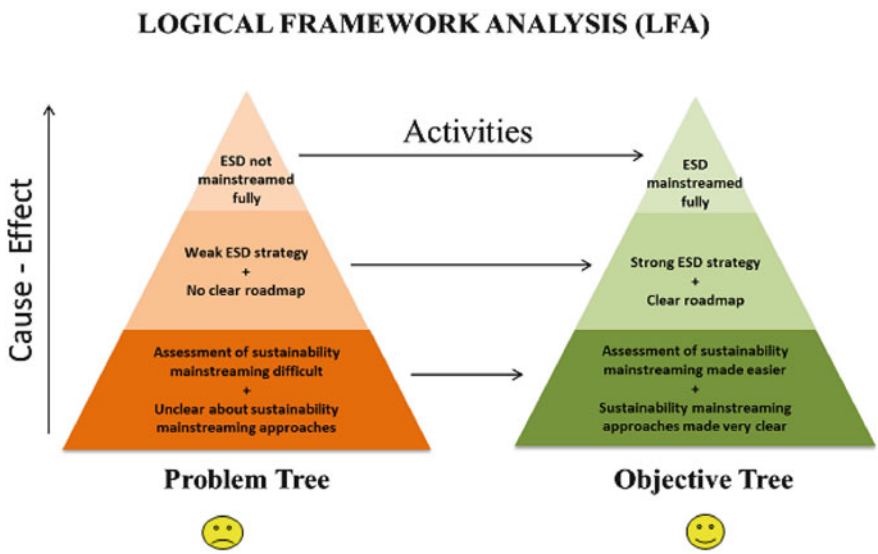

Fig. 1 The problem tree and objective tree that were used to identify priorities for the sustainability assessment project

making sustainability mainstreaming approaches very clear. So the goal of the project was stated as follows: "to develop an indicator-based methodology for the assessment of sustainability infusion into curriculum, research and community activities as a firm basis for USM's faculty and sustainability practitioners to successfully implement its APEX commitments."

The next or middle-level problems and their solutions identified the *targets* or *specific objectives* of the project as follows:

(i) Develop an indicator-based methodology for estimating the extent of current sustainability integration in USM academic activities in targeted areas such as teaching, research and community initiatives.
(ii) Develop a set of detailed *Sustainability Indicators* (SI) to serve as a guide for USM's efforts to mainstream sustainability across the board.
(iii) For the long term, to use the overall outcome of this project to develop a *Sustainability Index* suitable for rating or ranking different sections of USM, or universities in general, on their overall sustainability performance.

The *action* needed to achieve solutions to the problems described in the deepest level of the Problem Tree formed the basis for all the *activities* and *subactivities* or *tasks* of the project.

Development of the Sustainability Assessment Model

It was decided to develop an assessment model that followed three steps: Screening, Identification, and Classification.

Step 1: Screening

This step involved asking and answering the following three questions regarding *Education for Sustainable Development* (ESD) for a preliminary assessment systems such as specific courses (semester-long formal study units) taught and research or community projects (funded or voluntary) carried out:
ESD 1: How will the action/initiative impact business/economy?
ESD 2: How will the action/initiative impact the environment/ecology?
ESD 3: How will the action/initiative impact people/society?

We looked for answers for the above questions within the context of the sustainability priorities identified in the USM-APEX sustainability roadmap and known as "5 + 3": the five sectoral areas of WEHAB (water, energy, health, agriculture, and biodiversity) and the three cross-sectoral areas of production-consumption, climate change-disaster risk management, and population-poverty, selected as the sustainability priority areas in the USM-APEX sustainability roadmap. Annotations for each of the area are available under the link in the bracket. (Visit here[4] for full details of the WEHAB "5 + 3" priority areas.) It was clear that a reasonably good understanding of the principles and practices of sustainable development (SD) and education for sustainable development (ESD) were essential for completing this step (see USM-APEX Sustainability Fact Sheets[5]).

In answering the questions above, the following conventions were used:

- \+ sign, if the answer was distinct, positive or yes,
- ~ sign, if the answer was intermediate or neutral (neither distinct/positive/yes nor indistinct/negative/no),
- – sign, if the answer was indistinct, negative, or no.

The +, ~, and – signs can also be understood to represent *high*, *medium,* and *low* levels of sustainability content, respectively.

The answers to the three ESD questions listed above can generate all of the possible combinations and permutations shown in Appendix 1a. These may be regrouped into three different patterns, as represented by the three cartoon faces in Appendix 1b and in Appendix 3: Distinct or Positive, Intermediate, and Indistinct.

Of these, only actions and initiatives in the distinct category were considered in Step 2, Identification. Actions and initiatives in the Intermediate and Indistinct categories were not considered because of their limited sustainability content. However, the results obtained in Step 1 are still used in presenting final results in full detail. At this stage, it is worth emphasizing that the decision to select only the distinct group for further analysis was no verdict on the overall merit of the other items analyzed, just a recognition that they were low in *sustainability* content. This is akin to the screening of a full set of applications to prepare a short list for further consideration within the context of an advertised position in a university.

Step 2: Identification

All courses/projects which were identified as Distinct, meaning that they scored *at least two + signs* during Step 1, were selected for further analysis. All these courses or projects contained sustainability components, but in varying degrees. Step 2 was therefore designed to get a semi-quantitative measure of the *degree* of sustainability infusion through a more detailed analysis.

This step involved the use of a 24 question sustainability indicator checklist (summary in table in Appendix 2, visit here[6] for full details), based on the "5 + 3"

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[4] WEHAB +3 is available for download at: http://cgss.usm.my/images/wehab%20plus.pdf.

[5] USM-APEX Sustainability Fact Sheets are accessible at: http://cgss.usm.my/images/fact%20sheet%20latest%20version%20for%20reprint%20may%2020121LATEST.pdf.

[6] The sustainability indicator checklist is available for download at: http://cgss.usm.my/images/si%20new%20check%20list%20sd.pdf.

approach of the USM sustainability roadmap described under Step 1. The sectors and cross-sectors impact each other to different degrees.

Of the 24 questions used as proxy indicators, the first eight address the three pillars of sustainability—economy, environment, and society—and the approaches of ESD in general. The next ten questions address WEHAB sectors, and the last six are linked to the three cross-sectoral priorities of the roadmap. All 24 questions are 'sustainability' centered; while the first 8 are focused on the three pillars of SD and ESD in a broader way, the remaining 16 are more specific to the sustainability challenges under the WEHAB +3 areas.

The Identification was completed by using the 24 indicators, applied as questions, to check the sustainability content of each course or project that had been graded as Distinct in Step 1 and therefore qualified to enter Step 2. Each of the questions in the checklist were asked in order and the answers were recorded using the +, $\sim$, – scheme. When all questions had been answered, a percentage sustainability assignment was made based on the total number of positive responses (+) as a percentage of the total number of questions asked (24). For example, if a particular course retuned 18 positive (+) responses for the 24 indicator questions asked, the result is represented as a percentage, (18/24) $\times$ 100—or 75 %. While it is a semi-quantitative approach, the results are very useful for further classification of assessed units. Some degree of quantitativeness in an assessment will help to generate better future responses in improving the assessed items. The number of $\sim$ and – scores were not considered. This is once again something of an elimination exercise, akin to the selection of one candidate from a shortlist of candidates for appointment to an advertised post.

Step 3: Classification

Based on the results of Step 2, a sustainability color code was assigned to each item (course or project) that qualified to enter this further step, based on its sustainability percentage. The following green, yellow, and red color coding was then used, with the cut-off points or bands as shown below:

Green. High sustainability—70–100 % positive (+) responses;

Yellow. Medium sustainability—30–69 % positive (+) responses;

Red. Low sustainability—1–29 % positive (+) responses.

It is important to bear in mind that all courses and projects included in the above classification in this step do contain SD/ESD components, but in different percentages. Thus, even the courses in the red band have some level of SD/ESD content. The red sign is used to indicate that there is plenty of room for this band of courses to move into the yellow and then green level through planned sustainability reorientation.

A flowchart for SAM is given in Appendix 3.

Application of SAM to Sustainability Auditing at USM

The USM sustainability audit, conducted using SAM, involved 43 departments in 26 schools and 17 Centers of Excellence. The audit reviewed teaching, research, community engagement, and other informal and non-formal activities conducted by the sections assessed. A selected set of results is presented below:

Teaching

SAM was applied to 2,671 courses taught in the Schools that were audited. Figure 2 shows the results by category. The total number of courses with one sustainability component was 1,173, or 44 %. This included 14 % with an economy component (ESD1), 5 % with an environment component (ESD2) and 25 % with a society component (ESD3). The number of courses with a combination of two elements of sustainability was 735 (27 %), and 228 courses, or 9 %, had components of all three elements of sustainability.

These results may be used to show the situation in Science & Engineering and in Arts & Humanities separately, as presented in Figs. 3 and 4.

Research

A similar analysis was carried out for 2,651 research projects at USM (Research, Universiti Sains Malaysia 2009). It revealed that the total number of projects with at least one component of sustainability was 1,508, or 57 %. Of these, 792 projects, or 30 % of the overall total, focused on ESD3 or the society component.

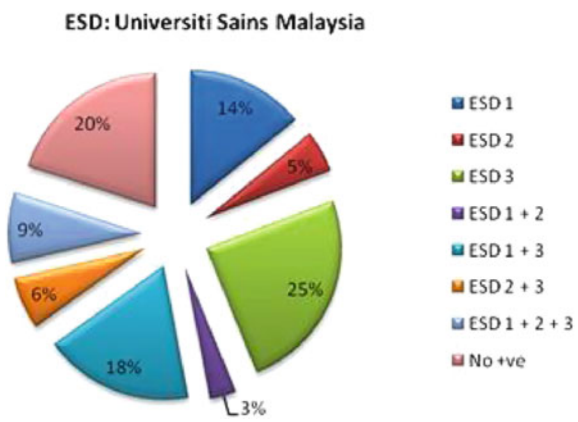


Fig. 2 Summary results of the application of SAM to 2671 courses

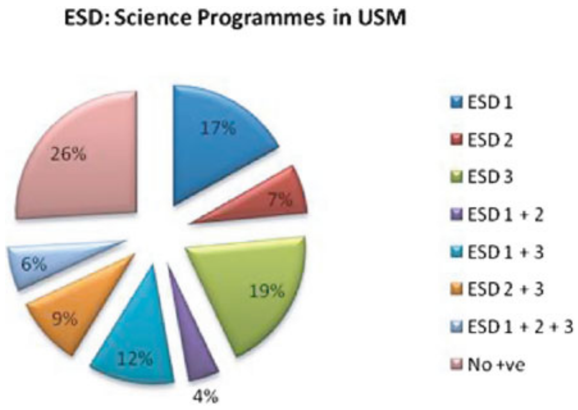


Fig. 3 Summary results of the application of SAM to courses in Science and engineering, USM

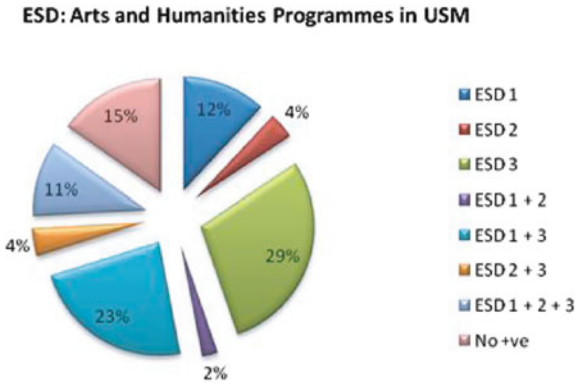


Fig. 4 Summary results of the application of SAM to courses in Arts and Humanities, USM

When projects with more than one component are also considered, 54 % of projects are seen to have ESD3 as at least one of their components. The environment and economy pillars of SD featured in fewer projects, as shown in Fig. 5.

Community Engagement

The application of SAM to **416** community projects at USM (Community Engagement, Universiti Sains Malaysia 2009) showed that the highest number of activities had impacts on both the economy (ESD1) and society (ESD3) pillars, with a total of 178 activities or 43 % addressing both of these components. The second highest was ESD3 (society) alone, with 127 projects (30 %). Other activities that had combination impacts included 58 (14 %) that addressed all three pillars, 47 (11 %) that addressed environment (ESD2) and society (ESD3), and 1 (0.9 %) that addressed economy (ESD1) and environment (ESD2); see Fig. 6. The

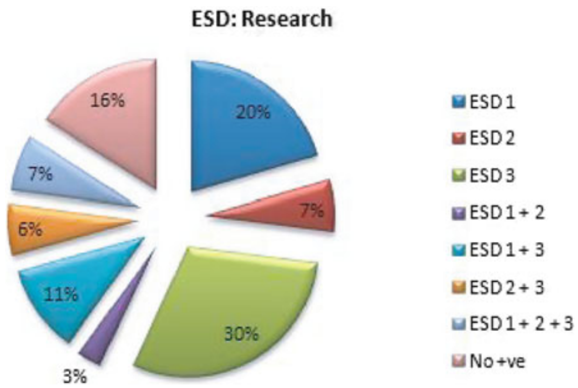


Fig. 5 Summary results of the application of SAM to 2651 research projects, USM

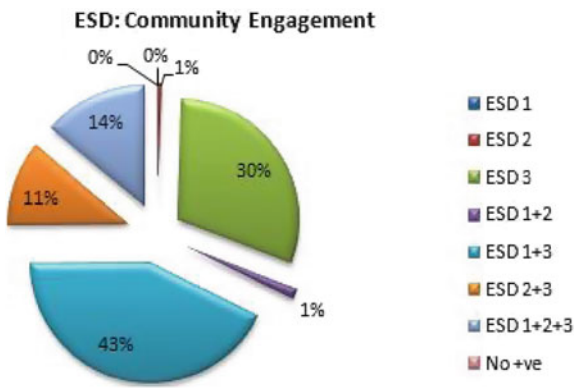


Fig. 6 Summary results of the application of SAM to 416 community projects, USM

treatment of results here is essentially the same as that used for teaching and research. What we learnt is that the projects in this area at USM focused more on either economy or society, and less on ecology or environment. Following the audit, there are efforts to engage in more integrated approaches wherever possible, although a substantial part of the work may still be voluntary short-term specific engagements. Shifting them to a programmatic approach where community risk reduction toward major sustainability concerns under the three pillars will take time, but this would be the way to go.

The application of SAM has created a detailed database which may be applied on a variety of levels such as individual, departmental, school, institute, or university-wide systemic levels at which changes have to occur to help transform USM into a sustainability-led university). The results may help reorient individual courses or projects, or they may be applied to an entire department, school or center, rating them on their performance in any area and identifying sustainability gaps. This would help generate section-specific efforts to improve sustainability performance.

These results have been endorsed by the university formally. Our next move will be to enable the schools, centers, and institutes to carry out the audit themselves for self monitoring and evaluation.

Sustainability Indicator Framework and Worksheets

Once the sustainability assessment stage has been completed, the next logical step is for individual practitioners and sections to consider effective ways to improve their sustainability performance through course reorientation or major revision, developing new courses in gap areas and designing sustainability integrated research and community projects. From our experience, at this stage there is urgent need for common guidelines to assist different sections of the university in the sustainability transformation process. Part of the problem was that sustainability in the minds of some was synonymous with staff-student ‘volunteer activities’ relating to campus cleaning, energy or water audit, waste management, environmental awareness networks and outreach. Very few take an integrated approach to infuse sustainability issue/s into the curriculum, research and out of campus community activities they are involved in. This became clear during the sustainability road shows that CGSS conducted in the campus. This is when we felt the need for a more structured and defined approach to sustainability mainstreaming. In this context, assessing the current level of sustainability integration was a necessary starting point and SAM was developed for this purpose. In the indicator framework we showed clearly that both approaches are needed for a full scale mainstreaming of sustainability. Still the question of ‘how’ does remain. The worksheets are designed to provide guidance in this area. Indicators are used to prompt users to act in a certain way that when those actions are completed, the indicators return positive responses. We provide enough details on *how* to approach the situation but not exactly *what* to do. This is up to individual actors to decide based on their disciplinary requirements and how sustainability plays out in their field of work, but focusing on the WEHAB +3 priority set by the university. To assist in this process, a set of SMART sustainability indicators (Specific, Measurable, Attainable, Relevant, Time-bound) encompassing USM’s mission areas have been developed.

The methodology and results that follow are primarily aimed at and guided by, mainstreaming USM’s “WEHAB +3” (or “5 + 3”) approach to sustainability transformation, the ‘Alternative University Appraisal’ (AUA 2010) for ESD in Higher Education Institutions, ‘Sustainability Assessment Questionnaire (SAQ) for Colleges and Universities (SAQ 2009) and the ‘Values-based Indicators (for sustainability)’ developed by University of Brighton, UK (University of Brighton 2010). At the same time, they are equally applicable to any Higher Education Institution (HEI) attempting to integrate sustainability in its programs. Different institutions may wish to replace the 5 + 3 focus of USM with their own sustainability priorities, given the difficulties that many HEIs face in addressing sustainability issues comprehensively (Miller et al. 2010).

The SIs will have two major applications:

(i) As checkpoints that ensure the original goals and targets of a project are not strayed away from and enable problem areas that may occur during implementation to be addressed (Swanepoel and De Beer 2006) before these problems are amplified later on in the project. We have presented goals and targets for three different timelines, with corresponding indicators. For example, the short-term indicators address various activities that need to completed during the planning stage, the mid-term refers to the implementation stage and the long term is aligned to the final stage. Thus, there are specific indicators to give feedback on progress of the action from beginning to end.
(ii) At the completion of the project's lifecycle, these Indicators could be used to evaluate the overall project or those that are still in the midst of implementation to ensure sustainability integration is on target. In the latter case the subset of indicators that refer to the timeframe of relevance will apply, e.g., planning, implementation, and completion stages.

The Methodology

Two sets of indicators were developed: a Framework Indicator and a set of Indicator Worksheets. These were based on the USM sustainability roadmap focussing on the WEHAB sectors and the three cross-sectoral themes that encompass the sustainability priorities of today's globalizing world and Malaysia's 2020 vision (Hezri 2004). Within the context of the two-pronged approach of USM-APEX roadmap for sustainability transition, which is to address (i) major *global* sustainability challenges and (ii) *campus* sustainability, the indicators discussed here are intended to assist in the operationalization of the roadmap at different strategic phases of the APEX-project cycle. For this reason, indicators are developed for the short term (planning phase–baseline or process indicators) the middle term (implementation phase–action or result indicators) and the long term (concluding phase–outcome or impact indicators).

The assumption here is that once the indicators show that the project is on course, in terms of completing various planned tasks/activities and it is producing the necessary outcomes, then it is reasonable to assume that the impacts will be forthcoming. For example, a good enrolment in a course revised for sustainability, good pass rate, good student feedback, etc., will indicate effectiveness and efficiency. To an extent, these are proxy indicators but with time, such indicators may be confirmed for real. Regarding the sustainability of the project itself, if it is a concern that must be addressed carefully during the planning stage and necessary indicators must be developed.

USM's ultimate APEX goal is to become a university recognized around the world for sustainability, and so it is committed to building sustainability into its own core activities, thereby practicing on campus what it preaches globally. The Framework Indicator is designed to show the university how it can make progress toward this goal by integrating its global sustainability priorities into its teaching and research and its campus sustainability concerns into student and staff-based community activities. The Framework Indicator also clearly identifies institutional arrangements that will be needed to create an enabling environment for this transition, such as changes in corporate functions and the broader adoption of ESD. This Framework Indicator may be seen as a zoomed-out sketch of the sustainability landscape; the four Indicator Worksheets, for their part, are the zoomed-in versions, providing more details related to USM's core mission areas: teaching, research, community engagement, and institutional arrangement.

The Framework and the Worksheets have the following in common: (i) the use of SMART indicators; (ii) a "tri-phasal" timeline that includes Short-term (2010–2011), Mid-term (2011–2013) and Long-term (2014–) phases; (iii) goals, targets, and indicators for each period; and (iv) indicators matching activities within these periods. It proved helpful to take "backcasting" approach, in which the long-term goals, targets, and indicators needed to secure the desired future sustainability situation were determined first, followed by mid-term ones and finally short-term ones. Sustainability indicators, although crucial, need to be accompanied by practical steps for implementation (Getzner 1999). This approach ensures a continuous monitoring regime which is non-judgemental, corrective, and proactive.

While the *Indicator Framework* provides a zoomed-out broad-brush landscaping of USM's sustainability integration, the *Worksheets* are a zoomed-in version with additional specifics about their respective sections and suggested activities to "make sustainability happen" at USM. For example, the Teaching worksheet considers formal, non-formal and informal curricular approaches within the three timeframes with corresponding goals, targets and indicators (Fig. 7). The two short-term goals under Formal Teaching are *to reorient existing courses to include sustainability topics* and *to develop new courses in gap areas based on the overall sustainability focus of degree programs*. These goals are to be achieved by adopting short-term targets such as *using locally relevant case studies to factor in sustainability topics as appropriate* and *developing new courses to be offered as part of the sustainability imbued degree program*. Success in reaching targets is gauged by short-term indicators including *number of reoriented courses, student choice of such courses, number of new courses approved for offer,* and *student enrolment in such courses.* This flow of goals, targets, and indicators and the division into three time periods applies to all four worksheets.

The Research worksheet, for its part, addresses the three categories of process research, solution-oriented action/applied research and fundamental research for primary knowledge generation, and testing of hypotheses. The Community Engagement worksheet considers campus community, private sector, public

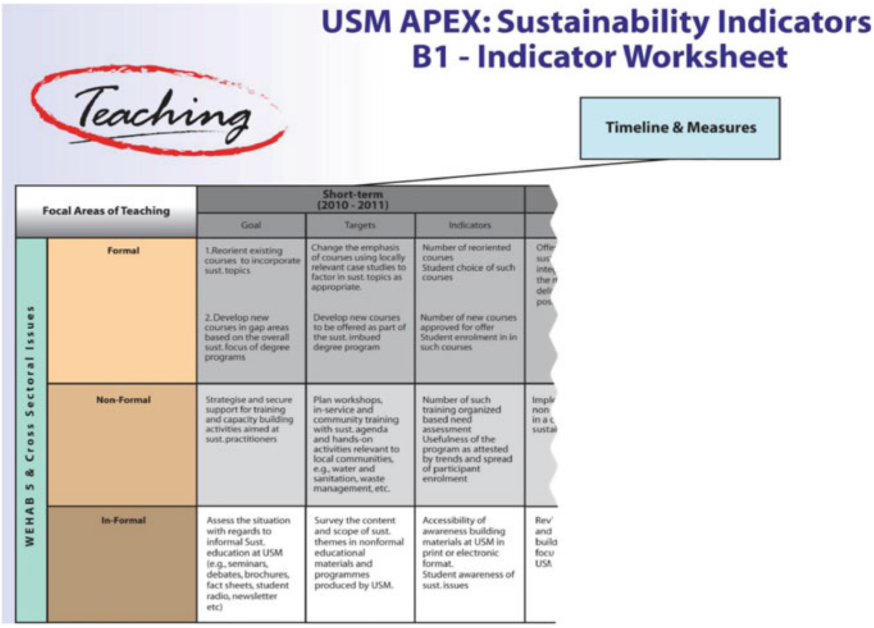


Fig. 7 A section of the teaching worksheet

sector, and non-state actors as its focus, while the Institutional Arrangement worksheet covers all corporate functions and all ESD initiatives.

Popular sources such as UNDESA's CSD indicators (1996), UNESCO-Bangkok's ESD indicators (2007), UN-MDG indicators (The World Bank 2002), Pacific ESD Action Plan indicators (2007), and other Web-based sources were referenced in designing the SI Framework and the Worksheets to ensure that the indicators measured the sustainability processes and practices needed to train the sustainability practitioners of tomorrow (Hak et al. 2007).

Application of the Research Indicator Worksheet to a CGSS Research Project

In 2011, as part of USM's *delivering excellence* initiative, the Center for Global Sustainability Studies at Universiti Sains Malaysia (CGSS@USM) launched a USM-APEX community engagement project entitled "Enhancing Sustainable Living within Universiti Sains Malaysia and its Neighboring Communities". This project involved awareness-building and hands-on activities on integrated waste management through training in recycling and composting.

Using the Roadmap's Research indicator guidelines, CGSS developed a log frame with goals, targets, and corresponding indicators to ensure successful implementation of the project. Table 1 presents a part of this detailed log frame focusing on Institutional matters to illustrate how the short-, mid- and long-term phases of the project each have their own goals, targets and indicators.

This project, undertaken jointly by CGSS and RCE-Penang, received a United Nations University Regional Center of Excellence recognition award for successful community awareness and capacity building initiatives (Fig. 8). This information is included to show that projects that were developed and implemented using the approach highlighted here bring about good results that are internationally recognized.

Scope and Way Forward

The research results summarized here—the sustainability assessment using SAM and the worksheet-based indicators for taking corrective and proactive measures to mainstream sustainability—are intended to serve as a descriptive guide rather than a prescriptive, one-size-fits-all formula for influencing the academic and non-academic activities of the university. Like global sustainability agreements such as Agenda 21 and The Future We Want that resulted from the UN summits in Rio (1992 and 2012), the SI worksheets are also meant to direct people toward doing the right things in sustainability. It is not written specifically for any particular department or school; but all can use it to generate activities within their mandate and special circumstances). As a result of our sustainability auditing and the documentation of its results, it is expected that individual sections will develop their own specific indicators based on their disciplinary needs, but guided by the model presented here. This view is supported by other practitioners as well; Prabhu and collaborators, for example, speak of *"the assumptions in the descriptive assessment indicators being made to manifest into specific indicators by the management or institutional bodies to form prescriptive indicators"* (Prabhu et al. 1996). However, more focused tasks and corresponding indicators will be introduced during APEX phase II, due to start in 2014.

Using the sustainability database generated by SAM, we are now in the process of developing a "sustainability index" as illustrated in Appendix 4. The sectoral data from teaching, research, community engagement, and institutional arrangement may be used to collect information for the four cluster indicators applied to each of the four sectors (T, R, C, & I) in the last column of the figure in Appendix 4. By standardizing the results and applying appropriate weighting, it is possible to carry out a successive aggregation process to obtain values for the dimensions and the fields in turn, and finally a sustainability index as a single number. The weighting factors are essential to adequately represent the strategic importance of each of the cluster indicators in terms of the time and resources that go into generating their numerical values. In teaching, for example, formal teaching takes

Table 1 Enhancing sustainable living within Universiti Sains Malaysia and its neighboring communities: use of indicators for overall planning and project management

	Category/ Timeline	Short Term			Mid-Term			long Term		
		Goal	Target	Indicators	Goal	Target	Indicators	Goal	Target	Indicators
Stakeholders: schools	Institutional	Evaluate existing recycling initiatives	Assess level of student\teacher participation Scope of recycling themes in informal school curriculum	Assessment report on success of past recycling initiatives Non-formal school activities for students and their involvement in them	Implement school campus recycling initiatives	Build awareness of students & teacher on the benefits of recycling of recycling (Green Crusaders, etc.) Facilitate student empathy toward recycling	Number of Recycling bins located in school campus Weight or value of recycled materials	Enhance institutional systemic capacity to mainstream recycling practices	Reorient institutional strategy to create a school culture that is conductive for recycling	percentage of budgetary allocation for recycling initiatives and overall awareness building Number of students/ teachers participating in voluntary recycling initiatives

Fig. 8 United Nations University Regional Center of Excellence recognition award

more priority than non-formal/informal teaching in all the USM Schools, whereas in Centers and Institutes the situation may be reversed.

As in all other universities, at USM also there are barriers and drivers for the integration of sustainability into USM. We admit that there are significant barriers, both perceived and real, in terms of staff awareness, attitudes, expertise, and institutional commitment to accelerating the sustainability embedding processes. This is not so much an issue of the work we are presenting here but pertain to the sustainability mainstreaming exercise itself. This is more global a problem than what we can comment more here. A more thorough analysis of the application of the model in USM will be produced in future.

Acknowledgments The authors are deeply indebted to the research assistants of the indicator research team (Nordiana binti Mohd Yusoff, Nur Afiqah binti Ismail, Masratul Hawa), to Ratisya Radzi and Nurhazliyana Hanafi of CGSS@USM, Christopher Smith for editing the draft, and to all others who helped to make this project a success.

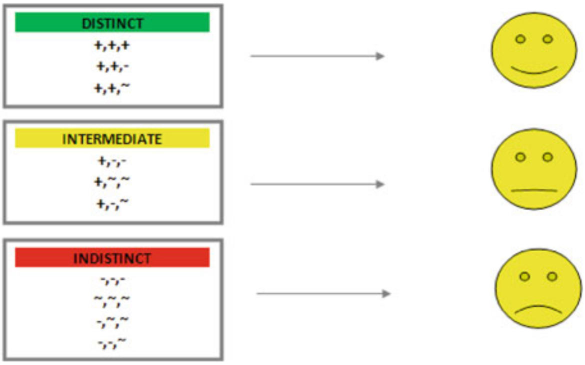
Appendix 1

Permutation Combination

(a)

	Eco	Env	Soc		Eco	Env	Soc		Eco	Env	Soc
3 +	+	+	+	3~	~	~	~	3-	-	-	-
	~	+	+		+	~	~		+	-	-
2+,~	+	~	+	2~,+	~	+	~	2-, +	-	+	-
	+	+	~		~	~	+		-	-	+
	-	+	+		-	~	~		~	-	-
2+,-	+	-	+	2~,-	~	-	~	2-,~	-	~	-
	+	+	-		~	~	-				
					+	-	~				
					~	+	-				
				+,~,-	-	~	+				
					+	~	-				
					-	+	~				
					~	-	+				

(b)



The (+, ∼ , –) responses when applied to the three pillars of SD, Economy (Eco), Environment (Env) and Society (Soc), generate the following permutations.

(*Note* This table itself need not be understood in any depth to apply SAM, but this explains the basis for it. It is true that those who use SAM need to have a working knowledge of SD and ESD. There are no other easy approaches to assessing sustainability content as we have attempted here. It is similar to a clinical approach; while instrument based test results are useful in diagnosis, qualified and experienced medical personnel are needed to treat patients).

Any combination of two or more positives (+) with other sign was considered to indicate a distinct situation for sustainability—a smiling face. The other two faces have less and less + signs and hence relatively less sustainability content.

Appendix 2

Brief check list for SAM–KIPs* and KPIs* (Based on USM-APEX Sustainability Priorities—WEHAB +3)

No.	Indicator type: Impact indicators (8 KIPs); scope—general (check compatibility of statements here to audit items)	+ (H)	~ (M)	– (L)	Remarks (sector/cross-sec)
1	Depletion of natural capital; institutional arrangements Development footprints; globalization, culture				Environment
2	Pollution; institutional arrangements Integrated waste management - 3R approach				Environment
3	Knowledge economy, skills generation; poverty eradication (social uplift)				Economy
4	Emphasis on “the economy and society are wholly owned subsidiaries of the environment” or “the economic goods and services come from the ecological goods and services”				Economy
5	Green business for income generation and societal well being				Society
6	Health, conflict resolution, social capital, democracy, equity, good governance				Society
7	In human history, there have been ‘waves’ of major innovations. The next wave of innovation will be in Sustainability. EE/ESD as the educational approach for this innovation				EE/ESD
8	The intent of the ESD decade (2005-14, UNDESD)				EE/ESD
No.	*Indicator type: performance indicators (10 KPIs); scope—‘WEHAB +3’ (WEHAB = water, energy, health, agriculture and biodiversity)*	+	~	–	*Remarks*
9	Quality and quantity				Water
10	Distribution and accessibility				Water
11	Efficiency/accessibility:				Energy
12	Diversification/renewable energy				Energy
13	Communicable diseases				Health
14	Non-communicable diseases				Health
15	Land use and land cover changes				Agriculture
16	Food security				Agriculture
17	Biological goods and services				Biodiversity
18	Habitat integrity, conservation				Biodiversity
No.	*Indicator type: performance indicators (6 KPIs); scope—WEHAB +3’ (3 = (i): climate change/ disaster risk management, (ii): population/poverty, (iii): production/consumption)*	+	~	–	*Remarks*
19	Science, sectoral impacts and capacity building				Climate change/ disaster risk management

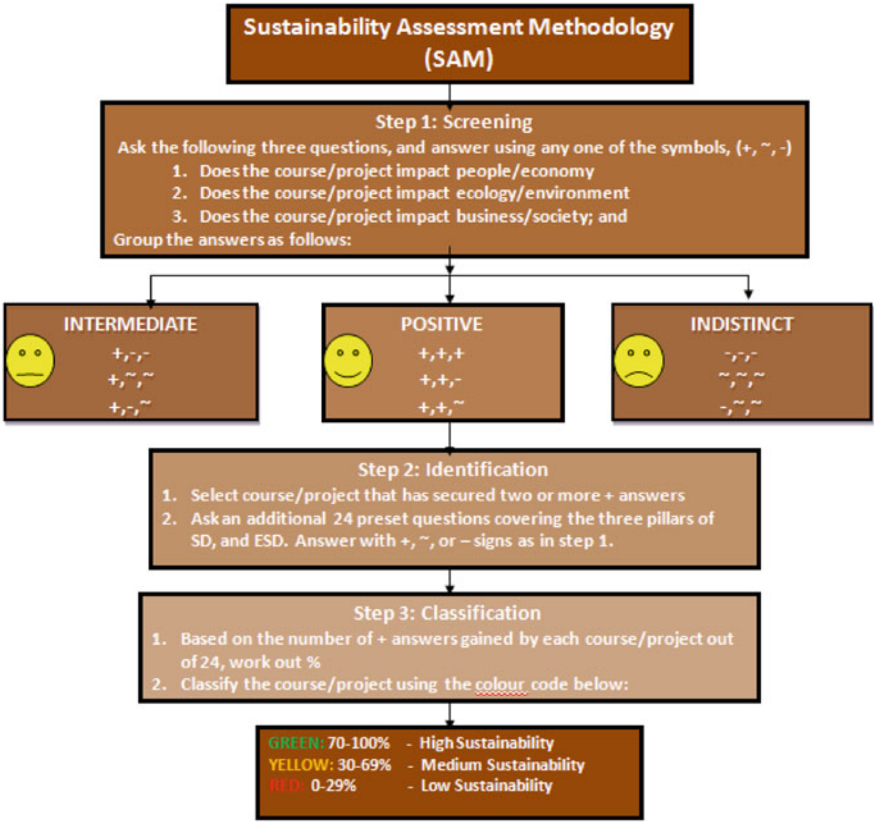
(continued)

(continued)

No.	Indicator type: Impact indicators (8 KIPs); scope—general (check compatibility of statements here to audit items)	+ (H)	∼ (M)	– (L)	Remarks (sector/cross-sec)
20	Mitigation, adaptation, Networking and Policy				Climate change/ disaster risk management
21	Demography, settlement, natural resources, income generation, and Poverty				Population/poverty
22	Human capital, education, health, globalization, culture, and governance				Population/poverty
23	Natural resource use, pollution, policies				Production/ consumption
24	Industry, trade, transportation, business, market, policies				Production/ consumption

(+) If the answer is positive/yes
(∼) If the answer is neutral (neither positive or negative)
(–) If the answer is negative/no (if in doubt here, use precautionary principle)
**KIP* Key intangible performance; *KPI*, Key performance indicators

Appendix 3


Sustainability Assessment Methodology (SAM)
Step 1: Screening
Ask the following three questions, and answer using any one of the symbols, (+, ~, -)
1. Does the course/project impact people/economy
2. Does the course/project impact ecology/environment
3. Does the course/project impact business/society; and
Group the answers as follows:
INTERMEDIATE
+,-,-
+,~,~
+,-,~
POSITIVE
+,+,+
+,+,-
+,+,~
INDISTINCT
-,-,-
~,~,~
-,~,~
Step 2: Identification
1. Select course/project that has secured two or more + answers
2. Ask an additional 24 preset questions covering the three pillars of SD, and ESD. Answer with +, ~, or – signs as in step 1.
Step 3: Classification
1. Based on the number of + answers gained by each course/project out of 24, work out %
2. Classify the course/project using the colour code below:
GREEN: 70-100% - High Sustainability
YELLOW: 30-69% - Medium Sustainability
RED: 0-29% - Low Sustainability

Appendix 4

Sustainability Audit

(All responses to be linked to sustainability mainstreaming)

Index	Field	Dimensions	Indicators
Sustainability Index	T	Formal, Nonformal & Informal	(i) % of faculty competent in or passionate about sustainability education as a function of the total (ii) % of sustainability infused formal courses (iii) % enrolment of students in sustainability infused courses (iv) % of nonformal/informal projects by students + faculty
	R	Process, Action & Fundamental	(i) % of faculty competent in or passionate about sustainability research as a function of the total (ii) % sustainability infused research projects (iii) % of action or applied research in sustainability (iv) Number of innovative research, patents/ recognition , external funding and publications
	C	Campus, Public & Private	(i) Number of campus sustainability projects actively promoted by students and staff (ii) Number of active Kampus Sejahtera and campus greening activities by student and staff (iii) Number of active projects/activities with private sector involvement (iv) Rate your policies and enabling environment for networking/partnerships and capacity building aimed at community stakeholders on a 0-100 scale
	I	Corporate & ESD	(i) Rate your strategies/policies, action plans in place for procurement on a 0-100 scale (ii) % of budget for staff development and incentives available (iii) Rate your innovative water , and energy saving and waste management measures on a 0-100 scale (iv) Rate your ESD understanding and involvement on a 0-100 scale

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The Unit-Based Sustainability Assessment Tool and its use in the UNEP Mainstreaming Environment and Sustainability in African Universities Partnership

Muchaiteyi Togo and Heila Lotz-Sisitka

Abstract This paper reports on the development and use of a Unit-based Sustainability Assessment Tool (USAT) for establishing the status of Education for Sustainable Development initiatives and sustainable development practices in universities. The tool was developed for use in the Swedish/Africa International Training Programme (ITP) on 'Education for Sustainable Development in Higher Education' and complements the UNEP Mainstreaming Environment and Sustainability into African Universities (MESA) '*Education for Sustainable Development Innovations Programmes for Universities in Africa*' materials. The USAT facilitates a quick assessment of the level of integration of sustainability issues in university functions and operations, both to benchmark sustainability initiatives and identify new areas for action or improvement. It is basedon a unit-based framework which allows for sustainability assessments to be done per division, unit, department, or faculty within universities. Collectively, the unit-based assessments provide for development of an institution wide picture of university sustainability. The USAT has been widely used, in different ways, in African universities which are participating in the MESA Universities Partnership, and it has been found that it provides a useful reflexive learning tool for furthering sustainability objectives. This chapter discusses the context in which the USAT was developed, its development and pilot use at Rhodes University and the design features of the tool. The chapter also showcases use of the USAT in a whole university assessment at the University of Swaziland to illustrate how data from the assessment can be analyzed and presented and what the tool enables reviewers

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_15,

to perceive from the results. It further illuminates how the tool is being employed in identifying actions for change (called change projects) in the MESA Universities Partnership. Use of the USAT across a range of African universities suggests that its value lies in showing the level of integration of sustainability, and in facilitating change oriented learning and practice.

Introduction

The Unit-based Sustainability Assessment Tool (USAT) was developed and is being used during a time when education is increasingly being recognized to be one of the central approaches to sustainable development. The role of education in sustainable development was emphasized through Agenda 21 at the Earth Summit in Rio de Janeiro in 1992. This same vision was later consolidated at the United Nations general assembly in 2002 when the Decade of Education for Sustainable Development (ESD) (2005–2014) was declared following the recommendation of the World Summit on Sustainable Development (WSSD) Plan of Implementation (UNESCO 2005), showing the significance of education and learning in responding to the challenge of sustainable development. UNESCO defined the overall goal of the UN Decade of Education for Sustainable Development (UNDESD) as:

> … to integrate the values inherent to sustainable development into all aspects of learning to encourage changes in behaviour that allow for a more sustainable and just society for all (UNESCO 2005, p. 1).

Universities were challenged to become key players in educating society about sustainable development (UNEP 2006) through developing the capacities of future decision-makers; developers and managers of business and industry; and other social institutions (University Leaders for a Sustainable Future (ULSF 1990). They also have significant influence on policies and decision-making at government level and in industry and other types of organizations.

A number of international conferences on environmental education and sustainable development, for example the Talloires conference (France 1990), made declarations which define university roles in addressing sustainable development. Priority roles of universities in sustainable development defined through these declarations include the following:

- developing ecological literacy among students to prepare them to deal with environmental problems,
- applying their (universities) knowledge in solving the problems of local communities,
- establishing and implementing sustainable physical operations,

- aiding the development of an environmentally literate people through public outreach,
- developing interdisciplinary curricula,
- encouraging research that contributes to local, regional, and global sustainability,
- collaborating with government, non-governmental organizations, and industry, and
- cooperating with other universities to facilitate sharing of information pursuing practical solutions to sustainability issues (Wright 2002, pp. 214–218; 2004, pp. 13–17).

The green economy (UNEP 2009), which is one of the recent topical approaches to sustainable development also identifies capacity building, training, and education through strengthening national capacity to respond, as one of the enabling conditions for a sustainable society (UNEP 2011). ESD was also emphasized in the recent Rio + 20 outcome document through resolution 233, which emphasizes promotion of ESD beyond the DESD. Resolution 234, which focuses on the role of education institutions, says:

> We strongly encourage educational institutions to consider adopting good practices in sustainability management on their campuses and in their communities with the active participation of, inter alia, students, teachers and local partners, and teaching sustainable development as an integrated component across disciplines. (United Nations 2012, p. 44).

It is within this context of an increasing realization of the role of education that the United Nations Environment Programme (UNEP) initiated the development of universities partnership in 2004 to help African universities to mainstream sustainable development in their operations. The partnership, Mainstreaming Environment and Sustainability in Universities in Africa (MESA) Universities Partnership, is aimed at enhancing the quality and relevance of university education through implementation of Environmental Education and sustainability across university operations and functions (Ogbuigwe 2007). The MESA Universities Partnership is in direct response to the objectives of the UNDESD and is structured into three phases[1] that run for the duration of the UNDESD (2005–2014). The first phase (2004-2007), aimed at establishing and piloting of the MESA Universities Partnership in 15 % of universities, was successfully completed (UNEP 2007) but was found to have heavily depended on individual professionals participating in the MESA Universities Partnership. Sustainability mainstreaming initiatives started by the professionals were not being taken up at university level in their institutions. A *'systems-wide approach to mainstreaming'* was therefore found necessary (UNEP 2007, p. 4), emphasis in original) so as to

[1] Phase 1 (2004–2007): Establishing and piloting of the MESA Universities Partnership Project in 15% of African Universities; Phase 2 (2007–2010): Consolidation and strengthening of MESA Universities Partnership Project activities in 30 % of African Universities; and Phase 3 (2011–2014): Expansion of the MESA Universities Partnership to 60 % of African Universities (UNEP 2007, p. 1).

bring change at an institutional level rather than in individual courses/teaching contexts of MESA participants only (UNEP 2008). The need for developing further tools to support such an approach was also identified (ibid.). This tool was therefore developed to support phase 2 of the program in which:

> A stronger *systems-approach* needed to be developed in MESA to support systemic changes in universities, so that innovations were not only dependent on individual efforts and *university leaders* needed to become more involved (UNEP 2008, pp. 32) (emphasis in original).

The USAT (Togo and Lotz-Sisitka 2009) was developed to support mainstreaming of sustainability in the MESA Universities Partnership, and to provide a means of facilitating change oriented learning and practice in participating universities. It was developed as part of a PhD study situated within the MESA Universities Partnership, which explored the development of systems approaches in mainstreaming environment and sustainability in African universities (Togo 2009). The tool was developed in response to lessons from phase 1 of the program, particularly, the need for a stronger systems approach to enable take up of initiatives by the MESA Universities Partnership participants at university level. Sustainability Assessment Tools (SATs) help define priorities for universities while at the same time providing a basis for institutions to compare and reflexively review their sustainability efforts. The tool was also meant to articulate criteria/priority issues for African universities from the roles of universities defined through sustainability declarations in higher education to consider their relevance in African university contexts, and to explore if other perspectives needed to be brought into the picture. The research, which developed the USAT, was based on a case study of Rhodes University and developed an in-depth understanding of a whole systems approach to sustainability mainstreaming and how the tool can be used to support such an approach (Togo 2009).

The Development and Design Features of the USAT

A Review of Other Tools

The priority sustainability mainstreaming issues defined through the indicators of the USAT were influenced by other SATs and also aligned with the roles of universities defined by sustainability declarations. Before its development, the relevance of some of the existing SATs to the study and by extension, in supporting a system approach in mainstreaming sustainability in the MESA Universities Partnership, was considered. These include the Sustainability Assessment Questionnaire (SAQ) (ULSF 1999), the Auditing Instrument for Sustainability in Higher Education (AISHE) (Roorda 2001) and a tool for the Graphical Assessment of Sustainability in Universities (GASU) (Lozano 2006).

The SAQ offers its users a comprehensive definition of sustainability in higher education (Shriberg 2004), covering critical dimensions of higher education, that is: curriculum, research and scholarship, operations, faculty and staff development and rewards, outreach and service, student opportunities, and institutional mission, structure and planning (ULSF 1999). As Shriberg (2004) argues, the questionnaire was found to have a clear focus on sustainability and sustainability processes and to be helpful in designing sustainability strategies at local level. However, the SAQ was found to be not quite suitable to support the MESA Universities Partnership because it is primarily qualitative and hence responses cannot be used to rate or compare institutions (ULSF 1999). The SAQ also assess sustainability at the level of the whole institution which can potentially mask any good practices taking place in individual departments and units. This was going to make the required form of intervention in the case of the MESA Universities Partnership difficult, that is, strengthening individual sustainability practices into university-wide initiatives.

The AISHE makes it possible to decide by internal or external auditing, to which level the university (or a part of it) has succeeded in implementing sustainability. It consists of 20 criteria within five fields of attention, namely: vision and policy, expertise, educational goals and methodology, education contents, and result assessment (Roorda 2001). It is aimed at expanding sustainability efforts across Europe and the world, resulting in certificates, awards, and other forms of recognition for users. The AISHE can foster participation in the auditing process and is a good example of a process-oriented approach to sustainability assessment (Shriberg 2002). However, the AISHE criteria are abstract and difficult to understand and the tool does not explicitly include indicators on motivations for pursuing sustainability (ibid.).

The GASU was developed through modification of the Global Reporting Initiative Sustainability Guidelines to facilitate the analysis, longitudinal comparison, and benchmarking of universities' sustainability efforts and achievement (Lozano 2006). The Global Reporting Initiative guidelines which are inclusive of the three dimensions of sustainable development (economic, environment/ecological, and social) were modified to include education as one of the dimensions; to make them suitable for universities (ibid). The GASU uses indicators grouped under economic, environmental, social, and educational dimensions and offers a condensed graphical overview of these (Lozano 2006). Its major strength lies in the fact that it is indicator-based (ibid.), which makes it better in terms of transparency, consistency, and usefulness for decision-making over accounts and narrative assessments. It can also be used to measure and compare progress, two aspects which Shriberg (2002) identified as most difficult in assessing sustainability in higher education. However, the GASU indicators were found to fall short of some of the roles of universities defined through sustainability declarations and relevant in the African context.

While these tools were found to have their strengths in assessing sustainability in universities, none of them fully satisfied the features sought by the study. One of the main critiques, from the point of view of the PhD study (Togo 2009), is that the tools audited sustainability at university level and did not capture initiatives taking place at departmental level well enough, except as examples. Since the university tends to be managed via departments and unit heads in a broader management system, it was found necessary to develop a tool that allowed for a unit-based framework, but which could also produce systems-wide data. Such a tool needed to give an insight into the 'whole' picture of sustainability in universities but needed to allow for flexibility so that it could be used at department, faculty, and division (or unit) level to guide assessment of university-wide change initiatives so as to identify potential areas of intervention. We also needed a tool that could be used at various levels of the university system to initiate reflexivity and change oriented learning and practice.

The SAQ, AISHE, and GASU were therefore reviewed and adapted, and provided a basis for developing indicators for a USAT (Togo and Lotz-Sisitka 2009) (USAT, see Appendix 1A-D). The USAT has built-in flexibility which enables it to be used at departmental or unit level and across the entire institution. The tool was informed by both the strengths and shortcomings of the other three SATs and was designed to be easy and quick to use, indicator-based for benchmarking and comparative purposes; and to be applicable in individual departments and units hence not requiring much effort in the assessment. It also attempts to meet some of the ideal features of good SATs like being able to address contextually appropriate issues important to campus environmental and socio-economic efforts; enabling benchmarking and assessment of efforts over time while making comparison of efforts possible; and being comprehensible to various stakeholders Shriberg (2002, pp. 74–76).

Methodologically, the tool was based on a whole systems approach and was also influenced by critical realism. The tool was intended for use in a whole university context and therefore was designed to assess sustainability in all the operations and functions (components) of a university. While the whole systems approach (Sterling 2003, 2004) argues that the whole institution is of concern, Archer (1995, p. 14), in her theory of social change, argues that different strata (or units) may possess different emergent properties and powers different to the powers of other strata thus may have unique "independent causal influences" which influence the whole in different ways. For example, one faculty or unit may have different structures, histories, cultures, priorities, resources, actors, etc., to another, and may therefore influence the whole system in dissimilar ways. The USAT was developed in such a way that it can be used to study teaching departments and other institutional units at a university separately to capture possible differences in sustainability mainstreaming due to different influences and emergent properties of these departments which result in unique impacts/influences on the whole institution. If units are not differentiated in the analysis, areas of success and areas of possible intervention may be overshadowed, and may remain poorly understood in the context of the whole. The unit-based structure of the tool which enables use at departmental level still allows a whole picture of sustainability mainstreaming at the university to be built from these assessments as will be discussed later.

Piloting the USAT

Sustainability Assessment at Rhodes University

The USAT was initially developed with three parts: A, B and C. That original version was employed to assess sustainability in the whole institution at Rhodes University (Togo 2009). The assessment, while it was in response to the research questions of the Ph.D., was also part of the development process of the tool and helped to inform its further refinement.

The sustainability assessment, guided by critical realism's levels of reality (Sayer 2000), was meant to establish the sustainability practices taking place and the level to which the practices were mainstreamed in selected departments and divisions at RU (the critical realist empirical level of observed events (ibid)). The process followed in the assessment was that of going through the relevant part of the USAT together with the assessor so as to clarify some of the indicators (where necessary). Two printed copies of the USAT were used with both the assessor and the Ph.D. researcher recording the scores that the assessor allocated for each of the indicators. The assessment was also tape recorded (with prior consent) and this helped both to verify the scores later and to capture the discussion surrounding the assessment for possible elaboration and justification for the scores.

The assessment enabled identification of a few errors in the original tool which were then corrected. These included repetition of numbering for some indicators and similar codes for some indicators which had to be re-coded. Most important however, the USAT enabled establishment of the level of integration of sustainability in the various operational divisions of the university. It was also found possible to build a whole picture of university sustainability in teaching departments from Part A of the tool. The Rhodes University assessment also validated the choice of HODs as suitable respondents in carrying out sustainability assessments as they were all found to be knowledgeable of the operations of their departments or units. This was validated through the use of X as one of the criteria for rating performance to help check quality of responses (this will be further explained in the next section). X indicates lack of information on the practice.

USAT Piloting Within the MESA Universities Partnership

Just after its use at Rhodes University, the tool was developed into a draft booklet for wider piloting in the MESA Universities Partnership. This pilot version of the tool, developed in 2008, was mainly used by members participating in MESA Universities Partnership to identify possible change actions (named 'change projects') in their institutions (UNEP 2008). These can be curriculum changes, campus management changes, or policy changes (amongst others) that contribute towards a more sustainable university. About 18 universities from different African countries; out of a total of 23 universities participating in the partnership's staff development program that year; used it to identify their change projects.

The tool was employed in different ways (some used only one part) and in various contexts. This facilitated checking the quality of the tool, usefulness when the assessment is done by other users who are not necessarily the researchers who developed it, and its relevance in and adaptability to different contexts. The researchers obtained important feedback on the tool which led to its improvement to suit a broader context, including a recommendation which led to the development of Part D which focuses on policy issues.

A Unit-Based Design and Indicators

This section briefly outlines the design features of the USAT. For a full explanation, please see the USAT booklet developed for the MESA Universities Partnership (Togo and Lotz-Sisitka 2009). The current four parts of the tool focus on different operational functions of the university. Each of the parts define criteria for mainstreaming sustainability for the intended division, but, at the same time, leaving room for modification of indicators depending on the context in which the tool is being used. The tool is also open ended and allows users to add any relevant indicators which may not have been captured but are relevant in some contexts. This makes it adaptable to various contexts. The GASU informed the development of indicators that are measurable, their rating and graphical representation of the results of sustainability assessments.

Part A pays particular attention to the core mission of universities and covers curriculum, teaching approach, research, community service activities, examinations/assessment and staff expertise. Generally the indicators help to establish the levels of integration of sustainability in teaching, research (including the level to which such content is examined), community service and sustainability partnerships. Some of the indicators were informed by the AISHE especially those focussing on teaching approach and examination. Staff expertise in sustainable development and staff willingness to be involved in sustainability practices was also included as, without expertise and even willingness to participate, mainstreaming of sustainability becomes a challenge (see Appendix A.1).

Part B (Appendix B.1) deals with other university operations and the management of the university, including estates division as well as management divisions like human resources, planning, and research. It was modeled on the operations section of the SAQ which identifies practices that are emphasized by institutions moving toward sustainability internationally (ULSF 1999). The idea is to benchmark or get a snapshot of the institution's sustainability performance in practices like waste management, air pollution reduction, energy conservation, water conservation, landscaping, transportation programs, purchasing, etc. In addition to rating, Part B also requires the assessor, among other things, to indicate what can be done to improve the practice.

Part C drew on the SAQ to design as set of indicators for student involvement in sustainability and considers the way students are involved in the operational management of the university (e.g., are student groups involved in recycling, waste management, or energy saving initiatives on campus?). Such initiatives can be linked to other activities (as outlined in Part A, B, and C of USAT) or they can be self-initiated, independent initiatives taken by students outside of the mainstream teaching, research, and management activities of the university. Part C indicators, like Part B also requires the assessor to indicate key areas and to show where he/she does not have adequate information regarding the practice, and, in addition, to give an outline of the actual activities on the ground (Appendix C.1).

Part D which also partly drew on the SAQ (ULSF 1999) is targeted at university managers; is designed to assess sustainable development related policy at various levels, and other university written statements. It focuses on integration of sustainability in higher education policy and the degree to which the policy is shaped by national and global sustainability issues and strategies. It also considers the degree to which institutional policies and written statements show commitment of the university to national and global sustainable development agendas.

Coding of Indicators

The indicators were coded for no other reason than to allow ease of representation in tables and graphs. Most of the indicators are wordy and it was going to be a challenge representing then graphically without coding.

Rating of Indicators

The rating of identified activities (for all USAT parts) is based on evidence indicating the presence of the identified indicators and practices. This results in ordered response levels (Uebersax 2006) loosely based on the Likert scale. Explanation and translation of the scales into percentages; and graphical representation of assessment results was based on the GASU (Lozano 2006). Respondents selected the score from 6 choices ranging from X to 4 where:

- X (don't know): lack of information but not necessarily an absence of such information.
- 0 (none): absence of information regarding the indicator (about 0 % of such information).
- 1 (a little): poor performance in the concerned indicator (about 25 % of full information regarding the indicator).
- 2 (adequate): regular performance (about 50 % of full information required by the indicator).
- 3 (substantial): good performance (about 75 % of full information required by the indicator).
- 4 (a great deal): excellent performance (more than 75 % of full information required by the indicator).

Identification of Respondents

While the USAT is used at the level of individual departments/divisions, there is need for identifying a suitable and knowledgeable respondent for quality data. The USAT uses a built-in quality check mechanism, the rate 'X', to ensure that the respondent to the assessment has adequate knowledge regarding the work of the department or division. Where more than 40 % of the indicators are rated X (don't know), this is used as an indicator that there is need to identify another, more knowledgeable main respondent. As mentioned earlier, heads of divisions and departments were found to be knowledgeable enough to perform the assessments at Rhodes University. However, the use of X as a quality checking mechanism was maintained in the final USAT in case of irregular circumstances, like, for instance, where a new HOD has no full understanding of the department's operations.

Analysing USAT Data

For Part A, USAT data can be presented in table form or graphically in radar diagrams (after Lozano 2006) and histograms. Radar diagrams can be developed for each of the departments in which sustainability assessment was done and a whole university picture can be built from the assessment of individual departments. This will be demonstrated in the section showcasing a whole university assessment at the University of Swaziland (UNISWA). For Part B to D, sustainability assessment can be done for the whole university with persons heading the university's Estates Division (Part B); the student representative council or student environmental society (Part C) and the planning division of the university (Part D). In that case, data are represented in radar diagrams, in the same way as the data for individual teaching departments, but will be representing overall university performance. While this is the way the tool was used at Rhodes University, UNISWA and other contexts, Part B to D can also be used at the level of individual divisions if the identified practices exist at levels lower than the overall university. A whole university picture for the assessment will then be developed from the individual assessments in the same way as USAT Part A data.

A Systems Approach to Change Initiatives in the Mesa Universities Partnership

Whole University Assessment of Curriculum and Pedagogy at UNISWA

The sustainability assessment that was done at UNISWA is part of the MESA Universities Partnership sustainability mainstreaming practices. The objective of the assessment was to determine the extent to which the university was responding to issues of environment and sustainable development through its operational functions and to establish evidence of such practices. The research was therefore designed to capture empirical evidence of sustainable development initiatives at the university. The study employed systems thinking (Banathy 1992) as a guiding framework in collecting and analysing data. Based on the concept of holism, all the operational divisions and units of the university which among other things are implementing or are expected to implement sustainable development practices were represented in the study. Teaching departments were stratified according to their faculties and at least one department was selected from each of the university's seven faculties for inclusion in the study. Non-teaching divisions included in the study are: Operations/Physical Planning, the University Planning Centre (UPC), the Student Representative Council and environmental groups.

There are a few other divisions which were involved in the study but were not exposed to USAT assessment as they provide support to other units, particularly, teaching departments, for example the Centre for Community Service and UNISWA Research Centre. Their involvement in sustainability practices was already reflected through the operations of these other units.

Involved HODs at UNISWA did a self-assessment of their divisions. Results of the sustainability assessment were captured using Microsoft Excel and radar diagrams were constructed for each of the departments to give a snapshot view of the level of mainstreaming of different sustainability practices. While data from other data gathering techniques will not be discussed in this chapter, it is necessary to mention that interviews and document reviews were undertaken to supplement USAT data.

The tool enabled the establishment of the level of integration of the practices defined through USAT indicators in the different departments and divisions of the university. To give an example from Part A of the tool, integration of sustainability in the activities of the Department of Consumer Sciences was found to be very low. There is little sustainability content in the curriculum and there were no research initiatives in sustainable development (see data table in Appendix A.2 (column 4) and Fig. 1a). There were also no sustainable development partnerships between the department and other universities and/or other stakeholders. Most of the indicators were rated 1 (a little) and the average indicator score was also 1. However, there was a high level of willingness among staff to participate in sustainability (a rating of 3: substantial) even though expertise in the discipline was low (rating of 1) (Fig. 1a).

In university physical operations, most of the practices identified by the USAT (Part B) were not yet taking place at UNISWA except (Fig. 1b, raw data in Appendix 2B). These included waste reduction practices, recycling of solid waste, CO_2 and air pollution reduction practices, sustainable landscaping, etc. Most of the practices were still not quite developed and were rated 1 (a little).

A number of student initiatives for sustainable development were established to be in place from USAT Part C assessment. The extent of implementation of most of them was indicated to be a little (rated 1) during the sustainability assessment.

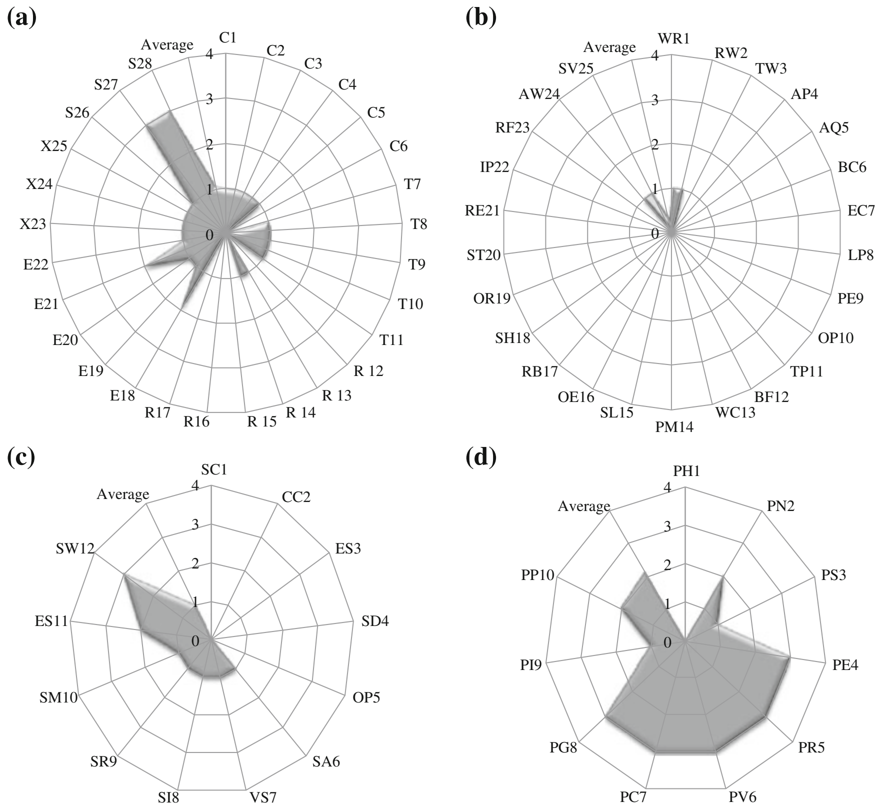


Fig. 1 A pictorial representation of USAT (Part a–d) results. **a** Department of consumer sciences **b** university physical operation **c** student activites **d** policies and written statements

Those which were rated 0 (none) were mainly practices implemented by the university for the benefit of students (see Fig. 1c and Appendix C.2). These included: career counseling; sustainability practices in residences (e.g., recycling); and orientation program(s) on sustainability for students. USAT data also revealed that the students themselves were willing to get involved in environment and sustainability issues (rated 2–adequate) and had initiated most of the sustainability practices they were involved in independent of university structures.

For Part D of the USAT, all sustainable development practices identified by the indicators are being implemented at the university, except mainstreaming of sustainability in the country's higher education (which was rated 0–none). The extent of involvement in the practices, however, differ with the scores ranging from 1 (a little) to 3 (substantial) (see Fig 1d and Appendix D.2). Generally, the results show that sustainable development is to an extent, reflected in UNISWA's written statements.

The radar diagrams provide a pictorial view of how the departments/divisions are performing in mainstreaming sustainability. For departments/universities wanting to improve their sustainability practices, this information helps to point out areas for further improvement. The diagrams are also useful in benchmarking progress especially when departments want to engage in continuous assessment of progress. Areas of progress and those lagging behind are easily identifiable from comparing sets of data from different time periods.

Beyond an individual department, USAT data can also be used for comparative purposes. USAT Part A data can be used to compare the level of integration of sustainability among different departments within one university. The Department of Geography, Environmental Sciences and Planning (Department of Geography) at UNISWA, for example, unlike in Consumer Sciences, is highly involved in sustainable development practices defined through USAT indicators. A comparison of the radar diagrams for the two departments will quickly reveal these differences (Fig. 2). For Parts B to D, this comparison is also possible where assessment will have been done, say at faculty level.

The USAT enables the building of a whole picture from assessments done in a number of departments with similar operations, e.g., teaching departments. This whole picture can be built in two ways: to reflect overall performance per department, or overall performance per each of the sustainability indicators. Figure 3 shows overall university performance per department represented using a histogram (Fig. 3a) and a radar diagram (Fig. 3b). From 28 indicators in USAT Part A, the highest possible score for each department is 112. Overall performance for each department was obtained by totalising all indicator scores for each department and presenting them out of 112. The histogram, though reflecting overall performance per department, also shows the rating for each indicator.

Overall performance for all parts of the USAT can also be shown at university level for each indicator. At UNISWA, it is only in teaching departments that

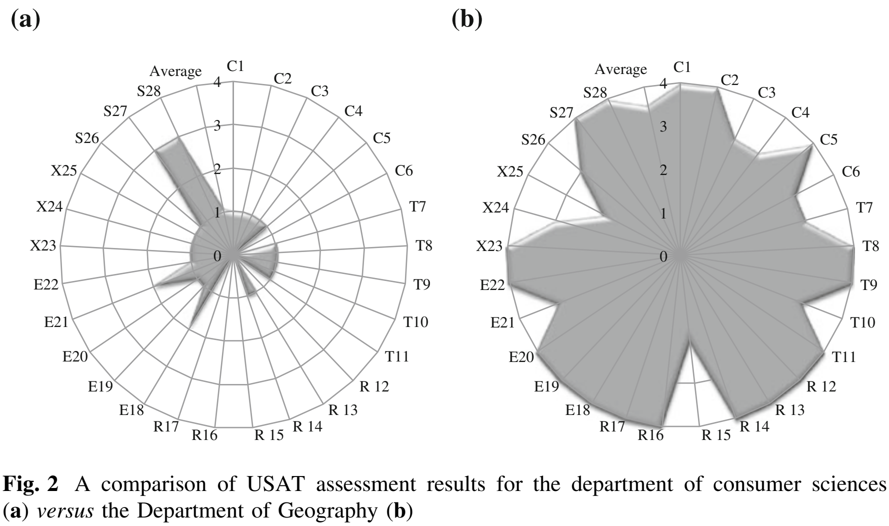


Fig. 2 A comparison of USAT assessment results for the department of consumer sciences (**a**) *versus* the Department of Geography (**b**)

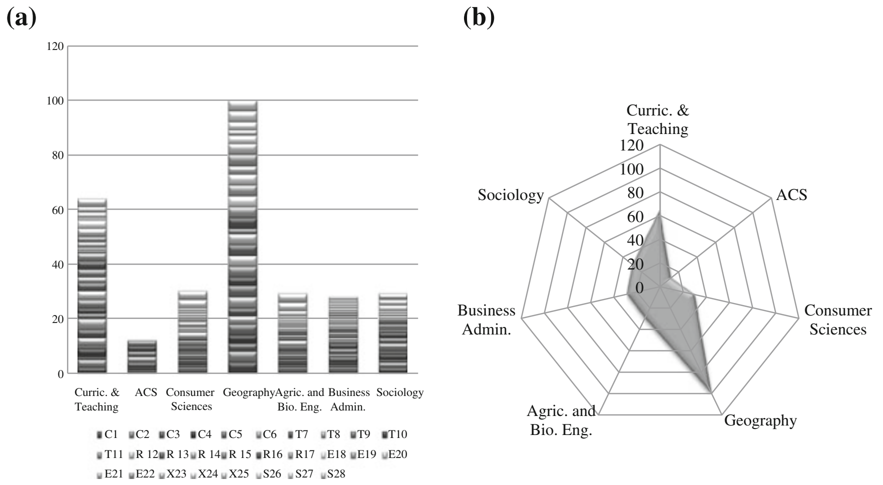
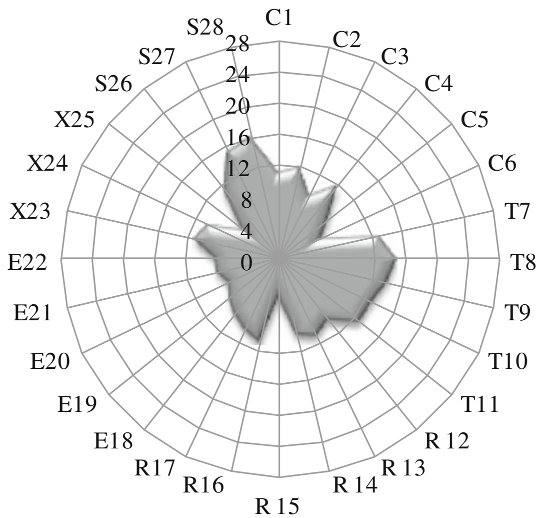


Fig. 3 Overall university performance per department. **a** A histogram showing total performance per department **b** a radar diagram showing total performance per department

multiple assessments were done. Each indicator (USAT Part A) was rated seven times (in the seven teaching departments that participated in the assessment). The highest possible rating for each indicator is four. The highest possible score for each indicator across departments is therefore 28. Figure 4 shows overall performance, out of 28, for each indicator.

Calculating overall performance, whether per department or per indicator; helps in strategic planning for universities involved in mainstreaming sustainable development. Performance per department will clearly show which departments

Fig. 4 Overall performance of the university per indicator



are lagging behind in mainstreaming sustainability and which ones are performing better. Performance per indicator also shows the level of involvement of the university in various practices, making clear those practices (defined by indicators) which are lagging behind. For universities wanting to strengthen their mainstreaming activities, this helps in identifying intervention areas.

Parts B to D of the USAT also help to collect qualitative data to explain the sustainability practices at the university (Part C) or to give those involved in the assessment a chance to present what they think can be done to improve the situation (Part B and D). This helps reviewers to start to reflect on their practices and to think about ways of improving them thus facilitating progressive thinking. However, in terms of evidence for the practices, not much can be gathered through the assessment.

Using the USAT to Identify Change Projects

The main aim for developing the USAT was to inform the MESA Universities Partnership as mentioned earlier, by providing a tool that would facilitate identification of change projects by participating members in their institutions. After its refinement and publication, the tool is continuously being used in the MESA Universities Partnership by staff development participants to identify change projects. Table 1 summarizes how it was used in some of the participating universities in 2011.

The USAT has proven to be a useful tool in the MESA Universities Partnership. The initiatives outlined in Table 1 show the influence the tool is having in sustainability mainstreaming in Africa but are only a few examples of how it is being used. The sustainability auditing process using the USAT is said to be enabling situating change projects in a wider context and allowing participants "to conceptualize possible change, and to see how ESD can be strengthened in the institution; and it provides them with 'data' that can be discussed in relation to practices in the institution" (Lotz-Sisitka and Hlengwa 2011, p. 16).

USAT assessments have revealed the need for curriculum reviews in many universities, including some of those outlined in Table 1 (e.g., in the University of Botswana and the university of Gondar, Ethiopia). USAT assessments have also influenced the development of new academic courses (see Buisitema University and Makerere University, Table 1). In some cases, the need for developing new academic programs was also revealed. For example, in 2008, a USAT assessment at the University of Botswana (not in the table) led to the introduction of a Masters Degree in Environmental and Sustainability Education (Togo 2009). At NMMU (Table 1) Part C (students' involvement) of the tool was adapted and used to assess sustainability among the student body. Following the assessment, the university has since recognized the need for some of the facilities that are defined as important through USAT Part C indicators. The university is also employing the

Table 1 Identifying change projects using the USAT

University	The change project and how it was informed by the USAT
Botswana: University of Botswana	*Integration of ESD into Faculty of Education Modules in Early Childhood Education (ECD) and Education Leadership and Management (ELM) programs* USAT auditing of courses was done and it informed a curriculum revision in two modules: Early Childhood Development (ECD) and Education Leadership and Management (ELM) to strengthen ESD focus
Ethiopia: Gondar University (GU) (Faculty of Health Sciences)	*Development of University Guidelines for Integrating ESD into University Curricula* A USAT assessment was done in 5 faculties. The results showed the need for curriculum re-orientation. A draft document on Guidelines for Integrating ESD into University Curricula was produced. The university is preparing itself for large scale curriculum re-orientation under a modular system, and the ESD guidelines will be used in this context
South Africa: Nelson Mandela Metropolitan University (NMMU) (Sustainability Unit)	*NMMU Student Mobilisation Project* Part C of the USAT was adapted and used to assess involvement of students in sustainability practices. The USAT results were used as foundation for the project which resulted in various initiatives and actions including the registration of a student organization, a Student Mobilization Indaba, and an Agent of Change leadership capacity development workshop. The USAT is being used for ongoing evaluation and there is evidence of substantive improvement in the project with time. Three new priorities for the university were also identified through USAT assessment that is: establishing an environmental centre for student activities; sustainability practices in residences and career counseling for work opportunities related to Environment and Sustainability
Uganda: Buisitema University (BU)	*Focus on curriculum development and teaching practices infused with SD in the Science Education faculty* USAT analysis showed low levels of integration of sustainability into university programs, and a lack of community engagement. This led to the development of a cross cutting course for the Bachelor of Science Education programme which was due to begin in August 2012

(continued)

Table 1 (continued)

University	The change project and how it was informed by the USAT
Uganda: Makerere University (MU)	*Integration of SD into the 'Theory and Practice of Educational Administration' and Management course outlines* The USAT audit of different sub-disciplines in the School of Education showed poor integration of ESD concepts and approaches in all courses. Integration of ESD is being done in one of the courses. A draft of the course outline with revisions to mainstream ESD has already been produced. Later, internal discussion of the USAT audit results showed that there is a desire by staff to gain a deeper understanding and skills in sustainable development in the School of Education as a whole. It was proposed that an effective way to deal with this would be to design a Postgraduate diploma and Masters Degree course in ESD in the School of Education; to develop short courses on ESD; and to enhance community engagement

Source Adapted from Lotz-Sisitka and Hlengwa 2011

tool to continuously assess progress with time, showing the usefulness of the tool in benchmarking progress.

While in many cases, like in the examples captured in Table 1, only one part of the USAT was employed in assessing sustainability for purposes of identifying change projects, some universities used all the four parts of the tool. Besides the UNISWA example discussed in this chapter, Mansoura University in Egypt (not in the Table) also performed a whole university assessment. It is also one of the universities that used Part B–D of the tool at faculty level before building a whole university picture from the assessments (Mostafa 2011). This also serves to show the flexibility in the way the tool can be employed. Most important is its potential to 'seed change' in universities toward sustainability within an emergent and reflexive social change approach (Lotz-Sisitka and Hlengwa 2011).

Concluding Remarks

Data from USAT assessment only show the level of integration of sustainability (for the identified indicators) in university functions. The data does not provide any form of evidence for the practices except Part C, which require respondents to explain the sustainability activities on the ground. At the same time, it does not show how mainstreaming has been happening in an institution. From the assessment that was done at Rhodes University, it was therefore found necessary to supplement data from the sustainability assessment with other data collection techniques. These include interviews to get a fuller explanation of the practices particularly for Parts A, B, and D, analysis of documents with evidence of such practices which also help to show if sustainable development is being addressed holistically (i.e., whether all sustainable development dimensions; ecological, social and economic; are addressed). Examples of relevant documents include course material, examination scripts, research reports; community service reports student magazines, minutes of meetings and even content from the university website. Observations of practices can also substantiate data from other sources.

The USAT has had considerable influence in sustainability mainstreaming practices in the MESA Universities Partnership. This shows that the tool is relevant to the African context, even though in some cases the indicators had to be adapted to suit local circumstances. Because of its in-built flexibility, it was used in various ways with many of the universities employing only one out of its four parts. The main value of the USAT lies in its demonstrated potential to reveal the level of integration of sustainability in university operations and enabling identification of starting points for change oriented learning and action projects for the incorporation of sustainability in universities.

Appendix The USAT

USAT Part A: Teaching Departments

PART A Unit-Based Sustainability Assessment Tool Teaching, Research and Community Service

Institutions/departments committed to sustainability feature certain topics in their course offerings, e.g., globalization and sustainable development; environmental philosophy; nature writing; land ethics and sustainable agriculture; health promotion, urban ecology and social justice; population, intercultural understanding and peace, women and development; human rights, overcoming poverty, sustainable production and consumption; the role of information and communication technologies and many others (ULSF 1999). Sustainability would be integrated into faculty and student research on topics such as renewable energy, sustainable building design, ecological economics, indigenous wisdom and technologies, population and development, total environmental quality management, etc. (ibid.) The USAT is designed to assist in assessing the extent to which your department is engaging in sustainable development concerns in its teaching, research, and outreach activities. It requires you to give your impression on the identified dimensions using the assessment criteria below.

Assessment criteria	
X = Don't know	no information concerning the practice
0 = None	there is total lack of evidence on the indicator
1 = A little	evidence show poor performance
2 = Adequate	evidence show regular performance
3 = Substantial	evidence show good performance
4 = A great deal	excellent performance

Code	Indicator	Score					
		x Don't know	0 None	1 A little	2 Adequate	3 Substantial	4 A great deal
	Curriculum						
C1	The extent to which the department offer courses that engage sustainability concerns						
C2	The level of integration of sustainability topics in courses referred to above						
C3	The degree to which local sustainability issues and challenges form part of the department's teaching programme						
C4	The degree to which global sustainability issues and challenges form part of the department's teaching programme						
C5	The extent to which the department enroll students in courses that engage sustainability concerns						
C6	The level of cross faculty collaboration in teaching sustainability programs						
	Teaching approach How far the teaching approach contributes to development of the following characteristics among students:						
T7	The capacity to make informed decisions						
T8	Critical thinking skills						
T9	A sense of responsibility						

(continued)

(continued)

Code	Indicator	Score x Don't know	0 None	1 A little	2 Adequate	3 Substantial	4 A great deal
T10	Respect for the opinions of others						
T11	Integrated problem solving skills						
	Research and scholarship activities						
R12	The extent to which the department (staff and students) is involved in research and scholarship in the area of sustainability						
R13	The degree to which global sustainability issues and challenges form part of the department's research						
R14	The degree to which local sustainability issues and challenges form part of the department's research						
R15	The extent to which the department is collaborating with other faculties, institutions, and stakeholders in pursuit of solutions to sustainability problems						
R16	The extent to which aspects of sustainable development are used in selection/execution of research						
R17	The level to which aspects of sustainable development are reflected in the department's research outputs						
	Community Engagement						
E18	The extent to which the department (staff and students) is involved in community engagement in the area of sustainability						
E19	The level of commitment of the department's resources in sustainability projects in the community						
E20	The degree to which local sustainability issues and challenges form part of the department's community engagement						
E21							

(continued)

	The extent to which the department collaborates with other stakeholders in addressing community sustainability challenges
E22	The extent to which aspects of sustainable development are used in selection/execution of community engagement projects
	Examination (assessment) of sustainability topics
X23	The extent to which sustainability aspects are assessed/examined during course
X24	The extent to which sustainability aspects are considered in evaluating/assessing projects
X25	The degree to which sustainability aspects are assessed in evaluating service learning programs
	Staff expertise and willingness to participate
S26	The level of expertise of staff members in the area of sustainability
S27	The extent to which staff members are willing to carry out research and service activities on sustainability aspects/topics
S28	The extent to which staff members are willing to teach sustainability topics
	Others (please specify):

USAT Part B: Operations and Management

PART B Unit-Based Sustainability Assessment Tool Operations and Management

Institutions committed to sustainability often emphasize some of the operational practices listed below (adapted from ULSF 1999). The USAT helps to assess the extent to which an institution has implemented these practices using the assessment criteria below. Please complete the score sheet, Add a tick ($\surd$) for key project areas and where more information is needed, leave blank where the practices are non-existent. Briefly indicate what you think can be done, what can be done to improve the sustainability of the practice.

Assessment criteria	
X = Don't know	no information concerning the practice
0 = None	there is total lack of evidence on the indicator
1 = A little	evidence show poor performance
2 = Adequate	evidence show regular performance
3 = Substantial	evidence show good performance
4 = A great deal	excellent performance

Code	Practices	Rate	Key area	Inadequate info	What can be done to improve the sustainability of the practice?
WR1	Waste reduction practices				
RW2	Recycling of solid waste (including paper, plastic, metal, etc.)				
TW3	Source reduction of toxic materials and radioactive waste				
AP4	CO_2 and air pollution reduction practices (including alternative fuel use, renewable energy sources, emission control devices, etc.)				
AQ5	Indoor air quality standards and practices				
BC6	Building construction and renovation based on ecological design principles				
EC7	Energy conservation practices (in offices, laboratories, libraries, classrooms, and dormitories)				
LP8	Local food purchasing programme				
PE9	Purchasing from environmentally and socially responsible companies (including buying and using 100 % post consumer chlorine free paper)				
OP10	Organic food purchasing programme				
TP11	Transportation programme (including bicycle/pedestrian friendly systems, car pools, bus pass programs, electric/natural gas campus vehicles)				
BF12	Use of bio-fuel				
WC13	Water conservation practices (including efficient shower heads and irrigation systems)				
PM14	Integrated Pest Management practices (including reduction of pesticides to control weeds)				

(continued)

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Code	Practices	Rate	Key area	Inadequate info	What can be done to improve the sustainability of the practice?
SL15	Sustainable landscaping (emphasizing native plants, biodiversity, minimizing lawn, etc.)				
OE16	Integration of sustainability operations into the educational and scholarly activities of the university				
RB17	The presence of a body responsible for sustainable development at the institution				
SH18	Consideration of aspects of sustainability in staff hiring decisions				
OR19	Consideration of aspects of sustainable development in orientation programs for new staff members				
ST20	Staff development in sustainable development				
RE21	Staff rewards in sustainable development				
IP22	Consideration of aspects of sustainable development in institutional planning				
RF23	Allocation of research funds for sustainability projects				
AW24	Awareness raising in sustainable development				
SV25	Visibility of sustainable development through celebration of environmental days (e.g., Arbor day, water week, etc.)				
	Others (please specify):				

USAT Part C: Student's Involvement

PART C Unit-Based Sustainability Assessment Tool Student's Involvement

Institutions committed to sustainability provide students with specific opportunities and settings. They also encourage students to sustainability issues when choosing a career path. Conversely, students can initiate some of the activities, especially, if the institution is supportive. Listed below are some of the opportunities and activities for and by students (some were adapted from the ULSF 1999) which reflect commitment to sustainability. The USAT helps in assessing the degree of involvement of students in environmental and sustainability issues using the given assessment criteria. Add a tick (√) for key areas and where more information is needed; briefly outline key activities in the area of sustainability

Assessment criteria	
X = Don't know	no information concerning the practice
0 = None	there is total lack of evidence on the indicator
1 = A little	evidence show poor performance
2 = Adequate	evidence show regular performance
3 = Substantial	evidence show good performance
4 = A great deal	excellent performance

Code	Activities and opportunities	Rate	Key areas	Inadequate info	Outline of activities (what exactly is being done?)
SC1	Student environmental centre				
CC2	Career counseling focused on work opportunities related to environment and sustainability				
ES3	Environmental societies or other Student Group(s) with an environmental or sustainability focus				
SD4	Sustainability practices in residences or dormitories by students (e.g. recycling)				
OP5	Orientation programme(s) on sustainability for students				
SA6	Student environmental and sustainability awareness programs				
VS7	Voluntary community service by students related to sustainability issues and concerns				
SI8	Involvement of student groups across campus in sustainability initiatives				
SR9	SRC involvement in environmental and sustainability initiatives				
SM10	Student collaboration with management in the area of environmental and sustainability				
ES11	Environmental and sustainability activities initiated by students themselves (independent of departments, lecturers, management, etc.)				
SW12	Students' willingness to take responsibility in the environmental and sustainability area				
	Others (please specify):				

USAT Part D: Policy and Written Statements

PART D Unit-Based Sustainability Assessment Tool Policy and Written Statements

Part D of the USAT focuses on integration of sustainability in higher education policy and the degree to which such higher education policy is shaped national and global sustainability issues. It also considers the level to which institutional policies and written statements reflect mainstream sustainability issues, and the degree to which they show commitment on the part of the university to address national and global sustainable development agendas. According to ULSF (1999), institutional commitment to sustainability can also be expressed through written statements of the mission and purpose of the institution; Rate activities and opportunities in the environmental and sustainability area by completing the score sheet. Add a tick (√) for key areas and where more information is needed; leave blank where the practices are non-existent. Briefly outline key activities in the area of sustainability.

Assessment criteria	
X = Don't know	no information concerning the practice
0 = None	there is total lack of evidence on the indicator
1 = A little	evidence show poor performance
2 = Adequate	evidence show regular performance
3 = Substantial	evidence show good performance
4 = A great deal	excellent performance

Code	Practices	Rate	Key Area	Inadequate info	Elaborate on the situation	What can be done to improve the situation
PH1	The extent to which the country's HE policy reflects an engagement with sustainability concerns					
PN2	The degree to which national and global sustainability issues inform decision-making processes in HE policy and structures					
PS3	The level of support given to HE institutions on sustainability programs					
PE4	Existence of sustainability/ sustainability related policies at the institution					

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(continued)

Code	Practices	Rate	Key Area	Inadequate info	Elaborate on the situation	What can be done to improve the situation
PR5	Integration of sustainability issues in institutional policies					
PV6	Integration of aspects of sustainable development in university vision and mission statement					
PC7	Reflection of local sustainability challenges in policies and written statements					
PG8	The degree to which policies and written statements reflect national and global sustainability issues					
PI9	Implementation of policies of sustainability/sustainability related policies					
PP10	Plans to improve sustainability focus in the next policy review cycle					
	Others (specify):					

Appendix 2 USAT Data Tables

Data table for all teaching departments

Indicator	Department							
	Curriculum & Teaching	ACS[a]	Consumer Sciences	Geography	Agricultural & Biosystems Eng.	Business Administration	Sociology	Total score per indicator
C1	2	0	1	4	1	1	2	11
C2	3	0	1	4	1	1	2	12
C3	1	1	1	3	1	1	1	9
C4	3	1	1	3	1	1	2	12
C5	1	0	1	4	1	0	1	8
C6	3	0	0	3	0	0	0	6
T7	3	2	1	3	1	2	1	13
T8	4	2	1	4	1	1	2	15
T9	2	2	1	4	1	2	2	14
T10	2	2	1	3	1	2	2	13
T11	3	2	1	4	1	1	1	13

(continued)

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Indicator	Department							
	Curriculum & Teaching	ACS[a]	Consumer Sciences	Geography	Agricultural & Biosystems Eng.	Business Administration	Sociology	Total score per indicator
R 12	3	0	0	4	2	1	0	10
R 13	3	0	1	4	1	1	1	11
R 14	2	0	1	4	1	1	1	10
R 15	3	0	0	2	0	0	0	5
R16	3	0	1	4	1	1	1	11
R17	3	0	0	4	1	1	1	10
E18	0	0	2	4	1	1	1	9
E19	1	0	1	4	1	1	0	8
E20	1	0	1	4	0	1	0	7
E21	2	0	2	3	0	1	0	8
E22	2	0	1	4	0	1	0	8
X23	3	0	1	4	1	1	1	11
X24	3	0	1	3	1	1	1	10
X25	1	0	1	2	1	1	0	6
S26	2	X	1	3	2	1	2	11
S27	2	X	3	4	3	1	2	15
S28	3	X	3	4	3	1	2	16
Average	2.3	0.5	1.1	3.6	1.0	1.0	1.0	
Total (112)	64	12	30	100	29	28	29	

r* Academic Communication Skills

Data table for operations and management

Indicator	Rate
WR1	1
RW2	1
TW3	0
AP4	1
AQ5	0
BC6	0
EC7	0
LP8	0
PE9	0
OP10	0
TP11	0
BF12	0
WC13	0
PM14	0
SL15	1
OE16	0

(continued)

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Indicator	Rate
RB17	0
SH18	0
OR19	0
ST20	0
RE21	0
IP22	2
RF23	0
AW24	1
SV25	1
Average	0.32
Total (100)	8
Rating (%)	8

Data table for students' involvement

Code	Rate
SC1	
CC2	0
ES3	1
SD4	0
OP5	0
SA6	1
VS7	1
SI8	1
SR9	1
SM10	1
ES11	2
SW12	3
Average	1
Total (48)	11
Rating (%)	22.9

Data table for policy and written statements

Indicator	Rate
PH1	0
PN2	2
PS3	1
PE4	3
PR5	3
PV6	3
PC7	3
PG8	3
PI9	1
PP10	2
Average	2.1
Total (40)	21
Rating (%)	52.5

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Part IV
Reorienting the Curricula: Good Practices from Different Edges of the World

A Syllabus for Resilience in Higher Education

Dennis F. X. Mathaisel and Clare L. Comm

Abstract Much anxiety surrounds the future of higher education. With escalating costs, tuition, and class sizes, and the increasing exclusion of many poor and minority students, higher education needs to become more accessible and sustainable. This paper defines five "abilities" for the resilience of higher education: availability, dependability, capability, affordability, and marketability. The literature indicates that components of each of these abilities are lacking at many institutions. To remedy this problem, the authors developed a syllabus for resilience based on these five "lessons." The authors also use several case studies to validate the framework's applicability to higher education.

Keywords Resilience in higher education · Higher education sustainability · Resilient colleges and universities

Introduction and Background

According to Taylor (2010), author of *Crisis on-Campus: A Bold Plan for Reforming Our Colleges and Universities*, "The higher education system is broken and needs to be overhauled." Quality in higher education is declining, and colleges and universities are not adequately preparing students for life in a rapidly changing and increasing competitive world (Taylor 2010). Learning, developing, and perfecting new skills are vital to success in our ever-changing, global economy.

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_16,

There is a common relationship between the financial bubble and education bubble. The value of college and university assets has plummeted. Debts are increasing. Costs continue to climb. In a recent Pew Research Center poll (2011) of 2,142 adults, 75 % of Americans think a college education has become too expensive for most people, and only 55 % of higher education graduates think college prepares them for a job. Hence, higher education is becoming unaffordable, unsustainable, and of questionable value to some parents and students. Consequently, colleges and universities need to respond to this questioning of their value by focusing on their ability to be resilient and sustainable.

Peter Drucker, business consultant and management guru, continues with the same idea, stating "Thirty years from now the big university campuses will be relics. Universities won't survive (unless a radical change is made). It's as large a change as when we first got the printed book. The cost of higher education has risen as fast as the cost of health care. And for the middle-class family, college education for their children is as much of a necessity as is medical care—without it the children have no future. Such totally uncontrollable expenditures, without any visible improvement in either the content or the quality of education, means that the system is rapidly becoming untenable. Higher education is in deep crisis (Lenzner and Johnson 1997)." On the other hand, in many cases, higher education in the United States remains pre-eminent. Its scholarly papers are still the most cited, and it remains the top destination for foreign students. American universities dominate international college rankings. When countries like China, Korea, and Singapore seek to improve their higher education systems, one of their benchmarks is the United States. "The United States is overwhelmingly a reference point for what they want to happen," says Aims C. McGuinness Jr., a senior associate at the National Center for Higher Education Management Systems, who has advised both states and countries on educational reform (Fischer 2009). But, can and will this pre-eminence continue? In a recent Pew Research Center poll (2011) of 1,055 university presidents only 19 % rated the U.S. higher education system as best in the world, and 51 % rated it as one of the best in the world, with concerns that 10 years from now the ratings may be lower.

For-profit educational institutions add to problems in higher education, because faculty academic freedom is nearly meaningless, and tuition is no bargain for students (Auxter 2010). Corporations are purchasing and refurbishing for-profit institutions to make a profit while trying to prove that traditional higher education is obsolete. However, with lower graduation rates and little employment information about their graduates, for-profit universities lack academic accountability. Heavy branding and advertising campaigns portray for-profits as the higher education choices for the next generation of students. Financially, almost half of federal loan borrowers in for-profit colleges defaulted within the first 2 years of loan repayments by 2009 (Auxter 2010). This leads to the belief that for-profit education is not producing well-rounded students nor attracting research-driven and knowledge-motivated faculty.

To be sustainable, higher education today must be treated as a business. To be resilient to the problems it faces, higher education today should also be regarded as a marketable service with qualified, knowledgeable graduates who will contribute positively to society. To the student, higher education is a means to employment. In most cases, it is a means to employment that is more fruitful financially than with just a high school diploma (Eddy 1998). At the graduate level, some universities are producing a product for which there is no market (i.e., candidates for various teaching positions that do not exist) (Taylor 2010). In addition, Ph.D. and Masters Programs, in some cases, have become extremely lengthy. Graduates may not finish the programs until their 30s, with debt surmounting the price of an average home, and without the guarantee of a job (Taylor 2010). Even when economic conditions are generally prosperous, economic insecurity afflicts well educated and highly experienced members of the US labor force (Lazonick 2009).

There are also problems for students in the U.S. starting their higher education in community or 2 year colleges, because these colleges are receiving less government funding, and their students come from the bottom lower socio-economic distribution in the U.S. Consequently, their completion rates are very low. About 44 % of the nation's college students are enrolled in these colleges and will play a major roll in determining how quickly educational attainment rises and sustains itself (Leonhardt 2013).

To be resilient, each institution of higher education, whether it is a 4-year selective college or a community college, needs to develop and communicate its competitive advantages. Clear, definable goals, strong leadership, and keen communication plans are needed. The application of all five essential abilities that are laid out in the syllabus presented below, will illustrate how higher education can achieve this goal of resilience.

Discussion: A Syllabus for Resilience

Sustainability and resilience have become popular goals. They have also become wide-ranging terms applicable to any enterprise on a local or a global scale for long time periods. Sustainability has many interpretations. However, the traditional meaning centers around the words "endure", "maintain", or "support", which is the focus of this paper. Here, sustainability means to aim to maintain the readiness and operational capability of systems or services in the entity through the adoption of a strategy or plan for sustainability that meets established performance requirements in the most effective, efficient manner over the entity's life cycle. The scope varies among entities, of course, but it does include the key word "ability." A college or university that is resilient possesses the five abilities illustrated in Fig. 1. In the discussion that follows, the authors present a syllabus of five lesson plans for a course in resilience and then capstone that course with a set of case studies for resilient colleges and universities.

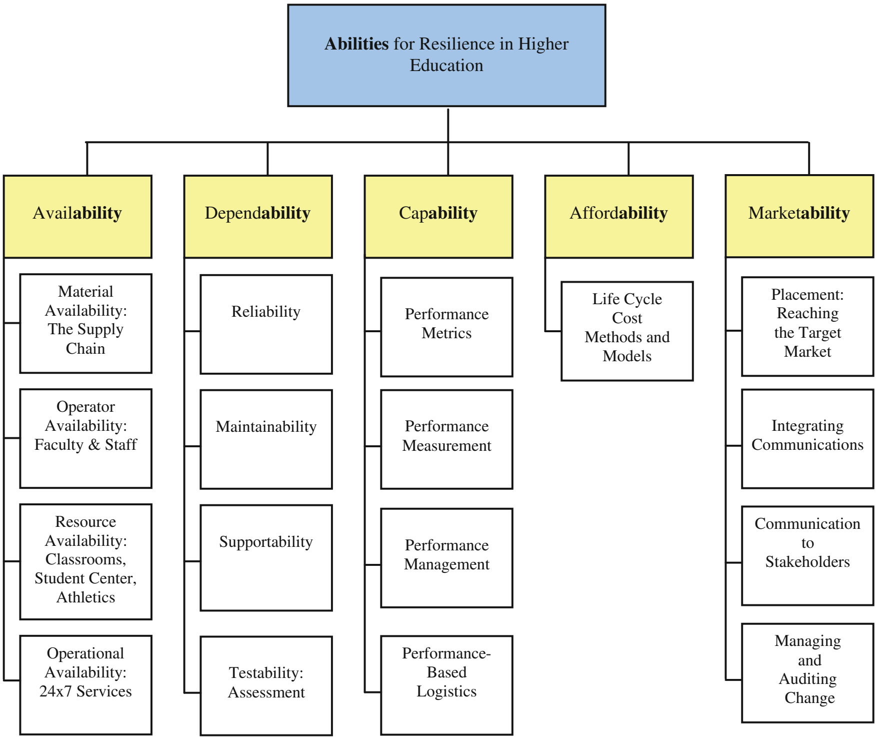

Fig. 1 Abilities for resilience in higher education

First Lesson: Availability

Availability is the ability to have access to the right technology, materials, facilities, tools, and people that makes sustainability possible. Availability to higher education in the United States has become a problem because of expensive tuition costs and access to physical campuses. More and more students are working and enrolling in higher education classes simultaneously, so balancing on-campus courses has become challenging. However, the introduction of online education has increased the availability of education across the globe. From Fall 2002 to Fall 2007, online enrollment in degree-granting postsecondary institutions increased from 1,602,970 (9 % of total enrollment) to 3,939,111 (21.9 %) (Taylor 2010). The online education phenomena is expanding target markets and allowing universities to better reach these target markets—a key component of resilience. Online education may also allow for further availability across other demographics, satisfying another component of endurance.

In addition, online education is an example of innovation mixed with flexibility—another key component of sustainability. The use of information and communication technology in higher education makes it possible for universities to offer students much more flexible access to learning resources, administrative services, and academic staff; but it also encourages students to expect such flexibility (Ellis 2010). According to Mark Taylor, information needs to be available for America to grow in the global world (Taylor 2010), and the invention of online learning provides the means to learn and teach globally. In some cases, online classes are less expensive than on-campus classes, so online education provides a less expensive means to a degree as well.

To be resilient, a university must be flexible in its course content. Basic principles classes are still needed for a well-rounded understanding, but colleges and universities must offer classes that reflect new trends and technology. If there is a specific need in the job market for a specific set of skills, higher education should provide classes and degrees that will prepare students with the knowledge to succeed in this field. For example, entrepreneurship classes in MBA programs are becoming more popular because students and potential students are showing an interest in starting their own businesses. So, if there is a demand for such classes, universities must remain open and flexible to meet this demand. Universities must also create easy access to these classes across all demographics.

Second Lesson: Dependability

Dependability refers to the reliability, maintainability, supportability, and consistency of the service. Students must be able to rely on a university to deliver the tools for success, whether it is through their career placement center or with better understanding of specific subject material. The higher education system is sustained by the ingenuity and passion of those who have chosen an academic life (Ellis 2010). Students depend on teachers and mentors for their education. Colleges and universities need to ensure that the quality of their service, education, and research produces well-educated graduates.

Commitment to education and research promotes movement toward the institution's defined goals. Tenure was established for professors to express their educational ideas through teaching and research without the concern of retribution. Tenure furnishes universities and colleges with the reliable mentors and educators they need to resolve social and economic problems and endure. Currently, 35 % of college/university positions are tenured or tenure-track (Taylor 2010). However, tenured professors still need to be held accountable for their actions. According to the National Commission on Research, "When well designed, the system of accountability involves an appropriate balance between independence and control, between incentives and constraints, and between the costs and benefits of the various procedures and requirements used (Altbach 1999)."

In terms of maintainability, universities should produce education for mass consumption (Taylor 2010). Degrees are more specialized and the number of degrees offered at universities is expanding. Even so, institutions of higher education need to offer a range of degrees to maintain dependability in the market.

Potential students need to depend on the university to offer traditional degrees as well as new, specialized degrees.

With respect to supportability, Charles M. Vest, president of the National Academy of Engineering and former president of the Massachusetts Institute of Technology, says China, Korea, and Singapore are engaging in major efforts to build-up higher education. In the U.S., he says, the same sense of urgency does not exist. He compares the situation to the obliviousness of American manufacturing during the time Japan was building its industry (Fischer 2009). The need for government support is the base of Vest's argument. Public policy supporting the importance and dependability of higher education will certainly give higher education the ability to be resilient.

Third Lesson: Capability

Capability is about performance metrics, performance measures, and performance management. One measure of the effectiveness of a university is linking a graduate's specific degree to the success in his/her career. In addition, one can measure the capability of a university to produce reliable outcomes by the effectiveness of the institution's leadership. To be sustainable, universities must be capable of preparing students for successful careers. Learning is the basis of higher education. An institution's ability to prepare its graduates to tackle problems is crucial to success. A proven track record of successful graduates not only indicates a university's capability to provide a successful service, but also establishes its roots for future growth.

Sustainable leadership matters. It preserves, protects, and promotes deep and broad learning for all in caring relationships. Leadership becomes central to management (Hargreaves 2006). Effective leadership is one of the foundations of a resilient institution. Effective leadership, meaning the ability to communicate the institution's goals, wisely taking action to achieve these goals, and communicating successes to the student body and faculty while continually planning for the future, is the vehicle driving a sustainable institution. According to Professor Robert Ellis, "Clever leadership, design and management can create an ecosystem which adapts to change, improves through learning, learns through experience and can bring itself back into balance through the efficient working of its own internal processes (Ellis 2010)." Sustainable leadership lasts. It preserves and advances the most valuable aspects of learning and life over time, year upon year, from one leader to the next (Hargreaves 2006)." Leaders should communicate their skills and ideas to future leaders so the learning and prospering process can continue. Information sharing encourages further growth. Leaders can do this in the form of policies, politics, written works, and through productive faculty.

Recently in the United States, higher education leaders have been criticized for moving too slowly to position their schools for a changing world. An example was the dismissal and then reinstatement of the President of the University of Virginia for these reasons. Consequently, to be resilient college presidents need to embrace technology as a means of improving student learning.

Fourth Lesson: Affordability

Affordability focuses on life-cycle cost. It is no secret that college has become expensive and, in many cases, unaffordable. According to the Center for College Affordability and Productivity, "Since 1980 in the U.S., the average real cost of attending a 4-year public institution (tuition, fees, and room and board) has more than doubled, going from $6,300 per year to just over $14,000 in 2009. At private institutions, the real cost has gone up by close to 150 % in the same period, rising from $13,700 per year to $33,400" (see Fig. 2) (Center for College Affordability and Productivity 2010).

The financial assets of a university are the bottom line for resilience. Depletion of these assets would have dire effects. Simply stated, with no financial assets, there is no future. For example, a well-known, traditional private institution may not have sufficient life-cycle liquid assets to cover its staggering debt if another crisis occurs. Financial cutbacks may not be enough to support this entity. So, a

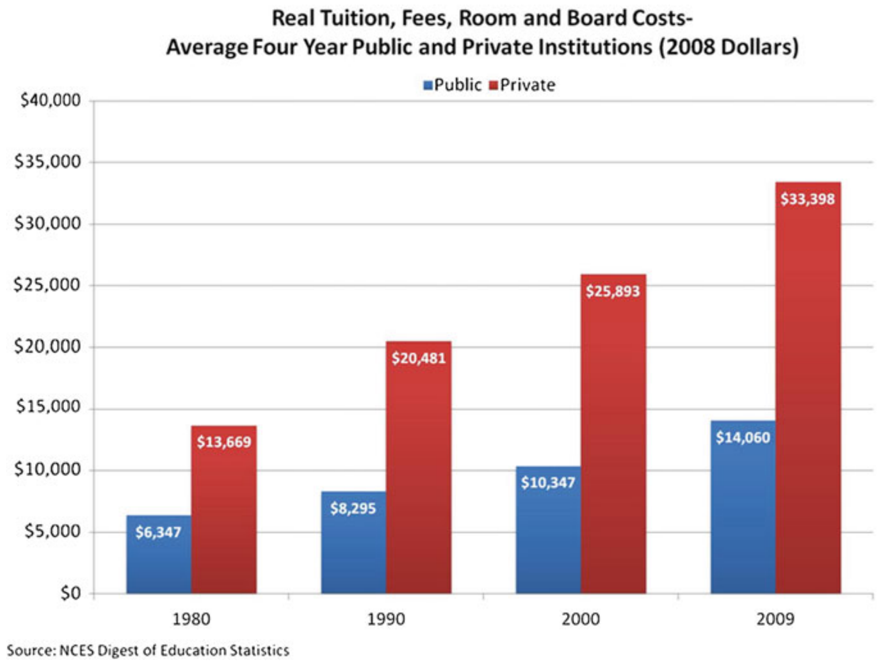

Fig. 2 Rise in real college costs. *Source* The center for college affordability and productivity (2010)

number of consequences can happen: the private university can close its doors; seek a government bailout; or sell the debt to another country, which would assume control over the university (Taylor 2010). The problem for this institution lies in its old traditional ways of thinking. This inhibits the private institution from adapting quickly to the environment, and reputation alone cannot sustain a university.

Increasing unaffordable tuition rates are the main life-cycle problem for higher education in the United States. For higher education to be resilient, it must become more affordable and available to students who do not have the financial means to attend college. It must be able to provide a quality education while reducing the life-cycle cost of its services. For example, 2 years or community colleges have lower costs for a student the first 2 years of college versus the higher cost of attending a 4-year college for 4 years. Higher education cannot totally depend on government subsidized student loans, scholarships, and Pell grants to offset its high costs. Further, these loans must have a low interest rate so students can afford to repay them.

Fifth Lesson: Marketability

Marketability is defining a market for products or services, understanding consumer needs, managing change over time, identifying improvements for the benefit of the stakeholders, and selling sustainability concepts to those resistant to change (Mathaisel et al. 2009). Plans to change and develop marketability must start with clear, achievable goals. It is the responsibility of the leadership to determine the campaign's mission, what new image is required, and later judge whether the set goals are being met (Gregory 1993). For an educational institution, it should not be the goal to just increase the financial bottom line. Each institution of higher education must define its sustainable knowledge-based competitive advantage and pursue a marketing plan for this advantage. Properly communicating the competitive advantage, while managing change, leads to resilience.

Reputation can be a result of a clearly defined competitive advantage. Reputation is the institution's image from the community's point of view. It can also be the global image of the institution. Image begins with the perception of the institution, and the perception is reality to the public (Gregory 1993). However, reputation is not enough to ensure sustainability. As Dr. Jacqueline Moloney, Executive Vice Chancellor of the University of Massachusetts Lowell, states: "When developing a business plan for the future, having a reputation wasn't a sustainable model. We needed to develop a keen business plan in a more entrepreneurial, business disciplined way (2010)."

Goals give purpose to ventures (Hostrop 1983), and the competitive advantage can provide the means to achieve goals. For example, one leading public institution boasts baseball research in its engineering department. This is a great competitive advantage over other institutions because this institution offers interesting, applicable research that others do not. Another example is an institution catering exclusively to multicultural or minority students, as is the case with Bloomfield College and the University of Texas El Paso, which are presented as case studies in the next section of this paper. As stated previously, education is a marketable service and students and graduates are its products. This service's products are generating useful, timely, and applicable research, and capitalizing on this differentiation will plant the roots for growth. In addition to offering research results from its latest projects, students in the baseball example can sponsor summer athletic camps, offer advice to coaches and teams, host seminars, or develop an NCAA research panel.

Image advertising, when properly executed, can dramatically help to move an institution toward meeting its goals. It is, in fact, the very leading edge of strategy, essential in positioning an institution for maximum growth (Gregory 1993). Image advertising is related to branding, which is communicating and identifying the identity of a product, service or business. In treating universities and colleges as businesses, the following goals of image advertising can be utilized (Gregory 1993):

1. Building public awareness and acceptance and establishing a more favorable market position.
2. Redefining an institution after a merger, acquisition, or name change.
3. Pre-selling target markets to support product marketing.
4. Influencing stakeholders and the community.
5. Establishing an institution's position on timely issues.
6. Assisting in the management of a crisis situation.
7. Attracting and keeping quality faculty and staff, while creating a cooperative environment in their communities.

Image can make or break the resilience of a college or university. This image will accompany the new faculty and research and breakthroughs that an institution produces. Obviously, it should relate to the institution's innovations. It's the image that is ultimately going to sustain a college or university. In addition, only through advertising can an institution of higher education publicly express their uncensored, unedited views about the society in which they operate and the events that affect their prosperity (Gregory 1993).

Capstone to the Course: Case Studies in Resiliency

Bloomfield College, New Jersey, USA

Bloomfield College is a 4-year private liberal arts college chartered by the State of New Jersey. The college is a member of the Association of Presbyterian Colleges and Universities. It attracts a geographically diverse resident and commuter population easily reached by train, bus, or by car just 15 miles (24 km) from New York City. The mission of Bloomfield is to allow its student population to attain academic, personal, and professional excellence in a multicultural and global society. Most of Bloomfield's students come from poor economic backgrounds and need all kinds of support in making the transition to college. Bloomfield's earlier problems were captured in a single statistic: its 6-year graduation rate was just 9 %, when about 70 % of the school's budget comes from tuition (Leslie and Fretwell 1996).

Because New Jersey provided generous tuition assistance to students from low-income families, as well as per capita support to institutions enrolling them, Bloomfield concluded that, to be resilient, it would have to concentrate first on affordability, then on capability. To begin, Bloomfield developed a set of "formative" assessments about its student population: who are their students; and what do they need? Currently, 97 % of full-time undergraduates receive some kind of need-based financial aid, and the average need-based scholarship or grant award is $14,453. Tuition and fees are $25,050. A major grant provided faculty with opportunities to rethink their teaching strategies. Through the grant, the faculty were allowed time to study and redesign courses (Leslie and Fretwell 1996).

Part of this redesign was the development of a set of student competencies. Bloomfield was not able to find other model programs dealing with a similarly situated population of students, so it had to create its own student-advancement initiative, which was defined around the capability of students to live and work in a multiracial/multicultural society. After interviewing faculty, students, and others, an initial set of 30 competencies were subsequently boiled down to eight: (1) Aesthetic Appreciation; (2) Communication; (3) Community Orientation and Citizenship; (4) Information Literacy; (5) Multicultural and Multiracial Awareness; (6) Problem Solving and Critical Thinking; (7) Professional Skills; and (8) Scientific and Technological Skills. The Community Orientation and Citizenship competency requirement represents an appreciation of communities and environments in all their diversity—local, national, and global and is connected to a sense of service, civic engagement, and social responsibility. The College is committed to its mission to prepare students to attain academic, personal, and professional excellence in a multicultural and global society. Thus, community service is central to the educational experience of the students. From the onset of enrollment to graduation, Bloomfield students discover that their active participation in community service affords them with opportunities to utilize their education, skills, and talents to make profound differences in the lives of others. The support and assistance they provide to various local, national and international organizations, agencies, churches, and schools represent the compassionate hearts of its students (Bloomfield College 2013). These abilities that differentiate Bloomfield from other institutions are what currently allow Bloomfield to be resilient in the face of difficult economic times.

HWA Chong Institution, Singapore

The HWA Chong Institution (HCI) in Singapore is the culmination of the watershed merger between the former Chinese High School (founded in 1919) and Hwa Chong Junior College (founded in 1974) in 2005. HCI is an independent school for students covering both secondary and pre-university levels. A Ministry of Education-designated "Future School," it operates under the Special Assistance Plan for bilingualism, and it offers the Integrated Program and the School Based Gifted Education Program. The goal is to allow their students to master twenty-first Century competencies because of globalization and changing demographic and technological advances. The institute implements all five abilities from the syllabus for resilience by focusing on character development, values, and team-work, in addition to producing academic excellence.

Their educational model is a holistic model, which focuses on critical, caring, and creative thinking (O'Malley 2012). Many of their students hope to become entrepreneurs: HCI has produced 51 President's Scholars to date. The institute benchmarks Stanford University for entrepreneurship, the University of California Berkley for Academic Development Programs, Columbia University for Global Learning Alliances, and Duke University for Cancer/Medical Research (HWA Chong 2013).

In terms of applying the five abilities for resilience, their programs are available only to the best and brightest students in Singapore. Many of their students are scholarship students who otherwise could not afford to attend the institution. The 4,000 students are drawn from the top 3 % of the national cohort, as well as from the mainland and Malaysia. More than half have their S$300 (HK$1,600) monthly fees paid for by scholarships (O'Malley 2012). HCI produces dependable high quality education, as is evident by their consistent rating as one of the best educational systems in the world. They constantly measure their performance against other school systems throughout the world to ensure that they have the capability to produce high quality graduates. Lastly, they use their great worldwide reputation to market the institution.

University of Massachusetts Lowell, USA

UMass Lowell (UML) began as the Lowell Normal School, a teaching college founded in 1894, and the Lowell Textile School, founded in 1895, to train technicians and managers for the textile industry. Both institutions extended their offerings over the next 75 years to meet the growing needs of the region. Lowell State and Lowell Tech, as they were then known, merged in 1975 to form the University of Lowell. In 1991 the campus became part of the University of Massachusetts system. UMass Lowell experienced a huge turnaround in the late 1990s, when they were informally dubbed as higher education's "best kept secret." Dr. Jacqueline Moloney, Executive Vice Chancellor of UML, revealed that the university's syllabus for resilience included: the availability of new supplier relationships; the capability to develop a business plan with strict performance measurements; affordability to all students through its cost controlling measures; and marketability through branding and ideas for generating more revenue (Moloney 2010).

According to Moloney (2010), UML had to be resilient, and it needed to look at resilience strategically. "You have to be smart and business disciplined to be sustainable." In terms of availability, UML had a business-savvy team negotiate contracts with suppliers and business partners, such as Aramark for food services. Strong business partnerships with profitable contracts translated to financial sustainability. Moloney's team consistently met goals by using dependability and capability as benchmarks and constantly reviewing the entire planning process, which was transparent. This open environment empowered the team to set and reach higher goals. UML recently purchased the Doubletree Hotel, now known as UMass Lowell's Inn and Conference Center (ICC) and the Tsongas Arena, now known as the Tsongas Center. Branding and advertising strategies, as well as the financial plans for these properties, were carefully planned and executed. The acquisition of the ICC increased on-campus undergraduate living from 25 to 40 %. It also offered the university a facility to display research while acting as a revenue generator. As Moloney stated, "You don't just make a plan and spend the money. You need to figure out how you're going to pay for it by generating new revenue."

Controlling expenses was vital to financial resilience. Commercial ventures and intellectual property are important for financial sustainability too because they preserve and generate future revenue. So, Moloney was able to apply the affordability concepts in the resilience syllabus to tackle the university's deficit. There was massive cost cutting the first year. To achieve their goal, they had to cut costs and keep a focus on the core mission. Again, the entire planning and budget process was transparent. She created a strategic planning commission consisting of over 200 faculty and staff to oversee planning and budgeting. The process was managed and monitored constantly, which allowed the university to stay on target. UML openly recognized the high price tag for education, especially graduate education, so they invested more in teaching assistants, internships, and financial aid packages for the students to help lighten the financial burden. Over 70 % of undergraduate students at UML now receive financial aid. Continuing Education was a player in the affordability turnaround. The department grew from a $4 million operation to over a $28 million operation.

Moloney also recognized that the answer to resilience was marketability, and UML began branding itself with a new logo, marketing team, and a public relations firm to communicate the competitive advantages of UML. Maloney also stated that marketability and branding contributed to its turnaround. Visibly and consistently communicating the university's logo, colors, and tagline creates a certain "package" for UML—world-class higher education, viable research, career services, continuing education, variety of facilities, and a trusted, branded name. As another example, research showed that students participate more and receive more educational value in smaller classrooms. So, UML focused on the student learning experience through its removal of the “mega” (150 plus students) classes in the college of management. Moloney: “We were not there 10 years ago; hoping people would figure out that we have a great university with a lot to offer. Having a reputation isn’t enough, and it isn’t a sustainable model. There’s more intimacy in smaller classrooms, this leads to student retention, which equals sustainability. The bottom line of UML was to increase student retention while adding value for the students.” Their branding strategy is successfully delivering this message—increasing enrollment and retention both in undergraduate and graduate programs.

University of Texas, El Paso, USA

The University of Texas at El Paso (UTEP) is a 4-year state university and a component of the University of Texas System. The school was founded in 1914 as The Texas State School of Mines and Metallurgy. It became Texas Western College in 1949 and The UTEP in 1967. Enrollment in 2012 was 22,749. UTEP is the largest university in the U.S. with a majority Mexican–American student population (about 70 %). UTEP was the first college in the American South to integrate its intercollegiate sports programs, and to this date it is the only school in Texas to bring home a NCAA Men’s Basketball Championship, which was in 1966.

Like Bloomfield College, UTEP assessed its availability to students. UTEP’s location near the US—Mexican border was ideally situated, and the university recognized that it needed to draw its students from a predominantly minority population center to be resilient. UTEP aggressively sought outside funding for its initiatives in support of minority students (Leslie and Fretwell 1996). Although it is far from Texas’s other population centers, El Paso offered a unique niche to the university. El Paso’s current population of more than 800,000 is only one-third of the total metropolitan area of El Paso and Ciudad Juarez, Mexico (the metropolitan area covers both sides of the border.) With more than $76 million in annual research spending, UTEP was dedicated to becoming the first national research university serving a twenty-first century student demographic. It is a designation that had increased the region’s economy and quality of life, while offering a wealth of research opportunities for undergraduate and graduate students.

Compared to all other public research institutions in the U.S., an undergraduate degree from UTEP is affordable. Full-time UTEP undergraduates incur the lowest out-of-pocket cost or “net price” for their degrees (http://www.utep.edu/). As UTEP approaches its 100th birthday in 2014, it is committed to its mission of providing minority students access to excellent academic programs. UTEP was recognized by Washington Monthly as number 12 in the nation for excellence in social mobility, research, and service. More specifically, UTEP ranked #1 among all U.S. universities in the Social Mobility category for helping its students achieve their dreams and professional aspirations (Washington Monthly 2012).

Virginia Commonwealth University, USA

Virginia Commonwealth University takes its founding date of 1838 from the year the Medical College of Virginia (MCV) was created as the medical department of Hampden-Sydney College. MCV became independent in 1854 and state-affiliated in 1860.

The University's Monroe Park Campus began in 1917 as the Richmond School of Social Work and Public Health. In 1925, it became the Richmond division of the College of William and Mary; and in 1939, its name was changed to Richmond Professional Institute. It separated from William and Mary in 1962 to become an independent state institution. The Medical College of Virginia and Richmond Professional Institute merged to become Virginia Commonwealth University (VCU) in 1968, and it is now the most comprehensive urban university in the state with an enrollment of more than 29,000 students.

Facing a 22 % budget cut, in 1993 VCU undertook a major program of fiscal and operational restructuring (Jones 2005). The goal was to provide available resources that could help it address new opportunities. The strategic plan utilized 22 individual task forces to identify areas of improving its capability while cutting life cycle administrative costs (affordability) by as much as 15 %. The university's resiliency is attributed to: changes in enrollment management; improvements in campus facilities; better use of information technology; a mindset to strengthen graduate and undergraduate education; implementation of a program of a staff and faculty reward system; and an intensive marketing campaign. Its capability efforts focused on the goal of achieving a ranking among the top 50 universities in the nation. As one indication of its resiliency, in 2013 dozens of VCU's graduate and first professional programs were recognized by U.S. News and World Report as among the best in the nation, including No. 1 rankings for sculpture and nurse anesthesia (U.S. News and World Report 2013). Its marketability efforts focused on improvements in public service and promoting targeted areas of excellence. One of the most promoted developments at the university was the creation of the new School of Engineering in 1996, founded by a pledge for start-up of $11 million from private sources and a large grant from the state of Virginia, which in turn stimulated Motorola Corporation to locate a manufacturing and technology center in Richmond, Virginia. Motorola then became a partner with the School of Engineering. VCU's School of Medicine now operates one of the largest medical research centers in the state, attracted $185 million in sponsored research programs in 2004, and is the largest employer in Richmond (Jones 2005).

Conclusions

Flynn and Vredevoogd (2010) identified 12 emerging trends in higher education: (1) Globalization will influence and shape all aspects of teaching and learning; (2) The wide range of ability, preparedness, background, opportunity, and motivation of higher education students will require more varied and holistic approaches to inclusive learning; (3) The demand for more experiential outside learning opportunities will require faculty to respond thoughtfully and proactively; (4) Colleges and universities will be expected to deliver more education in less space to increase their learning per square foot; (5) Achievements in technology will drive ongoing changes in all aspects of college and university life and offer new opportunities to enhance and broaden learning experiences; (6) Interdisciplinary learning will become increasingly common and popular; (7) Students will take much greater control of their own learning as proactive producers and managers of their own learning solutions, materials and portfolios; (8) The average age of students will continue to rise; the mix of cultures, ages, and learning styles will become increasingly varied and rich; (9) Competition for students and resources will force colleges and universities to sharpen their brands and identities and to distinguish themselves in new ways; (10) Colleges and universities will become increasingly important parts of regional economic development, both in creating growth and taking advantage of it; (11) The structure of educational institutions and the types of employment relationships between them and faculty will continue to multiply; inequities among faculty will cause tensions; and (12) Accountability and assessment tools will continue to become common in defining institutional effectiveness.

The application of the five lessons/abilities presented in this paper is the syllabus for higher education resilience when considering the 12 emerging trends in higher education. Availability ensures access to the right technology, materials, facilities, and tools for the global population. The new network culture has led to the development of online education and made higher education more accessible to all ages and cultures. In traditional 4-year colleges more slots could be set aside for the availability of community college transfer students. While availability brings students and faculty to a university, consistency, and reliability make them stay. Dependability increases student retention, and student retention is a main goal of a college or university. Clear, definable measurements tell the university if it is achieving its goals. Performance should be graded, and its renowned capability/performance should lay the foundation for future research, revenue, and success. For example, more outcome-based financing should be used to reward colleges that do the best job with challenging students and increasing student graduation rates. While the current price tag of American higher education is hardly sustainable, reducing costs, and increasing financial aid can augment higher education's resilience by making it affordable. More transparency about which colleges (4 year or community colleges) benefit from federal education spending should be made available to the public. Further, higher education institutions can be held accountable to maintain defined student retention and graduation rates if they receive government funding and their students can get government subsidized loans. Publicizing an institution's financial, academic, and social successes enhances the institution's overall marketability. Higher education must start with a plan of clear, measurable goals and a team to constantly monitor and refine these goals after they are implemented. Promoting an institution's competitive advantage with consistent branding will also enhance the resilience of higher education institutions.

According to Andy Hargreaves, author of *Sustainable Leadership*, "Change in education is easy to propose, hard to implement and extraordinarily difficult to sustain" (Hargreaves 2006). Colleges need to utilize their current resources while generating future, profitable venues and preparing students for future careers. The road to resilience is ever-changing, and the key to success is change; especially when the change is needed for survival and can be achieved by following the syllabus for resilience in higher education.

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A Discipline-Based Model for Embedding Sustainability in University Curricula

Dianne P. Chambers

Abstract This chapter outlines the current context of universities, one that challenges them to integrate Education for Sustainability (EfS) into the curriculum of all courses and subject areas and proposes a model to help guide universities in achieving this goal. For a university to embark on any major change to its curriculum it is proposed that two issues are need to considered to improve the chances of the success of the project. These are an understanding of processes of organizational change, because shifting a curriculum is a very major change for those that design and teach curricula, and the other is an understanding of academic identity, because it is individual academics within their departments who will be the people who need to conceptualise what the new curriculum will look like and design subjects and courses to meet the university's goals. The model has as its phases: Goal setting; Discovery; Discipline-based planning; Cross-discipline coordination; Design and Implementation; and Coordination and Progress Reporting. These phases build upon each other to promote the success of achieving the university's goals. The chapter proposes a framework that universities and other tertiary institutions facing this challenge could apply. Thus, it does not look at the specifics of what should or should not be in such a curriculum, but rather it explores and proposes a model for the process an institution could apply to achieve the goal of embedding Education for Sustainability across the whole curriculum.

Keywords Education for sustainability · Change management · Academic identity · Curriculum change

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_17,

Introduction

This chapter first outlines the current context of universities, which challenges them to integrate Education for Sustainability (EfS) into all courses and subject areas and proposes a model to help guide universities in achieving this goal. The model is based on processes of change management, which is the introducing and making permanent an intentional change to an organization and comes from the business world and literature from the field of management, and an understanding of the primary allegiance of many academics to their discipline. These two fields are briefly outlined to frame the proposed model. The model is designed to be flexible so that it is applicable to a wide range of discipline areas within a university, and to universities in many contexts.

As has been discussed in many places (for example McKeown 2002 and Haigh 2005) '*Sustainability*', '*Education for Sustainability*', '*Education for Sustainable Development*', and so forth are defined in many ways. Common elements include going beyond knowing *about* sustainability, that is, in addition to having content knowledge to also develop an awareness, values, dispositions and skills to live in a sustainable way. This is in accordance with Australia's second *National Action Plan for Education for Sustainability* (DEWHA 2009) and will be the meaning of EfS used in this chapter.

In a university context there is a greater challenge than merely for our students to learn content about sustainability and related issues and to live sustainably themselves. This is because university graduates have a disproportionate impact on the lives of many others through their roles as professionals and business, educational, political, or design leaders. University graduates are the decision makers of society and so their understandings and dispositions regarding sustainability will influence their professional, as well as personal, decisions and these will have major repercussions across their communities for many decades after their graduation. For example, the decision of the CEO of a major corporation for her business to develop a more sustainable product will affect both employees and the business's clients or consumers—which could be millions of people. An engineer who develops a process that causes less environmental damage than the existing process can influence the production of waste around the world, and each teacher influences the lives of the thousands of students they teach over their career. Thus, universities have a responsibility to contribute to society and sustainability through their graduates. There are a number of external drivers for universities toward addressing, integrating, or embedding sustainability and EfS into their teaching. These include national objectives set by the governments, for example the Australian government's *National Action Plan for Education for Sustainability* (DEWHA 2009) that specifically challenge universities to include sustainability in the curriculum of all courses and in university operations, and self-imposed drivers such as the Talloires Declaration.

The Talloires Declaration (see http://www.ulsf.org/programs_talloires.html) is a voluntary commitment to sustainability made by many universities that has been signed by over 400 university presidents and chancellors in over 50 countries. Signatories to the Talloires Declaration commit their university in a number of ways that are relevant to sustainability in the taught curriculum:

1. Increase awareness of environmentally sustainable development.
2. Create an institutional culture of sustainability.
3. Educate for environmentally responsible citizenship.
4. Foster environmental literacy for all (…).
6. Involve all stakeholders.
7. Collaborate for interdisciplinary approaches (…).

Thus, many universities have made a public commitment to shifting their curriculum so that sustainability will be a part of their taught curriculum. In addition to the objective of EfS being integrated into the taught curriculum, the hidden curriculum (Orr 1992), that is, the learning about sustainability absorbed by staff and students including through the way the campus is built and operates, is also included through developing institutional cultures of sustainability. However, it is the challenge faced by universities of shifting their taught curriculum to include EfS that is the focus of this chapter, which proposes a model for working toward the goal of integrating EfS into the curriculum of all university courses/ subject areas.

Models of EfS in the Curriculum

A number of approaches to incorporating sustainability into the curriculum have been described, with Stephen Sterling's (2004) statement (Table 1) being an elegant summing up of complex ideas. Sterling sums up the stages of response to sustainability in the curriculum as:

- Bolt on
- Build in
- Rebuild or redesign (Sterling 2004).

This framework was expanded by Sterling and Thomas (2006) to describe 'bolt on' reforms as education *about* sustainability, 'build in' as education *for* sustainability, and rebuild or redesign as sustainable education. A clearly defined goal that is articulated and reinforced by a university will help to guide members on the

Table 1 Approaches to incorporating sustainability in the curriculum (From Sterling 2004)

Sustainability transition	Response	State of sustainability
Very weak	Denial, rejection or minimum	No change or token
Weak	'Bolt on'	Cosmetic reform
Strong	'Build in'	Serious greening
Very strong	Rebuild or redesign	Wholly integrative

destination that is being aspired to, so that the risk of stalling at a stage on the journey is less likely to occur. Revisiting and reexamining the curriculum on numerous occasions will be needed to ensure that institutional goals are being met (Phillips 2009).

A university that is wanting to integrate EfS in its curriculum is likely to find that a patchwork is already in place, with some hotspots of enthusiasts, some who have 'dipped their toes in the water', and others who have never considered the issue as relevant to their academic discipline or their teaching. This mix of starting points in different parts of a university, and possibly within a department, needs to be acknowledged when planning for institute-wide changes so that existing expertise can be identified, celebrated, managed, and built upon. Early adopters should be seen as valuable resources and potential local champions who may be able to guide and facilitate change within their discipline and faculty. However, the actions and aspirations of early adopters may not be aligned with the university's goals and this could become an area that may need to be managed carefully.

Framing Concepts of the Proposed Model

For a university to embark on any major change to its curriculum, whether it be integrating EfS or some other goal, it is proposed that there needs to be two issues considered to improve the chances of the success of the project. These are (i) understanding processes of organizational change, because shifting a curriculum is a very major change for those who design and teach curricula, and (ii) an understanding of academic identity, because it is individual academics within their departments who will be the people who need to conceptualize what the new curriculum will look like and design subjects[1] and courses to meet the university's goals. That is, such a change is not one that academic staff will merely experience and adapt to, but rather they will be the conceptualizers, designers, and implementers of any change that occurs—or they will be where resistance to change manifests itself. Knowing how to manage change in an organization and understanding the motivations of those that you are wanting to design and implement a change, it is proposed, will increase the likelihood of success in achieving the organization's goals.

Change Management

Management is required to achieve specific and predetermined changes in an organization. Aspects that need to be thought out when considering and planning for change include people, processes, and culture (JISC 2006). Aspects of these

[1] The term 'subject' is used to refer to a single unit of study that is part of a larger program, such as a degree. In some places the term 'course' or 'unit' may refer to what is termed a subject here.

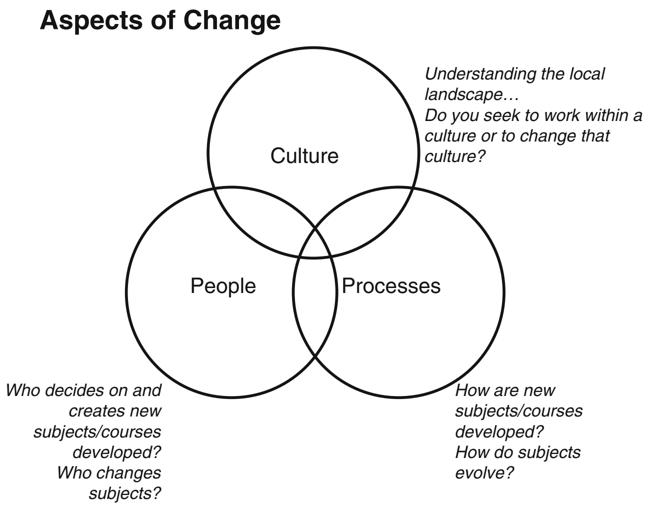

Fig. 1 Aspects of changing a university curriculum. Adapted from: JISC (2006)

that need to be considered when redeveloping a university's curriculum include an understanding of the current processes of subject creation and who is involved in it—are subjects developed by individuals or by a team?; who is involved and how are new subjects created?; what is the process for changing subjects? and so forth (Fig. 1).

Culture is also an important consideration; an understanding of the current culture is needed to manage any substantial change in an organization, and when the goal is to integrate sustainability across a curriculum then thought also needs to be given to whether a shift in the culture itself is one of the goals of the undertaking, in addition to the more explicit change of integrating sustainability in the taught curriculum.

As part of the planning process determining what type of change is desired will also help in the planning process. Lorenzi and Riley (2000) define four types of change—*operational*, *strategic*, *cultural*, and *political*—and a shift to integrating sustainability across a university's curriculum is likely to involve, at least, the first three of these. Another framework for considering change categorizes change as *developmental*, *transitional* or *transformational* (Ackerman 1997), which align neatly with Sterling's (2004) *bolt-on*, *build-in* and *rebuild* responses for sustainability in the curriculum.

The people and cultural elements needs to be very carefully considered when planning change—universities are very complex organizations and academics are complex people. Organizational change, such as integrating EfS into the curriculum, is much more than simply rewriting a subject, and proposing or requiring a change such as this is likely to be perceived by some as a threat of personal loss (Lorenzi and Riley 2000). Potential perceived losses could included the disruption of an established process or perhaps a loss of autonomy of deciding what a subject 'should' contain, or a sense of a lack of respect for what experts in the field already have in the curriculum. Others may feel threatened about needing to teach in an area that they do not feel expert in, about an already full workload to which more work is being added, or resistance to change in general.

On the other hand, some people will welcome the opportunity to learn and expand their expertise and to undertake some deep consideration of their academic discipline and how it intersects with sustainability. People have a desire to feel good about themselves, to take pride in their work, and be part of a significant achievement (Lorenzi and Riley 2000). A university should keep this in mind and frame the university's goals in this light.

In framing its goals, a university will need to have a clear vision of how it perceives its role and its responsibilities, including social responsibilities, to its local, national, and international communities. This vision may not initially be shared by all members of the university, and this will need to be managed, and because universities are large and complex organizations the various interest groups will need to be identified and consulted and the bureaucracies navigated through.

Communication to teaching academics should thus emphasise the university's vision and the role that a university and its graduates play in society, so that the efforts of academic staff to redesign or rebuild a curriculum are seen as a contribution to this vision, rather than merely an imposition. Communication with the university staff about the initiative will help frame responses to it. Keeping staff informed about what is happening and offering meaningful opportunities to participate in decision making reduces cynicism about a change (Reichers et al. 1997), which support the process.

There is much written about change management and this body of knowledge and literature should be engaged with when considering integrating EfS in a university's curriculum. This section gives only a glimpse that may be of use when embarking on this journey.

Academic Identity

When working with a group of people who are involved in a major change it is beneficial to understand the group, the motivations of its members, and the group's cultural norms and traditions. That is, as outlined above, an understanding of the people and the culture of the group will help the process to succeed. It is academic staff who will be redesigning or redeveloping the curriculum in their subjects and so knowing about their motivations and culture will be helpful.

There are two main themes that emerge from studies about academic identity and culture. The first is that for most academic staff their primary allegiance is to their subject or profession, with allegiance to an institution being secondary, and the second being the belief among academics that there are significant differences in what academics do in the different disciplines and how these activities are described and valued (Healey 2000). This is confirmed by Henkel (2000):

> One of the most persistent themes in this study is that academic working lives continued to be centered in their discipline, whether they saw themselves primarily as researchers, teachers, managers or a combination of more than one of those. Almost all located themselves within a discipline or sub-discipline, identifying themselves as economists, biochemists, theoretical physicists, and so on.
>
> Henkel (2000, p. 256)

Disciplines, thus, provide the main organizing structure of universities and the basis of the many cultures within a university (Becher 1994). Becher (1994) was an early voice in recognizing the differences in academic identities between the disciplines and he drew attention to these cultural differences to inform the activities of researchers and policymakers. He drew on the work of Bailey (1977, cited in Becher 1994) who elegantly describes the discipline-based cultures and 'tribes and territories' of the universities:

> Each tribe has a name and a territory, settles it own affairs, goes to war with others, has a distinct language or at least a distinct dialect and a variety of symbolic ways of demonstrating its apartness from others. Nevertheless the whole set of tribes possess a common culture: their ways of construing the world and the people who live in it are sufficiently similar for them to be able to understand, more or less, each other's culture and even, when necessary, to communicate with members of other tribes.
>
> Bailley (1977 cited in Becher 1994, p. 151)

This tribal and territorial metaphor of the disciplines resonates with those who are intimate with universities. If you have visited a number of departments within a discipline you could probably name various tribal totems—Gary Larson cartoons being common in biology departments, while images of Einstein (always with wild hair and often with his tongue sticking out) often decorating spaces in physics departments.

It is proposed that a commonality across the various tribes of the university is that directives or mandates are often not welcome, and that directing academics about what to include in teaching their discipline may not be well received, in particular if from someone outside that discipline. Thus, an acknowledgement and understanding of the different cultures and norms of the various tribes/disciplines within a university should inform and shape any change management process for integrating EfS in the curriculum.

Proposed Framework for Integrating EfS in the Curriculum

Change management processes and what is known about academic identity informs the following proposed model for integrating sustainability into a university curriculum (Fig. 2). The proposed model is consistent with the frameworks

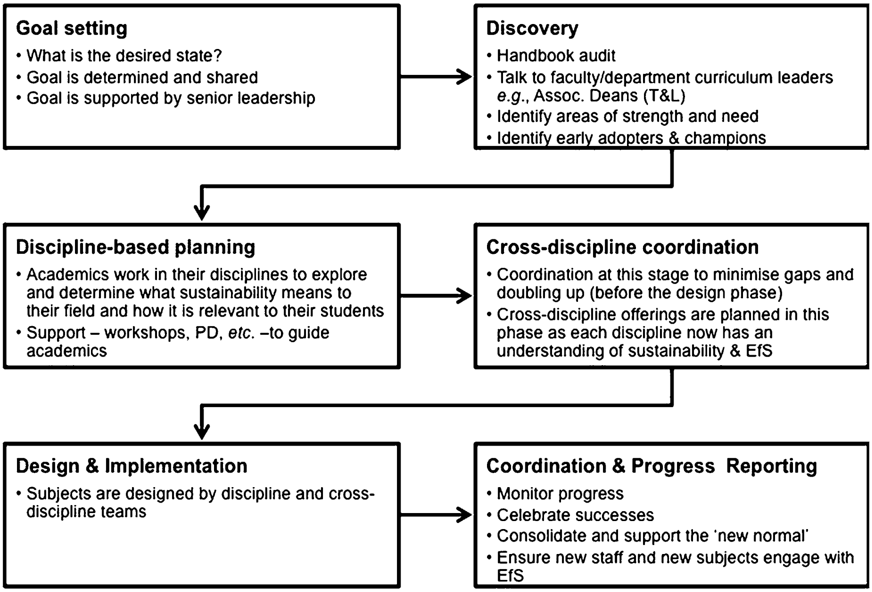

Fig. 2 A discipline-based model for embedding sustainability into university curricula

and concepts of change management and organizational change, but builds on these to deal with the specific complexities and challenges of universities and academics.

Goal Setting

A first stage of any managed change process is to determine the goals of the change, that is, what is desired state? what is the vision that will be achieved by this change process? These goals needs to established, understood, and supported by the university's senior leadership, and will need to fit with that university's understanding of its role and responsibilities in society. The goal-setting stage is critical, as all else is based on these goals, and so people from a range of parts of the university will need to be consulted and will need to take into account the role of that university in society.

When the time is appropriate this vision needs to be shared with members of the university, including the reasoning behind it and the benefits it will bring to the university, to graduates, and to the wider community. Allocating resources to achieve the goal will signify a commitment to achieving the goal.

Discovery

The *Discovery* phase develops an understanding of current practices, identifies areas of strength or weakness, locates early adopters, and begins a dialogue with curriculum leaders about sustainability, EfS, and what sustainability and EfS may mean to and for the various disciplines.

This would include an audit of the university's current teaching offerings (via the university's subject handbook or subject catalogue or similar) to identify subjects that include aspects of sustainability and EfS and these subject coordinators who may be identified as early adopters. This would then be followed up with a discussion, informed by the audit, with curriculum leaders in each faculty/department to clarify if the subjects identified are a true reflection of where activities around EfS and sustainability are occurring, if some areas have been missed, and if more key words should be included when doing an audit of the handbook. Getting and maintaining buy-in from those in the faculties who play a leadership role in curriculum development will be key in achieving the desired outcomes later in the process.

Engaging with early adopters, who are potential local champions, may need to be done carefully so that efforts already invested are seen to be valued, in particular if the university's vision of sustainability in the curriculum differs from an early adopter's vision.

Discipline-Based Planning

By the start of this stage the university knows what it is already in place regarding EfS and sustainability in the curriculum of its subjects, has identified early adopters and has engaged with curriculum leaders in all the faculties. It is at this stage the hard work really begins, as getting engagement from the academics within each discipline will be the foundation on which real change in the curriculum will be built. Early adopters whose ideas are aligned with university goals could lead activities in their discipline or their work could be showcased to demonstrate what is possible.

Academics in each discipline area should be briefed about EfS, and how it differs from education *about* sustainability, and about the three main areas that sustainability is built around—environment, society, and economy. This is needed so that everyone within the university shares a common understanding of terminology; even if it is a local definition, it needs to be a shared definition within a university.

Experience has shown that when people hear the term 'sustainability' most people assume 'environmental sustainability' and do not consider the other two areas aspects of sustainability (society and economy). When hearing EfS many people assume content knowledge only, rather than developing attitudes or dispositions about sustainability issues in students. Thus, many people's first response is to assume that sustainability and EfS do not concern them, their discipline, or their teaching. This challenge needs to be overcome through exploration and discussion of what is meant by these terms.

In addition to developing an understanding of what sustainability and EfS are, the university's goals and their benefits (for the university, for graduates, and, for the community) needs to be explored and expanded upon, so that individual academics understand the basis and goals of the initiative—both the shorter term goal of integrating EfS into the curriculum and the longer term goal of having a positive impact on society and the environment through the actions of graduates.

Academics need to understand the reasoning behind the initiative and be convinced that the outcomes are desirable, or the success of the initiative will be put at risk. Investigating the Total Quality Assurance (TQA) initiative in the UK in the 1990s Henkel (2000) found that there were many ways departments subverted institutional initiatives in ways 'to sustain the disciplinary agenda' (p. 261). Some departments that had power within the institution could resist institutional initiatives, while others appeared to comply with perceived expectations, but actually made only minimal changes. Some departments resisted change to the TQA initiative by compartmentalizing it, so that it became only an administrative concern that was seen as the province of administrators rather than of academics (Henkel 2000). A potential parallel is that departments embrace the operational aspects of environmental sustainability, and increase recycling and switching lights off, but leave the curriculum of their various subjects largely untouched. Acknowledging and discussing the major influence that universities have on their community and the environment through the work of their graduates needs to be discussed and celebrated.

This stage thus entails engaging with hundreds, and probably thousands, of academics across the university and support and guidance will be needed. Workshops, professional learning opportunities and staff to support and guide academics through their discussions and conceptualizing of ideas will be needed. It is suggested that there will need to be an intense effort to first engage academic staff with what is meant by sustainability and EfS and then with the university's goals and the reasoning behind it. Discipline groups should then each be invited to develop a response to what sustainability and EfS means to their specific discipline.

The production of a discussion paper by a team within a discipline to stimulate debate and inform further consultation within the discipline would be helpful to the process. After an understanding of sustainability and the discipline has been developed the discussion would then turn to a consideration of sustainability and EfS in the curriculum of the subjects offered by that discipline. At this stage subjects should not be worked on in detail, but rather a debate and discussion to identify how the major sustainability issues relevant to the discipline, as identified in the discussion paper, relate to the taught offerings and what graduates in their field should know to empower them in their professional lives.

Cross-Discipline Coordination

Although the heavy work of curriculum redevelopment will be occurring within discipline groups, some cross-university coordination at this stage can help reduce the workload and increase the benefits by coordinating between departments and disciplines, as and if required. Having an holistic view can help the university, or perhaps at faculty level, minimize doubling up of efforts and identify and minimize any gaps. This is best done before subjects are designed and developed in the next stage, so as to reduce unnecessary workload for academics.

Opening discussions about cross-discipline offerings should be encouraged at this time, as by this stage each discipline group (department or team) should have its own understanding of sustainability and EfS for its discipline and will be in a position to engage with other disciplines to consider possible shared offerings or ways that similar material will not be covered in many subjects done by the same students.

More importantly, due to the complex nature of almost all challenges of shifting to a sustainable future, very few of these challenges can be fully addressed by any single discipline. Thus there will be many benefits gained when cross-disciplinary and interdisciplinary teams work together to develop subjects and sequences of subjects, as well as academics gaining understandings of the issues from the perspectives of other disciplines.

Design and Implementation

After discussions about cross-discipline opportunities and ways to avoid unnecessary doubling up have been undertaken and decisions made, the hard work of reconceptualizing and redesigning subjects needs to be undertaken by academics or teams of academics to develop the new curriculum of the subjects. This is a major undertaking and adequate time should be allowed for staff to do this work. During this period of curriculum redevelopment or reconceptualization support and guidance should be offered to academics to keep the university's goals in mind and senior leadership should be very visible in their support of the goals. Opportunities to share ideas and successes should be taken so that the creativity and vision of frontrunners can lift the vision of all in attaining the university's goals. During the implementation phase, that is after the curriculum has be created and before and when the teaching is taking place, providing support for staff, including engaging sessional staff with the university's goals and vision and giving them any professional learning that is required, will need to continue.

Coordination and Progress Reporting

Once the new subjects are in place progress will need to monitored and successes celebrated, as well as identifying areas that need further work. Supporting what may be a shift in values and the cultural change needed for this type of reform to establish the 'new normal' will need continuing support from university leaders at all levels. The university goals should continue to be visible and the hard work of academic staff should be valued and celebrated. As, or before, new staff join the university the values of the university should be shared with them, and induction activities should include time spent on the university's goals in this area so that new staff continue to integrate EfS into their teaching activities.

Conclusions

As societies demand and universities challenge themselves to integrate EfS into courses and subject areas it is proposed that change need to be planned and managed and that lessons from the literature of change management be taken on board to inform the process. Should the process fail, then getting academics staff to engage on a second attempt is likely to be very difficult indeed. As part of this process goals need to be established and clearly (and repeatedly) articulated by leaders of the university and within the disciplines. It is proposed that a discipline-based approach for understanding and engaging with sustainability be first undertaken, followed by planning and implementation the new curriculum. In particular at the start, but through all stages staff will need to be supported as they makes changes. In parallel with changes to the taught curriculum the hidden curriculum of the university, its buildings and process, should be being developed by other staff of the university so that the curriculum reforms are backed up by the operations of the university.

An initiative to integrate EfS into all courses and subject areas is a vast undertaking and so for it to succeed the goodwill, creativity, and capabilities of staff will be needed and it is proposed that this be done through structured and discipline-based approach. The challenges and opportunities within each university will vary, as will the leadership and resources directed to attain the goals, but, whatever the local circumstances, the scale of the undertaking should not be underestimated if real change, and not just cosmetic 'greening', of the curriculum is to be achieved.

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A Methodology for Reorienting University Curricula to Address Sustainability: The RUCAS-Tempus Project Initiative

Vassilios Makrakis and Nelly Kostoulas-Makrakis

Abstract Our world faces considerable environmental, economic, social, and cultural challenges that need to be met at various levels. Responses to calls for curriculum revision to address sustainability, although very critical, are often slow and superficial. In this paper, it is argued that a participatory action and transformative learning approach toward engaging academics in curriculum change for sustainability is needed. The chapter describes the Reorient University Curricula to Address Sustainability (RUCAS) methodological approach aimed at engaging university staff in sustainability curriculum change at 12 universities. It also describes its underpinning theoretical assumptions, the research facts, and the critical curriculum design considerations.

Keywords RUCAS · University curricula · Reorienting · Sustainability

The Current State of Sustainability Crisis

In the course of the last few decades, humanity has been experiencing the impacts of an unsustainable economic model based on economic growth driven by profit maximization, resulting in excessive depletion and degradation of natural resources. The prevailing economic and monetary model has increased the people's purchasing power in the most affluent societies but in turn it generated unsustainable modes of production and consumption. Even though global consumption has reached its highest peak in recent years, access to basic needs such as education, health, and food has not been met. It is estimated that of the more than six billion people on Earth, over 1.1 billion people in the developing world cannot

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_18,

afford the necessary for their human survival, 2.5 billion people lack access to improved sanitation, 101 million children are not attending primary school, with more girls than boys missing out and 4 million newborns worldwide are dying in the 1st month of life (UNICEF 2010). The global economic disparity among nations is accompanied by equally devastating inequality within the nations. In 31 countries, less than 20 % of the population controls more than 50 % of the national wealth, so an enormous economic wealth has been accumulated almost exclusively in the developed world, while the world's poorest nations have grown even poorer (UNDP 2000). Presently, about 20 % of the world is consuming eighty percent of the world's resources, while those consuming less are trying to catch up by following existing models (UNEP 2011). A recent UN (United Nations) (2012) report shows that these disparities over the past three decades occurred in parallel with accelerating trade and financial flows, the spread of international production networks and rapid technological change. These disparities are in parallel with an increased military expenditure in both economically developed and less developed countries (Shah 2012). Globally, most countries have made significant advances both in GDP and in Human Development Index measures, but overall, the record of development on a world scale is that the benefits of development have been distributed unevenly, as the gaps between rich and poor nations, and between rich and poor groups within individual countries, are widening (Harris 2000). Concerns are raised that continuing this unsustainable development model and practices might not only ultimately lead to human degradation; socially, culturally, and economically, but also put at risk its very human existence.

All these show the urgent need for a radical transformation through an alternative development model that places due emphasis on sustainable well-being. In our understanding, sustainable well-being is close to Aristotle's eudaimonic well-being as contrasted to the prevailing hedonic well-being driven by unsustainable behaviours and modes of production and consumption. Hellenic philosophy drew an insightful distinction between happiness derived from transient pleasure, (hedonia) and that derived from a meaningful life (eudaimonia), composed of moral virtue, reason, and self-development (Begley 2012; Boniwell 2012; Coggan and Kelly 2007; Steger et al. 2008). For Aristotle, the actualization of virtues was the way to live together a good and meaningful life. Kjell (2011) argues that sustainable well-being illustrates individuals' interdependencies with other people and nature and suggests that positioning well-being more clearly within the sustainability framework can enhance both the role of sustainability and well-being.

Summing up, the sustainability crisis is largely based on the:

1. Unsustainable modes of production and consumption.
2. Increased proliferation of military expenses and unsustainable use of technology.
3. Generation of growing gaps of social, economic, and political inequality.
4. Globalization of the market economy driven by greediness of capital accumulation.

The Role of Higher Education Institutions in the Sustainability Crisis

Education systems, at all levels, and especially Higher Education bear their own responsibility for the sustainability crisis, for the simple reason that educational institutions produce all sorts of leadership who drive society and economy as well as shape an unsustainable consumers' culture (Makrakis 2011). Corcoran and Wals (2004) observe that "[t]he scope and range of the negative impacts of university educated people on the natural systems that sustain Earth are unprecedented" (p. 3). It is also notable that while most people have positive environmental attitudes and are concerned about environmental issues, a much smaller proportion of people actually translate their knowledge and concern into action (Fujii 2006; Sattmann-Frese 2005; Finger 1994). Research shows that current environmental policy and goals have not been incorporated into the centrally stated goals of universities, indicating that sustainability is not seen as a priority goal (Lidgren et al. 2006). A mismatch has been also found between faculty members' beliefs about education for sustainable development and their observed classroom practices that could be attributed to several factors, such as their lack of pedagogical knowledge (Qablan et al. 2009). Sustainability challenges the current paradigms, structures as well as predominant practices in higher education (Tilbury 2012). However, simply educating citizens to higher levels does not necessarily lead to higher levels of sustainable ways of thinking and living.

Higher education is facing its greatest challenge to provide the knowledge, skills, values, and action competence to its graduates to cope with the huge environmental, social, and economic challenges locally and globally. This seems to be one of the greatest intellectual, ethical, and political challenge that higher education has ever faced, taking into consideration that teaching and learning about sustainability has been in decline since 2001 (Carlson 2008). This may be due to the fact that sustainability, which focuses on broad, systems-oriented approaches to social and ecological problems, does not easily fit into sharply divided disciplines (ibid). However, it is a fact that within the tertiary sector there have been various landmarks in respect of the design of approaches and mechanisms to bring sustainability closer to higher education (Leal Filho 2010a), which has led to the formation of various initiatives and declarations, including such as the "Talloires Declaration of University Presidents for a Sustainable Future" and the COPERNICUS Alliance "Universities Charter or Sustainable Development" (Leal Filho 2010b). However, with a few exceptions, such as the Ubuntu Declaration, the majority of the declarations' agreements and action plans have never been fully implemented (Leal Filho 2011). To our knowledge, there is lack of comparative studies showing various trends related to sustainability processes and impacts in the field of higher education as well as persistence to focus on environmental sustainability measures in higher education institutions instead of seeing sustainability from a holistic perspective.

All constituencies of a university system, that is teaching, research, curriculum, administration, infrastructure, and other functions are critical to transform universities toward sustainability. There is thus need to review and critically question to what extent our universities are responsible and committed to an education that acts as a force for personal and social change toward sustainability. This could involve a number of strategic questions such as:

1. What competences do we want our graduates to have in order to be able to cope with the sustainability crisis?
2. What are we currently doing to equip students develop these competences?
3. What are the best strategies for reorienting curricula, teaching and research toward building a more sustainable society?.
4. How do we educate our students to learn to live together sustainably?

A survey was designed and carried out in 11 universities that participate in the Reorient University Curricula to Address Sustainability (RUCAS) project (Makrakis et al. 2012). The aim of the survey was to identify, among other things, the knowledge students get from their courses in relation to sustainable development, the sources of sustainability knowledge, the teaching methods, the attitudes toward learning to live sustainably, the sustainability actions and the perceived functions and roles of universities. The results of this survey would be used for developing the strategy and the capacity-building program for reorienting university curricula to address sustainability. The study population was set to include all final year students of six academic disciplines, namely, educational sciences, social sciences, applied sciences, business/economics sciences, technical sciences, and health sciences. The questionnaire developed and piloted was administered to all courses attended by students in these disciplines. In total, 3,757 replies were collected among the 11 university partners: 54 % females and 46 % males. In terms of student geographic composition, 62 % come from the three Middle East countries (Egypt, Jordan, and Lebanon) and the remaining 38 % from Europe (Greece, France, Ireland, Italy, and Sweden). There were variations among the country samples, with the higher response from Jordan (39 %) and the lowest from Ireland (1 %). The variation is mainly due to the number of disciplines involved in each country and the size of institutions. In this chapter, we present part of the results obtained through this survey, directly related to the purpose of this chapter.

Among the 3.757 students participated in the RUCAS study, 30 % declared that have taken courses directly related to sustainable development, 50 % have taken courses including some aspects of sustainable development and 21 % have done a course assignment or project that concerns sustainable development. Comparing European and Arab students, the corresponding results for Arab students are 20, 48, and 12 %, while for European students are 23, 50, and 19 %, respectively. In terms of academic disciplines, Table 1 shows that the most active in embedding sustainable development in their curricula are the disciplines of Business/economics followed up by Educational Sciences. The least active ones are those of Health Sciences and Technical Sciences.

Table 1 Sustainable development curriculum experiences by academic disciplines

Disciplines	SD courses taken		Relevant to SD		SD assignments		No
	No	Yes	No	Yes	No	Yes	
Education	65 %	35 %	38 %	62 %	76 %	24 %	800
Sciences	70	30	48	52	84	16	915
Technical sciences	83	17	70	30	86	14	423
Health sciences	86	14	62	38	94	6	325
Soc. sciences	70	30	55	45	73	27	763
Business/Ec.	54	46	34	66	65	35	414
Total	70 %	30 %	50 %	50 %	79 %	21 %	3,640

When students were asked to rank the key sources of information about sustainable development, the Internet was ranked first by 37 % among EU students and 63 % among Arab students and even higher than university courses (20 % for EU students and 16 % for Arab students). Surprisingly, Radio scored much higher (33 %) than university courses (16) and TV (16 %) among Middle Eastern students (Table 2).

Students' attitudes addressing learning to live together sustainably was assessed through a series of 10 items listed in Table 3 with the percentages of responses. Initially, the Likert-type items running from 'strongly disagree' (=1) to 'strongly agree' (=6) were set. In Table 3, however, we compressed the 6-point scale into four measuring scales, from 'strongly disagree' (1) to 'strongly agree' (4). The internal consistency through a Cronbach a reliability test showed a 0.66 value. Respect for nature, solidarity, equality, empathy, and co-responsibility are the key values expressed through these items, which cut across the environmental, economic, and social dimensions of sustainable development.

Examining the percentages of respondents reporting attitudes toward learning to live together sustainably reveals statistically significant difference between the European and Middle Eastern students at the $p < 0.001$ probability level. More specifically, European students' attitudes are more favorable toward learning to

Table 2 Sources of information and knowledge regarding sustainable development issues

Sources of information	Rank 1		Rank 2		Rank 3	
	EU	ME	EU	ME	EU	ME
Internet	37	63	21	14	15	9
University courses	20	16	14	15	15	32
TV	19	16	18	21	16	26
Newspapers	17	25	21	23	17	21
Publications/brochures, etc.	13	26	17	21	14	20
Events (conferences, etc.)	8	14	10	15	11	27
Peers, friends, family, etc.	11	21	16	21	14	22
Special interest groups, etc.	8	25	6	19	13	17
Radio	6	33	8	21	13	16

Table 3 Students' attitudes toward learning to live together sustainably

Attitudinal statements (Mean = 3.3 (6-point scale)/(2.3-4-point scale); St. deviation = 0.80; α = 0.66)	Strongly disagree		Disagree		Agree		Strongly agree	
	EU	ME	EU	ME	EU	ME	EU	ME
People should be prepared to make sacrifices to improve the quality of life for others	7	22	11	8	56	38	26	32
Everyone should look after themselves rather than rely on the government for help	24	20	20	13	41	36	15	31
There is little connection between the protection of the environment and people's quality of life	66	43	9	10	19	25	6	22
Economic growth and increased employment are more important than protecting the environment	62	40	19	18	15	28	4	14
There is very little someone like me can do to protect the local environment	60	51	17	14	18	24	5	11
What I do in this country has little effect on the quality of life for people in other countries	49	35	19	16	26	32	6	17
What other countries do to improve or destroy the environment is none of our business	87	66	5	8	5	15	3	11
The third world or less developed countries should deal with their own problems and not look to the world for help	70	29	13	10	13	27	4	34
There is very little someone like me can do to protect the global environment	50	44	19	15	25	25	6	16
The governments' priority should be to improve the quality of life for people in this country rather than other countries	27	15	25	9	37	27	11	49

live together sustainably than Middle Eastern students indicated by the percentage of students expressing disagreement with the negative statements that denote less respect to nature, solidarity, co-responsibility, and empathy. Among the most contrasted items is the one stated that "The third world or less developed countries should deal with their own problems and not look to the world for help" where 70 % of European students disagreed compared to 29 % of Middle Eastern students. Another item stated that "There is little connection between the protection of the environment and people's quality of life," where 66 % of European students expressing strong disagreement compared to 43 % of Middle Eastern students. Similarly, in the item "Economic growth and increased employment are more important than protecting the environment," 62 % of European students expressed strong disagreement compared to 40 % of Middle Eastern students. In another item stated that "The governments' priority should be to improve the quality of life for people in this country rather than other countries," only 11 % of European students expressed strong agreement compared to 49 % of Middle Eastern students. In a similar vein, but with a more balanced difference, 24 % of European students and 20 % of Middle Eastern students strongly disagreed that "Everyone should look after themselves rather than rely on the government for help." Totally, the average mean is a bit more than the average, (3.3 on the original 6-point scale and

2.3 for the compressed 4-point scale, which indicates that despite sustainable development (SD) has been gathering momentum for the last two decades, little progress is now being made to change from unsustainable to sustainable pathways.

The above results are also reflected in Table 4, which presents a number of key actions that students have done during the past month. These actions reflect the key values of the attitudinal statements, that is, respect for nature, solidarity, equality, empathy, and co-responsibility. The first, respect to nature, referring to the environmental dimension consists of a combination of attitudinal statements such as saving energy, recycling, and buying environment-friendly products. The other values, solidarity, empathy, co-responsibility, and equality, refer to the social and economic dimension of sustainable development and consist of such actions as to purchase fair-trade products and voluntarism.

In total, only two sustainable actions surpassed the others, namely, switched off unnecessary lights (89 %) and using energy saving light bulbs (75 %), followed by recycling can, glass or paper (51 %). It seems that students' actions are directed more to those environmental sustainability actions that also contribute to saving money, while other sustainability actions such as the purchase of eco-labeled and fair-trade products, donating money to charities, voluntarism as well as refusing to take plastic bags when offered in supermarkets are less evidenced. Do we act because we save money of that action or because we are emotionally and ethically committed in the action? Do I use energy saving bulbs for the sake of spending less or because it makes me feel that my actions are helping to build a more sustainable world? Reflecting upon these questions shows the driving force behind our sustainability actions. Comparisons between European and Arab students surveyed show that the former surpassed the latter on actions related to environmental sustainability (saving energy and recycling), while the latter (Arab students) surpassed the former (European students) on actions related to social sustainability (voluntarism and donating money to charities).

Table 4 Actions done during the past month for sustainable development reasons

Have you done any of the following actions during the past month for SD reasons?	Europe		Middle east		Total	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Switched off unnecessary lights	90	10	88	12	89	11
Purchased eco-labelled and fair-trade products	45	55	28	72	36	64
Recycled cans, glass, or paper	84	16	31	69	57	43
Used carpooling	40	60	34	66	37	73
Purchased environmentally friendly products	51	49	33	67	42	58
Did any form of voluntary work in your community	15	85	41	59	28	62
Donated money to charities	21	79	39	61	30	70
Refused to take a plastic bag from the supermarket	44	56	17	83	30	70
Used energy saving light bulbs	77	23	73	27	75	25

Table 5 Teaching and learning methods-arranged according to the first three ranked

Teaching and learning methods	Rank 1		Rank 2		Rank 3	
	N	%	N	%	N	%
Lecturing	2,328	62	453	12	535	14
Project-based learning	646	17	1,150	31	940	25
Interactive engagement	719	19	1,059	28	854	23
Case-based instruction	749	20	875	23	909	24
Inquiry-based learning	623	16	929	25	817	22
Inter-disciplinary teaching	739	20	886	24	726	19
Problem-based learning	634	17	816	22	838	22
Tech-supported instruction	816	22	849	22	689	18
Placed-based learning	756	15	603	16	988	26
Discovery-learning	598	16	734	20	915	24

Summing up, the results of this survey show that the progress toward the goals established in Rio (1992) has been slower than it was hoped, despite that almost half of students surveyed had some experience with courses dealing with issues directly and/or indirectly related to sustainability. Things cannot be changed by just adding and/or embedding sustainability in one of two courses being taught with conventional pedagogical methods. Table 5 reveals that most of the students (62 %) rated that the most dominant teaching method was lecturing, while other teaching and learning methods such as place-based learning (15 %), inquiry-based learning (16 %), problem-based learning (17 %), discovery learning (16 %), inter-disciplinary teaching (20 %), which are suitable with learning to live together sustainably, are much less evidenced in higher education pedagogies. It is our contention that the focus on disciplinary boundaries at the expense of interdisciplinary or more holistic curricular approaches is a major constraint for such results. The fact that in most of the universities participated in the survey some courses related to sustainability have been introduced is not an adequate response to our current sustainability crisis. What is needed is a shift to alternative teaching and learning paradigms. Embedding sustainability into the university curricula necessitates a context of learning that is enabled by student-centred learning and teaching approaches.

The RUCAS survey has also studied Sterling's (2001) four main functions of education: (1) To replicate society and culture and promote citizenship—the socialization function; (2) To train people for future employment—the vocational function; (3) To help people develop their potential—the liberal function; and (4) To encourage change toward a fairer society and better world—the transformative function. The last function is seen by Sterling as central to achieve a more sustainable educational system. Assessing the students' preferences toward these functions shows what values are dominant and what directions are needed to be taken as well as how to better understand the extent to which sustainability issues

Table 6 Students' attitudes toward learning to live together sustainably

Perceived functions for HEIs	Total	GR	IT	IR	FR	SW	EG	JOR	LEB
To replicate society and culture and promote citizenship-*the socialization function*	6 %	1 %	1 %	0	1 %	1 %	28 %	8 %	1 %
To train people for future employment-*the vocational function*	21	17	24	15	14	9	17	22	30
To help people develop their potential-*the liberal function*	31	26	46	50	42	46	18	24	37
To encourage change toward a fairer society and better world-*the transformative function*	42	56	29	35	43	44	37	46	32

have become incorporated in the university's function. Table 6 shows that, in total, there is a clear trend toward the transformative function that sees a university as an agent of change toward a fairer society and a better world. More specifically, 42 % of students indicated that function compared to 6 % that perceived the university's role to replicate society and culture and promote citizenship. When taking into consideration the country of students, perceptions are spread between the liberal and the transformative function. Italian and Irish students indicated a clear preference to the liberal function, in contrast to the Greek (56 %) and Jordanian (46 %) students who were oriented toward the transformative function. It is interesting to note, that the Egyptian students' preferences are situated between the socialization (28 %) and the transformative (37 %) function. A more balanced preference between the liberal and transformative function was revealed among the French, Swedish, and Lebanese students. Similarly, a more balanced preference is revealed between the vocational, liberal, and transformative function among Lebanese students.

Finally, the impact of having taken a sustainable development course to learning to live together sustainably is significant at $p < 0.0001$ with F (3339) = 75.5 and standardized beta coefficient equal to 0.15. Similarly, attitudes toward sustainability had a positive explanatory impact to learning to live together sustainably at $p < 0.001$ with F (3339) = 62.7 and standardized beta coefficient equal to 0.12. The regression analysis shows that both independent variables explain 4 % of the learning to live together sustainably variance. Although, statistically significant, this figure is very low, which is also reflected in the low value of the beta coefficients. These findings suggest there is need for a revised curriculum, not only in terms of content, but also in terms of teaching and learning methodology, including learning processes such as values clarification and critical reflection, as it has been also pointed earlier.

Reorienting University Curricula to Address Sustainability: A Response through RUCAS Tempus Initiative

Objectives and Key Processes

A major challenge of the twenty-first century for institutions of higher education is to educate students on learning to live together sustainably. This challenge implies that university curricula and teaching methods should be revised and improved upon in order to infuse sustainable development and translate knowledge and critical consciousness into action. Reorienting university curricula to address sustainability (RUCAS) is very urgent and necessary to equip graduates with knowledge, skills, perspectives, and values of sustainability so as to assume responsibility for creating a sustainable future and lifestyle. The RUCAS project was funded by the European Commission Tempus Programme for a three-year period (2010–2013) and coordinated by the University of Crete. More specifically, the project aims to:

1. Support the development of Education for Sustainable Development (ESD) in the Higher Education sector in Egypt, Jordan, and Lebanon.
2. Build capacity amongst university staff to embed ESD in curricula and pedagogy.
3. Review and revise undergraduate curricula to address ESD in line with Bologna and Lisbon processes.
4. Assist the coordination and dissemination of ESD policy, research, curriculum reform, and practice relating to ESD in the partner institutions that are expected to function as role models in the region.

The RUCAS project adopts a multi/interdisciplinary and systemic approach contextualized in the partner countries and regions. The approach entails the following key processes:

- Establish continuous dialogue with university faculties regarding directions and means of education for sustainability.
- Develop ESD competences for university students contextualized to the European Union and Arab region.
- Evaluate ESD student competences in the participating Higher Education Institutions (HEIs).
- Establish and apply a Virtual Learning and Management System for running a community of practice in reorienting university curricula to address sustainability.
- Develop an ICT-based training Toolkit on ESD curriculum reform and innovation in Higher Education, reflecting the ESD student competences framework.
- Establish Virtual Training Centers in each partner university to support the process of reorienting university curricula to address sustainability.

- Build capacity amongst university staff to review, revise, infuse, and embed ESD in undergraduate university curricula; and institutionalize and disseminate ESD curriculum reform.
- Apply and evaluate the revised university curricula with respect to the ESD student competences.
- Bridge the gap between HEIs and society through the placement of at least 100 students from each of the six partner institutions (600 in total) in the Arab partners.
- Promote reorienting HE toward ESD as a viable avenue for "whole institution" curriculum reform, research and teaching across all HEIs in the Arab region and the other member institutions.

The above key processes are driven by three methodological approaches: (1) competence-based education (CBE); (2) infusing sustainability; and (3) participatory action research. Five clusters of generic competences were developed and validated together with corresponding disciplinary competences in six prioritized disciplines: Educational sciences, social sciences, applied sciences, business/economics sciences, technical sciences, and health sciences (Makrakis et al. 2012). The clusters adopted for the generic competences were based on the Delors' UNESCO report 'Learning: the treasure within' (UNESCO 1996), which recognizes four pillars for education of twenty first century: (1) learning to know, (2) learning to do, (3) learning to live together, and (4) learning to be. We also added the fifth pillar of 'learning to transform oneself and society' that has been later introduced by UNESCO as the 5th pillar (Fig. 1). Infusing sustainability in university curricula refers to the integration of content and skills into existing courses in a manner that does not jeopardize the integrity of the courses themselves. The infusion approach allows us to address sustainability, not by adding another course, but through enriching areas of existing courses enabled through capacity

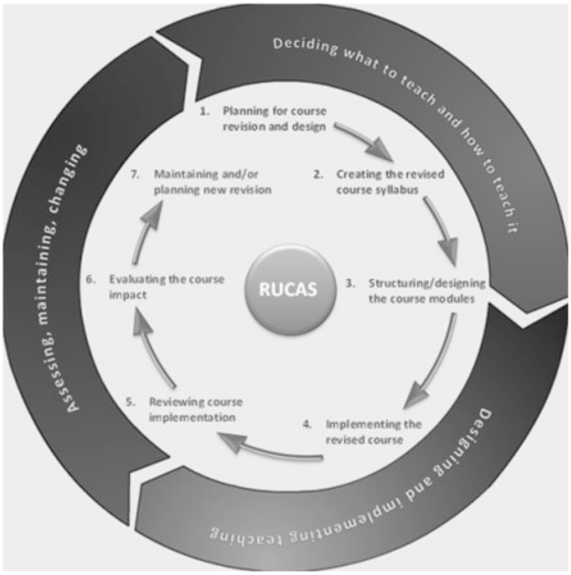
Fig. 1 The five ESD competence clusters

building of participating university teaching staff. The nature of the participatory action research approach adopted is a collaborative and cyclical process, through which the involved staff of the 12 participating universities experience reflection, observation, planning and action. Participating university instructors are registered in an online community of practice that offers them a space for interactive communication, exchange of ideas, practices and resources. Considering university instructors as part of a "critical community" of practitioners who not only want to improve the quality of teaching and learning in their institutions, but who also seek to transform those structures, practices, and behaviors that provide constraints to turning universities into sustainable ones, is of critical importance.

The RUCAS Seven-Step Model

In designing or revising a course, instructors are usually faced with at least three crucial decisions: (1) what to teach and how to teach it; (2) how to design and implement a course; and (3) how to ensure that students are learning what is being expected. We have worked out a model of seven interactive and cyclical processes to respond to these three critical questions (Fig. 2). The RUCAS model provided the guiding instrument in the revision, implementation and evaluation process.

Fig. 2 The RUCAS model



Deciding What to Teach and How to Teach it

Step 1: Planning for course revision and design (composed of the following five tasks):

1.1 Identify objectives for ESD that suit your subject area.
1.2 Identify what ESD content is missing in the courses you teach.
1.3 Match the identified objectives for ESD with your course objectives.
1.4 Identify ESD-related strategies that suit your subject area.
1.5 Identify what ESD teaching methods are missing in the courses you teach.
1.6 Match the identified ESD teaching methods with your courses.

In dealing with the above tasks, university teaching staff participating in the RUCAS project needed to critically reflect on the content of their courses and teaching methods to see what gaps and what emphases are missing related to sustainability. Questions such as the following were asked: What and how much knowledge about sustainability is required in the course? Does the course already include the examination of and the development of perspectives and values that lead to the transition to a healthy, just, equitable, secure, and environmentally sustainable society? To what extent are students encouraged in this course to be aware of the connections between the environmental, social, cultural, political, and economic aspects of sustainability? Are the teaching methods used consistent with the values, ethics, and principles of education for sustainability? As the RUCAS survey indicated, the content and prevailing teaching methods do not encourage change toward a fairer society and a better world that was mostly preferred by students. Teaching methods were also teacher-centered focusing on lecturing, while teaching methods and learning strategies which are more suitable to teaching for learning to live together sustainably were less evidenced. A teaching methodology paradigm shift was thus attempted, moving the emphasis from teaching to learning and to a more student-centered curriculum. This change necessitated professional development both on reorienting teaching methods and a curriculum design process with a greater emphasis on learning to live together sustainably.

Step 2: Creating the revised course syllabus (composed of six tasks)

2.1 Identify important learning goals/objectives and outcomes.
2.2 Formulate appropriate feedback and assessment procedures.
2.3 Select effective teaching/learning activities.
2.4 Lists required and recommended textbooks and materials and where to find them.
2.5 Create a thematic structure for the course.
2.6 Write the course syllabus.

This process encourages university instructors participating in the RUCAS project to clarify what sustainability concepts they want their students to learn in the context of the course they revise. Teaching staff were to decide which themes to emphasize within their courses to ensure that they fit the environmental, social, and economic aspects of sustainability contextualized in their local and regional conditions. Identifying important learning goals/objectives and outcomes aligned with appropriate feedback and assessment procedures is of critical importance in this process. Ensuring the alignment of learning outcomes, teaching methods and learning activities and assessment tasks is decisive to the course revision process. Learning outcomes are statements that describe what students will be able to do upon successful completion of a course, module or unit. In each learning outcome, key assessment criteria are evident, which can be further elaborated in an assessment task and provide feedback to both students and instructors.

In designing feedback and assessment tasks emphasis is placed upon strategies that help to develop student's own capacity for self-assessment in learning. Selecting effective teaching/learning activities that are ill-structured and student-led are connected to learning goal/objectives and outcomes and merge theory with practice. Any relevant materials or digital learning objects attached to learning activities are listed as resources. All these constitute the basis for creating a thematic structure of the course content in topics and placing them in a logical weekly arrangement for a learning-centred syllabus. In the RUCAS design, a syllabus is perceived as a "learning contract" between the instructor and the students that sets the ground rules for all the course goals, objectives, outcomes, methods, topics, activities, assessment tools, and so forth. It also serves as a planning tool for structuring the course modules, course implementation and assessment. A RUCAS syllabus template was developed and guidelines were issued for formulating all the syllabus components.

Designing and Implementing Teaching

Step 3: Structuring the course modules (composed of four tasks)

3.1 Develop a list of the modules.
3.2 Review the readings that are provided in the syllabus.
3.3 Break-up each module on a set of units.
3.4 Provide the overview, key concepts, aims, learning outcomes, learning activities/assignments, and readings in each module.

This process helps university instructors to clarify more the syllabus and structure the course modules. Structuring the course syllabus into course modules implies first a re-organization of the weekly topics in the syllabus and second aligning the course goals/objectives and learning outcomes to course modules structure. Regarding the first, it does not necessarily imply that there must be a module for every week elaborated in the syllabus. It could be that a module can run for more than 1 week, depending on the topics of the course. As the weekly topics are placed in a logic sequence, this should also be reflected in the modules.

The revised course content could be broken into manageable and meaningful modules. The general practice is that a 14 weeks syllabus can be composed of 5–10 modules. However, exceptions are allowed depending on the demands of a course. Learning activities are designed for each module in the course.

Step 4: Implementing the course

4.1 Staff expertise and capacity building.
4.2 Learning and pedagogy.
4.3 Delivery methods and tools.

This process focuses on how the revised courses can be implemented within an existing undergraduate curriculum of the RUCAS partner institutions. Successful implementation beyond the readiness of the teaching staff requires certain conditions such as infrastructure, appropriate learning, and pedagogy and teaching resources and tools. The three RUCAS regional training workshops carried out were instrumental for building participated instructors' capacities for implementing the revised courses. In terms of learning and pedagogy approach, the convergence of experiential, constructivist and transformative learning abbreviated as ExConTra learning paradigm has been developed and adopted (Makrakis and Kostoulas-Makrakis 2012b). According to the ExConTra learning approach, students apply what they learn in class and community. In addition, it helps students develop critical reflection, deepen their understanding of the complex causes of environmental, social, and economic problems, and enhances their social and civic skills. Pedagogies like service learning, problem-based and participatory, interdisciplinary and inquiry-based learning are inherent in the ExConTra learning approach. To reach this goal, the RUCAS utilizes a number of modes of instruction, including audio, video, and media presentations, readings, discussion sessions, offline/online assignments, and other teaching and learning support systems.

Assessing, Maintaining, and Changing

Step 5: Reviewing the progress of course implementation

5.1 Pre-course assessment.
5.2 In-course assessment.
5.3 Post-course assessment.

While the revised courses are being implemented, a reviewing process has been designed and adopted by the partner institutions. Pre-in-and post-course surveys were used to assess student learning from the start of the course until the end. A pre-course assessment is used at the beginning of the course to capture the extent of student knowledge and understanding about key course concepts related to sustainability. It is also used to measure students' attitudes and values relevant to course concepts. In-course assessment is based on the strategy of reflection-in-action (Schön 1983): that is the capacity of professionals to consciously think and possibly make changes about what they are doing while they are doing it. Post-course assessment adopts the strategy of reflection-on-action (Schön 1983): that is, thinking back on what the RUCAS participated university instructors have done during the course implementation in order to discover how their knowing-in-action may have contributed to an unexpected outcome. It is also supplemented by summative assessment procedures to demonstrate what has been achieved in line of the expected outcomes and comparisons with pre- and in-course assessment results.

Step 6: Evaluating the course impact

Evaluating the RUCAS revised courses contributes to the continuous improvement and enhancement of the curriculum revision process and of teaching and learning for sustainability through review, reflection, and action for improvement. An impact evaluation reveals the extent to which any observed changes in outcome indicators is due to the program activities. There is a number of different ways in which the course impact evaluation can be implemented. The RUCAS project uses a framework based on four levels: (1) participated instructors reaction to the capacity-building workshops to RUCAS; (2) students' learning change in attitudes, knowledge, skills, values, and actions; (3) instructors' course content and teaching transformations; and (4) changes at institutional/organisational level.

Step 7: Maintaining and/or planning new revision

The results of the impact assessment together with all other collected and analyzed data regarding the RUCAS project indicate successes and shortcomings that should be considered for maintaining and/or proceeding to new revisions and improvements. Based upon participated action research and the principle of 'continuous improvement,' the curriculum revision, implementation, and evaluation process could be subject for further revisions in content, pedagogy, teaching materials and tools and re-examination of the strategies used.

Discussion

As pointed in the introduction, humanity has been experiencing the impacts of an unsustainable economic model that has generated the current sustainability crisis humanity is facing worldwide. Higher education bears its own responsibility for this crisis, through which graduates become all sorts of leaders who in one or another way drive society and economy. Today's graduates will take future management and leadership roles, and will need the knowledge and skills to make informed decisions, taking into account the complexity of the social, economic, and environmental issues that exist in the twenty-first century (Scott and Gough 2007). The fundamental problem faced in meeting the challenges of the sustainability crisis in higher education is a narrow understanding of knowledge, teaching, and learning. Higher education curricula are vertically structured without leaving room for cross-fertilisation of disciplines and merging knowledge with real-life experiences. Education for sustainability is often marginalized in curricula, which in turn reproduces and perpetuates academic divisions of knowledge that separate the natural and social sciences and the humanities, and fails to acknowledge lay and tacit knowledge (Huckle 2008). Regardless of the academic disciplines, students must learn and practice holistic systems thinking and be able to apply such thinking to real world situations and problems that they face, locally and globally. Sustainability provides higher education institutions an opportunity to confront their core values, their personal theories and practices, their entrenched pedagogies, the way they think about resources and allocated these resources and their relationships with the broader community (Wals and Jickling 2002).

Curricula and pedagogy are the most vital components of education for sustainability (Makrakis and Kostoulas-Makrakis 2012a). The RUCAS survey results show that students' attitudes and actions toward sustainability are more oriented to the environmental sustainability, while the other dimensions of social, economic, and political sustainability are lagging much behind. Current university curricula in the participants' universities are largely driven by modernist educational philosophies that divorce knowledge from real-life experiences, equipping students with knowledge, skills and values that contribute to unsustainable modes of production and consumption, largely recognized as the main sources of sustainability crisis. The de-contextualization of knowledge through its compartmentalization into fields of specialization that continues to characterize modernist university curricula needs to be transformed toward a more holistic view of knowledge. University curricula should not only be limited to the environmental dimension of sustainability, but students should also learn about the social, economic, cultural, and political dimensions of sustainability issues.

It is clear that the modernistic metaphors that now characterize higher education are inappropriate and insufficient for generating a vibrant discourse on education for sustainability and that regenerative frameworks must be articulated as guides to help sustainability educators find a new path and pedagogy suitable for sustainability (Williams and Brown 2011). The results also show that the most dominant teaching method was lecturing, while other teaching and learning methods such as place-based learning, inquiry-based learning, problem-based learning, discovery learning, inter-disciplinary teaching, which are suitable with learning to live together sustainably, are much less evidenced. Through sustainability-suitable pedagogies, higher education graduates would be able to contribute to building a society that is more socially vibrant, economically just, and environmentally sustainable. Such approaches to sustainability in Higher Education allow students to personalize their learning by integrating different curricula domains and multiple perspectives. The concept of learning personalisation builds on the experiential, constructivist and transformative (ExConTra) pedagogies (Makrakis and Kostoulas-Makrakis 2012b). It is worth pointing out, that almost half of students surveyed indicated a preference to the transformative role and function of universities compared to only 6 % that perceived the university's function is to replicate society and culture and promote citizenship.

Without major transformative changes in what and how we learn, education will play an instrumental role in the hands of those who want to control and perpetuate an unsustainable society. Countering instrumentality, while not easy, implies that the role and function of higher education should provide opportunities for students by making connections not only with their community and the natural world, but also by making connection with the head (cognitive knowledge), the heart (emotional and spiritual learning), and the hands (putting knowledge into action). The pedagogical use of action (hand) has a historical foundation traced to the principles of Dewey (1938), who criticized the false dichotomy of knowledge and practice. There is an overlapping and strong relationship between and among the cognitive (head), spiritual (heart), and active (hand) processes of learning and pedagogy (Pigza and Welch 2010; Welch and Koth 2009; Sipos et al. 2008). Lindholm and Astin (2008, p. 186) speak of how "people's abilities to access, nurture, and give expression to the spiritual dimension of their lives have also been found to impact how they engage with the world and to foster within them a heightened sense of connectedness that promotes empathy, ethical behavior, civic responsibility, passion, and action for social justice". Such a kind of pedagogy challenges both students and faculty to clarifying who they are; what they may become and what they might become together. The ExConTra learning paradigm provides a unified whole into the educational process through pedagogies such as place-based and service-learning. In this way, students and faculty experience what Freire (1970) calls praxis—a cycle of action and reflection in order to transform the world. Transformative learning in the context of higher education requires major shifts in personal perspectives and unsustainable university structures to enable the emergence and application of critically reflective and inter/transdisciplinary pedagogies. It can also enable university educators to get the appropriate readiness to transform themselves and the unsustainable structures that enclave them in passivity.

Head, Heart, and Hands cannot be seen as distinct processes but as a whole that provides both students and instructors with a wide range of theoretical and practical knowledge for transforming oneself and society. As pointed by Brühlmeier (2010), this principle of coherence is valid for all three areas: intellectual (head), emotional/moral (heart), and practical (hand). Connecting the five pillars of sustainability competences with learning processes, the head stands for learning to know and learning to be, with due emphasis on education for sustainability processes such as learning to reflect on personal experiences and clarify own values; the heart stands for learning to live together sustainably with due emphasis on processes such as learning to reflect on own values and finally hand stands for learning to do and learning to transferring theoretical knowledge to practice.

As it is pointed by Mezirow (2003, p. 57–58), it is above all learning to "transform problematic frames of references—sets of fixed assumptions and expectations—to make them more inclusive, open reflective and emotionally able to change." Reorienting existing education at all levels to address sustainable development is very urgent and necessary, so that all can gain knowledge, skills, perspectives, and values conducive to creating a sustainable future and lifestyle.

Universities must combine specialized subject knowledge with problem-based and integrated modes of seeing and working, not only in research, but also in teaching; and they must create the necessary interdisciplinary research and teaching structures to enable the embedding of sustainability in their curricula (Godemann 2008). Interdisciplinary pedagogical methods need careful thought and planning, which necessitates appropriate capacity-building interventions. The RUCAS research results show that significant changes are needed in the curriculum of every discipline and the pedagogy used to implement that curriculum as well as a re-definition of the role of educators and education.

The methodological approach adopted by the RUCAS project reveals a number of processes through which we can infuse sustainability into university courses and curricula. This model is being implemented within a consortium of 12 universities, six in the European Union and six in Middle East (Egypt, Jordan, and Lebanon) led by the University of Crete. Within the 3 years of the RUCAS initiative, we have transferred expertise from European universities through the organization of three regional workshops in Beirut, Cairo and Amman, where more than 150 university staff coming from six disciplines have been trained on revising course curricula to embed sustainability. An Online Community of Practice (OCoP) developed is being used as a resource, repository, and forum (http://community.cc.uoc.gr/). Almost 250 university courses have been revised to address sustainability across the six prioritized academic disciplines (educational sciences, social sciences, applied sciences, technical sciences, business/economics sciences, and health sciences). A pilot initiative for student placement and practicum has been carried out, through which more than 3,000 students have been involved in producing collaborative projects dealing with local sustainability issues. Replication and up-scaling are fundamental objectives of the RUCAS project as it provides the opportunity to build on best practices and lessons learned and expand the reach and impact not only within partner institutions, but within partner countries. The issue of up-scaling is inherent in the project itself as the RUCAS project provides a viable avenue for "whole institution" curriculum reform, research, and teaching across all Higher Education Institutions in the Arab region. The RUCAS Sustainable Universities Network portal has been developed (http://rucas.edc.uoc.gr) which focuses on the institutionalisation of sustainable development within our partner universities and beyond. Virtual Training Centers are also established in each Arab partner university ($N = 6$) which are used for capacity-building and as resources for reorienting university curricula to address sustainability. The revised student courses and the institutional ESD framework policies and practices that are being developed are also expected to be the drivers of change within and among institutions in the partner countries and region.

Acknowledgments This work has been developed within the framework of the Reorient University Curricula to address Sustainability (RUCAS) project that has been funded from the European Commission (European Commission, TEMPUS- No 511118-2010-GR-JPCR). The content of the paper reflects the views of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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The Low Carbon Curriculum at the University of Newcastle, Australia

Elizabeth Date-Huxtable, Gary Ellem and Tim Roberts

Abstract The University of Newcastle, Australia, has developed a vision and goals for sustainability practice in its Strategic and Environmental Sustainability Plans for which an operating framework and procedures need to be developed. In this paper we develop our institution's strategy for sustainability reporting in teaching and learning by identifying actions to improve sustainability practice that can be implemented and measured. We use the planning tool "backcasting from success" to identify implementation paths for realizing the vision and goals of our institution's Environmental Sustainability Plan (ESP). We then use Schumacher's accounting and accountability tool to design a reporting system or Scorecards for embedding sustainability learning across curricula. The results of the design process are three Scorecards for the Lecturer, the University and the Student, which target criteria of three populations within the university, academic staff, administrative and technical staff and students, who can impact targets of the ESP. Each scorecard contains criteria for success in embedding sustainability learning across curricula and levels of performance on these that measure relative success. The Scorecards are at the conceptual stage of implementation and their effectiveness in achieving improvements in embedding sustainability across curricula will be tested initially using selected courses whose staff wish to pilot the scorecards. If successful they will impact all levels of teaching and learning at our institution and affect behavioural changes that increase disciplinary applications of sustainability

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_19,

practice and graduate professional preparation in integrating sustainability practice with their professions. The paper is a venture into auditing of changes in behaviour that potentially reduce whole-of-institution ecological footprint.

Keywords Education for sustainability · Teaching and learning · Scorecard · Institutional reporting

Introduction

As the corporate and political sectors debate and ultimately integrate environmental sustainability into their everyday thinking and practice, there will be a need for trained professionals to support and implement changed disciplinary practice for a more environmentally sustainable future (Hargroves et al. 2009). Universities are the conduit to building such a workforce and at the same time providing innovative business and technological solutions to sustainability issues. Hargroves (2011) predicted that whole curriculum renewal, which keeps pace with or ahead of demand for professionals trained in both disciplinary and sustainability practice, will be required in the next 15 years. Students will expect to be educated in sustainability perspectives and processes while they undergo cognitive and behavioural changes to become trained professionals (Leihy and Salazar 2011). However, "sustainability is not yet well integrated in specialist or generalist coursework programs in Australia,…[and] the emphasis of such programs is usually [on] technological solutions and scientific ken to the detriment of human cultures and behavioural change" (Sherren 2006).

Education for Sustainability (EfS) is already a growing practice in Australia and internationally and is most successfully implemented using a strategic systems approach (Desha and Hargroves 2011). The Australian Government's National Action Plan for Education for Sustainability, 'Living Sustainably' (Commonwealth of Australia 2009), aims to integrate education for sustainability into all university subject areas to support and encourage whole-of-institution change for sustainability, including research, teaching and learning, and campus management. Some Australian universities are implementing 'Living Sustainably' (e.g., Hocking et al. 2011), and others, such as the University of Newcastle, have developed similar sustainability policies and plans. The University of Newcastle's Strategic Plan, 'Building Distinction' (2011–2015), states that: "As a University we should be a leader in changing perspectives and attitudes to economic growth, education, health and environmental sustainability, enabling the transition to greener economies. We will ensure that sustainability is fostered and integrated with our research, teaching and campus management activities through a strategic plan for environmental sustainability."

The University's Environmental Sustainability Plan (2011–2013) includes a teaching and learning theme: "to deliver leading-edge interdisciplinary teaching and learning experiences to equip students with knowledge, confidence and enthusiasm so they can positively engage in fostering environmentally sustainable solutions through their careers and everyday living". A number of goals have been identified as part of this theme. The goals are interrelated and fall into the following three areas:

1. Increasing the opportunities for students to participate in learning about sustainability
2. Engaging teaching staff in improving sustainability content and practice through professional development
3. Developing a reporting process for sustainability progress in teaching and learning.

The Tom Farrell Institute for the Environment (TFI) is assisting the University of Newcastle's Committee for Environmental Sustainability in developing a reporting process for sustainability progress that documents engagement of staff and opportunities for students in teaching and learning about sustainability in their disciplines. Using "scorecards for the Lecturer, the University and the Student" (below), we will attempt to demonstrate that a core institutional process in the development of modern graduates, embedding education for sustainability in curriculum (which we have labeled 'the low carbon curriculum'), can reduce the graduate's and the institution's ecological footprints. In this paper we develop the scorecards as a basis for future research, during which we will test the effectiveness of teaching and learning about sustainability on behavioural change in university staff and students toward reducing their ecological footprints.

Measurement and the Ecological Footprint

What is the ecological footprint of "growing" a student from admission to graduation? Can we produce graduates well-versed in sustainability perspectives and processes while they undergo cognitive and behavioural changes to become trained professionals? Will the product be a graduate who continues to tread lightly on the earth? A large number of metrics that document sustainability practice are available (e.g., AASHE Sustainability Tracking and Assessment Rating System [STARS] 2008, Global Reporting Initiative [GRI] 2000–2011) but do these measure sustainable behavioural change and business and technological innovation for sustainability?

To answer these questions we (at TFI) have developed a way to measure the ecological footprint of growing a student, in order to determine whether with successive measurements we can reduce it. We used the planning tool, "Backcasting from Success" (Robèrt et al. 2002). Briefly and with reference to the teaching and learning goals of our institution's environmental sustainability plan, we envisioned successful strategies of EfS for students, lecturers and administrative and technical staff. We then "backcast" to the current reality to identify potential implementation and innovation actions that could bring about these goals of embedded sustainability learning and practice in university teaching and learning (Fig. 1). Three strategies developed in this paper aim to actively engage staff and students individually and collaboratively in campus sustainability management by 'connecting' them with their energy and resource use on campus and in their future work place. They also aim to engender lifelong behavioural change in graduates through integrating sustainability content and pedagogies into teaching and learning in all disciplines. Each strategy targets one "population" within our university, academic staff, administrative and technical staff or students. The strategies and criteria for action are not intended to be exhaustive of ways to achieve environmental sustainability but have targeted widespread practices with immediate and long-term relevance to our institution's Strategic and Environmental Sustainability Plans.

The first strategy supports academic staff in becoming actively aware of practices in their disciplines that reduce energy and resource use, waste production and impacts on biodiversity and in using pedagogies for presenting this "sustainability content" so that students learn sustainable disciplinary practices and carry them into professional environments. Suitable pedagogies are now well known in higher education for engaging students in deep learning and developing in them lifelong learning skills (Biggs and Tang 2007), and include experiential or work-integrated learning, such as university-negotiated work experience in appropriate environments (Collis 2008), cross or interdisciplinary learning, which usually involves teamwork by students to apply technical knowledge to environmental, social, ethical and economic problems, and "meta-learning" through reflection, such as writing a journal about learning experiences. In this context, it is also appropriate to calculate the ecological cost of expansion or retrofit of campuses with environmentally sensitive buildings that require students to travel to the institution regularly, study in buildings that require services and attend classes that consume energy, paper and other products; and to accommodate location-independent Web2 technologies which provide new pathways to tertiary educational practice for sustainability.

Based on the preceding discussion, five criteria were identified to guide action for academic staff ('the Lecturer', Table 1):

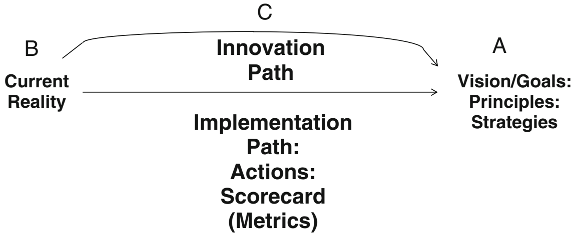

Fig. 1 Using 'Backcasting from Success' (Robèrt et al. 2002), we develop *A* a vision of success with principles to guide and strategies to achieve the goals of our vision then backcast *B* to the current reality to develop *C* the implementation and innovation paths and actions to realize the goals of the vision

Table 1 Lecturer scorecard: criteria relate to the level of sustainability practice demonstrated by academic staff

Grading scale 1 = worst to 5 = best	Level 1	Level 2	Level 3	Level 4	Level 5
Criteria 1 and 2: Professional Development					
Performance:	Induction only	Induction, begin Graduate Certificate Tertiary Teaching (GCTT), proactive course (re)design	Induction, GCTT complete, in-house workshops, course level application	Induction, GCTT complete, in-house and expert workshops, program level application	Induction, GCTT complete, in-house and expert workshops, program governance, research and workshop contributions
Criterion 3: Sustainability Content, Learning Activities and Assessment					
Performance:	Minimal or no sustainability content	Sustainability content linked to disciplinary context	Sustainability content linked to experiential learning activities	Experiential learning activities linked to assessments	Sustainability principles embedded in (inter)disciplinary practice
Criterion 4: Contribution to Ecological Footprint					
Performance:	Become aware of ecological footprint of course delivery	Reduce ecological footprint through behavioural change	Reduce footprint through behaviour and business innovation	Apply reductions across programs	Lead continuous improvement of behavioural change and innovation
Criterion 5: Auditing (Course Assessment Returns, Institutional Reporting)					
Performance:	No sustainability action or changes	Acknowledge action and minor course/program changes	Major course/program changes	Continuing improvement in course/program	Linking course/program content to multidisciplinary activities and research

The first two criteria, sustainability induction and professional development, are combined and apply to all teaching by an academic staff member. Criteria 3–5 are relevant to each course a lecturer teaches. Levels of performance on each criterion are indicative of the embedding of sustainability teaching and learning and practice in each course and can be assessed (audited) cumulatively across programs or divisively by student

- Attend sustainability principles and practices induction
- Include sustainability teaching in professional development
- Reduce energy and resource use and waste during course/program preparation, delivery and assessment in relation to what is learned and how it is prepared, method and schedule of delivery and how learning is assessed
- Include sustainability content and learning activities during courses and increase the level of its sophistication through study programs from first to final year, in a way that ties it to disciplinary learning and practice
- Contribute to sustainability auditing and reporting at an institutional level.

The second strategy engages university administrative and technical staff in supporting academic staff to change course and program content and pedagogies to including experience and practice of sustainability principles within their disciplines, in reporting and rewarding these activities and in supporting student achievement of learning disciplinary practice that is integrated with sustainability principles.

The following five criteria were developed to guide action for administrative and technical staff ('the University', Table 2):

- Develop a staff recruitment process that includes job selection criteria that target a track record in sustainability practice and a "sustainability processes" introduction in staff inductions.
- Develop sustainability targets and rewards for achieving them as part of performance management.
- Develop a sustainability reporting process as part of Course Assessment Returns and "stream" this into the University's annual sustainability reporting.
- Support professional development of staff in embedding sustainability into disciplinary and interdisciplinary curricula through in-house and external training and research.
- Support professional development of students through appropriate experiential or work-integrated learning in sustainability-related projects.

The third strategy, also comprising five criteria, was developed to guide provision of opportunities for students ('the Student', Table 3) to study sustainably and to learn about sustainably practising their discipline:

- Strive to provide a sustainable study environment with accessible study mode options by reducing energy and resource use and waste.
- Increase the offerings of disciplinary and interdisciplinary courses and programs that embed sustainability learning.
- Increase the opportunities for discipline-related and interdisciplinary, co-curricular and extracurricular, experiential and work-integrated learning about sustainability.
- Close the feedback loop by soliciting and incorporating feedback from students and staff about opportunities for sustainability learning.
- Seek feedback from graduates about their preparedness for applying sustainability principles in their work.

Table 2 University scorecard

Grading scale 1 = worst to 5 = best	Level 1	Level 2	Level 3	Level 4	Level 5
Criterion 1: Recruitment and induction					
Performance:	Sustainability included in job selection criteria or sustainability practices introduced in staff inductions	Sustainability included in job selection criteria and practices introduced in staff inductions	Some staff recruited on sustainability criteria, induction information influences some staff behaviour	All staff recruited on sustainability criteria, induction information influences some staff behaviour	All staff recruited on sustainability criteria, induction information influences all staff behaviour
Criterion 2: Performance management					
Performance:	Isolated staff or manager setting/meeting performance criteria	Some staff and managers setting/meeting performance criteria	Some staff units setting/meeting performance criteria	Some staff units sustaining the setting and meeting of performance criteria	All staff units sustaining the setting and meeting of performance criteria
Criterion 3: Course/Program reporting					
Performance:	Isolated staff or manager reporting	Some staff and managers reporting	Some staff units reporting	Some staff units sustain reporting	All staff units sustain reporting
Criterion 4: Staff professional development					
Performance:	Some staff undertaking PD	Some staff undertaking PD and embedding sustainability practice	Some staff units undertaking PD and embedding discipline-specific sustainability	Some staff units coordinating PD and interdisciplinary embedding	All staff units coordinating PD and interdisciplinary embedding
Criterion 5: Provision work-integrated learning (WiL) opportunities in sustainability					
Performance:	Isolated students undertaking WiL	Some students undertaking WiL	Some student groups/cohorts undertaking WiL	Some student programs undertaking WiL	All student programs undertaking/coordinating WiL

Criteria relate to the provision by the university administration of opportunities for recruiting and inducting staff with experience in sustainability practice in their discipline, for providing professional development (*PD*) in sustainability teaching, for including sustainability practice in performance management, course/program assessment and institutional reporting and for providing work-integrated learning (*WiL*) opportunities in sustainability practice for students

Table 3 Student scorecard

Grading Scale 1 = worst to 5 = best	Level 1	Level 2	Level 3	Level 4	Level 5
Criterion 1: Ecological footprint of study environment/mode					
Performance:	Known ecological footprint of infrastructure use	Increased efforts to reduce and audit infrastructure use	Reduced use of face-to-face (f2f) versus online learning modes	Reduced use of f2f mode and sound use of online modes	Sustained record of reduced f2f use with sound online alternatives
Criterion 2: Courses and programs with sustainability learning					
Performance:	Known number of courses/programs with sustainability learning	Increased number of courses/programs with sustainability learning	Increased number of programs with aligned disciplinary learning of sustainability practice	Increased number of programs with aligned disciplinary and interdisciplinary sustainability learning	All programs with aligned disciplinary and interdisciplinary sustainability learning
Criterion 3: Interdisciplinary, WiL, co-curricular and extra-curricular opportunities					
Performance:	Isolated opportunities for extracurricular sustainability learning	Some opportunities for extracurricular and WiL about sustainability	Some opportunities for co-curricular and WiL in courses	Sustainability learning opportunities aligned in some programs	Sustainability learning opportunities aligned in all programs
Criterion 4: Feedback loop from staff and students					
Performance:	Feedback collected from some students on sustainability learning	Feedback collected from some students and staff on sustainability learning	Feedback collected from representative staff and students	Feedback used to improve sustainability learning in some programs	Feedback used to improve sustainability learning in all programs annually
Criterion 5: Graduate success					
Performance:	Feedback collected from some graduates on usefulness of sustainability learning	Feedback collected from representative sample of graduates	Feedback used to improve learning in key courses	Feedback used to improve learning in some programs	Feedback used to improve all programs

Criteria relate to levels of achievement for students in sustainability learning and practice during their study programs and immediately after they graduate, in terms of the ecological footprint of their study modes, sustainability learning opportunities within courses, programs and in work-integrated learning (*WiL*), extra- and co-curricular activities, and the feedback to the university by staff, students and graduates about the success of these opportunities

Scorecards for Sustainability Teaching and Learning

To develop a way of measuring the criteria, we (at TFI) used Schumacher's total accounting and accountability model (Saravanamuthu 2006, 2009) to identify levels of action (metrics) that demonstrate low (1) to high (5) achievement on each criterion in education for sustainability. We collated them into separate Scorecards for the Lecturer, University and Student (Tables 1, 2, 3).

The Scorecard for the Lecturer (Table 1) incorporates the three interrelated goals for teaching and learning in the Environmental Sustainability Plan. It measures the levels of support and achievement of academic staff in embedding sustainability in curriculum and practice through staff induction, professional development and performance management (Criteria 1, 2 and 4). It measures the level of sustainability learning available for students through curricular and co-curricular activities (Criterion 3). And it contributes to reporting of sustainability practice, which can be calculated per student, course or program or for the whole institution while also recording the level of performance by a staff member for promotional purposes (Criterion 5).

The levels of performance on sustainability criteria are both a guide for the lecturer and a venue for provision of constructive feedback by their performance manager. It is intended that as a lecturer progresses along their career path, professional development opportunities can be tied to their contribution to teaching. An early career lecturer, that is, an academic who has recently begun a career as a lecturer, undertaken a staff induction upon appointment to a lecturing position and begun a tertiary teaching qualification, would most likely be working at the level of course development, beginning to develop experiential learning opportunities for their students and beginning to record their sustainability content and pedagogies in course administration and assessment returns. A late career academic may be working at the program governance level, making changes across programs to stream embedding of curricular and co-curricular learning about sustainability from first to final year, administering and reporting sustainability practice among staff in the school or faculty and leading disciplinary and interdisciplinary teaching and learning and/or research in sustainability practice.

The Scorecard for the University (Table 2) records the level of support provided by administrative and technical staff of education for sustainability and sustainable practice in teaching and learning across the university. It includes recording of the recruitment of staff with track records in sustainable practice in their discipline and the introduction of institutional practices in sustainability to academic staff, contributing to sustainable practices of teaching and learning and assisting with professional development of sustainability teaching (Criteria 1, 2 and 4 respectively). It also records the level of support by administrative and technical staff of students in their learning of sustainable professional practice through co-ordination of appropriate work-integrated learning opportunities (Criterion 5). Finally, it collates sustainability reporting from the course/program management system across the institution (Criterion 3), a process that would be co-ordinated by our institution's administrative unit for reporting of quality assurance in teaching and learning. At an early stage of sustainability practice, a university would be becoming aware of its level of embedding of sustainability teaching and learning, the curricular and co-curricular opportunities it is achieving for its students, as well as the level of sustainability practice and professional development of this achieved by its staff. It would also be implementing institutional reporting of these. A university with experience in sustainability practice and reporting would be recording high levels as well as continued improvement of sustainability practice and embedding of sustainability teaching and learning in curricular and co-curricular activities, as well as continued professional development by staff that is coordinated through performance management.

The Scorecard for the Student (Table 3) records the level of sustainability practice (Criterion 1), curriculum (Criterion 2) and experiential or work-integrated learning (Criterion 3) offered within a course or program, which are the results of curricular and co-curricular opportunities provided to them by their lecturers with the support of the university. Criteria 4 and 5 constitute the opportunities for students and graduates respectively to provide feedback to the university about its level of sustainability practice and professional preparation provided to students in sustainability practice and sustainable living and working. Students with few curricular or co-curricular opportunities within their courses or program to relate sustainability practice to their disciplinary and interdisciplinary learning may give highly critical feedback as they will be poorly prepared to enter a workforce that expects employees to be conversant with sustainability practice within their profession. In contrast students with many opportunities to practice and reflect on the relationship between their discipline and sustainable living and working are likely to give both good and constructive feedback and they are likely to report greater success in obtaining employment in their chosen discipline.

Support for Staff

Central to becoming a sustainable university is support for staff, both academic and administrative/technical, to embed sustainability in curriculum, co-curricular activities and university practice. We (at TFI) are developing "Greening the Curriculum" workshops and self-paced, online resources to support academic staff who want to integrate sustainability learning into their teaching. The workshops can be completed as "stand-alones" without assessment or they can be completed together with assessment as an elective course. This would make the first two workshops accessible to non-academic staff who are not involved in curriculum development. Workshops offered through the professional training and development calendar will include:

- What is sustainability?: how does sustainability practice relate to the participant's discipline and work as an academic, administrator or technician

- Sustainability principles and practice at University of Newcastle: the "nuts and bolts" of sustainability policy, planning, implementation, and curriculum evaluation and reporting through student feedback and peer review, plus a campus tour of "sustainability-sensitive" infrastructure
- Embedding sustainability teaching and learning in disciplinary practice: an exploration of different pedagogies and practices suitable for the participant's discipline and course(s)/program(s). Sustainability pedagogies introduced during the third workshop will include methods of information transfer, discussion forums about ethics, beliefs, principles of sustainability, roleplaying scenarios of planning and decision-making with diverse stakeholders, individual and group investigations using transdisciplinary methodologies, experiential and work-integrated learning approaches and educational technologies to support online delivery with reduced ecological footprint
- Presentation workshop: a reporting session for participants, who undertake the assessment, to demonstrate materials and activities developed for a course/program and an evaluation of it via student feedback and/or peer review as an oral presentation with supporting documentation.

Self-paced, online resources that support the workshops will be available through self-enrolment in a Blackboard course and will guide the participant through:

- "What is sustainability?": examples of disciplinary embedding of sustainability teaching
- "Sustainability principles and practice at University of Newcastle": university and sector policy documents on environmental sustainability, and methods of evaluating sustainability teaching and learning, followed by a quiz
- "Embedding sustainability teaching and learning in disciplinary practice": resources to support a participant's development of a proposal for course design or redesign embedding sustainability learning and teaching as a formative assessment for those attempting the elective course.

At the workshops and in the online materials we will also discuss rewards available for the lecturers who embed sustainability in curriculum or develop innovative processes to support this, such as "Green Gown" awards offered by Australasian Campuses Towards Sustainability, Inc., and funding and professional loadings available for curriculum development and research into sustainability learning

The Future

Our concept of university sustainability reporting for teaching and learning has been developed with a view to implementing and reviewing it in line with our institution's first Environmental Sustainability Plan (2011–2013). During the review process we plan to test its effectiveness in measuring improvements in EfS practice through its contribution to the LiFE Framework for university learning and teaching developed by the Australasian Campuses Towards Sustainability, Inc. in collaboration with the Environmental Association for Universities and Colleges (Wellington and Faghihimani 2012). In the first stage of testing we will select courses whose staff are introducing sustainability practice and learning activities and who wish to pilot the scorecards. This will form the basis of a forthcoming research paper.

To increase support for EfS among our institution's staff we are planning to develop an application of the online curriculum planning tool, Unit Planner (Phillips 2011), to assist with sustainability curriculum development. In addition, we are planning to develop or to invite development by software expertise of an ipad app that will assist with sustainability administration, such as planning room size for class size and activities, using room infrastructure "greenly" and economically, timetabling to reduce travel required by the majority of students and staff, reducing the quantity of materials used, especially paper, moving to online/ distance delivery, including assessments, and other expedient uses of educational technologies.

If a "low carbon curriculum" is to be truly instituted as core business then it is imperative that the above measures (i.e., scorecards) are developed in concert with institutional innovations that bring together the whole institution, including buy-in by the Vice-Chancellor or equivalent, changes in organisational structure such that the campus becomes an exemplar of sustainability in all areas, and a realisation that traditional planning of teaching spaces and transport infrastructure must be modernised to reflect the energy saving possibilities of alternative curriculum delivery methods to students who are of the information age.

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Assessing Sustainability in University curricula: Case Studies from the University of Leeds and the Georgia Institute of Technology

Rodrigo Lozano and Mary Katherine Watson

Abstract As more universities become interested in, and engaged with, sustainability, there has been a growing need to assess how their curricula addresses sustainable development and its myriad of issues. This book chapter presents an update of the Sustainability Tool for Assessing UNiversities' Curricula Holistically (STAUNCH®), and its application in two universities: (1) the School of Civil and Environmental Engineering at the Georgia Institute of Technology (Georgia Tech); and (2) the Bachelor and Master degrees from the Faculty of Business and the Faculty of Environment at the University of Leeds. The update includes the influence of the number of students enrolled in courses and the relative weight in credits of the courses in respect of the degrees. In addition, the tool provides graphs with information about which sustainability criteria are being most and least addressed. The curricula assessment can aid in better understanding the current status of a university's courses and degrees and identifying how they could be changed to become more sustainability-oriented. While the curricula assessment at Georgia Tech and the University of Leeds show different approaches for curricula contribution to sustainability, the results indicate that STAUNCH® can be instrumental in identifying courses that more adequately cover the breadth and depth of sustainability issues and exhibit higher contributions to sustainability. Overall, STAUNCH® can provide a systematic method for evaluating the strengths and weaknesses of a curriculum for the purpose of devising curriculum reform strategies to promote student sustainability learning. This can then help universities in making societies more sustainable.

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_20,

Keywords Curricula assessment · Sustainability · Georgia Institute of Technology · University of Leeds · Sustainability Tool for Assessing UNiversities' Curricula Holistically (STAUNCH®)

Introduction

As the number of higher education institutions (HEIs) engaging with sustainability grows (see Boks and Diehl 2006; Lozano 2006a, 2010; Wemmenhove and de Groot 2001), there has been an increasing interest in how they embed the principles of sustainability into their systems, including: education, research, operations, outreach, and assessment and reporting (Cortese 2003; Lozano 2006a), as well as collaborating with other universities; fostering transdisciplinarity; making SD an integral part of the institutional framework; creating on-campus life experiences; and 'Educating-the-Educators' (Lozano et al. 2013).

Universities' institutional progress toward sustainability has generally been focused on campus management, reporting degrees, and research initiatives (Lozano 2010; Lozano and Peattie 2011). By comparison, progress on the incorporation of SD into the curriculum has been slower, more limited, and piecemeal (Capdevila et al. 2002; Lozano and Watson 2013; Lozano and Young 2013; Thomas 2004; Velazquez et al. 2005). In spite of the recognized need to incorporate SD into curricula (Barth and Rieckmann 2012; Shriberg 2002b), and some efforts to explore its adoption into courses, schools, and universities, this has been little and slow (Boks and Diehl 2006; Capdevila et al. 2002; Thomas 2004; Velazquez et al. 2005). Limited research has been done on attempting to explain the incorporation of SD into university curricula (Capdevila et al. 2002; Thomas 2004; Velazquez et al. 2005). Some of the research on sustainability in universities' curricula include: Lozano's (2010) article, which explores the dynamics of the adoption and diffusion of SD in curricula by analyzing the results from the curricula audit of over 5,800 course descriptions at Cardiff University in Wales; and Ceulemans and De Prins (2010) paper, which offer a teacher's manual and method for the integration of SD into curricula, based on experiences in Hogeschool-Universiteit Brussels. Additionally, a number of authors have analyzed degrees and courses related to sustainability (see Glavic et al. 2009; Lourdel et al. 2005; Lozano 2010; Lozano and Peattie 2009, 2011; Lozano and Watson 2013; Lozano and Young 2013; Segalàs et al. 2010).

In general, four main approaches can be found for incorporating SD into higher education curricula, as proposed by Lozano (2010):

1. Some coverage of particular environmental and/or social issues and material in an existing course (Thomas 2004);
2. A specific SD course added to the curriculum (Abdul-Wahab et al. 2003; Thomas 2004; von Blottnitz 2006);

3. SD intertwined as a concept within pre-existing disciplinary-oriented courses, with the relevant SD component issues matched to the nature of each specific course (Abdul-Wahab et al. 2003; Boks and Diehl 2006; Peet et al. 2004);
4. SD offered as a specialization within the framework of particular faculties or schools (Kamp 2006).

Current curricula in higher education emphasize disciplinary specialization and reductionist thinking (Cortese 2003; Lozano 2010). As a result, many graduates are unbalanced, over-specialized, and mono-disciplinary graduates (Lozano 2010; Lozano and Watson 2013).

Within the incorporation process, three levels have been identified: (1) Major progress in embedding SD into undergraduate and post-graduate degrees; (2) Some limited progress; and (3) Relative difficulties in making credible and rigorous connections in courses and degrees, in spite of an interest in adopting the SD agenda (Thomas 2004).

A curricula assessment can offer university leaders a starting point for change, by providing a picture of where the courses and degrees are addressing sustainability issues, and where they could be improved (Lozano 2010; Lozano and Peattie 2009, 2011; Lozano and Young 2013). This could then be complemented with staff development projects (Barth and Rieckmann 2012; Shriberg 2002b) and curricular changes (Barth and Rieckmann 2012).

Many tools have been presented to assess the sustainable development initiatives of universities, including the Auditing Instrument for Sustainable Higher Education (Roorda 2001), the Graphical Assessment for Sustainability in Universities (GASU) tool (Lozano 2006b), and the Environmental Management System Self-Assessment (Shriberg 2002a). However, many of these assessments focus on the broader sustainability of a university's operations, while providing little or no insight into sustainability content of the curricula. However, the Sustainability Tool for Assessing Sustainability in UNiversities' Curricula Holistically (STAUNCH®) system is aimed at overcoming this shortcoming by assessing the extent to which a curriculum addresses the economic, environmental, social, and cross-cutting sustainability dimensions (Lozano 2010; Lozano and Peattie 2009, 2011).

This research presents and discusses the results from the STAUNCH® assessment of the B.Sc., in Environmental and B.Sc., in Civil Engineering from the School of Civil and Environmental Engineering at the Georgia Institute of Technology, as well as the Faculties of Business and Environment at the University of Leeds. This provides an illustration of the STAUNCH® assessment at two different curricular levels.

The Sustainability Tool for Assessing UNiversities' Curricula Holistically (STAUNCH®)

The STAUNCH® system was developed in 2007 with the aim of moving university curricula beyond the current emphasis on anecdotal evidence and non-comparable ad hoc reviews.[1] It was later updated in 2010 to consider the influence of the number of credits of each course (i.e., where a course has 20 credits it *may* have double the impact of a 10 credit one) and the number of students enrolled in the courses (see Lozano and Young 2013). In addition, the updated system features four new pie charts of criteria coverage for the economic, environmental, social, and cross-cutting themes, which can help to identify the coverage of SD criteria.

The STAUNCH® system relies on the explicit published course aims and outlines as a data source. This means that all the necessary information is (or should be) easily accessible, but it also means that the accuracy of the results depends on the accuracy/specifics of the published information. SD education delivered in the classroom but not reflected in the course documentation will not be captured.

The assessment is done on the course descriptors, or syllabi. It has two objectives: (1) to assess systematically how a university's curricula contributes to SD (i.e., the SD issues' coverage, depth, and breadth), by assessing its courses, degrees and schools; and (2) to facilitate consistent and comparable auditing efforts capable of handling a large quantity of data, and its application across multiple institutions.

STAUNCH® is based on two combined equilibria: first, cross-cutting theme issues (such as Holistic thinking, and SD statement, see Table 1), which are considered to be those that integrate economic, environmental, and social dimensions; and second, the SD contribution, which is calculated using formulae that look for the balance among the four dimensions, taking into consideration their strengths.

The analysis is three tiered, where the basic unit of analysis is the published course description: first, the analysis of course descriptions provides the results for the degrees; second, the degree results as the school's building blocks; and finally, the schools considered as the building blocks of the university.

STAUNCH® follows three steps:

1. *Data collection*. STAUNCH® relies on using explicit published course information, including aims, outlines, and descriptions as data sources;
2. *Data input and grading against the selected criteria*. When all the available data has been collected it is entered and graded against the issues presented in Table 2, according to the following strength criteria:

[1] For a more detailed explanation of the STAUNCH® system refer to Lozano (2010), Lozano and Peattie (2009, 2011).

Table 1 STAUNCH® 2010 curricula contribution to sustainable development assessment criteria

Economic	Environmental	Social
• GNP/Productivity/Profitability • Resource use/exhaustion (materials, energy, water) • Finances • Production/consumption patterns • Developmental economics • Markets/commerce/trade • Accountability	• Policy/Administration • Products and services: transport, ecoproducts and services, LCA • Pollution/Accumulation of toxic waste/Effluents • Biodiversity • Resource efficiency/eco-efficiency/cleaner production • Climate change: Global warming/Emissions/Acid rain/Ozone depletion • Resources use: depletion and conservation of materials, energy, water • Desertification, deforestation, land use: erosion, soil depletion • Alternatives: energy, technologies	• Demography/Population • Employment/Unemployment • Poverty • Bribery/corruption • Equity/Justice • Health • Politics • Education and training • Diversity and social cohesion • Culture and religion • Labor/Human rights • Peace and security • Work/life balance
Cross-cutting themes • People as part of nature/Limits to growth • Systems thinking/application • Responsibility • Governance • Holistic thinking • Long term thinking • Communication/Reporting • SD statement • Disciplinarity • Ethics/Philosophy • Transparency		

Source (Lozano and Young 2013)

- ***Blank*** *"Ignored"* (effectively a score of zero): indicating that a particular issue is not mentioned;
- *1 "Mentioned"*: the issue is mentioned, but no explanation is given about how it is addressed;
- *2 "Described"*: the issue is mentioned and there is a brief description of how it is addressed;
- *3 "Discussed"*: there is a comprehensive and extensive explanation of how the issue is addressed;

3. Analysis of degrees, schools, and the university's contribution to SD. STAUNCH® offers two types of reports for each part of the university (typically a School or Faculty): a summary report, and a detailed report; and four

Table 2 SD Contribution and qualitative levels

Hypothetical degree	Contribution	Level
U0001	0.00	None
U1001	0.01–0.67	Very low
U2001	0.67–1.29	Low
U3001	1.30–1.99	Medium
U4001	2.00–3.50	High
U5001	>3.50	Very high

graphs: (1) A map of contribution versus percentage of courses; (2) A chart representing the relative contribution to each SD dimension (economic, environmental, social, and cross-cutting themes); (3) A relative frequency chart of criteria strength; and (4) A map of contribution versus weighted average strength.

Two of the key points in the analysis reports are: (1) the level of contribution, indicating the 'breadth' and 'depth' of coverage of sustainability issues (the higher the contribution's value the better the balance among economic, environmental, social, and cross-cutting dimensions); and (2) the percentage of courses contributing to SD, given by the number of courses that relate to SD, divided by the total number of courses in each degree. Table 2 provides an illustration of this, as well as the qualitative level.

The STAUNCH® system is aimed at helping universities assess the depth and breadth of their SD-related curricula in a holistic and systematic way to produce standardized and comparable results. STAUNCH®'s results provide a 'snapshot' of how SD is currently being addressed within a university. Its reports detail the percentage of courses currently addressing SD, their balance among the conventional dimensions of SD (economic, environmental, and social), as well as those themes that cut across them. This information offers the possibility to detect whether SD is integrated across the curricula or is being broken down into individual issues to be addressed as a portfolio throughout the curricula. The reports can also serve to question current degrees, discuss how they could better contribute to SD, and help the institution better align with the Decade of Education for Sustainable Development (DESD) (UNESCO 2005).

The STAUNCH® system has been used by a number of universities, such as Cardiff University (see Lozano 2010; Lozano and Peattie 2009, 2011), University of Leeds (Lozano and Young 2013), Monterrey Tech, Worcester University, Georgia Institute of Technology and 11 Welsh universities through funding from the Higher Education Funding Council for Wales (HEFCW).

Case Studies

Two case studies are presented to show the systemic approach of STAUNCH®: two undergraduate degrees from the Georgia Institute of Technology (Georgia Tech) and two faculties from the University of Leeds. The courses were analyzed by this article's first author, who has analyzed over 10,000 courses from Cardiff University, Monterrey Tech, Georgia Tech, and the University of Leeds. Only some results and graphs are presented for each case study to serve as an illustration of the results that STAUNCH® provides.

Georgia Tech Curricula Contribution to Sustainability

Georgia Tech is one of the premier public research universities in the USA. Georgia Tech is home to six academic colleges: Architecture, Management, Liberal Arts, Computing, Engineering, and Sciences (GIT 2011).

Georgia Tech is committed to training engineers to engage in sustainable development. Based on this, CEE implemented a Civil Engineering Systems course to teach students about sustainability using a systems approach, where students learn about the economic, environmental, and social dimensions of sustainability during the semester and then apply principles by conducting a sustainability analysis of an existing infrastructure system. While CEE at Georgia Tech has made considerable efforts to incorporate sustainability principles into the curricula, a formal assessment was needed to determine the effectiveness of these efforts.

Forty-four courses offered by the School of CEE were analyzed with STAUNCH®. The analysis revealed that the curricula have strengths of 1.35 with contributions to sustainability education of 1.28. Both metrics are classified as "medium" (see Fig. 1). In addition, 12.8, 64.1, 2.3, and 20.8 % of sustainability

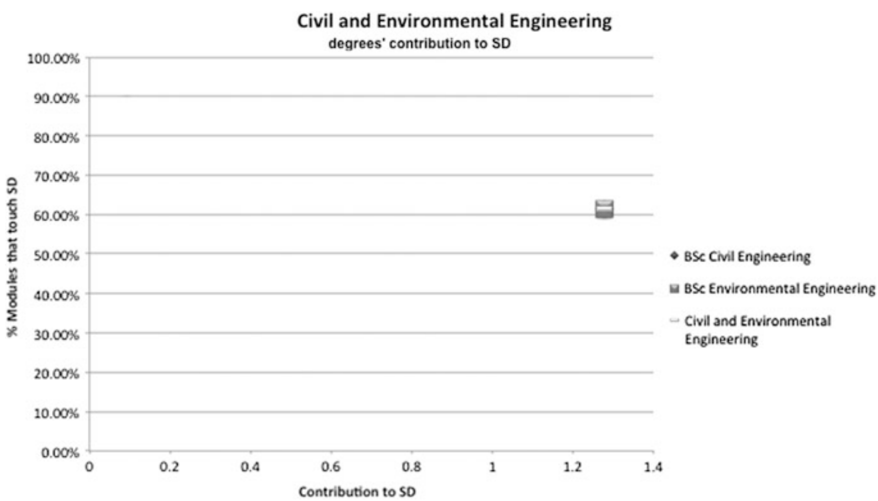

Fig. 1 Civil and Environmental engineering contribution to SD versus percentage of modules related to SD

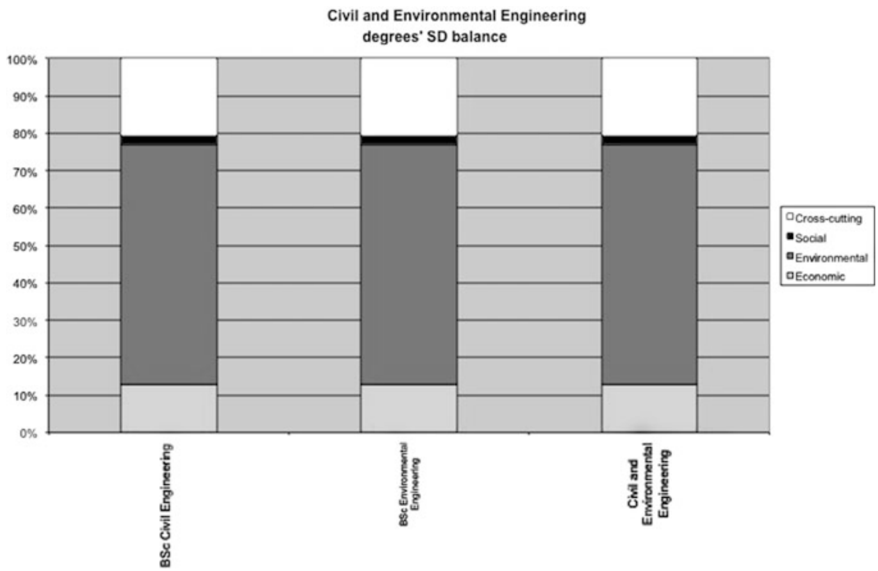

Fig. 2 Civil and Environmental engineering SD balance

content is related to the economic, environmental, social, and cross-cutting dimensions, respectively (see Fig. 2).

Although CEE has made substantial efforts to incorporate sustainability into the curricula, additional strives are needed to complete the integration. While the environmental dimension of sustainability is extensively covered (see Fig. 3 for the issues covered), the other three dimensions coverage could be improved. The STAUNCH® results also suggest that some issues are being neglected in the current curricula, including markets/commerce/trade, resource efficiency/eco-efficiency/cleaner production, and diversity/social cohesion. Identifying courses that could address these currently over-looked issues could also improve the curricular contribution to sustainability.

University of Leeds Curricula Contribution to Sustainability

The University of Leeds was founded in 1904, but its origins go back to the nineteenth century with the founding of the Leeds School of Medicine in 1831 and then the Yorkshire College of Science in 1874 (Leeds 2012b). The University of Leeds is an independent corporation established by Royal Charter (Leeds 2012a).

The university of Leeds has 33,223 students from 145 countries (29,429 full time students, 3,794 part time students), of which: 24,983 are undergraduates and

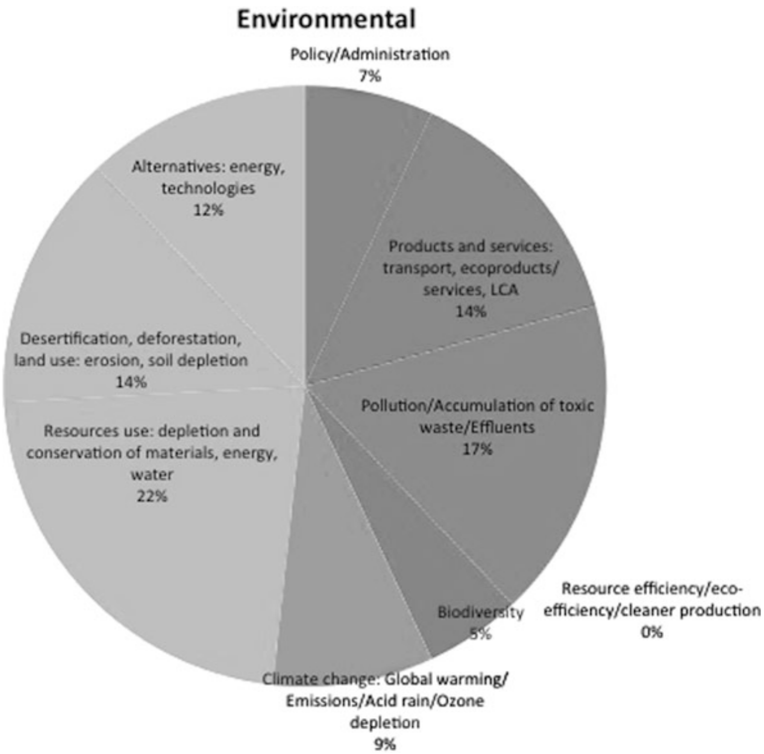

Fig. 3 Civil and Environmental engineering contribution to the environmental dimension

8,240 are postgraduates. Over 2,000 students volunteer for local community projects. The university has 7,543 staff from 99 different nationalities (Leeds 2012a).

The university has committed to spending £157 million by 2016 on new buildings and refurbishment to create an environment in which to pursue excellence in research and teaching. It has won a number of environmental awards, including a 'Highly Commended' in the 2011 Green Gown Awards for Promoting Positive Behaviour in relation to its UTravel Active transport project (Leeds 2012a).

Part of the university's efforts toward sustainability is the curricula assessment project for the Faculties of Business and Environment (including the Institute for Transport Studies, School of Earth and Environment, and School of Geography), including all bachelor and postgraduate degrees for the academic year 2009–2010.

From the Faculty of Business, 698 courses were analyzed for 14 bachelor degrees and 16 post-graduate degrees. From the Faculty of Environment, 2,063 courses were analyzed, from 15 bachelor degrees and 56 post-graduate degrees. Typically, an undergraduate student in the University of Leeds has to gain 360 credits, 120 per year, while a taught postgraduate has to achieve 180 credits.

Table 3 Summary of the university of Leeds faculties' results

	Percentage				Percentage of courses contributing to SD (%)	Contribution	Strength	Percentage students exposed (%)
	Economic (%)	Environment (%)	Social (%)	Cross-cutting (%)				
Faculty of business	78	2	19	1	63	0.98	1.31	63
Faculty of environment	15	54	7	24	62	1.75	1.25	66

During the assessment, the following assumption was made: Dissertations, and similar projects, were not graded because of their usual variability in topics and results.

Table 3 presents the summary of the results from both faculties. As it can be observed, they each have a similar number, and percentage, of students exposed to SD. However, the contribution to SD from the Faculty of Environment is considerably higher (1.75 vs. 0.98), while the strength of both faculties is fairly similar (1.31 and 1.25, respectively). Also, the Faculty of Environment has a better balance among the four dimensions, than the Faculty of Business.

Figure 4 provides an example of the criteria coverage of the environmental dimension from the Faculty of Business, where it can be seen that the criteria with the highest coverage is 'Products and services', while the one not addressed is 'Desertification, deforestation, and land use'.

Discussions

The STAUNCH® system is aimed at helping universities assess the depth and breadth of their SD-related curricula in a holistic and systematic way to produce standardized and comparable results. STAUNCH®'s results provide a 'snapshot'

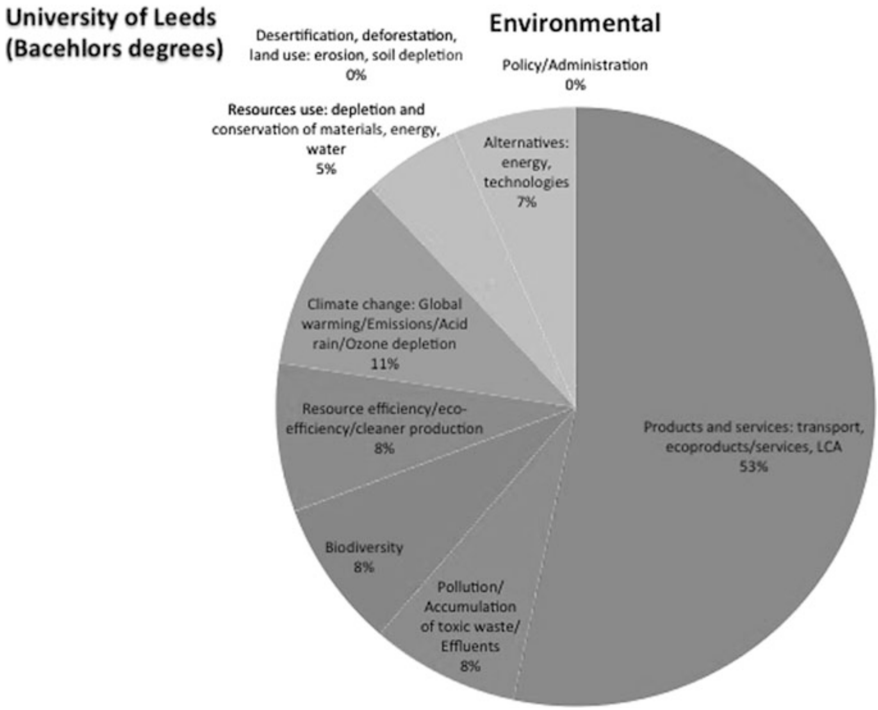

Fig. 4 Results from STAUNCH® criteria coverage of the environmental dimension for the faculty of business

of how SD is currently being addressed within a university (Lozano 2010; Lozano and Peattie 2009, 2011; Lozano and Young 2013).

The STAUNCH® assessment of the curricula for Georgia Tech and the University of Leeds shows a wide range of approaches to sustainability in the curricula, even within the same institution. This concurs with Fien's (2002) and Matten and Moon (2004), who indicate that sustainability has not yet permeated throughout the different disciplines and curricula. The STAUNCH® results offer the possibility to detect whether SD is integrated across the curricula or is being broken down into individual issues to be addressed as a portfolio throughout the curricula. The reports can also serve to question current degrees, discuss how they could better contribute to SD, and help the institution better align with the DESD (Lozano 2010; Lozano and Peattie 2009, 2011; Lozano and Young 2013).

Sustainability needs to be better intertwined within existing modules (see Abdul-Wahab et al. 2003; Boks and Diehl 2006; Peet et al. 2004) to improve the contribution of curricula to sustainability. This could help universities move toward a more balanced, synergistic, transdisciplinary, and holistic academic system, thus helping graduates better contribute to making societies more sustainable (Lozano 2010).

While incorporating sustainability concepts, it is important for educators and directors of teaching and learning (see Lozano 2010; Lozano and Peattie 2011) to consider both the contribution (i.e., balance and depth) for the four sustainability dimensions, as well as the coverage strength. Over- or under-emphasizing any one dimension in their undergraduate education may lead graduates to do the same in their careers (refer to Davidson et al. 2007; Mihelcic et al. 2003).

Conclusions

There has been an increasing interest in assessing and incorporating sustainability into curricula at all levels, as well as examining how students may gain an understanding of the impacts of their decisions and actions on the environment and society. However, questions still remain on the scope, extent, and impact of what is being taught, and the validity and reliability of curricula assessments. This paper shows the results from the curricula assessments of the B.Sc., degrees in Civil and Environmental Engineering at Georgia Tech and the Faculties of Business and Environment at the University of Leeds using the STAUNCH® 2010.

As previously indicated (Lozano 2010; Lozano and Peattie 2011), the results from the curricula assessments can help to stimulate discussions with directors of learning and teaching on how to better incorporate sustainability into the curricula. Curricular assessment can present university leaders with a starting point for change by providing a picture of where the courses and degrees are addressing sustainability issues, and where they could be improved (e.g., degrees where less than 50 % of students enrolled are exposed to sustainability issues).

We need courses and degrees that deliver an education that considers its full implication to sustainability, and we need more and better-educated graduates, who understand and implement holistic and transdisciplinary approaches to address the four dimensions of sustainability (economic, environmental, social, and time) and their inter-relations.

Curricula assessment should also be complemented with research on pedagogy approaches and their efficacy in delivering sustainability education, and 'educating the educators' degrees (see Barth and Rieckmann 2012; Huisingh and Mebratu 2000; Lozano et al. 2009), as well as assessments of campus operations, research, and outreach.

A challenge that remains is how to assess the contribution and impact that curricula and university life may have on students' personal and future professional lives, and ultimately on helping make societies more sustainable.

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ICTs and the Design of Sustainable Higher Education Teaching Models: An Environmental Assessment of UK Courses

Sally Caird, Andy Lane and Ed Swithenby

Abstract The research involved a carbon-based environmental assessment and data analysis of 30 Higher Education (HE) courses in campus-based and distance education systems in fifteen UK institutions that were using a range of teaching models to provide teaching, learning and assessment. The increasing pervasiveness of Information and Communication Technologies (ICTs) combined with new pedagogical approaches and practices to using them, is creating innovative teaching models. There has been little research on the environmental sustainability of complex HE teaching models whether face-to-face, distance-taught (print-based), online, or blended. This raises questions about whether greater use of ICTs in HE has better or worse environmental impacts than more traditional models. To be able to compare environmental impacts across a wide range of HE courses, we developed a classification of teaching models, using lecturers' ratings to establish the use of online, face-to-face, print-based distance, or ICT-enhanced blended teaching models. Next the environmental assessment methodology was designed to inform data gathering and analysis of the key sources of carbon impacts associated with HE courses, including: staff and student travel; purchase and use of ICT devices and educational materials; residential energy consumption; and campus site operations. This chapter examines the role of ICTs in UK-based HE teaching models and their carbon-based environmental impacts and identifies models and practices that will benefit sustainability drives in HE.

Keywords Sustainable higher education teaching models · Greening pedagogical design with ICTs · Carbon-based environmental assessment

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_21,

Introduction

Low carbon Higher Education (HE) teaching systems are part of the carbon reduction strategies needed to meet the targets set by the Higher Education Funding Council for England (HEFCE), which refer to reductions of 43 % by 2020 and 83 % by 2050 compared with 1990 baseline levels (see HEFCE 2010). Carbon reduction initiatives are often presented under the sustainability banner, although sustainability may refer to economic, social or pedagogical sustainability as well as environmental sustainability. Furthermore, environmental sustainability applies to more than carbon reduction, including issues with waste; waste water management; water use; wildlife protection and supply chain issues in the procurement of products and services. The focus of this chapter is on the energy consumption and carbon impacts of HE teaching models.

HE drives toward sustainability have been mainly about: greening campus buildings; Education for sustainability; and sustainability action projects (see Tilbury 2011). The challenges of supporting transitions to environmental sustainability have not been fully addressed by current systems, structures and practices in HE, according to a Global University Network report (ibid 2011). Few studies have considered the whole system carbon-based environmental impacts of different models of delivering HE. One notable exception was the Factor 10 Visions study 'Toward Sustainable Higher Education,' which assessed the carbon-based environmental impacts of campus-based and distance teaching-based Higher Education systems (Roy et al. 2005). This study however, took place when there was limited adoption of Information and Communication Technologies (ICTs) in UK HE teaching models, which are defined by the primary way teaching, learning, and assessment is provided, that is the pedagogical provision. There is consequently the need for new studies of HE environmental impacts to take account of the transformative impacts of ICTs on HE teaching models.

In recent years, there has been widespread deployment of ICT-based infrastructure, such as Virtual Learning Environments (VLEs), Local Area Networks, wireless networks and cloud computing services in United Kingdom (UK) higher education. This infrastructure includes the networks and server equipment that support the VLE platforms housing educational content, tools and applications within learning systems, with scope for tools and applications to be housed separately on devices, such as mobile, tablet, and phone devices. A wide range of ICTs are available for HE to offer students the type of interactive, collaborative, synchronous and personalized online learning experiences, that were only previously available in the classroom. Pedagogical use of ICTs bring the benefits of flexible learning by reducing the effect of temporal and location differences between teachers and students, thereby opening up opportunities for students to learn at anytime, anywhere, at any pace and using various ICT devices. This has enabled increased experimentation in the use of ICTs, both hardware and software within that infrastructure, to support both pedagogical provision and innovation.

Such ICT-based pedagogical applications are regularly reviewed in reports, such as the annual New Medium Consortium Horizon reports, which has identified several key emerging technologies including Mobile Apps, Tablet computing, Game-based learning, Learning Analytics, Gesture-based computing and The Internet of Things (referring to a new generation of Smart objects) (Johnson et al. 2012). Several Open University (OU) report outline the affordances offered by ICTs for innovating pedagogy (Sharples et al. 2012). Such reports draw attention to the opportunities offered by ICTs to transform HE systems of delivering teaching, learning and assessment. For example, enhanced e-Book technology supports collective reading and collaborative writing by students and includes embedded tutoring; Learning Analytics and "diagnostic testing with rapid feedback" supports individualized learning pathways; accreditation of learning can be supported by new online "badge" award systems (Sharples et al. 2012).

Pedagogical use of ICTs and rich media is often referred to as e-learning or online learning; although there is inevitably a range of technology-enhanced pedagogical applications, from wholly online or e-learning courses to ICT-enhanced blended teaching models where ICTs are used to supplement other teaching delivery methods (see www.jisc.ac.uk). Some level of pedagogical use of ICTs is increasingly ubiquitous, although there are university courses in the UK that are primarily classroom-based. It is predicted that blended, distributed, or hybrid learning mixing traditional and online approaches will become the dominant scenario in UK HE, with expectations that many ICT-based pedagogical applications will be adopted within the next 5 years (see Johnson et al. 2012).

In addition to the potential to replace traditional face-to-face and distance teaching models, or blend online with traditional teaching methods, the pedagogical use of ICTs has led to radical new learning designs. Such designs include: the development of digital education resources, both 'closed' fully copyrighted and 'open' openly licensed online open educational resources (OER), increasingly being shared across institutions and countries under open licences (Lane 2010). Another radical design is exemplified with Massive Open Online Courses (MOOCs) which support global online learning communities and empower learners to become producers of global educational resources (Sharples et al. 2012). For example, the Futurelearn platform www.futurelearn.com/, Coursera https://www.coursera.org/; and Edx https://www.edx.org/about all offer MOOCs.

This chapter examines the role of ICTs in the design of low carbon HE teaching models. The SusTEACH project conducted a carbon-based environmental assessment and data analysis of 30 HE courses and modules in campus-based (19) and distance education systems (11) from 15 UK HE institutions. The terms course and module are alternately used in HE to refer to the set of modular, standardized, independent, or interrelated teaching units that construct an undergraduate or postgraduate degree qualification program. Degree programs may also be called courses but to avoid confusion the term course is used hereafter in the first sense and to cover both courses and modules. This investigation included re-analysis of data gathered for the Factor 10 Visions project which assessed the environmental impacts of twenty courses representing campus-based and distance education systems (Roy et al. 2005), together with an analysis of new data gathered on ten courses which were selected to represent HE Teaching Models using ICTs across four UK HE institutions.

This chapter also discusses the SusTEACH project in terms of how the findings support understanding of the transformative impact of ICTs on HE Teaching models and their contribution to carbon reduction.

Methodology

There were a number of steps involved in undertaking the carbon-based environmental impact assessment of HE courses.

First, we needed to conceptualize the role of ICTs in delivering HE course provision for the purposes of classifying the different HE Teaching Models being used. This was based on an examination of lecturers' and academic designers' plans to use various teaching methods to deliver the teaching, learning and assessment provision, including the use of: face-to-face teaching; print-based distance teaching; and ICTs and rich media to supplement or substitute traditional teaching methods. The analytical framework we developed is available online as the SusTEACH Planning Tool (http://www9.open.ac.uk/susteach). This was used to help classify HE courses as having face-to-face, distance teaching, online, or blended ICT-enhanced teaching models (Table 1). Face-to-face teaching and ICT-enhanced Teaching Models were in campus-based HE systems, whereas Distance, ICT-enhanced Distance, and Online Teaching Models were in distance teaching systems with supported open learning.

Second, we needed to develop methods for conducting the carbon-based environmental assessment of HE courses. Building on the Factor 10 Visions study (Roy et al. 2005), we gathered data on the main sources of carbon-based

Table 1 Classification of higher education (HE) teaching models designed to provide the teaching, learning, and assessment on courses

Classification of higher education (HE) teaching models	Number of courses
The face-to-face teaching model—uses mainly face-to-face teaching methods with no ICT-enhancement	14
The distance teaching model—uses mainly traditional distance teaching methods such as using printed educational materials with supported learning and has little or no ICT-enhancement	3
The online teaching model—provides mainly online teaching, learning and assessment, available on the course/module Virtual Learning Environment and usually offered within a distance education system	4
The ICT-enhanced distance teaching model–uses traditional distance teaching methods, enhanced by some use of ICTs, e.g., to provide online links to downloadable resources or audio-visual digital resources, e.g., CD's and DVD's	4
The ICT—enhanced face-to-face teaching model–uses face-to-face teaching methods enhanced by some use of ICTs, e.g., to provide online links to downloadable resources	5
Total courses	30

environmental impacts associated with HE teaching. This involved gathering primary data from students and staff via online questionnaire surveys about their course-related activities, including:

- Travel to and from places where the teaching or learning takes place. Data gathered included information on types of trip, number of trips, round trip distance, mode of travel, regular and occasional travel and travel at the beginning and end of the term or semester;
- ICT device purchase and use. Data gathered included the purchase of ICT devices and software and the time spent per week using ICT devices on and off-campus for connecting to university Websites and for offline study;
- Purchase and use of paper, printed publications, and other educational resources.

Students and staff were also questioned about their choice of residential accommodation and study-related home energy consumption as the environmental assessment included *additional* residential energy consumption that is attributable to the course in the UK. Following the Factor 10 study, it was considered that energy used by students in term-time residences is an intrinsic part of studying full-time in campus-based HE institutions and therefore a proportion is attributable to each course being studied (Roy et al. 2005). For students living away from their main home, we assessed term-time residential energy consumption, although did not assess any additional course-related energy consumption at their main home, as this is likely to be minimal; it would also add complexity to data collection. For students living at home, the assessment included only the additional energy consumed for course-related activities. Data collection included information on types of dwellings, heating systems, lighting and electrical appliances, e.g., printers. This was supported by databases on energy-use in dwellings (e.g., The English House Condition Survey (CLG 2011), the Higher Education Statistics Agency (HESA 2011) and the National Home Energy Rating (NHER) software available for modeling typical UK dwellings (NES 2005).

Whilst this approach leads to higher carbon impacts associated with HE systems where students live away from their main home, this approach is supported by UK research with over 250 households that shows that energy consumption from single occupancy households equalled or exceeded that of family occupied homes (EST 2012). This implies that household energy consumption is dwelling-related and may not fluctuate significantly in response to the number of occupants in residence: consequently when students live away from home their term-time residential consumption is arguably an additional energy impact.

Assessment also covered campus site operations using data available from HESA on energy consumption (www.hesa.ac.uk) as well data collected from a separate scoping study on some specific characteristics of the distance teaching system, such as the module production and presentation process and transportation of teaching materials.

Third, there needed to be a mechanism for normalizing the data collected to enable the comparison of the environmental impacts of the courses under investigation. The standard UK Credit Accumulation and Transfer Scheme (CATS) system of HE institutional arrangements for measuring student progression toward defined learning outcomes and qualifications, offers a time-based measure for comparing the environmental impacts of courses (see www.qaa.ac.uk). This partly matches the European Credit Transfer Scheme within the European HE Area (ECTS 2009). The CATS system identifies 1 CATS credit as equivalent to 10 hours total study including writing assignments, field work, etc. and calculates that 360 CATS credits are required for an UK undergraduate Bachelor's degree and 180 credits for a postgraduate Master's degree. Normalizing the data in this way allows for inter-institutional and intra-institutional comparisons of courses.

Fourth, measures of energy consumption in megajoules (MJ) and carbon conversions in kilograms of carbon (Kg CO_2) were established to support the assessment of environmental impacts. Data collected on course-related activities were first converted into energy consumption data and then converted to CO_2 data using the latest carbon conversion factors available from the UK Departments for Environment, Food and Rural Affairs, and Energy and Climate Change, which provide conversion factors for all fuel sources based on units of consumption and for transport modes for the UK context (AEA 2011).

The environmental assessment focused mainly on measures of delivered energy and direct greenhouse gas (GHG) emissions of fossil fuels at the point of use, as this was a consistent measure provided by most data sources on CO_2 emissions. This refers to the amount of energy delivered without adjustment for the indirect emissions associated with fuels consumed during the production process prior to the point of use or fuel combustion. These measures were used for calculating the carbon impacts associated with using transport vehicles, heating systems or printers used for study.

For paper, printed materials, and ICT equipment, it was appropriate to use measures of embodied energy, which refer to calculations of primary energy consumed over the life-cycle of a product or system associated with extraction, production, distribution, use and eventual disposal that gives rise to indirect emissions. This was established with reference to a detailed review of available life-cycle environmental impact assessment studies (see Caird et al. 2012).

Finally, the data on each environmental impact was organized into consistent forms and normalized using CATS credits (or hours of study) to provide the average energy consumption, and CO_2 emissions of a course or module using the 'per student per 10 CATS credits measure' (equivalent to 100 study hours). This allowed for direct comparisons of the impacts of HE courses within the Teaching Models framework (for further details on the methodology see Caird et al. 2012).

Results

The results of the carbon assessment and data analysis of courses were classified within the five HE teaching models shown in Table 1 and are presented in Table 2 and Fig. 1.

Table 2 CO_2 emissions (kg) of teaching models (per student per 10 CATS credits)

CO_2 emissions (kg)						
Teaching models	Travel	ICTs	Paper, print, and other materials	Residential energy	Campus site operations	Total
Face-to-face	128.50	4.33	11.39	57.00	76.69	277.91
Distance	16.98	2.00	13.04	1.59	15.51	49.12
Online	2.28	12.83	4.20	0.82	15.51	35.65
ICT-enhanced distance	6.18	13.38	6.93	3.11	15.51	45.11
ICT-enhanced face-to-face	107.48	6.40	11.18	44.26	76.69	246.01
All teaching models	52.28	7.79	9.35	21.36	39.98	130.76

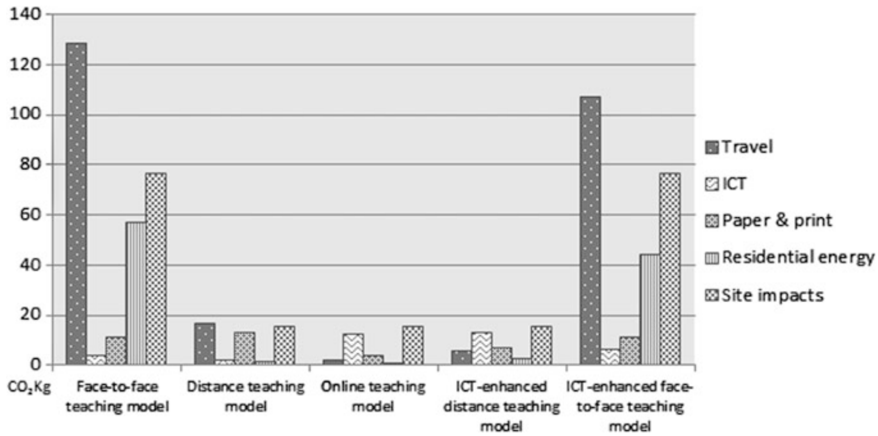

Fig. 1 Total CO_2 emissions associated with HE teaching models (per student per 10 CATS credits)

Findings

The Online Teaching Model has the lowest energy consumption and carbon emissions (36 kg CO_2) per student per 100 study hours (10 CATS credits) in comparison with other Teaching Models (Table 2 and Figure 1). This is essentially a distance-taught provision that is hosted via the university website or VLE. There are consequently specific computing and hardware requirements for students, which include broadband Internet connection and access to ICT devices and software. This accounts for the comparatively high carbon impacts associated with the purchase and use of ICT devices which are offset against this model's lower impacts associated with course-related travel, consumption of materials and requirement for additional residential accommodation.

The Online Teaching Model describes HE courses that replace face-to-face teaching and print-based distance teaching methods using an online learning system and university VLE. The model may include some use of face-to-face or print-based teaching methods, although it is mainly an online provision. In one course for example, there is a small face-to-face teaching component requiring students to travel to attend several day schools, which accounts for a small travel-related carbon impact, although most of the provision is via online tutorials, Internet forums, and e-mail (Table 2).

The Online Teaching Model's minimal carbon impacts also support the dematerialization claims associated with using ICTs for teaching, learning and assessment provision. There were few specially developed educational materials and few book purchases. The comparatively small carbon impact associated with paper and printed materials is mainly due to students printing materials, which may be explained by a preference to read printed material rather than read on-screen or to address limited regular access to ICT devices. Although this is a rebound effect, in comparison with other models, this model has the lowest materials-related carbon impacts.

The carbon emissions associated with the Online Teaching Model are 21 % lower than the blended ICT-enhanced Distance Teaching Model and 27 % lower than the Distance Teaching Model (Table 2).

Within the distance education system, this supports the view that the online model's substitution of distance teaching methods and the blended model's ICT-enhancement of print-based distance teaching both achieve carbon reductions. Within HE campus-based systems, comparisons with the Face-to Face Teaching Model suggest the blended ICT-enhanced model achieves minor carbon reductions (of 11 %) by using ICTs to supplement and enhance rather than replace classroom-based teaching (Table 2). The benefits needs to be weighed against high transport impacts as the analysis revealed that 35 % of the carbon emissions associated with the ICT-enhanced Face-to-face Teaching Model was attributable to student air travel between their home and term-time residence. This suggests that the blended model enabled students to travel longer distances to attend short periods of face-to-face teaching, whilst studying online for part of the course.

Although the carbon impacts associated with the Online Teaching Model are comparatively low, further examination of the findings in Table 2 shows that the carbon impacts associated with other distance teaching models are also comparatively low, irrespective of whether they are ICT-enhanced Distance Teaching, Online or Distance Teaching Models. Whilst the impacts associated with ICT purchase and use increased with the ICT-enhanced Distance and Online Teaching Models, the carbon impacts associated with staff and student travel, and paper and print consumption are reduced compared with the Distance Teaching Model. Overall this suggests some offsetting of carbon impacts associated with travel and materials consumption to ICT-related consumption within the distance education system, although online and blended ICT-enhanced teaching models achieves carbon reductions.

The key differences in carbon impacts are between teaching models provided within campus-based systems, namely Face-to-face and ICT-enhanced Face-to-face Teaching Models, and distance-taught systems of delivering HE, namely

ICT-enhanced Distance, Distance or Online Teaching Models. By comparison with campus-based Teaching Models, the carbon impacts associated with distance teaching models are 93 % lower for student travel, 80 % lower for campus site operations, 96 % lower for residential energy, and 83 % lower overall. This supports the Factor 10 Visions study which found that on average the production and delivery of distance teaching produced 85 % fewer CO_2 emissions than campus-based HE courses (Roy et al. 2005).

Within the distance education system, students are supported to learn via distance and online teaching methods whilst living at home which reduces the need for students to take additional residential accommodation, travel to university sites, and use campus facilities. Taken together, the main sources of average carbon emissions for all HE teaching models were travel (40 %), campus site operations (31 %) and residential energy (16 %). These are therefore the key areas to tackle to reduce CO_2 emissions in UK-based HE.

Conclusions

Low carbon teaching systems are needed to meet carbon reduction targets set for HE institutions in the UK. Few studies have considered the whole system environmental impacts of HE Teaching Models—a complex area for investigation although arguably important for supporting transitions to sustainable HE systems. Furthermore, the transformative impact of ICTs on the HE teaching, learning and assessment provision has added to this complexity and raised questions about the likely environmental impacts of new pedagogical designs and teaching models using ICTs.

The SusTEACH study of the carbon-based environmental impacts of HE teaching models in the UK shows that the use of ICTs and rich media to provide online and blended ICT-based teaching models can achieve significant carbon reductions. This is evident from comparisons of teaching models within campus and distance-teaching HE education systems, and from findings on the comparatively low carbon impacts of the Online Teaching Model. The main sources of carbon impacts in HE Teaching Models are associated with travel, residential energy consumption and campus site operations. Such impacts are offset when online methods, as well as traditional distance teaching methods, are used to replace classroom-based face-to-face teaching.

Further research is needed to extend data collection on carbon impacts to a larger sample of HE courses to reflect the way pedagogical use of ICTs is changing course design. In addition, energy consumption data will change with further greening of university and residential buildings and technologies, as well as changes in student behaviors. The measurement of energy consumption and carbon conversion will also change with decarbonization of the UK grid and new lifecycle environmental impacts studies.

The SusTEACH project led to the development of an online toolkit, which included a suite of tools to support environmental appraisal of HE courses and modules based on UK data (see http://www9.open.ac.uk/SusTeach/). This includes two carbon calculator tools for lecturers and students to calculate the energy consumption and carbon impacts associated with teaching and learning activities. Lecturers may also explore different pedagogical designs with the SusTEACH Planning and Modeling Tools, which are designed to model the likely energy consumption and carbon impacts associated with online, blended and traditional teaching models. At an institutional level, the toolkit could be used by HE senior executives to assess the carbon impacts of existing course, module and qualification programs; establish university carbon reduction targets; and enforce carbon thresholds to regulate the design and delivery of new programs. Further details on using the Toolkit is explained in a teaching unit for the Open Learn platform published in 2013—'The environmental impact of teaching and learning' (http://www.open.edu/openlearn/nature-environment/the-environment/the-environmental-impact-teaching-and-learning/content-section-0).

The SusTEACH findings suggest that the use of ICTs in HE teaching could significantly reduce carbon impacts if they are used in pedagogical designs to replace classroom-based teaching and reduce the need for students to travel to classrooms; take additional residential accommodation away from home; and use campus facilities. If ICTs are simply used to supplement existing face-to-face classroom teaching and do not reduce students' travel behaviors or accommodation requirements, then their impact on carbon reduction in higher education institutions will be limited. Whilst online models have a comparatively low carbon impact, some blended ICT-enhanced models enable students to travel long distances, including from abroad, to attend short periods of classroom teaching while studying online for the rest of the course, and this model is unlikely to achieve carbon reductions.

Pedagogical and economic considerations usually feature more strongly than environmental concerns when lecturers and senior management decide on the most appropriate teaching model for a course, module or qualification program. The 'holy grail' of sustainable education is to address all aspects of pedagogical, environmental and economic sustainability. Even if ICT-enhanced pedagogical designs deliver carbon reductions this needs to be weighed against the benefits for students of sharing practical group work experiences, and using laboratory facilities or engineering workshops, although online innovative pedagogies increasingly offer students opportunities for personalized, media-rich, learning pathways, with scope for individual and collaborative learning. The ICT-based transformation of HE offers a great opportunity to design new teaching models that deliver the benefits of carbon reduction as well as enriched pedagogical provision.

Acknowledgments The SusTEACH project is funded by the Joint Information Systems Committee (JISC) under the Greening ICT Program me. We are grateful for the support of a large number of interested participants in the project from The Open University, Cranfield University, Loughborough University and University of Oxford. For further project information see http://www.open.ac.uk/blogs/susteach/. To access the Toolkit tools, resources, references and further details see http://www9.open.ac.uk/SusTeach/.

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Action Research in Communities of Practice to Develop Curricula for Sustainability in Higher Education

Anne Sibbel, Kathryn Hegarty and Sarah Holdsworth

Abstract Universities worldwide have recognized their responsibilities for transformative learning to promote sustainability. To meet this challenge requires extensive curriculum innovation, but substantial progress has been made only in some institutions. Expedient strategies are urgently required to reshape teaching and research to make a significant contribution to sustainability through higher education. This chapter describes some influential initiatives emerging from a single project concerned with education for sustainability. These initiatives include a dedicated community of practice, professional staff development activities, and ongoing action research in teaching by a few sustainability champions. Several key influences on outcomes are identified. In particular, it is the formative, defining relationships that academics have with their disciplines, or professional fields, that influence the diffusion of sustainability education. This means that the impetus for sustainability education must begin from within local disciplinary contexts, if it is to engage and resonate with teaching and research staff. From this point, it was possible to develop the tools and processes to support a wider university community in recognizing responsibilities for sustainability education. Finally, a model explains the synergistic effects of these initiatives, emerging from this single project, for collaborating to build an effective multidisciplinary frontline for curriculum change.

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_22,

Background

The Imperative for Curriculum Change

Knowledge about ways to approach sustainability is constantly evolving, as research collects and analyses more data describing the micro or macro processes occurring in living or nonliving systems. So far, a pervasive change in human behavior is the only unequivocal, uncontested requirement for sustainability. New learning is required to motivate and guide this behavior change. However, we have not undertaken the essential overhauls required of all systems, including university teaching, to bring about behavior change for sustainability. The discipline-centric, competitive academic environments, and the traditions in teaching and learning there, seem incompatible with this objective. Rather than leading change, higher education continues to prepare graduates to adapt to unsustainable conditions rather than to direct change, perpetuating the status quo, including unhealthy living conditions, inequalities and injustice, and the continual depletion of natural resources.

There are many factors contributing to this predicament. The processes of teaching and learning within university environments are extremely complex, with many so interactions between academic staff and students, so many sources of input, many frames of reference and points of tension. These include academic assessment requirements, staff and students' expectations, ethical requirements, students' prior learning experiences, and academics' teaching experience. There are important responsibilities for assuring academic rigor, including meeting the prescribed requirements for graduates' professional registration or practice, and for accommodating the typically diverse capabilities of learners. These requirements all form part of the setting, and add to the list of major impediments to curriculum change.

Much remains to be done to develop university curricula to motivate and empower graduates to work toward sustainability. A commitment to education for sustainability means challenging accepted social norms and values and usual practice. It requires establishing benchmarks for best practice, new objectives for teaching and learning, and developing the tools to assess progress toward those objectives.

The Potential for Change in Universities

The intellectual capital, the autonomy of academics and the importance they attach to knowledge and research, means that universities have the capacity and resources required for major change. While the diverse range of activities taking place within a university might seem like an obstacle, this complexity means that there are a greater number of opportunities to respond to this challenge. In ecological terms, this capacity to simultaneously adapt at different points in the system translates to evolutionary success. It is important to recognise the many implicit assumptions which influence practice within a university. For instance, assumptions that academics are always experts or that knowledge has always accumulated through rational, objective pathways, affect attitudes and responses of students to the content of subjects, or the capacity of academics to learn from their students. Challenging these assumptions is one place to start.

Transformative Education for Sustainability

Much has been written about the importance of transformative education, particularly when planning education for sustainability (Burns 2011; Ferrer-Balas et al. 2008; Wals 2009). Effective transformative education leads to learning which enables and encourages individuals to critically reflect on personal values, review them in the light of new knowledge, then to act in ways consistent with the revised values system. Transformative learning processes are participative, requiring learners to contribute to a socially constructed knowledge base (Domansk 2007). Within a program of study in higher education, this means that teachers and learners would collaboratively reflect, de-construct and reconstruct the content and pedagogy for each course within that program (Sipos et al. 2008). The processes are iterative in that they change individuals' ability to participate, as their experience, confidence, and skills develop.

Moving to transformative education relies on changing the existing paradigm so that pedagogy is based around real world problems, encouraging learners to participate and take charge of their own learning. Curricula must encourage students to approach problems in a 'non-territorial, cooperative, collaborative' way (Meppen and Bourke 1999, p. 397). They need the skills and motivation to reach consensus. Rather than leading to dysfunctional conflict, different perspectives become the trigger to search for points on which to build that consensus. This is in direct contrast to transmissive educational approaches which tend to instill and perpetuate a set of values, and discourage questioning of traditional knowledge and practice. Such approaches are unlikely to inspire change. Kimble et al. (2008) note that passion and enthusiasm for change cannot be regulated or subjected to policy initiatives but they are crucial to the success of initiatives for change. As such, transmissive education is incompatible with the extensive revisions to curricula required to establish education for sustainability.

Managing Change in Universities

Change projects in higher education, especially in the field of learning and teaching improvement, are hardly novel. Projects for improving teaching practice and learning outcomes proliferated in English speaking countries since the Dearing Report in the UK exhorted academics to consider their contribution to the world via their teaching (National Committee of Inquiry into Higher Education 1997). Since then, more and more localized innovations for sustainability education emerged (Down 2006; Eisen and Barlett 2006; Fenner et al. 2005; Moore 2005; Moore et al. 2005); however these were generally siloed and isolated in nature, and highlighted as many deficits as positives. The difficulties were widely recognised, perhaps due in part to the inherent ‘top down’ nature of many approaches adopted (Holt et al. 2011). As with all organizations, universities may suffer from change and restructure fatigue. A considerable body of research has highlighted the key role of academics in the change process. For instance, Kumar et al. (2005), authors of an inspiring local education for sustainability initiative at University of Michigan, claimed that sustainable futures, and the education to achieve them, is incumbent on the gatekeepers of the professions; that is, academics. The following sequence began with a project exploring the opportunities and resource needs of academics to initiate curriculum change for sustainability.

BELP Project

Background

The Beyond Leather Patches Project (BELP)[1,2] at RMIT University was a 12 month action research project in 2005. The title recognized the traditions associated with historical learning and teaching practice in higher education and the need to reevaluate academic identity, role, and function. An important assumption guiding the design of the BELP project was that ‘academic development is a key mechanism for achieving curriculum and institutional change for sustainability’ (Holdsworth et al. 2009, p. 63). This assumption had been validated by previous research in this area (See for example, Dawe, Jucker and Martin 2005; Eckel and Kezar 2002, 2003; Holdsworth et al. 2006; Tilbury et al. 2005).

The BELP project built on the outcome of some attempts to introduce environmental education at RMIT University between 1996 and 2004. Around this time, some the major representative bodies for universities in Australia committed to aligning with education for sustainability policy (ATN 2008; AVCC 2006; UNESCO 2007). Some resources were available (for example Alverez and Kyle 1998; and Second Nature 2002) but had not been applied or adapted within RMIT University (Thomas and Nicita 2002, 2003).

Emerging in published research was evidence of a diverse range of barriers to implementing education for sustainability in the tertiary sector (Filho 2000, 2002).

[1] The authors wish to acknowledge the work of the BELP project team A/Prof. I. Thomas, Dr. S. Bekessy, Dr. S. Holdsworth, Dr. C. Hayles and Ms. P. Mnguni.

[2] Funded by the Greenhouse Unit of the Victorian Department of Sustainability and Environment.

They included academics' lack of understanding of the importance of change, lack of awareness of the resources available to guide that change, inadequate knowledge and skill bases for using these resources, the failure of university policy to promote learning for sustainability, and with that, the failure to acknowledge any time or efforts of staff in pursuing this curriculum change.

Project Description

Realizing these barriers, the BELP project aimed to provide opportunities and motivation for educators to begin to engage in the theory and practice of sustainability education. The objectives of the project were:

- "to understand the drivers for and barriers to curriculum change
- to undertake a series of action research projects aimed at applying organizational learning and cultural change processes for embedding sustainability into the curriculum of a university
- to develop a flexible change framework for sustainability education for use by other academic units and universities, and
- to make general recommendations about the types of models and approaches that can influence organizational learning and change for sustainability" (Holdsworth et al. 2006, p. 117).

The BELP project team comprised five academic staff. This included champions appointed in each of two different discipline-based schools to facilitate discussions about sustainability education and to assist other academics to change their curriculum. Two other members were actively involved in engaging staff across the university to facilitate the sharing of knowledge and experience of teaching sustainability. Another team member coordinated the project and prepared resources, including curriculum materials, to support that engagement.

Curriculum change for sustainability requires a 'bottom-up' approach to achieve a 'groundswell' (Thomas 2004, p. 42). So, rather than initiating change through a 'centrally mandated, whole-of institution policy' (Holdsworth et al. 2006, p. 114), the BELP project was designed to lead educational change from the 'grassroots'. On the other hand, organizational change within institutions requires upper level management support to legitimise that change (Bekessy et al. 2003). Clearly university management exerts a considerable influence on academic activity and resource allocation. For this reason, the preparedness of a school leader to support this curriculum change was a criterion for including that school in the BELP project.

'Cultures of teaching' had been recognised as the 'prime focus for educational change' (Hargreaves 1997, p. 1). Cultures in teaching might be evident in the ways academics apply their disciplinary expertise, interact across interdisciplinary boundaries, and negotiate the forms, purposes and pedagogies through which knowledge and learning experiences are offered and experienced by students

(Dawe, Jucker and Martin 2005; Eckel and Kezar 2002, 2003; Holdsworth et al. 2009; Tilbury et al. 2005). For this reason, the project methodology was designed to be adaptable to each discipline area.

Change requires opportunities to explore what education for sustainability could mean, how that meaning could translate into practice, and how that experience could be shared with colleagues to motivate and inspire them. Within each school, an academic champion volunteered to provide peer support and coordinate the action research in discipline-specific curriculum renewal and development. With insights into the culture of their respective schools and understanding of the discipline areas, they were able to identify potential opportunities for effectively embedding sustainability content into the curricula. The champions' role was to support the school staff, so the drive came from within, rather than being directed by external agents, overcoming a previously identified barrier to change (Alabaster & Blair 1996; Thomas 2004). Combined with the assistance offered by the BELP team, each champion was assured of the support of the respective school leaders, a factor which critical to this methodological design. Finally, teaching loads and other duties were reduced to provide time for the champion to undertake this work.

Change is dependent on establishing relationships across a community to build unanimous support and validation of activities and outcomes. The effectiveness of the champions as primary change agents was dependent on a number of variables. They needed to be valued and respected members of their schools to engage others, to facilitate collaboration and knowledge sharing. More specifically, academic status, tenure and some personal attributes including leadership style and capacity to influence others were important (Holdsworth et al. 2006).

An action learning methodology was adopted, following Marquardt's (1999, 2004) approach around six components:

- a problem or challenge of importance to the group
- a group of 4–8 members of an organization
- a process that emphasises questions and reflection
- the power to take action on strategies developed
- a commitment to learning at the individual, team and organizational levels
- an action learning facilitator who focuses on and ensures that time and energy are devoted to capturing the learning and improving the skill level of the group.

This methodology was applied to three activities: sustainability course audits, action learning training workshops and action learning groups. The results of the course audits identified the sustainability content of courses currently offered within two schools, and staff attitudes toward teaching sustainability. This informed the development of a series of workshops conducted to help educators shape their own visions of sustainability and presented an analysis of the type of support needed to transform teaching approaches. The action learning groups provided this support for individuals or small groups as needs were identified during discussions in the workshops and through subsequent reflections shared by participants.

Project Outcomes

Of the many outcomes, there were several indicators of success. The initial support from three leaders of different discipline areas for a collaborative, interdisciplinary project represented an important change. The project exposed and recognised the existing sustainability champions, and enlisted additional academics to the cause. For those participating, the project identified a clear link between curriculum change and organizational change. It was clear that introducing education for sustainability relies on an understanding of the change process. This includes both the internal influences for change, such as staff capabilities and discipline-based conventions in teaching, as well as broader influences, such as university policy.

The project led to the introduction of a sustainability focus in 16 courses offered within two very different disciplines and the development of a flexible change framework (Holdsworth et al. 2009). After one year, sustainability skills were included in some job descriptions, which led to some subsequent appointments of individuals with experience in teaching and research in sustainability (Holdsworth et al. 2009). This provided an injection of expertise and commitment to maintain the momentum. At the same time, inevitable staff turnover in a large institution meant the loss of two existing champions who were not replaced. This situation demonstrated the need for ongoing commitment by management to education for sustainability to support enthusiastic champions at the teaching interface. It also highlighted the necessity of providing professional development for all staff to raise their awareness about the importance of education for sustainability.

Over decades, the concept of sustainability has been variously interpreted and applied, often dependent on the discipline-based frameworks of practitioners. In this project, the initiatives were driven by those who understood the culture and practice of the discipline. Situating the nexus for change within specific disciplines was an appropriate way to minimize the anticipated resistance to that change.

Findings were consistent with published research describing change management. A project must have real, local meaning and resonance for staff on the front line to ‘buy in’ or ‘take up’ the change sought (Gardner 2006; Kotter and Cohen 2002; Senge et al. 1999, 2005). The importance of having an emotional connection to a change project was clear. Champions, as localised drivers of change, care passionately for the issue or cause for which they advocate. They offer an opportunity to create the ‘bottom up’ change which is the foundation of lasting innovation. Just as important as sharing resources and insights, these champions motivated and inspired each other to continue overcoming the barriers to change, as they emerged. Recognizing the time and efforts of these champions, as part of their professional work, was essential for maintaining their commitment, enthusiasm, and building their resilience.

Despite the efforts of the team and champions, the project failed to achieve all of its objectives. In part, this can be attributed to the short duration of 12 months allocated for the project. An approach which relies on goodwill and initiative of a few individuals in the complex higher education environment is not viable beyond the short term. Further, the investment in discipline-focussed activity may have limited the scope of the project, so that the need for change was recognised by only a small group (Holdsworth et al. 2009). To create the necessary 'groundswell', further work was required to recognize, recruit, and support new champions or to develop the capabilities of interested people open to exploring opportunities and applying new ideas in a wider disciplinary context.

A Community of Sustainability Educators

Background

The outcomes of BELP project confirmed the potential of a collaborative effort at the grassroots level within the university for organizational learning and curriculum change. It was necessary to engage a much larger cohort of academics and to find cost- and time-effective ways to contribute to developing their capabilities in education for sustainability. Sectoral and institutional obstacles and drivers informed the context. The disciplinary focus of academics, and the ways that work is often organized within universities, are major obstacles to change. The prevalence of casual and short-term employment contracts for young academics, underscoring the time constraints that bedevil higher education projects of this nature, was recognized as another major obstacle to overcome.

The role of collaboration and interaction in learning was recognized in higher education in the late 1980s, giving rise to the idea of a community of practice as, among other things, a means for promoting project specific-learning. The role of a community of practice is perhaps best understood through the groundbreaking work of Wenger and Lave (Wenger 1998) who initially explored the mechanisms which enable collective, often informal, learning to occur. A community of practice has been variously redefined and described, through practice, as a collective enterprise relying on reciprocal engagement and shared interests and concerns. In the form which was commonly adopted within higher education from the 1990s, shared characteristics of practitioners, including commitment to a field of knowledge or practice, was the key to this very different approach to curriculum development (Kimble et al. 2008; Wenger 2011).

Within a flat, democratic and fluid leadership structure, perhaps with a convenor, or through shared administration and leadership roles, communities of practice are notably distinct in the ways they manage knowledge in terms of their defiance of hierarchical structure. This fluidity is made possible, even in highly stratified organizations such as universities, by a focus on and commitment to the shared domain. Essentially, they share the responsibility for the work without being constrained by the formal structures within the organization (Wenger 2011)

Communities of practice are 'voluntary…..(and can) generate enough excitement, relevance, and value to attract and engage members' (Wenger et al. 2002a, p. 2). Essentially, learning is the product of the interactions within this group of people focused on a common task, so dependent on the social relationships within that group, and their influence on individual cognitive activities (Sense 2004). The emphasis on social learning is particularly significant because it allows the community to draw on a shared passion to address the barriers to realization of the objectives. These barriers include the constraints of time and the typically diverse responsibilities of academics, the limited mechanisms for valuing new educational practice, and the often frustratingly slow pace of culture change in higher education. This speaks directly to the challenge of diffusing education for sustainability.

From the mid 1990s, communities of practice were established all over higher education, often associated with management initiatives. The limited success of these initiatives could be attributable to this perceived need to manage or control the processes, an idea which runs contrary to the organic nature of the inception and functioning of communities of practice. (Wenger et al. 2002a). Despite this, there was evidence of an organic emergence of shared concerns and the establishment of a common focus. The communities of practice could identify key skills for sustainable futures, and plan curricula which could develop and enhance these, regardless of their discipline (Kimble et al. 2008). Given the emphasis on the potential of a community of practice to construct a 'shared domain', the model seemed very appropriate for the task of curriculum development for sustainability (Wenger 1998, p. 72–73).

Project Description

An invitation to form a community of practice was extended to all university academic and administrative staff with an interest in education for sustainability. The initial session was attended by 16 'new' practitioners who had not previously been known for their interest in this area, along with several staff involved in the precursor BELP project. The subsequent sessions were held monthly during the teaching semesters through 2007–2010. Initial topics were proposed by the project coordinator, reflecting a range of priorities and concerns evident in BELP project. Some of these topics were explored, but these quickly gave way to the authentic emergence of themes for consideration by the community. For example, a session on the way academics experience and create change led to questions about student assessment and how this might be linked to the values of sustainability. In response, a few members presented their recently developed curricula, and the processes they used to encourage student reflection and to assess teamwork activities. This instilled confidence in others to share their work within the community, allowing all members to benefit from the experience, innovative ideas and useful resources. A key assumption of a community of practice is that members who seek to join or connect have an important contribution to share (Wenger et al. 2002b). Evident here was the value is placed on discovery, enquiry, and exploration as predicted within the framework developed by Wenger.

Over the course of the project, participants' engagement could be distinguished as 'core' and 'peripheral', which is normative within the community of practice ethos (Wenger et al. 2002b). Participation depends on individuals' needs at particular times, and other conflicting work commitments. Fluctuating participation is wholly legitimate and in no way undermines those individuals' involvement in a community of practice. This flexibility plays a significant role in accumulating the social and intellectual capital of the community of practice, especially in higher education settings, which tend to be disciplinary focused and hierarchical. Knowledge, as a form of intellectual capital, "needs a home base" (Wenger 2000, p. 247). Especially for younger academics, the community of practice provided such a base for the emerging and fledgling knowledge, so not dependent on or influenced by disciplinary structures.

Project Outcomes

There was a consensus that participating in the community of practice inspired individuals to revise their approaches to teaching and assessment and then to share their experiences with others. The supportive environment offered within the community of practice validated and affirmed the intellectual processes, the practices which developed and recognized the organizational barriers faced by educators. The organic emergence of topics for exploration was fundamental to the process. It ensured that needs for support were being directly met. It was clear that, in determining the activities, the group took ownership of the products of collaboration. This is consistent with findings reported in the literature which have demonstrated that learning communities often enable depth and local ownership of change initiatives (Cuddapeh and Clayton 2011).

Disciplinary identities remained a very strong organizing principle, so that disciplinary norms were often unconsciously imposed, as documented elsewhere (Hegarty and de la Harpe 2010). Some skills such as teamwork and problem solving were universally recognized as important learning outcomes across the disciplines, although the understanding of education for sustainability was not shared or interpreted in the same ways. Nonetheless, the community of practice provided scope for negotiation and exploration of the complexity of the conceptual and practical aspects of education for sustainability. The shared intellectual 'space' was commonly identified as the major benefit for the participants. It provided a context in which staff could legitimately express anxieties and concerns about potential and real conflicts within their discipline, and seek support and solutions from empathetic and experienced peers.

In terms of education for sustainability, the less experienced academics and researchers had some important curriculum innovations to share. Possibly a longer term association with traditional teaching practices and discipline-based content may have limited the capacity of more experienced staff to consider new approaches, to question the norms and to take risks with curriculum innovations.

To be effective, a community of practice must be able to work within contemporary academic cycles and meet administrative demands. This extends to meeting fiscal objectives in the typically economically constrained circumstances of universities in the twenty-first century. Time and intellectual space are the most contested terrains in higher education, so competing demands on this space tend to undermine staff commitment to initiatives for change. This project confirmed that creating and funding opportunities for staff to engage in the community of practice and associated activities were crucial factors for their involvement and commitment to curriculum change.

Practical, measurable teaching and learning strategies are essential for articulating and expanding education for sustainability ideas and for maintaining commitment. It was important to capture the shared knowledge emerging within the community of practice according to democratic principles and with clear guidelines around the generation of intellectual property. This was demonstrated in collaborative development of discussion papers which described processes for negotiation of the obstacles encountered. Other products of collaboration included policy proposals and analyses, grant and research proposals which structured and formalized further opportunities to advocate or lead projects for change. The community of practice also generated a number of purpose-driven networks, with objectives including advocacy within government and university peak-bodies, design and implementation of a new undergraduate course, and a number of localized curriculum innovation projects.

The community of practice members were vocal about the absence of institutional commitment to education for sustainability. In this instance, they referred to measures such as promotion criteria, teaching and research awards, grant and funding categories, and formal professional development programs. This suggests that change from the 'bottom up' needs to be in concert with genuine support from upper management. Despite this, the 'sustainability educators' continued to test new ideas, and inspired with greater confidence, to apply new knowledge they had developed. This next project is one of many which was instigated by members of that community of practice.

The Teacher–Student Community of Practice Project

Having explored the use of a community of practice as a tool to promote academic development to achieve education for sustainability, this research extended into the classroom. The potential of a community of practice to contribute to transformative learning became the focus. Caron et al. (2007) have recognized that a community of practice can meet some of the responsibilities traditionally assigned to the educator. This applies to curriculum development through action research in which, according to Warburton (2003), students themselves can play an important role. So this project was based on a community of practice formed by students, academics, and other professionals to guide curriculum development for sustainability.

Like the previous projects, this community of practice required a social learning space where individuals could collaboratively reflect and construct new knowledge. Obviously, the classroom offered accessible opportunities for interactions and a central point for locating resources, but this context does not necessarily assure productive encounters. Increasingly, an ever diversifying range of communication technologies are extending these opportunities and changing the nature of teacher–student interactions in contemporary education settings (Torres 2011). This means that the classroom now includes both real and virtual spaces, for sharing new ideas and information, negotiating meaning, constructing new knowledge and understandings, so potentially offering new ways of learning. It was decided to explore the use of virtual space as the context for learning for this community of practice.

Project Description

One course comprising 75 students, local and international, represented the typical diversity of learners within the university environment. These students were all enrolled in an applied nutrition course. Within this cohort, a small group of students had previously participated in a learning strategy which had contributed to substantial development in their self-reported capabilities for sustainability (Sibbel 2012). Based on the outcomes, they were identified as sustainability champions for this project. They were invited to lead discussions in the community of practice for curriculum development. The professionals included university health promotion staff, as well as the academics responsible for teaching the course. Together the professional and student groups met the criteria for a community of practice, with shared experiences of the university and shared interests in nutrition and health. They all identified as health professionals, whether as trainees or educators or practitioners, working within and outside the university.

The objectives of this project were:

- To share critical knowledge assets within the class
- To promote learning relevant to future sustainable professional practice for these students
- To redesign the curriculum based on the products of the community of practice.

Although not a requirement for involvement in a community of practice, the students had been somewhat prepared for this experience. They had already contributed to a real-world consultative process, as part of the development of local government nutrition policy, a task designed to model future professional activity. Professional feedback was provided on their individual responses to that task, including points for reflection on relevant personal values or knowledge.

The work of the community of practice was to plan for implementing the draft nutrition policy in the university environment. An online site was established for this process. An initial post was made by a member of the professional group to encourage students to draw on their knowledge of the university context and to apply the policy in creative ways. In the next iteration, students' responses were to be collated and interpreted by a professional, forming the basis of another post to stimulate further interaction. In this way, the professional group would be presenting new knowledge constructed from the students' contributions. The new posts included prompts to encourage further reflection by the community of practice. The students could observe or directly participate in the collaborative problem solving online and propose solutions. This allowed them to practice being a member of a committed professional team with an agenda for promoting sustainability through human health and well-being.

Transformative learning is ultimately evident as behavior change, for example, in ways students might engage with or interpret a problem, in the solutions they offer or even in new career aspirations. To assess outcomes relies on recognizing how a learning experience affects students' understanding and capabilities for meeting their responsibilities for sustainability. Capabilities for sustainability have been variously described (see for example, Barth et al. 2007; Blewitt 2010; Podger et al. 2010) to include the motivation to participate, confidence and resilience to persist in the face of obstacles, awareness of the complexities and uncertainties of real world problems, flexibility to adapt as situations change or new insights are acquired, creativity in problem solving, and political skills for effective communication, negotiation, and conflict management. These capabilities are required to deal with 'messy' or 'wicked problems' (Morris and Martin 2009; Tomkinson 2011), such as those faced when trying to contain ever-depleting resource bases, climate change, and global warming in ways which are just, ethical, and sustainable.

Project Outcomes

Through iterative cycles of this project, students' responses were examined for evidence which suggested changes in awareness of their responsibilities to the community they would serve as professionals. Change could also be indicated by students' references to principles of sustainability to support a claim they have made, or when they recognized any barriers to sustainability or factors which may promote sustainability. Some responses might imply an awareness of the environmental, social, as well as economic dimensions of the problem. Some responses might expose the gaps in student understanding of the concept of sustainability and its applications to promoting health on a university campus. This information was to be used to guide the revisions made to the curriculum.

For the academics, the synergies of research and teaching were obvious, and indicated the opportunities for further inquiry. For the university health promotion team, projects like this can offer valuable insights to guide the planning of future campus activities and assure services meet the needs of the target population. The reflections of these professionals, the resources uncovered through the cycles, or developed later by the academic course coordinator, were also to be used to support the new curriculum design.

This project highlighted the importance of finding ways to collate, interpret, and present new information to scaffold learning for sustainability. It confirmed that online technologies can provide an effective, virtual space for this collaboration. As anticipated, productive encounters could not be assumed. They rely on equitable participation of stakeholders, dependent on their values and commitment to achieving the objectives, as well as the opportunities provided for knowledge exchange. One of the main advantages of this approach was that participants could intervene when convenient. This flexibility was important for the professionals involved, whose participation would otherwise be constrained by other commitments in their workplaces. It meant that their expertise could be provided in a timely and cost-effective way and ensured closer alignment of the curriculum to the challenges of real-world practice. On the other hand, the voluntary nature of these contributions meant that competition with other demands on their time discouraged participation for many students. Clearly, further efforts were required to address prevailing attitudes and values which tended to dismiss or undermine the importance of this type of activity.

For the purposes of this research, there were no obvious advantages of working in applied nutrition. On the basis of the findings, curriculum development for sustainability through a community of practice comprising teachers and students could be undertaken in any discipline, or across disciplines. A more complete assessment of outcomes would require projecting these findings to predicting future performance of these students as graduates in professional practice, specifically how well they meet their responsibilities for sustainability. In this instance, the introduction of new health promotion activities on campus would be another useful indicator that the curriculum was concerned with the complexities of real-world problems.

The action research undertaken by this community of practice represents one approach to developing a curriculum which meets learning objectives for sustainability. Clearly, this is a work in progress, as any curriculum must continue to adapt in response to the tensions as they emerge when new ideas challenge existing mindsets and expectations around teaching and learning in higher education.

Conclusion

A commitment to sustainability means challenging accepted social norms and values and usual practice. In higher education, this translates to setting new objectives for learning and introducing new ways of teaching. This has major implications for academic development, workplace culture, and resources. This chapter has described a research sequence tracing three projects, each drawing on previous learnings and each relying on a new community of practice to explore ways to develop education for sustainability.

Because knowledge is socially embedded, learning relies on productive human interactions, as people collaborate to find, test, revise, organize, and explain ideas to each other. As much as a shared commitment to change and innovation, these interactions relied on an accessible and supportive space for collaboration and democratic decision making. Both virtual and real settings can provide this space for encounters which could lead to prescribed and even unanticipated outcomes.

Action research undertaken by a genuine community of practice seems to have the potential to overcome the many institutional barriers to education for sustainability. However, it was clear that the alignment of values and attitudes to sustainability within the community was an important determinant of outcomes. A community of practice formed by volunteering academics, already committed to education for sustainability or to learning about it, can have a significant and almost immediate impact. In contrast, the varying priorities of students described here limited the scope of their community of practice considerably, despite the commitment of the professionals involved.

From this research, it seems that a community of practice can be successful at many levels, including professional development for staff, through to setting learning objectives, designing new strategies for learning, and participating in professional work beyond the classroom, all required for establishing education for sustainability. Further research is required to fully realize the potential of this approach to implementing genuine and effective education for sustainability.

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Education for and Through sustainability: Toward Interdisciplinary Dialogue

J. Rogers

Abstract It is now widely accepted that sustainability education needs innovative, interdisciplinary, integrated, problem-based and transformative approaches to learning and teaching. However, in order for students to be able to appreciate, reflect on, and synthesize different disciplinary languages, content, methods, ways of knowing, and thinking these differences need to be made explicit and opportunities to interrogate these knowledge(s) and methods need to be embedded in the curriculum from the outset. Dialogue, discussion, and exchange of ideas are core sustainability principles that provide fertile ground for devising and delivering this type of interdisciplinary sustainability education, requiring a shift away from content-based shallow approaches to one of process based, participatory deep learning. The result is to teach less 'about' and more 'for' or 'through' sustainability. This chapter outlines the development and on-going evaluation of two university wide electives delivered by at RMIT University, Australia. Both courses—one fieldwork based, the other offered fully online—foreground interdisciplinary understandings and dialogue as key to education for and through sustainability.

Keywords Interdisciplinarity · Sustainability education · Sustainable development · Teaching methods · Deep learning · Participatory learning

Introduction

There is widespread consensus in the literature that education has a key role to play in the sustainability transition and that this education needs to be not only innovative, but also interdisciplinary, integrated, problem based, and transformative

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_23,

(Blewitt 2004; Dobson and Tomkinson 2012; Jones et al. 2010; Tomkinson 2011; UNESCO 2012; Warburton 2003). Developing and delivering curriculum in this way presents a range of challenges in higher education institutions traditionally organized along disciplinary lines and where the dominant approach to sustainability education remains prescriptive: environmental targets, audits, energy and water efficiency, sustainable design mapped on to the curriculum of various disciplines and fields. This chapter outlines the development and on-going evaluation of two university-wide electives delivered by the Landscape Architecture program at RMIT University, Australia. Both courses—one fieldwork based, the other offered fully online—foreground interdisciplinary understandings and dialogue as key to education for and through sustainability. The courses are offered as part of RMIT University's university wide elective program where students are required to complete a minimum of two electives in a 3-year undergraduate degree. The electives provide space for students to pursue an area of interest outside of any one disciplinary area and so the student who enroll in these courses come from a diverse range of disciplines and all have an interest in sustainability from the outset.

The arguments presented in this chapter are based on two key observations about the nature of sustainability and by extension education about, for and through sustainability. First, as Blewitt (2004, p. 2) notes sustainability is 'complex and complicated with no single discipline definitively addressing either the problems or the solutions'. As an inherently contested concept sustainability refers to a process or processes of change toward a more ecologically sound, just, and essentially unknown future. For Blewitt although sustainability and sustainable development *require* a 'transdisciplinary or interdisciplinary approach to teaching, learning, and research, disciplinarity is still an inviolable fact of University life' (Blewitt 2004, p. 2). Calls for transdisciplinarity or interdisciplinarity approaches to learning, teaching, and research challenge the notion of disciplinary expertise and the delivery of disciplinary knowledge toward one that places attention on the processes of learning itself and the collective generation of new knowledge(s) and practice(s) involving a "move from 'how do we educate for sustainable development' toward deeper attention to *education* itself: its paradigms, policies, purposes, and practices …and its *adequacy* for the age we find ourselves in" (Sterling 2008, p. 63).

The second key observation is that rather than having a fixed meaning or practice that can be easily 'known', bounded, and then delivered in a typical university learning environment, sustainability is essentially discursive, raising questions about the whole notion of teaching (Wals 2010). This perspective is not broadly acknowledged with a great deal of scholarly debate focusing on the 'about'—what sustainability is or should be, how it should be defined once and for all so that the task of implementation can proceed. The chapter begins with a brief discussion of sustainability and how it is currently understood. Three key approaches to sustainability are identified all of which suggest quite different approaches to sustainability and education for sustainability.

What is Sustainability?

Sustainability is a concept, like liberty, justice, democracy, tolerance, and freedom that lacks a clear and agreed on definition. It is, however, seen as '…one of those obviously right, intuitively essential, and fundamentally significant ideas (Cooper and Vargas 2004, p. 21). The 'problem' of sustainability is, however, for many commentators one of implementation (Cooper and Vargas 2004). Framed in terms of urgency and the 'common interest' there '…is a palpable pressure to conform' and 'questioners are immediately labeled as being less committed to the cause of sustainability than those who do not question' (Onwueme and Borsari 2007 p. 49). As Rydin (2003) notes:

> …if sustainable development can be demonstrated, it must be a positive feature. The type of closure to argumentation that is used adds strength to all these argumentative devices by emphasizing urgency, crisis, and the absence of an alternative path. The leadership provided by the discourse is both essential and the right way. This, again, precludes any argument against sustainable development. In these ways, sustainable development becomes a very powerful argument for a common interest in global environmental issues, an argument that is based on the lack of inherent disagreement between people (Rydin 2003, p. 9).

This difficulty with disagreement presents a particular challenge for sustainability education and begins to explain the impulse to teach *about* sustainability and why questioning and critique are often seen as being *against* sustainability.

But what is sustainability and what is the 'cause of sustainability'? Far from being self evident, many texts on sustainability begin by acknowledging that sustainability is a contested concept with multiple meanings. As Becker, Jahn, and Steiss observe, 'the only consensus on sustainability appears to be that there is no shared understanding' (Becker et al. 1999, p.1). One only needs to look at the range of concerns that fall under the 'sustainability' banner to gain some sense of this—from energy use to climate change, peak oil, transport, water shortages, population growth, food security, obesity, poverty and environmental justice, resource depletion, and species loss. And all of these concerns are accompanied by particular value judgements, assumptions, or moral positions about which concern could or should be privileged over another, or what is the most appropriate framework to integrate them all. This has led to a diversity of approaches to researching and writing about sustainability. Three key approaches stand out (Alvarez and Rogers 2006a, p. 176).

The first approach is concerned with definitions of sustainability—where they have emerged from, what they attempt to achieve and how they can be compared (Baker et al. 1997; Haughton and Hunter 1994; Neumayer 2003; Rees 1999; Redclift 1987, 1996; Hopwood et al. 2005). The second approach is more reductive. These writers frustrated by what they see as endless discussions over meanings and definitions argue that we need to get on with the task of implementation. The focus is on establishing what is unsustainable, how to make practices more sustainable and how to evaluate sustainable outcomes. This is the world of checklists, indicators, triple bottom-line accounting and ecological footprints (Cooper and Vargas 2004; Ewing et al. 2010; Hak 2007; Wackernagel and Rees 1996). It is managerial and based on the premise that once we have enough of the right kind of knowledge the planet (and the people who inhabit it) can be managed 'sustainably'. Debate centers on whether management does or should occur at the local or the global level (see for instance, Redclift 1996). One final approach focuses on sustainability as discourse—a way of defining and controlling the agenda for change and development across the globe (Darier 1996, 1999; Goldman 2001; Hajer 1995; Litfin 1994; Luke 1999, 2005; McBeth et al. 2010; Peace 1997; Sachs 1992; Sandilands 1999, 1996; Shiva 1992; Straume 2005; Wekerle 1996). Such work resists the temptation to define sustainability once and for all and focuses instead on the on-the-ground effects of discourses about sustainability.

To understand sustainability as discourse suggests that it has no fixed meaning, but is instead dynamic and open to change. Definition and redefinition '…becomes part of the process of enriching and renewing the concept' (Myerson and Rydin 2004, p. 99). This focus, the one adopted in this chapter, shifts discussion away from considering the usefulness of sustainability as a conceptual framework and whether it can deliver 'successful' outcomes toward an approach that remains alert to the contestation, the contradictions, the open-endedness and the multiplicity, without necessarily privileging any one perspective over another.

So what does this mean for sustainability education? Sustainability, understood in this way cannot be accepted passively but needs to actively involve learners in their own education, requiring a shift away from content-based shallow approaches to one of process-based participatory deep learning (developing their own poten Warburton 2003). Moreover, the breadth of concerns that fall under the sustainability banner means that it is necessarily interdisciplinary and involves 'making connections between sociopolitics, socioeconomics, and biophysics and something of a paradigm shift away from traditional disciplines toward more holistic ways of thinking (Warburton 2003, p. 44). The result is to teach less 'about' and more 'for' or 'through' sustainability.

Sustainability Education: About, For, or Through?

The discursive nature of sustainable development is reflected in many definitions of education for sustainability and sustainable development all of which suggest that education cannot be 'about' sustainability, nor can it be 'for' sustainability, if sustainability is understood as fixed and immutable. Instead, as Huckle and Sterling argue sustainability education 'is essentially process-driven, is participative and empowering, is liberatory and continuous and that it is necessitated by the possibilities and dangers presented by an emerging 'postmodern' world' (Huckle and Sterling 1996, p. xiv). Open dialogue, discussion, debate, and exchange of ideas are foregrounded rather than the transmission of content or the 'how to' of sustainability.

Similarly, and perhaps more forcibly, in their study of sustainability education Wals and Jickling (2002) suggest because decisions about sustainability ultimately rest on different interests and values the concept needs to be openly challenged, negotiated, and discussed rather than masking its complexity under a seemingly 'shallow consensus'. They argue that education for sustainability typically,

> …breathes a kind of intellectual exclusivity and determinism that conflicts with ideas of emancipation, local knowledge, democracy and self-determination. The prepositional use of 'for' prescribes that education must be in favor of some specific and undisputed product, in this case sustainability (Wals and Jickling 2002, p.222).

They contrast two approaches to education for sustainability. The first adopts an instrumental view of sustainability where 'sustainability is fixed, pre-and expert determined (i.e., academics), and to be reproduced by novices (i.e., students)'(Wals and Jickling (2002, p. 224). They argue that such an approach is not necessarily educational. This is contrasted to education for sustainability which can contribute to the creation of a (more?) democratic and environmentally just world—whatever such a world may look like'. Wals and Jickling (2002, pp. 224–225) For Wals and Jickling an emancipatory approach to education for sustainability must necessarily be participatory, open, and respectful of different perspectives and attitudes and provide 'a means to become self-actualized members of society, looking for meaning, developing their own potential and jointly creating solutions' Wals and Jickling (Wals and Jickling 2002 p. 225). This approach to education is based on a process of seeking rather than setting the sustainability agenda.

Wals and Jicklings distinction between shallow and deep consensus is an important one. It suggests that shallow consensus is reached based on a pre-prescribed idea of what sustainability is and that this desire for consensus leads to the imposition of a particular moral and ethical agenda based on defining 'right' and 'wrong' behaviors and ideas. Values, life experiences, and concerns about sustainability are lost in the quest for a common, shared vision that potentially has more to do with the teacher imposing a particular viewpoint than with the student. Deep consensus, on the other hand, can only occur within a learning environment that is respectful of differing perspectives and ideas. Such an approach also has the potential to transform sustainability discourse from one characterized by messages of constraint and imposition—or of simply saying 'no'—to one of openness to innovation and change. In doing so the potential exists for students to move beyond stories of catastrophe and doom, along with apocalyptic visions of the future toward imagining futures where they can actively intervene; where they can in fact imagine a future.

So if as Wals and Jickling argue, part of sustainability education is to provide 'spaces' to reflect and critique and challenge taken for granted concepts and precepts like sustainability that currently frame our everyday lives, then the issue for educators is where can we find such spaces. This chapter reflects on the development of two such ‘spaces’—one a fully online elective, the second a field trip. While the educational setting is quite different both share a common intention to unsettle students existing understandings of sustainability through a process of privileging dialogue and exchange, debate and contestation. The aim is to encourage students to think beyond prescriptive and fixed ideas about sustainability, to grapple with the possibilities of what it could mean, to effectively turn the concept back upon itself and open it up for critique.

Challenges in Sustainability

Challenges in Sustainability is a fully online, interdisciplinary university wide elective that aims to facilitate a process of learning that explicitly reflects sustainability as a process openly questioning, debating, and challenging some of the dominant ways in which the concept is understood and applied in practice. Students enroll into the course from programs all over the university—from disciplines as diverse as engineering, property management, Landscape Architecture, planning, and environment—and so the make-up of the class is interdisciplinary from the outset. However, beyond representing different disciplines the design of the course went further than this to consider how to develop linkages between these different fields of knowledge because as Golding (2009, p. 2) argues devising Interdisciplinary programs and courses involves ‘…teaching how to understand, navigate, and employ multiple and often contrary ways of knowing’. In order for students to be able to appreciate, reflect on and synthesize different disciplinary languages, content, methods, ways of knowing and thinking these differences need to be made explicit and opportunities to interrogate these knowledge(s) and methods need to be embedded in the curriculum.

In Challenges in Sustainability students are also made aware from the outset that learning needs to go beyond acquiring or even sharing knowledge about sustainability (although this is part of the process) to learning that engages with its uncertain, contested, and open-ended nature. Rather than position sustainability as a given ‘good’, students are asked the questions—‘sustainability of what and for whom?’ The online environment provides a forum for students to engage in these questions without some of the difficulties or awkwardness of face-to-face interaction.

The course is divided into two parts. The first part of the course focuses on the ‘theory’ of sustainability—what it is, where the concept came from and how it has been debated and challenged. The aim is to first, expose students to varying definitions and approaches to sustainability, including their own, and to consider and debate the ways in which these definitions are informed by different disciplinary and philosophical orientations along with divergent understandings of environment. Discussion forums are established around key questions, ideas, and issues and students are required to identify differing points of view and discuss and debate them online. Issues emerge out of students online discussions and in these forums the role of the teacher is to raise questions/issues/ideas for discussion rather than judge what is being said. Students come to the course well schooled in established ‘mantras’ of sustainability gleaned from the media and previous courses of study. There is an overriding emphasis in the early weeks on resource consumption and the need for behavioral change through education. The challenge is to encourage students to scratch beneath the surface and to extend their understanding—to consider the difficult and often messy questions that emerge in the discussion forums.

Alongside the discussion forums students are introduced to a range frameworks for thinking about sustainability and the differences in perspective that emerge in the discussion forums. These formal exercises are submitted to the teacher and are designed to inform contributions to the online discussions. They include a mapping exercise followed by a back-casting exercise before moving to resilience theory. Extended essay topics provide an opportunity to explore particular aspect of sustainability before moving to part two of the course that has the theme of introducing students to the practice of sustainability: the students own practice and sustainability approaches in the discipline domain of the student. The aim is for students to apply knowledge learnt in the first part of the course to examine critique and reflect on the practice of sustainability within their own discipline and in the disciplines of others. They are also asked to speculate on how the tools and techniques employed in practice could be developed further. The course concludes with a reflective summary of student learning—what they have learnt and more importantly how they have learnt. Interestingly and importantly, most student feedback tends to focus on what they have learnt from other students in the class rather than the teacher. This is clearly evident in the following reflective summary written by one of the students who was enrolled in the course in 2012.

> Throughout the course of this semester I have learnt much about various issues regarding sustainability and sustainable practices…The online discussion forums have been extremely useful for students to voice their opinions on various matters, and have provided a platform from which open discussion can take place. In this way, the online ‘forum’ has facilitated much debate and stimulated creative, open-ended discussions on a wide range of issues. In my opinion, this type of environment—in which creative thinking and critical analysis of others ideas is encouraged—is the perfect environment for a creative learning atmosphere; it is an environment in which interaction and cross-collaboration is fostered, and ultimately results in innovative and creative thinking… it has allowed the ‘virtual class’ to come together and in doing so has strengthened the collective understanding of sustainability.

Farming the Future

‘Farming the Future’ is also an RMIT wide elective and is available to student across the University. It is a field trip-based course, with two face-to-face classes preceding 4 days in the field. It is taught twice a year with field trips to a variety of regional and rural locations. Farming the Future was first offered as a course in mid-1990s. The course was initially developed to expose a largely urban-based local and diverse international student cohort to issues being faced by people living in rural and regional Australia. At that time the course engaged students in 'real' socioenvironmental problems—and the aim was to explore whatever environmental or social issue seemed most pertinent for people on the land. By the end of the1990's a sustainability discourse framework was developed to assist students to challenge some of the assumptions they brought to this course and that they were exposed to during field trips. This also involved a shift in pedagogy from one that was essentially teacher focused to one where the teachers saw themselves as facilitating a process where learners (both teachers and students) are exposed to different understandings of sustainability and are able to recognize the messy and complex reality of sustainability 'out there'. Students (and teachers) are encouraged to think about sustainability as a complex set of discourses and practices that interweave through and over peoples lives giving both meaning and legitimacy to their practice in some cases, while in others challenging their sense of certainty and assumptions about place. Students (and teachers) learn that above all else sustainability is not fixed or bounded but uncertain and contestable. Fieldtrip locations are chosen to highlight conflictual issues in relation to land-use planning and land management on the periurban fringe (Alvarez and Rogers 2006b), extensive and intensive farming districts (Alvarez and Rogers 2006a), and coastal areas.

The example described here focuses specifically on a field trip to the Wonthaggi district. Wonthaggi is a small coastal town, 150 km south east of Melbourne, Victoria's capital city. It is the site of a desalination plant that was intended to reduce water insecurity for Melbourne's population, (exacerbated by ten consecutive years of drought). The main theme of this particular field trip was industrialization of the landscape and included visits to both the site of the desalinization plant and an adjacent wind farm. The focus was not on the merits of either development, or even whether they were sustainable but rather how each of these projects were written and spoken about on the ground. Students were asked to consider why each of the projects generated so much conflict and disagreement locally and regionally, what was meant by industrialization of the landscape anyway and what did sustainability mean within the context of what had been occurring in the region.

The field trip included visits to the community blockade of the project and archaeological and cultural heritage sites in the area. Students also listened to representatives from local government, from the local action group, to landholders, and to local experts who introduced them to the flora and fauna and to local history. We also visited the local windfarm and spoke to local community members who opposed to that development. Issues that emerged over the 4 days included concerns about governance—How state government planning regulations overrode those of local government, what was seen as a refusal by government to engage with community groups, along with concerns about the level of privacy around the decision to build a desalinization plant. It was these local embedded understandings, experiences, and knowledge that students were given access to and gained so much from during the field trip. What became clear over the 4 days was that there was not one unified ‘community’ voice in the region nor was there one understanding of sustainability. While the voices of protest were clearly evident others in the community supported the development arguing that the injection of funds represented a significant boost to the local economy. And the concerns were different too. While some of the speakers focussed on the loss of visual amenity in the region others were much more concerned about climate change. Meetings with people who had had their land compulsorily acquired helped students to understand that rather than simply being a space on which to site a desalinization plant it was also a place, a home, an integral part of many people’s identity.

As is the case on all of the field trips students were exposed to multiple and often conflicting stories about what is considered a sustainable future for the region and it became increasingly clear that at the local level what was considered ‘sustainable’ by some was often seen to be the opposite or irrelevant by others. While some in the community embraced each project, there were others that remained bitterly opposed. These differing concerns challenged the students understanding of what constitutes ‘community’ and what constitutes a sustainable solution. From afar, for instance, a wind farm can and does appear like a sustainable solution until it hits the ground and the disquiet within the community could not simply be resolved using categories like right or wrong, sustainable or unsustainable. Rather than sustainability being seamless and unproblematic it was (and is) also deeply political.

Conclusion

Challenges in Sustainability and Farming the Future adopt an approach to sustainability education that privileges dialogue, debate, discussion, and exchange of ideas rather than simply transmitting ideas *about* what sustainability is, or should be. While the educational setting is quite different both share an understanding of sustainability as discursive and both aim to unsettle dominant understandings: to encourage students to think beyond prescriptive and fixed ideas and to grapple with the possibilities of what the concept could mean. In this way the courses provide an alternative to content-based, disciplinary bound approaches. Their location within the University wide elective program at RMIT means that students have, from the outset, differing perspectives that work to facilitate debate about what sustainability should or could mean in practice. The focus is on processes of learning where students are exposed to the value of differing points of view and where the role of the teacher shifts from disciplinary expert to that of facilitator. The result is to teach less *about* and more *for* and *through* sustainability.

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Education for Sustainable Development: Trends in Indian Business Schools and Universities in a Post Liberalization Era

Prakash Rao, Yogesh Patil and Rajani Gupte

Abstract Business schools and management education institutions across the world have traditionally focused on standard elements of corporate governance. In a globalized world, management education has seen rapid strides in adopting new and innovative curriculum design in line with the some of the important trends and advances in development. In recent years, environment and sustainability have caught the attention of various sections of society as critical issues threatening the very fabric of global business and polity. The 2002 Earth Summit clearly laid down the path of future sustainable development recommending among other issues the internationalization of educational systems at all levels of learning. The chapter focuses on exploring recent developments in sustainability education in some of the important Indian Business schools and Universities with implications for corporate business action. Recent economic and regulatory pressures, social inequities coupled with changes in energy sector, environmental protection, and sustainability have had a significant effect on Indian businesses necessitating the need for skilled professionals to deal with complex regulatory and policy issues in the future. The chapter analyzes and discusses the potential of Indian universities and B schools in evolving triple bottom line concept-based curricula in emerging areas like sustainable energy development, global carbon markets, renewable energy financing, ethics and corporate governance, sustainability reporting, voluntary disclosures, social reengineering, etc.

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S. Caeiro et al. (eds.), *Sustainability Assessment Tools in Higher Education Institutions*, DOI: 10.1007/978-3-319-02375-5_24,

Keywords Environment sustainability · Business schools · Curriculum · Internationalization · Regulatory policy

Introduction

Energy and environment conservation in recent times has gained considerable interest and importance as some of the most critical issues threatening the survival of life on earth revolve around managing natural resources and energy security. More than four decades back, the issue of industrial pollution and its impact on environment was highlighted as one of the first instances of decay of the environment (Carson 1962). Several global conventions were created nearly 20 years back under the aegis of the United Nations highlighting some of the key issues (De Sombre 2006). These include among others the United Nations Framework Convention on Climate Change (UNFCCC) and the UN Convention on Biological Diversity (CBD).

Across the world, management education was being imparted across some of the most well-known institutions in the United States, United Kingdom, France, Germany, etc. However, the key underlying thread among each of these institutions was the delivery of an education system aimed mainly at preparing standards and accepted forms of training using pedagogy in traditional management-related areas. These were also linked with the demand and requirements of industry prevalent then. Environment and sustainability practices as an area of study was little understood and hardly incorporated into the course curriculum of any management education institution across the world.

Over the past few years, there is a growing realization on the need to see sustainability as the center piece of all anthropogenic activities leading to rational use of resources and their conservation. The concepts of environment and sustainability have caught the attention of various sections of society as issues threatening the very fabric of global business and polity. Climate change as a global threat is being seen as a focus of attention by world leaders, academia, business and industry, and civil society. In an emerging economy like India, there have been several initiatives from Government, Business and Industry and civil society to promote integrated sustainability concepts combining air, water, energy, land and waste-related resources. The recent UN Conference on Sustainable Development (UNCSD) in 2012 has further stressed the need for evolving future strategies around how educational institutions and universities can provide direction to sustainable development mechanisms through various initiatives like sustainability curriculum development, green technologies, environment awareness campaigns, etc. In 2007, the United Nations Global Compact initiated the Principles of Responsible Management Education (PRME) and came up with a set of principles aimed at engaging academic institutions to consider sustainability as a core area of management education (PRME 2008). In recent times, apart from incorporating sustainability related curriculum in educational institutions, it is also been suggested that institutions of higher learning should also measure their sustainability quotient in terms of tracking various energy and ecological foot prints and impacts (Leal Filho 2012).

In the past two decades, there has been a renewed interest in diverse environmental issues like natural resource management, energy conservation, climate change, renewable energy, waste management, resource recovery, environmental economics, ethics and corporate sustainability, etc., among various institutions. Governments, business and industry, civil society organizations, academic institutions and universities, technologists, research and development organizations, developmental sector organizations and many others have been at the fore front of addressing the mandate of sustainable development through various initiatives. The role of educational institutions and business schools was therefore seen as a vital part of a process particularly for building sustainability-related models.

While the concept of embedding sustainability across business and industry has gained considerable momentum globally (WBCSD and WRI 2004), through several initiatives like Global Reporting Initiative (GRI), Carbon Disclosure Project (CDP), there are very few instances of academic institutions with a focus on achieving sustainability standards through energy and environment-related indicators. Investing in environment protection efforts is not only being seen as a business proposition but also in terms of significant economic gains by way of cost reduction and optimization of resource use and a reduced carbon footprint.

Apart from focusing on sustainable development-based curriculum, academic institutions in recent years are also considering the prospect of incorporating some of the emerging disciplines into their own sustainability models (DeMeglio 2009). These include areas like renewable energy, energy efficiency, innovative and clean technologies, sustainable transport and infrastructure development, green building architecture, industrial ecology to name a few. Assessing interdisciplinary areas like water, energy, landscape management, and waste management across institutions of higher learning will be seen as the next step in driving sustainable practices.

Post Independence Status of Education in India

The past few decades have perhaps been one of the most tumultuous phases in the development of mankind in the context of three important sectors namely industrialization, education, and environment. While the first two sectors have seen phenomenal increase in intellectual thought process leading to innovation and creative desire to excel, the third sector namely the environment has perhaps borne the brunt of the rapid progress made by industrialization.

While most of the industrialized world including the developed group of nations moved ahead rapidly, to create a welfare system within their polity, many countries which were under the rule of foreign nations or were just about emerging from colonialism were seen to lag far behind in terms of improving education standards and industrialization. In India, this could be divided as pre-independence era and post independence era. This chapter restricts itself to a discussion in post independence India when much of the focus initially was on rapid industrialization and agricultural practices for providing food security to millions of Indian citizens who were emerging out of a long history of colonial rule.

The post independence India has also been the period when much of the world's efforts have gone into building institutions of governance across the world ranging from political, economic, social, and environmental paradigms. Education has played a key part in driving the paradigm of growth across these sectors in the past 50 years or so. Since 1947, independent India has had a major thrust towards industrialization and agriculture, and building the country's granaries to fulfill the needs of its citizens was a key priority. On the other hand building capacity and strengthening the knowledge base of its citizens, was an equally important initiative of successive governments. While the food security issue saw the advent of the green revolution, the age of industrialization saw the development of management training as an answer to building a cadre of management professionals across the rest of the country to serve the needs of the industrialized world.

One of the first set of institutions which were created in India in developing management education as a priority need included the Indian Institutes of Management (IIMs).These institutions were created by an act of Parliament in the early 1960's. They came into being primarily to serve the needs of an industrialized economy. Parallely, across other centers in the country a few other educational institutions also started developing their own centers aimed at imparting management education. For example, the Symbiosis International University, which is now a renowned academic institution initially began its journey through establishing an institution focusing mainly on supporting foreign students, teaching them the English language and then diversifying into education, including management education, as the means to promote international understanding.

Review of Sustainability-Related Interventions in Educational Institutions

The World Summit on Sustainable Development (WSSD) at Johannesburg in 2002, (www.un.org) also popularly known as Rio +10 Summit, clearly laid down the path of future sustainable development recommending among other issues the internationalization of educational systems at all levels of learning.

The Political Declaration adopted at the WSSD stated that sustainable development is built on three "interdependent and mutually reinforcing pillars" viz. economic development, social development, and environmental protection—which must be established "at local, national, regional and global levels". This paradigm recognises the complexity and interrelationship of critical issues such as poverty, wasteful consumption, environmental degradation, urban decay, population growth, gender inequality, health, conflict, and the violation of human rights (www.un.org).

The WSSD also put forth a plan with a recommendation that the UN General Assembly consider adopting a clear focus towards the "Decade of Education for Sustainable Development" starting in 2005. The need for a new paradigm given the rapid pace at which man was using up the earth's' natural resources required an educational framework that not only addressed environmental issues at a basic and primary level but more importantly as a tool at higher management education levels to ensure that sustainability models were integrated into corporate business practices.

One of the early first initiatives in integrating sustainability and environmental concerns was introduced at the University of British Columbia in terms of developing the concept of Footprints as a means to understand and implement sustainability practices across various organizations. By measuring the footprint of a population, an individual, city, business, nation, or all of humanity can assess existing pressure on the planet, which helps us manage our ecological assets more wisely and take personal and collective action in support of a world where humanity lives within the Earth's boundaries.

The understanding of footprint assessment is now being used widely across business and industry (Global Footprint Network 2011) and particularly as course content (carbon and water footprints) in academic and management institutions as a tool for sustainability initiatives. The Ecological Footprint is being used to help corporations improve their market foresight, set strategic direction, manage performance, and communicate their strengths.

By providing a common unit, the footprint mechanism helps businesses to establish benchmarks, set quantitative targets and evaluate alternatives for future activities. The Footprint is compatible with all scales of company operations, and provides both aggregated and detailed results.

The need for business and industry to develop sustainable operations in the past decade or so has therefore been one of the driving forces for management institutions to incorporate sustainability and various elements of environmental management into management curriculum across the world.

With the adoption of the Rio +5 declaration in 2002, research on sustainable development practices of higher institutions has been an important aspect. Various models are being followed across the world by academic institutions to promote sustainable development. At the global level there have been several landmarks in the process of designing and operationalizing sustainable development activities at Universities through either legislations, regulatory frameworks, policies (UNCED 1992) or voluntary standards (UI Green Metric World University Ranking 2012). The Washington-based Aspen Institute has created a systematic ranking system of Business Schools around the world which have taken on sustainability initiatives (Godemann et al. 2011). It is also true that while more than 600 Universities worldwide have committed themselves to various aspects of promoting sustainable development, very few have been able to successfully integrate the principles of sustainable development into practice due to a combination of reasons, varying from lack of institutional interest, to limited resources or staff involvement (Leal Filho 2011). The role of business schools in creating leadership to tackle sustainability challenges has been a key factor (Adams et al. 2011) in driving the development of sustainable or low carbon universities. In the Asia Pacific regional attempts have been made to get a preliminary understanding of trends in sustainability in business education (Naeem and Neal 2012).

The concept of designing low carbon universities not only through sustainable development based curriculum (Godemann et al. 2011, Shriberg 2012) and frameworks (Chambers 2009, Viebahn 2002) but also through sustainable operations and research on innovative technologies has evolved considerably in recent times (Carbon Trust 2006). These are evident through studies on the environmental impacts of campuses and educational institutions (Leal Filho 2009; Pandey et al. 2011; Roy et al. 2008). Several universities have also initiated research and action to assess their GHG inventory (University of Toronto 2010) and tracking their carbon emissions profile (Sprangers 2011). Emphasis on grading of high performing organizations has also been reported against environmental sustainability parameters (Patil and Kulkarni 2008). The importance of sustainability has to be seen from not only a global perspective but also from a national and regional perspective.

Sustainable Development Education in the Post Liberalization Era in India

Following the reforms process of the Indian economy in 1991–1992, private sector growth and decontrol of various government sectors and organizations became a key factor in the managing the growth economy and its governance. In terms of the required changes in privatization and Foreign Direct Investments one saw the entry of many private players into building a new economic growth model for the country. Core sectors of industry like steel, heavy industries, infrastructure, power/oil and gas, road transport and highways, banking and financial sector, telecom and communication, media and information, IT, health, mining, etc., which were hitherto controlled by the Government saw the entry of private players in the investment climate of the country. Clearly the focus was to open up the economy to international trade and investment as the way forward for rapid growth and economic development (increased GDP). This was also perhaps seen as the approach to compete with the rest of the world toward sustainable development, poverty eradication, infrastructure development, and achieving the goals of improved human development indicators. However, in the quest to achieve high infrastructure growth there has been a serious impact on issues concerning environmental, societal, and equitable development. The Bhopal gas disaster of 1984, unplanned growth of developmental projects in Ecological sensitive zones, e.g, the Narmada Sagar Project, Tehri Dam project in the Himalayas, etc., saw a lot of negative public reaction as these projects were not only considered unsustainable but gave little importance to social development and equity concerns of the citizen. Such concerns prompted Industry, Government, civil society and educational institutions to reorient their academic programs toward an inclusive growth-based curriculum focused on bringing environment, development and equity-related issues on a common platform. Parallely, with the advent of various regulatory frameworks in India, e.g., The Central Electricity Act, 2003, several Power sector groups felt the need for trained and skilled professionals in designing and commissioning of efficient, reliable, and sustainable power projects. In the early 2000s, the booming Carbon trading markets and focus on renewable energy industry also further accelerated the need for such niche-based courses.

Sustainable development at Universities and academic institutions in India has been mainly seen from the point of introducing curriculum which is related to various aspects of sustainability and environmental conservation (Rao 2011). Since the introduction of Environment Sciences as a subject across post-graduate education institutions in India in 1984–1985 (Chhokar 2010) many Indian universities have introduced energy and environment-related courses as part of their conventional curriculum as compared to niche based Universities which have emerged only recently. Several institutions have started to consider the importance of environment as a compulsory element of education curriculum has been implemented by the Government of India at primary and secondary level as well as at higher education institutions (Krishnamoorthy 2005). The University Grants Commission has mandated that environment management courses should be conducted across all undergraduate institutions including programs like Bachelor of Business Administration (BBA).

Traditional science-based colleges and engineering institutions have at some stage incorporated energy efficiency, power sector-related courses as a part of their electrical engineering discipline. Apart from this, courses at Architecture and Planning Schools, have also been imparting training on Green buildings, certification for green buildings through their conventional academic programs. Institutions like the Bharathidasan University, Cenetr for Environmental Planning and Technology (CEPT), School of Planning and Architecture, have through their programs addressed the demand of industry for such courses.

From the operational perspective, there are very few examples of how sustainable development practices are implemented at Universities and other educational institutions (Edwin et al. 2012; Nandhivarman et al. 2012) at the national level. While some use fulltime residential courses and curricula on energy and environment (Rao 2011) as an attempt to promote sustainability, others follow a paradigm of undertaking short courses aimed at niche-based target groups.

Practices are either restricted to niche-based strategies (Nandhivarman et al. 2012) or through institutions like the Indian Institute of Science, Bangalore which has been collaborating on reducing its carbon emissions through various in-house related research and development activities. On the other hand there has been extensive research carried out at national and city levels to determine the environmental (Living Planet 2012) impacts and carbon footprints of cities and regions (ICLEI 2009). A recent example is the case of Pune's carbon footprint being mapped by The Energy and Resources Institute (TERI) for the Pune Municipal Corporation in 2012. The key aspect of environmental sustainability of the institution itself has not been studied in detail barring a few studies at the International level (Leal Filho 2012).

Post 2000, there has been a renewed interest in diverse societal issues like development, equity, and industrial growth. Issues like land acquisition, mining activities, rehabilitation and resettlement, natural disasters like floods, extreme weather events, climate change, ethics and corporate sustainability have taken center stage in the path to economic development. However, while governments, business and industry, civil society organizations, technologists, research and development institutes, developmental sector organizations and activists were at the fore front of addressing these issues for tackling critical area concerns of the environment, the academic community had an onerous task of building suitable and relevant capacity necessary to provide skilled professionals for the business and industry sector. The role of business schools was, therefore, seen as a vital part of nation building process particularly for building managerial capabilities in critical sectors like economic growth, social reengineering, and sustainable development.

Business, Industry, and Education for Sustainable Development in India

Following the economic liberalization process in India after 1991 as well as evolution of a robust regulatory environment and international focus on critical developmental issues has led to increasing interest shown by Business and Industry to focus on building ethics-based governance. With rising energy cost businesses now see investing in sustainability not only as a business proposition but also in terms of significant economic gains by way of cost reduction and optimization of resource use and reduced carbon footprint toward achieving the sustainability goal. The recent UN climate change negotiations have brought to the fore some of the important industry initiatives in promoting clean technologies, processes and capacity building efforts. Various Industry associations in India like the Confederation of Indian Industry (CII), Federation of Indian Chambers, Commerce and Industry (FICCI), and the Associated Chambers of Commerce and Industry of India (ASSOCHAM) have strongly advocated environmental responsibility as a key mandate of business operations and sustainable practices.

In this scenario, Indian business entities are looking at skilled talent with managerial competence not only in core technical disciplines like engineering and environmental sciences but also in emerging business areas like carbon trading, renewable energy financing, power trading, energy and power management, oil and gas management, etc., with added knowledge in conventional management subjects. From an Industry perspective this is important as it helps to develop a talented pool of young managerial talent to build sustainable business models in specialized areas like global business practices, global energy scenarios, carbon financing and market economics, environmental standards, energy policies and regulations, etc.

In India, a few business schools and academics institutions have begun to introduce and also altering existing curriculum to meet not only the requirements of students but also match the needs of business and industry for sustainability initiatives (Park et al. 2012, Tikoo 2009). The inclusion of integrating environment as an important component of corporate sustainability efforts has only been a recent development across Indian business schools with limited intervention.

Various models are being followed across the country in management institutions of higher learning to include environment related issues and subjects. While some use fulltime residential courses on the energy and environment, others follow a paradigm of undertaking short courses to meet specific needs of industry (Table 1). Most of these academic programs commenced after 2005 during the high growth economy era of the country.

On the other hand, some business schools have adopted the model of offering Sustainability based courses as electives rather than full time courses. These are normally embedded into core MBA programs with a focus on giving a green focus on marketing, finance, supply chain domains, etc. (Benn and Dunphy 2009; Park et al. 2012; Weybrecht 2010). While the number of institutions offering these courses currently is relatively few, it is only a matter of time before interdisciplinary industry centric courses are introduced by institutions of higher learning (Kurland et al. 2010). The recent initiatives by the Ministry of Human Resource Development, Government of India in opening up the education sector which will perhaps see changes in the way environmental management issues are considered by various universities and management Institutions. The introduction of the Foreign Universities Bill by the Government of India is likely to encourage institutions to further strengthen and build upon curriculum development with specific focus on sustainable development related subjects.

Many of the management institutions have introduced modules and electives related to emerging areas in the environment sector like carbon markets, oil and gas management, renewable energy management, etc., in their course curriculum. For example Institutes like the Institute for Energy Management and Research in Gurgaon, Haryana, India has made a concerted attempt at introducing Energy focused curriculum in its Post Graduate Program about 3 years back. However, it is important to mention here that most of courses offered provide focus on key aspects of business administration in environment and do not adopt a holistic approach to the triple bottom line concepts of sustainability.

Table 1 List of few Indian Business Schools and Institutes offering energy and environment based curriculum

Sr. No.	Indian Business Schools and Institutions	Program offered	Program duration
1	Amity School of Natural Resources and Sustainable Development, Noida, Delhi	Natural resource management	Two years MBA
2	Chhatrapati Shahu Institute of Business Education and Research, Kolhapur	Environment management	Two years MBA
3	Deen Dayal Petroleum University, Gandhi Nagar, Gujarat	Oil and gas, petroleum management, petroleum economics	Two years MBA
4	Indian Institute of Forest Management, Bhopal	Forestry management	Two years post graduate diploma
5	Indian Institute of Management, Ahmedabad	Carbon trading, carbon finance	One year diploma
6	Indian Institute of Social Welfare and Business Management, Kolkata	Public systems management	Two years master's degree
7	Institute of Energy Management and Research, GLIMS, Haryana	Energy management	Two years PGP in management
8	Management Development Institute, Gurgaon	Energy management	15 months executive post graduate diploma
9	Management Development Institute, Gurgaon, Haryana	Energy management	15 months PGP in management
10	National Institute of Industrial Engineering, Mumbai	Industrial safety, environmental management	Two years post graduate diploma
11	National Power Training Institute, Faridabad, Haryana	Power management	Two years MBA
12	Rajiv Gandhi Institute of Petroleum Technology, Rae Bareli	Petroleum and energy management	Two years MBA
13	Symbiosis Institute of International Business, Symbiosis International University, Pune, Maharashtra	Energy and environment	Two years MBA
14	TERI University, New Delhi	Business sustainability	Two years MBA
15	University of Petroleum and Energy Studies, Dehradun	Oil and gas management	Two years MBA

Industry Needs and Requirements

A case in study is the Symbiosis International University through its constituent institute, the Symbiosis Institute of International Business, conceptualized a unique post graduate program which was aimed at integrating energy development and environment issues concerns with social development and equity-related concerns. The program provided a holistic view to developing competencies in emerging technologies, economic issues for developing sustainable strategies. The programs core focus areas include sectors like sustainable energy development, renewable energy, energy economics, social and economic development, governance and regulatory mechanisms, etc. This unique program was developed purely on the basis of Industry needs and requirements. In 2009, a technical expert group consisting of nine Industry sectors ranging from renewable energy, manufacturing, process control and efficiency, IT services and consulting was established and requested to provide their suggestions on the design of a sustainable MBA program.

Based on the feedback and subsequent interviews the Group suggested the incorporation of a program which should be inclusive in nature and include various aspects of social development, equity and economic growth and environmental sustainability. The group suggested that areas like risk management, ethics and responsible governance, energy regulation, social engineering, IPR, market intelligence, innovation and design were key elements of such a program. By 2012, the Program has been further revised through consistent Industry feedback to include other relevant disciplines like power economics and governance, corporate sustainability management, water-energy nexus, power trading, public private partnerships, and governance mechanisms.

It is clear that changing Industry needs are very specific in terms of building managerial capacities of young professionals in various Industry domain areas. As a consequence, the Symbiosis MBA Program is one of the first such instances of an integrated program where elements of the triple bottom line concept were extensively adopted in course curriculum. This is expected to help professionals to develop clarity and thinking on the balance between infrastructure growth and sustainable development through use of methodologies and tools for developing sustainability standards and guidelines.

Courses, Disciplines offered by Academic Institutions of Higher Learning

While the role of environment protection and conservation can never be better emphasized through the institutions of higher learning, institutions have been focusing on certain key interest areas as well as the needs of the industry in developing educating young professionals. Management programs at institutions

Table 2 A few selected courses on energy and environment, and related areas at Indian Business Schools and Management Institutions

Sr. No.	Course	Subjects	Degree
1.	Energy and power	Energy audits and management, power management, energy trading, renewable energy business and financing, carbon markets,oil and gas markets	MBA, MSc
2.	Environment	Climate change, carbon management, environmental impact assessment, environmental audits, sustainability reporting, natural resource management, biodiversity conservation, green buildings	MBA, MSc
3.	Agriculture	Agro marketing, agri retail marketing, cottage industries development, insurance management, agroforestry management	MBA
4.	Rural development	Rural management, NGO sector management, cooperative management, rural financing	MBA, MSc
5.	Forestry and natural resources	Timber management, sustainable forest management, natural resource management, water management, agro forestry	MBA, MSc

of higher learning have focused on five major interdisciplinary areas viz. Energy and Power, Environment Management, Forestry and Natural Resources Management, Rural Management, and Agri Business Management. Within these areas, a range of diverse and emerging sectors are now being considered as course disciplines by universities and academics institutions as learning areas (Table 2).

Industry—Academic Interface in Environment Management Education

Science and technology have been the backbone of industry-academic linkages for many years around the world. Most of the path breaking inventions and discoveries of the past has often been attributed to research and development work at academic institutions. The commercial and business viability of these discoveries have gone on to be used in industry across developing and developed nations. Industry associations have played a major part in the evolution of sustainability based curriculum development in management and business schools in India. Business schools and industry have forged close links in promoting management education through regular industry interactions. The establishment of the Indian Institutes of Management in the early 1960s provided a sharp focus on industry linkages in carrying out research and consultancy for the industry, including in non-corporate areas like public systems, agriculture, energy economics, regulatory studies, NGO management, urban habitats, etc.

Post 1991, several private sector initiatives have come to the fore to design and implement business education along specific niche-based disciplines though collaborative partnerships. The Indian School of Business, Hyderabad is a case in example which was established in 1996 in a fast developing post liberalized Indian economy. The need for training young leaders in specialized managerial competencies in a globalized world was seen as major factor in boosting economic growth across India. The corporate sector through its efforts established a state of the art Business Schools through partnerships with the Wharton Business School and Kellogg School of Management, USA.

The importance of environment and sustainability as major corporate governance issues has further induced corporate India (Rao and Patil 2011) to be involved with setting up and strengthening management education facilities through curriculum development, industry mentorship, research, and consultancy. Industry professionals and companies have also been involved in supporting niche driven academic programs at Universities and Business schools. A case in point is the oil and gas sector where institutions like Deen Dayal Petroleum University, Gandhi Nagar, Rajiv Gandhi Institute of Petroleum Technology, Rae Bareli, have been established solely to focus on building managerial capacity in the field of oil and gas, petroleum economics, energy management, etc.

Conclusion

The importance of environmental sustainability as the future direction for corporate action is perhaps the need of the hour. This is particularly relevant in the context of some of the most challenging and complex global environmental issues the world is facing. Our current understanding of some of the key issue of impacts of climate change (Pachauri and Resinger 2007) only seems to suggest that there is very little time for the world to take action in mitigating the effects of greenhouse gas emissions which are likely to increase in an exponential way in a business as usual scenario (Meinhausen et al. 2009). The rising demand for energy and its consumption in order to achieve higher economic growth is cited as a key driver of higher GHG emission rates (IEA 2008). The increasing urbanization rate and local environmental stresses from over population, industrial development, migration, etc. (Mukhopadhyay and Revi 2009) are an indicator of some of the imbalances humans are likely to face. This could mean strategic involvement of not only country governments but also business and industry, academic institutions and civil society in an alliance that will help to build a sustainable and low carbon economy.

The importance of building and integrating sustainability-based education across academic institutions is a necessity. The current initiatives in industry–academic linkages in management institutions in India are by far few (Table 1) and inadequate given the enormous efforts need to tackle global and domestic sustainability problems.

There is an urgent need to build and strengthen environment sustainability across educational institutions in the country. Strengthening regulatory frameworks and framing appropriate policy guidelines across academic institutions and inclusion of new governance paradigms which focus on sustainability can significantly improve our understanding of the environmental issues and minimize our impacts.

This will only help in developing managerial competence across a wide range of industry including the larger issues of supporting an ethics-based governance model and value systems that is driven by sound social, environmental, and economic performance of business operations.

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