Towards integrated sustainability in higher education – Mapping the use of the Accelerator toolset in all dimensions of university practice

Dana Kapitulčinová ^{a, *}, Alan AtKisson^{b,c}, Joanne Perdue^d, Markus Will^e

^aCharles University Environment Center, Charles University in Prague, José Martího 2/407, 162 00 Prague, Czech Republic

^bCenter for Sustainable Development, Department of Earth Sciences, Uppsala University, Villavägen 16 SE-752 36, Uppsala, Sweden

^cAtKisson Group, 198 Tremont Street, #166, Boston, MA 02116, USA

^dOffice of Sustainability, University of Calgary, PP127, 2500 University Drive NW Calgary, AB, T2N 1N4, Canada

^eFaculty of Natural and Environmental Science, University of Applied Sciences Zittau/Görlitz, Theodor-Körner-Allee 16, 02763 Zittau, Germany

Abstract

The role of individual change agents and the human dimension in general are increasingly being acknowledged as critical elements in sustainability integration at higher education institutions. Yet few studies exist focusing on the use of tools and methods employed by change agents to promote systematic and institution-wide integration of sustainability principles at universities. To advance current knowledge, this article presents an overview of terminology used for integrating sustainability principles in higher education, as well as the tools, methods frameworks/models and approaches (TMFAs) available to change agents at universities. It follows by introducing an integrated change agentry approach encompassing a change management process and a supporting toolset - called the "Accelerator" - that has been used in higher education for about the past 10 years but not been previously covered in academic writings. The article reports on the toolset's use, drawing on survey data from users from different cultural and institutional settings spanning 17 institutions in 13 countries across 4 continents. The findings indicate that the Accelerator is a versatile toolset suitable for promoting sustainability integration in all dimensions of higher education practice at various stages of the integration process. However, very few of the institutions are using the toolset in an integrated way across all dimensions of institutional practice. The full potential of the Accelerator in supporting effective change management process towards holistic and integrated planning for sustainability integration in higher education therefore remains to be further explored as more universities and colleges embark on testing the toolset alongside other established approaches.

Keywords: Sustainability integration, Higher education, Education for Sustainable Development, Change agent, Transformational change, Change agentry toolset

^{*}corresponding author

E-mail addresses: <u>Dana.Kapitulcinova@czp.cuni.cz</u> (D. Kapitulčinová), <u>Alan.AtKisson@atkisson.com</u> (A. AtKisson), <u>jperdue@ucalgary.ca</u> (J. Perdue), <u>m.will@web.de</u> (M. Will)

1. Introduction – integrating sustainability at HEIs and the role of change agents

The recent adoption of the Sustainable Development Goals (SDGs) by the world's 195 nations (United Nations, 2015) has re-affirmed the global agreement on the urgent need for transforming our socio-economic systems to sustainable modes of operation within environmental limits (Steffen et al., 2015). In this context, higher education institutions (HEIs) present unique opportunities to leverage sustainability through all dimensions of their practice, including educational, research, and outreach activities, and direct campus operations (Cortese, 2003; Leal Filho, 2011), and perhaps even more critically, through the nexus of these practice areas.

HEIs have been acknowledged to play a key role in societal transformations – including the needed transformation towards sustainability² – ever since the "sustainable development (SD) paradigm" had been defined in the 1990s (Leal Filho, 2011; Stephens and Graham, 2010; Waas et al., 2010). The leadership role of HEIs, – particularly in the area of Education for Sustainable Development (ESD), has been highlighted (Leal Filho, 2011); and many HEIs throughout the world have embarked on the journey to address sustainability in their institutional practice (Lozano et al., 2015).

Further efforts to promote sustainable development principles specifically at and by HEIs can build on the wealth of experience and initiatives that have stemmed out of the UN Decade of Education for Sustainable Development (DESD) held between 2005–2014. As Holm et al. (2016) point out in the Introduction to this Special Volume: "*the DESD* was *designed to integrate the principles and practices of ESD into all aspects of education and learning, to encourage changes in knowledge, values and attitudes, with the vision of enabling a more sustainable and just society for all*". The Global Action Programme (GAP) on Education for Sustainable Development (ESD) picks up on where the DESD ended just as the 2030 Agenda and SDGs pick up from the MDGs and Agenda 21. The GAP aims to ensure continuation of current efforts and to encourage even more institutions – including HEIs – to follow the sustainable development pathway (Leal Filho et al., 2015). The recent approval of the SDGs and the GAP therefore brings a new urgency and need for clarity to the SD agenda generally and ESD specifically.

Although indications of progress on holistic integration of SD principles into all dimensions of university practice have been increasing (Alonso-Almeida et al., 2015; Lozano et al., 2015), the adoption of (E)SD using whole-of-institution approaches and integrated frameworks still appears to be in initial stages by the worldwide academic community (Lozano et al., 2013a, 2013b; Sammalisto et al., 2015). Furthermore, the process of integration of SD principles in higher education does not seem to be terminologically unified in the academic literature, bringing a certain degree of ambiguity to what is actually meant by terms such as "sustainability integration" or "transformational change" in the context of higher education.

² See **Appendix 1** for terminology used in this paper.

Despite terminological challenges, an increasing number of studies point out the importance of human factors, social learning processes and the role of change agents in pursuing SD principles at HEIs (Dlouhá et al., 2013; Spira et al., 2013; Verhulst and Lambrechts, 2015). Verhulst and Lambrechts emphasize that *"in order to successfully integrate sustainability in higher education, the role of individuals is crucial, yet often overlooked as an important success factor"* (Verhulst and Lambrechts, 2015, p. 190).

At higher education institutions, formally appointed or informal motivated individuals often take up the role of "change agents" who engage in active and conscious efforts to change organizational structures towards sustainable practices (Spira et al., 2013; Verhulst and Lambrechts, 2015). Change agents have been defined as *"individuals, groups or networks within or outside the organization that engage in an active and conscious effort to change organizational structures*" (Spira et al., 2013, p. 176). In this article, we focus primarily on the individual change agent as a human being capable of driving change in HEI, as opposed to e.g. 'higher education' itself as a change agent in the development of human society (Stephens et al., 2008).

At the level of individual change agents, the effectiveness to overcome existing tensions and barriers to change (Hoover and Harder, 2015; Lozano, 2006) is primarily dependent on three interdependent influences: understanding of the change management process, access to effective tools, and possessing personal mastery (Klimek and AtKisson, 2016). As Spira et al. (2013) note change agents in higher education settings can come from students, research, operational staff, or higher education management. Hoover and Harder (2015) highlight that change agents exist at all levels of HEIs and individuals in all positions within the institution can show agency.

Higher education institutions – like all organizations – follow distinctive sustainability maturation paths as their understanding of sustainability and ability to take action matures: typically starting from a stage of awakening or obligation to act, and eventually maturing into a transformative or integrated strategy stage (Sherry, 2003 in Lozano, 2006; Newman, 2007). An important leverage point in this change process is to assist HEIs to more quickly move up the sustainability maturation path through providing effective tools and process resources. Yet Spira et al. (2013) point out that there exist relatively few studies within the organizational change management literature specifically focusing on the tools available to change agents in higher education and the processes being employed to promote sustainability integration.

To help address the identified gaps in existing literature, the specific aims of this article are twofold:

(a) To perform a literature review of the term "sustainability integration in higher education" in order to clarify terminology used and to report on the tools, methods, frameworks/models and approaches (TMFAs) available to change agents in higher education for advancing sustainability principles at HEIs (b) To report on an integrated sustainability change agentry toolset – called the "Accelerator" – being used at HEIs worldwide to support the application of sustainability principles but previously unreported in the scientific literature.

Reflecting the aims outlined above, the paper is composed of two distinct but interrelated parts. The first part provides an overview of terminology used in the academic literature focusing on the integration of sustainability principles in higher education (HE) and introduces a practical TMFAs matrix specifically for HE. This section therefore focuses on the general topic of sustainability change agentry in a higher education context and provides theoretical background for the empirical part of the paper that follows. The second part of this article reports on the practical use of the Accelerator toolset in change agentry at HEIs worldwide. The key findings of both parts of the paper are then brought together in the discussion section including a note on the lessons learned as well as limitations of the current research. The paper concludes with pointing out the main conclusions. In its broadest sense, the presented research contributes to the current discussion on how SD principles can be more holistically integrated through all dimensions of higher education practice.

2. Literature review of "sustainability integration in HE"

In any concerted effort for change with a large number of individuals involved, speaking the same language is one of the keys to success. Even though the need for common understanding of the meaning of terms such as "sustainability integration" and "transformational change" in the context of higher education seems obvious, the authors of this article did not find any common clear definitions of these terms that would be consistently used throughout academic literature. A number of terms pertaining to sustainability in higher education seem to be used interchangeably as synonyms by some authors, while others make distinctions in their meaning.

The first part of this section therefore reviews the terminology used in academic literature focusing on the past ten years of published literature and defines the meaning of "sustainability integration" and "transformational change" for the purpose of this study.

The second part of the article focuses on existing TMFAs available to change agents in higher education and presents a new simple tool – the "SCAT matrix for HE" – that can be used by change agents in HE to aid the selection of relevant TMFAs to suit their particular needs in their particular context.

2.1 Terminology through time

To help define the term "sustainability integration in higher education" for the purposes of this study a desktop research was undertaken to review current academic literature. The questions guiding this review were the following: What is meant by "sustainability integration in higher education" in academic literature? What other terms are in use and what is their relation in terms of meaning?

2.1.1 Review method

To answer these questions, the Scopus database (Elsevier) has been used to search for the term "sustainability [...] AND higher education", where [...] was replaced by "implementation", "integration", "embedding", "mainstreaming", "institutionalisation" and "incorporation" in each of the searches with no restrictions on the data published (i.e. all publications until end of May 2016). The search terms were selected based on a quick pre-screening of the literature and the authors' expertise in this field. Both British and American spelling was applied. The results returned by the Scopus search (n = 677) have been further screened by reading through the titles and abstracts and only those results with the searched meaning were recorded for further analysis (n = 165). Academic articles, reviews, conference papers and book chapters were included. The period of the last ten years (2005 - 2015) - corresponding with the DESD - was of main concern.

2.1.2 The use and meaning of "sustainability integration in HE"

As the results of our search in **Fig. 1** show "implementation" and "integration" are the two terms that have been most commonly used in academic literature regarding sustainability in higher education over the past decade. The total number of search results in the period 2005 - 2015 were the following: implementation = 74, integration = 59, embedding 26, institutionalisation = 14, mainstreaming = 8, and incorporation = 6 (excluded from **Fig. 1** due to low counts for clarity). The evolution of terminology through time appears to have two stages: (1) literature in the period of 2005 - 2009 featured relatively few appearances of the terms used (max up to 5 in each year) with the variety of terms being used more or less equally often; while (2) literature in the period 2010 - 2015 grew in numbers and diversified in the terminology used towards the prevalence of the two terms "integration" and "implementation" (**Fig. 1**).

Most studies appear to use the searched terms as synonyms and only a few studies distinguish between some of the terms. This is, for instance, the case of Lozano (2006) who notes the work of Sherry (2003) and specifies three stages of "innovation adoption" of sustainability in HE including initiation, implementation and institutionalisation. This specification follows by distinguishing four stages of institutionalisation at HE including: intuition, interpretation, integration and institutionalisation. The same four-stage terminology is applied also in a study by (Sammalisto et al., 2015). Regardless of the three- or four-stage terminology used, there appears to be little consistency in the majority of the studies analysed (apart from those explicitly mentioned here).

The initial screening of the literature further showed that there exist several levels of meaning of sustainability "integration" in higher education as illustrated in **Fig. 2** ("integration" here in the meaning of all the terms depicted in **Fig. 1**). There is the level of the whole of the national educational system (Level 1) with the higher education sector as a sub-system (Level 2) containing higher education institutions (Level 3) and within those is specifically positioned the area of teaching and learning (often called Education for Sustainable Development)(Level 4).

Several authors, however, highlight that ESD is not restricted to the teaching and learning aspect at universities (i.e. what's in the curriculum), but that it includes also extra-curricular activities happening at the university – a so-called "hidden curriculum" (Winter and Cotton,

2012). We share this view that students learn through the entire "university experience", and so in this article we focus on the entire institution in a holistic way (including also governance, research, outreach, campus operations, and assessment & reporting) when looking at integration of ESD in higher education. We argue that by focusing on sustainability integration into all dimensions of institutional practice, universities educate students – as well as staff – by providing a holistic experience that supports more effective and integrated ESD learning at the institution and beyond.

Specific to higher education – as compared to primary and secondary education – is the relative autonomy of HE institutions as well as their teachers and researchers. Efforts in sustainability integration in HE are the result of global developments (such as the DESD, SDGs etc.) that both shape universities and are shaped by universities. Integration of sustainability principles in higher education therefore happens on different levels and along various pathways including via international as well as national support (sustainability-specific projects or programmes), via enlightened university leaders (establishing sustainability officers for the entire institution) or via committed individuals (including teachers, researchers, or students)(**Fig. 2**). The different scales on which sustainability integration happens have been noticed in previous works e.g. by Beringer and Adomßent (2008) who mention the 'macro' (HE public policy system), 'meso' (institutional governance and administration) and 'micro' level (e.g. operations) with regard to the "sustainable university" concept. We flag one additional level here pertaining to the country's entire educational system, i.e. the 'mega' scale (Level 1)(**Fig. 2**).

In this study, we focus primarily on the level of single higher education institution with all its five dimensions – teaching & learning, research, campus operations, outreach, and administration incl. assessment & reporting (Level 3, as illustrated in **Fig. 2**). Based on the review of several concepts and models, i.e. the 3-stage sustainability maturation process/ innovation adoption curve (Newman, 2007; Rogers, 2003; Sharp and Newman, 2011; Sherry, 2003 in Lozano, 2006), and the "sustainable university" concept (Velazquez et al., 2006; Lukman and Glavič, 2007), we present here a conceptual model for defining terminology used throughout this paper in **Fig. 3**.

Here, we use the term "sustainability integration in higher education" as *the entire process* from a "business-as-usual university" to a "sustainable university" including all stages of the process (i.e. initiation/awakening, implementation/pioneering and institutionalisation/transformation) *along a certain time* (**Fig. 3**).

"Transformational change" is then understood here as the change (i.e. difference in characteristics) in the state from "business-as-usual university" to a "sustainable university" when *sustainability has been fully integrated* (**Fig. 3**). The definition of a "sustainable university" by (Velazquez et al., 2006, p. 812) is taken into account:

"A higher educational institution, as a whole or as a part, that addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to

fulfil its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable lifestyles."

It is important to highlight, however, that while the model in **Fig. 3** represents the SD integration process for an HE institution *as a whole*, the various parts of the institution (e.g. the individual faculties, research groups, operational and administrative units, etc.) will be moving from the "business-as-usual" state towards the "sustainable university" state in a different way and at different pace. It will not be uncommon that one part of the university (e.g. an academic department or operational unit) will be much further along the "sustainability maturation curve" in integrating the principles of SD in the teaching and learning or operational practice compared to other parts of the university. In addition, we acknowledge that the "sustainable university" state and its meaning is continuously evolving (Lozano, 2006).

For "transformational change" to occur at the level of the *entire* HEI it is therefore essential that *all* units comprising the institution adopt sustainable development principles in their respective work. The challenge for sustainability change agents in HE is therefore to make sure that all dimensions of institutional practice are covered in sustainability efforts. The ability and approach of individual change agents to actively contribute to this process will depend, to a large degree, on the position of the individual within the university, their role and responsibilities, and their personal abilities and knowledge. A university lecturer will have different options for integrating SD in his or her work compared to e.g. a sustainability officer and e.g. a bachelor student within the same institution. Each of them will therefore need to use tools and methods to help accelerate sustainability integration into the university in their *particular context*.

With this in mind, the following section focuses on the existing tools, methods, frameworks/models and approaches documented as being used for sustainability integration in higher education from the perspective of a change agent typology.

[FIGURE 1, 2, 3 HERE]

2.2 Tools, methods, frameworks/models and approaches (TMFAs) currently used at HEIs

The change agent's aspiration in promoting SD integration at HEI is to keep to a minimum the time between the first introduction of the SD idea and the institutionalization of the idea (i.e. reaching the point of saturation = the "sustainable university" state) at the HEI (**Fig. 3**). In this gradual process, the change agent can apply a wide range of existing TMFAs available².

However, no two HEIs are the same and the change agent needs to choose the tools that best match the particular situation in the particular institutional context. Although a number of models have been proposed and some general patterns can be observed regarding SD integration at HEIs, there exists no single "recipe" of what "ingredients" to use and in what proportions to ensure success. It is, however, useful to be aware of all the potential "ingredients" at hand and how these can be used. Spira et al. (2013) emphasize that *"change agents should become*

aware of the multiple options they have to approach sustainability at their university and review them carefully" (Spira et al., 2013, p. 186).

This section therefore attempts to address the following question: What (types of) TMFAs have been used for what purpose in the various dimensions of the SD integration process at HEIs?

2.2.1 Review method of TMFAs

To answer this question and gain an overview of existing TMFAs, the selected search results (n = 165) described in Section 2.1.1. have been further analysed. All abstracts were screened for the terms "tool", "method", "model", "framework" and "approach" and all appearances have been recorded. These results were further checked by screening the full-texts of the articles and only those TMFAs that were determined to be well-defined and stand-alone (complete and not referring to other approaches) were added to the final list. In addition, the contributions on sustainability assessment in HE in the book by Caeiro et al. (2013) were searched through for relevant TMFAs. "X" marks have been added to university practice where the respective TMFAs have been used, i.e. reported in academic literature returned by our search.

2.2.1 Existing TMFAs and the "SCAT for HE" matrix

The desktop research of the peer-reviewed literature identified numerous TMFAs available to change agents aiming to integrate sustainability principles into the various dimensions of higher education practice. To provide an easy-to-follow structure to the final list of existing TMFAs, the sustainability change agents' toolbox for sustainability in higher education matrix – or the "SCAT for HE" matrix for short – has been created (see **Table 1**). The matrix is composed of two key dimensions: the "people dimension" (focusing on the position of the change agent within the HEI) and the "target dimension" (focusing on the institutional practice area where change should occur). The structure of the matrix has been inspired by the models and concepts of Alonso-Almeida et al. (2015); Spira et al. (2013) and (Urquiza Gómez et al., 2015), and the "people dimension" reflects the HEI structure in **Fig. 2**.

We believe that the overview in **Table 1** gives a good picture of what is available to change agents in higher education, but we are fully aware that this picture is by no means complete. We acknowledge that the range of TMFAs is vast and detailed listing of *all* existing TMFAs is beyond the scope of this paper. The aim here is rather to serve for illustrative purposes on the *types* of TMFAs available to change agents in HE. **Table 1** should therefore not be taken as an exhaustive list of TMFAs. A detailed research based on surveys and/or interviews among practitioners would be needed to assess what TMFAs are truly being used and how, rather than relying on what gets reported in the academic literature.

Some of the obvious limitations of our review process are the content of the searched database, focusing on English-language literature and the actual TMFAs reported in the published academic studies. In reality, there will no doubt exist TMFAs that are being used by change agents at HEIs, but which did not make it to the scientific literature. One such example that we are aware of is an integrated sustainability change agentry toolset – called the Accelerator –

that has been used at HEIs worldwide but has not been previously reported on in the scientific literature.

We have added the Accelerator toolset among the results in **Table 1** for general comparison purposes and further report on this aspect in Discussion (**Section 4.1**). Since only a few mentions of the individual tools and method comprising the toolset exist in the peer-reviewed literature (AtKisson, 1996; AtKisson and Hatcher, 2001) and there are virtually no records on the Accelerator toolset as such, we first introduce the toolset as a whole, followed by the approach taken to mapping of its use at HEIs in the sections that follow.

[TABLE 1 HERE]

3. "Accelerator" - an integrated sustainability change agentry toolset

TMFAs are clearly highly diverse in their formulations and tend to be oriented to a subset of change agent types in the HE setting, as illustrated in **Table 1**. Further, when considering the three stages of change including innovation identification, implementation, and institutionalisation, few TMFAs are portable across these scales and stages of change. A key challenge for change agents is discernment of TMFAs that are not only portable but also effective in accelerating sustainability integration or whole-of-institution integration. This section introduces a toolset that is suitable for use by most if not all potential change agent types and HE contexts, including teaching, operations management, or institutional-wide strategy and planning.

3.1 Introducing the Accelerator toolset

The Accelerator is a toolset comprising four process and analysis tools and one underlying method for integrated strategic planning from a sustainability perspective. These include³:

- Sustainability Compass (or The Compass of Sustainability, here referred to as "Compass") – developed in the early 1990s, originally as the basis of the "Compass Index of Sustainability," an indicator and aggregation framework (see AtKisson and Hatcher 2001, and AtKisson and Hatcher 2005). The Compass converts the traditional English-language compass directions (North, East, South, West) into the four interlinked dimensions of sustainability as originally defined by Herman Daly (Meadows, 1998). The Compass framework is now used as a sustainability assessment and management framework as well as a symbol of sustainability for communications purposes (e.g. in organizing university sustainability reports) (Fig. 4a).
- **Sustainability Pyramid** (or VISIS Pyramid, here referred to as "Pyramid") developed in the early 2000's as a workshop process for training and planning purposes (see

³ The tools and methods in this toolset evolved gradually over time and have been used in different locations in different contexts. Therefore, several names are in common use for some of these tools and methods, typically depending on geographical location (e.g. South-East Asia terminology differs to European one). We report here on the terms that we know are commonly used.

Hargroves and Smith, 2005, p. 447-456). The Pyramid leads groups through a process called "VISIS" that involves defining sustainability visions ("V"), identifying and assessing indicators ("I"), performing a systems analysis ("S"), selecting innovations to positively change the systems ("I"), and developing strategy for implementation ("S"). Usually the exercise includes building a four-sided, physical model of a pyramid that records the results of group work and organizes those results according to the four Sustainability Compass directions (**Fig. 4b**).

- The Amoeba Game (or The Innovation Diffusion Game, here referred to as "Amoeba") first developed in the early 1990s as a simulation exercise to illustrate the concepts of innovation diffusion and change agentry, as originally described by Everett Rogers in *Diffusion of Innovations* (see AtKisson, 1991; Rogers, 2003). Amoeba evolved to include the ideas of other change theorists and is now used as a tool for training change agents in analyzing and planning for the introduction of new ideas into organizations and other social systems (Fig. 4c).
- StrateSphere (no alternative names) a collection of strategic planning tools first assembled in the mid-2000's to support initiatives such as non-profit organizations and foundations in strategic planning for sustainable development. It includes the generic VISIS method (see below) as well as an assessment of team capacity, an analysis of the surrounding strategic environment, and a basic strategic planning template for defining a theory of change, setting goals and objectives, and describing an overall approach to implementation, monitoring and assessment (Fig. 4d).
- VISIS Method (also referred to as "VISIS"⁴) first described in the late 1990s and incorporated into the "Pyramid" workshop (above), VISIS is now described as an open-source methodology comprised of a generic sequence of steps for pursuing sustainable development training and planning. The five steps Vision, Indicators, Systems, Innovation, Strategy can be interpreted in multiple ways and at varying levels of sophistication depending on the capacity of the group (class, planning team, organizational board, etc.) using the method. VISIS provides the methodological basis to the Accelerator but can also be used in other generic ways that do not depend on the use of the proprietary Compass, Pyramid, and Amoeba tools (Fig. 4e).

[FIGURE 4 HERE]

All the tools and the underlying method have been developed based on a sound theoretical background and concepts described in the late 1990s and early 2000s (AtKisson, 2010a, 2010b) (see **Table 2**). The initial development of the tools and methods was closely linked to civil society initiatives, including the Sustainable Seattle urban indicators initiative of the early 1990s (AtKisson, 1996, 2010a). But in the last 15 years the fully developed Accelerator toolset

⁴ "VISIS" was originally known as the "ISIS Method", but in 2014 it was renamed to "VISIS" to reflect the importance of Vision as the foundation in any planning process, and to avoid confusion with militant groups identifying with the same acronym.

has been principally used for sustainability planning and change agency in non-governmental (e.g. United Nations organizations) and private sector (e.g. corporate consulting). Over time, the toolset has evolved with continuous upgrades and improvements.

[TABLE 2 HERE]

Through individuals working in the education sector, the Accelerator toolset has found its way during the past 10 years also into primary, secondary, and higher education practice and has been increasingly used at schools (Steele, 2015), as well as universities and colleges. Despite the relatively long history of use of the toolset in education, there exist essentially no references in the peer-reviewed literature describing how, when, why and by whom the Accelerator tools have been employed in higher education settings and what has been learned from this experience.

To address this lack of knowledge, this study considers HEIs as an initial focus area and poses the following research questions: a) What HEIs are using the Accelerator tools?; b) Which of the tools are being used for what purpose, i.e. in what dimension of institutional practice (teaching, research, operations, outreach)?; c) At what institutional level have the tools been used (single-users, entire institution)?; d) What are the strengths and weaknesses specific to the use of the tools in an academic environment? and e) Are the tools used in integrated ways and are there any general patterns observed that could be generalized for use in higher education?

3.2 Methods - Mapping the Accelerator toolset use among HEIs

To answer the posed questions, a two-stage survey approach has been taken in gathering information on the use of the Accelerator toolset among HEIs. First, a basic online survey with questions inquiring on the use of the tools at the particular institution has been distributed via the AtKisson Group mailing list that reaches approximately 200 members of the AtKisson Group user network – an informal network of individuals and institutions licensed to use the toolset. This list includes all members of the network from all sectors (private, academic, NGO, etc.) with the estimated number of individuals actively working in higher education being approximately 25 (as of September 2014). The basic survey contained questions regarding the institution name and location, practical use of the toolset (i.e. which tools/method comprising the toolset have been used, in what dimension of institutional practice – Teaching, Research, Campus operations, Internal outreach = engagement efforts within the HEI, External outreach = engagement efforts outside the HEI, Cross-institutional = both management and academics throughout the HEI – and on what scale, how frequently and for how long). In addition, space for any respondents' comments and a question on willingness to fill in a more extended survey on the use of the tools was included in the survey.

Second, a link to an online extended survey was sent only to those respondents who expressed interest in filling in more detailed information (n=8). The extended survey asked about further description of the particular use of the toolset at the institution. The surveys were sent out in

mid-September and end of September 2014, respectively, with 2 weeks' time allocated for completion of each of the surveys.

The research returned 20 full responses from 17 institutions. The position of the respondents was as follows: 11 staff in "teacher" position (i.e. lecturers or professors), 1 staff in "researcher" position (i.e. academic staff without teaching commitments) and 8 staff in "manager" position (i.e. employed as officers at the institution). In three cases there were two respondents from the same institution – always one "teacher" and one "manager". The respondents and their institutions have been anonymised in this manuscript since we were looking for general patterns in the returned data on the specific use of the tools rather than aiming to provide case studies with detailed information on the institutions themselves.

3.3 Key findings - Use of the Accelerator toolset among HEIs

The findings of our empirical research based on surveys show that the Accelerator tools and methods have so far been used in at least 17 higher education institutions around the world, spanning 13 countries on 4 continents (**Fig. 5**). The toolset has been used to various degree by both academic and management staff at institutions based in Australia, Canada, Czech Republic, Germany, Iceland, Indonesia, Ireland, Poland, Russia, Sweden, Thailand, UK and the United States (**Fig. 5**).

Teaching was reported as the predominant area of the toolset use (n=14) which represented more than 82% of the surveyed institutions (**Fig. 6, Table 4**). Interestingly, despite the strong focus on teaching purposes, the toolset has been employed to some extent at the reporting institutions also in all the other dimensions of university practices including research (n=4), campus operations (n=6), internal outreach (n=6), external outreach (n=6), and cross-institutional practices (n=2) (**Fig. 7, Table 4**).

The scale of use varied widely from individual use to the level of the entire institution (n=5), with the most common use reported on the level of a single research group or unit (n=9) (**Fig. 8**, **Table 4**). The most common use of the toolset is a periodic use of every 2-6 months or once a year (**Fig. 9**) and the length of use has been 1-5 years among most institutions (n=11), with 3 institutions that have been using the toolset for more than 5 years (as of September 2014) (**Fig. 10**). In one case, the information on the use of the tools goes back as far as 2003 at one of the universities in Australia.

[FIGURE 5 – 10 HERE]

The reported primary uses of the toolset were very diverse and included all the five dimensions of university practice – teaching & learning, research, operations, outreach, as well as reporting and assessment (**Table 3**). The respondents found the tools useful in various areas of their practice:

"I have found that it [the Compass] is a great tool for eliciting and organizing indicator development at the community level. I intend to incorporate the framework in other research and teaching opportunities as appropriate." Lecturer, US university (I2)

"I have found the tools very practical to use and it helps students to have a hands on tool to "do" sustainable development assessment and planning." Lecturer, Irish university (I11)

"We love these concepts and tools and find in our education and outreach work that they are very effective in explaining the concept of sustainability and processes that can be used to foster sustainability at [the university] and beyond." Director of a sustainability office, US university (I2)

The key strengths of the toolset highlighted by the respondents appeared to be the clarity, relative simplicity, adaptability and flexibility of the tools and methods.

"Key strengths of the tools are the low barriers to entry (easy to run a successful [workshop] by just following the manual), as well as the adaptability and flexibility of the tools." Educational coordinator, Swedish university (I15)

"Adaptable framework. Clear justification of framework theory and components." Lecturer, Indonesian university (14)

Four respondents also reported that the tools were "fun" and "engaging". Two examples include:

"Extremely intuitive set of tools that are engaging and fun for participants to experience." Director of a business school, Thailand (I3)

"These tools are educational, enlightening and fun!" Director of a university programme, Swedish university (I14)

With regard to weaknesses, these were very particular to the specific tools and contexts and did not show any general pattern. The mentioned weaknesses mostly pertained to: 1) the terminology and/or processes used as part of some of the tools and how these were modified; 2) timing of the activities done with the tools; and 3) suitability of the tools to certain institutions/conditions.

"Leverage points is [sic] sometimes an elusive concept, that is hard for students to 'grasp' within the limited time frame of the Pyramid workshop. Also, participants are starting to get tired during the innovation and strategy phases of the Pyramid process, which means that the critical edge of these parts is a bit weaker than in the indicators and systems parts."

Educational coordinator, Swedish university (115)

"The StrateSphere methodology is a bit much to swallow for an organization with no history nor culture for planning." Coordinator – research and knowledge exchange, Indonesian university (I5)

[TABLE 3 AND 4 HERE]

4. Discussion

The preceding sections reported on the key findings of the two main streams of research undertaken in this study, namely (1) a literature review of the terminology used in HE in the context of sustainability integration and relevant TMFAs applied in HE sustainability practice; and (2) an introduction of the Accelerator change agentry toolset and its use among HEIs worldwide. Here, we integrate the key findings and discuss the key lessons learned, as well as general implications for whole-of-institution sustainability practice in HE.

4.1 Sustainability integration in HE: terminology and TMFAs

As our analysis based on literature review showed (**Section 2.1**), "sustainability integration" is a complex and layered construct in the context of HE and it has multiple scales of applicability. The term "sustainability integration" is increasingly being used as evidenced by the literature review results (**Fig. 1**), but it is subject to multiple interpretations or perceptions of meaning. Even though we defined the terms "sustainability integration" and "transformational change" for the purpose of this study, we do not think (or expect) that all other practitioners will agree with our definitions and/or start applying them. It is not our aim to limit the richness of vocabulary being used in (E)SD literature, but rather to focus attention on the need for terminological clarity in academic writings in general. We hope that our conceptual models in **Fig. 2 and Fig. 3** can be helpful to the reader in this process of terminology clarification.

A more detailed analysis based on the literature review revealed that there exists a wide range of TMFAs that have been proposed and/or practically used in higher education to integrate sustainability principles in the various dimensions of institutional practice as presented in the 'SCAT for HE' matrix (**Table 1**). Some of these TMFAs have been under development relatively recently and applied rather locally (e.g. ESDGC framework), while others have been used for many years and applied in tens or perhaps hundreds of institutions around the world (e.g. AISHE, STARS).

We proposed the structure of the SCAT for HE matrix based on concepts and models found in the peer-reviewed literature (Alonso-Almeida et al., 2014; Gomez et al., 2015). The structure itself should not, nevertheless, be considered as fixed as the primary intention is to help change agents to find appropriate TMFAs to their particular situation. Depending on the specific HEI and the specific change agent's situation, the SCAT matrix categories can be adjusted to fit the particular context e.g. by adding another column focusing on 'On-campus experience' or 'Institutional framework' which have been identified as further important HEI dimensions by Lozano et al. (2015), but also by other categories that might be of interest to the change agent and his or her institution.

Although certainly not exhaustive, the results in **Table 1** indicate that there seem to exist differences in the diversity of TMFAs types available to change agents. Waas et al. (2010) note that most efforts to date have been focused on SD in the educational dimension (curricula/teaching) and operational/management dimension (esp. environmental management), while SD in university research has received scholarly attention only recently. This observation on the evolution of SD efforts in HE seems to be reflected also in our results of existing TMFAs where sustainability assessment and reporting appears to be most diversely developed, while specific TMFAs in the research category are more sporadic.

The results have shown that most of the TMFAs are specific for a certain dimension (teaching, operations, outreach, research, and reporting & assessment) and usually don't cross into most of the other dimensions. This appears logical, since many of the TMFAs target a specific area of institutional practice and do not attempt to fit all purposes. In the "whole-of-institution" context, it is nevertheless very interesting to note that a few of the TMFAs seem to suit the needs of change agents in multiple dimensions. TMFAs that have been reported to be used in three or more dimensions included environmental footprinting methods (Carbon footprint, Ecological footprint), participatory development methods, participatory assessment & reporting methods (AISHE, AUA, STARS) and the Accelerator toolset.

As Lambrechts & Van Liedekerke (2014) point out, footprinting methods can be useful not only in operations and assessment but also in HE teaching and governance (although care should be taken in the interpretation of results and they arguably do not provide a fulsome view on sustainability). Similarly, participatory methods can be used in many different activities promoting sustainability at HEIs (Disterheft et al., 2015). Rammel et al. (2015) highlight the need for more holistic and participatory assessment approaches at HEIs with focus on self-evaluation and open dialogue of various stakeholder groups, and identify the AISHE, AUA, and STARS systems as a good background for further developments in this field. The Accelerator toolset, which can also be used in many different activities with a diversity of stakeholders at HEIs, is further discussed in detail in the section that follows.

4.2 The Accelerator toolset in the context of other TMFAs

We structure the discussion here according to the main questions posed for this study.

4.2.1 HE institutions using the Accelerator toolset

The results of our survey showed that the Accelerator has been used at 17 higher education institutions located in 13 countries on 4 continents. The actual number of HEIs that have been using the toolset is likely slightly higher as we personally know of HE practitioners who have not completed our survey. More than half of the users have been located in Europe and the rest resided in Asia, Australia and North America. This geographical distribution reflects the regions where AtKisson Group network members have been professionaly most active.

4.2.2 Use of the Accelerator toolset in institutional practice dimensions

In the context of reviewing the existing TMFAs reported in the academic literature, the Accelerator appears to be unique among the change management TMFAs (based on our analysis presented in **Table 1**) in that it has been showed to be used to some degree in all five dimensions of institutional practice, including teaching, research, operations, outreach, and administration including assessment & reporting (**Section 3.3, Table 3 and 4**).

The area where the toolset has seen weaker use is the assessment & reporting dimension. This could be explained by the relatively large number of already existing frameworks for sustainability assessment and reporting specifically for HE that are being in use (**Table 1**). The potential for use of the Accelerator toolset – and in particular the Compass – in reporting & assessment at HEIs therefore remains to be further explored. It can build on the experience acquired from work with primary education institutions, where the Compass has served as an underlying concept for the development of the sustainability 'Self Assessment Matrix' for schools as part of the Compass Education whole-school model (Steele, 2015).

The results of our study indicate that the toolset is very versatile and can be applied in a wide range of contexts. The authors believe the versatility of the toolset to be a function of its strong theoretical foundations in change agentry and highly integrative sustainability-oriented concepts such as systems dynamics, innovation diffusion, and strategic planning.

On the other hand, it is interesting to note that the majority of practitioners have used the Accelerator tools only in one or two dimensions of practice at their institution (**Table 4**), and not as a "whole-of-institution" application. One can speculate that this fact pertains to the individual responsibilities and abilities of the users as discussed in **Section 2.1** and reflected in the "people dimension" of our SCAT for HE matrix (**Table 1**).

4.2.3 Institutional level of use of the Accelerator toolset

The relative versatility of the toolset has been supported also by the findings on the institutional level (scale) of use and frequency of use – ranging from individual use for one-off projects to the entire institution use for multiple projects in multiple years.

4.2.4 Strengths and weaknesses of the Accelerator toolset

The human dimension in the process of sustainability integration in HE is being increasingly acknowledged (Spira et al., 2013; Verhulst and Lambrechts, 2015). Apart from the relative simplicity and flexibility of the toolset, one of the key strengths appears to be very strong in the human dimension by creating engagement and "fun" among people. As Disterhelft et al (2016) highlight, "fun and celebration" can be classified as one of the critical success factors in participatory processes relating to SD in HE. In the authors' words: "...*it has become increasingly recognized that fun and celebration of achievements along the process, even the most little ones, are an important pillar for transformation in the long-term perspective because 'if it is not playful, it is not sustainable' (Dragon Dreaming International, 2014)*" (in Disterhelft et al. (2016, p. 176-177). The participatory and engaging features of the Accelerator toolset seem therefore particularly relevant for sustainability efforts at HEIs in those cases where more 'enlightened' atmosphere is desired.

With regard to weaknesses, it is important to stress that no toolset, including the Accelerator, can be expected to be a "perfect fit" for all change agents in all HEIs. Instead, the toolset and the use of the individual tools and methods requires adjustment to the concrete context (e.g. how much time is available, who the audience is, what the overall goal is, etc.). Accelerator appears to be "too much" for some users, who find its many elements and (especially in the case of StrateSphere) detailed planning tools to be in excess of their capacities and needs.

4.2.4 General patterns on the use of the Accelerator toolset

There are too few examples in our data set to make robust conclusions, but some general patterns can be identified in use of the Accelerator in HE institutions. First, teaching appears to be a universally attractive use for the tools, followed by operations planning and outreach functions. While the tools have been used in research, this was the second least-reported application, perhaps owing to their participatory nature, which is not always a universal aspect of SD in HE research. The most under-utilized application was for cross-institutional work as a support to inter-disciplinary and inter-departmental collaboration. This may be also be a reflection that less work is being done in the area of cross-institutional work, or it may be that the Accelerator tools are not as effective in this context.

4.3 Limitations of the study

The key identified limitation pertaining to the first part of the paper dealing with terminology used and TMFAs available to change agents pertains to the limited information that gets reported in the academic literature. As a result, the list of identified TMFAs, as well as the "people dimension" categories marked, are by no means exhaustive, but rather illustrative. We believe that the main value is in the framing of the SCAT for HE matrix itself rather than the individual entries based on our peer-review literature search.

There are also several limitations in the empirical part of our study presented in the second part of the paper that need to be acknowledged. First, the survey on the use of the Accelerator toolset was first of its kind and the responses mapped the situation in HE during an approximately 10-year period (the earliest record was from 2003, the cut-off for data collection was 2014). The accuracy and ability to cover all uses at HEIs in this period was therefore limited only to those respondents who were on the survey distribution mailing list and chose to respond within the given timeframe. Since the distribution of the survey (September 2014) more institutions have started to use the toolset, but to the best of our knowledge the current situation in 2016 is not so different so as to substantially change the key findings and conclusions of this study.

The role of students as sustainability change agents in HE and their uses of the Accelerator toolset have not been captured in our study to any substantial degree, since the HE contacts on the survey distribution mailing list were all university staff. We do however acknowledge the importance of students as sustainability change agents (as identified e.g. by Barth, 2013) and future mappings should attempt to include also this stakeholder group. We know from our

experience that Accelerator can be used by student groups advocating for sustainability integration at HEIs (personal communication, unpublished).

5. Conclusions

With the 2030 global agenda set to steer our society towards sustainability – using the SDGs universally and the GAP specifically for education – it is clear that further sustainability efforts in all areas of human activities, and at all levels of education are needed. In the transition towards environmentally, socially and economically safe and just society, higher education institutions have to play a key role. Human dimensions and the activities of change agents in higher education seem to be an important part of the solution to the complex transition process towards sustainable HEIs, as well as societies.

This study brings value to the current knowledge base on sustainability in higher education by bringing a new perspective on the terminology used in the academic literature and by providing conceptual models for eased communication on definitions and general terminological clarity. In addition, a new framework is proposed – the Sustainability change agents' toolset for higher education matrix (or 'SCAT for HE' matrix for short) – listing a range of examples of existing tools, methods, frameworks/models and approaches (TMFAs) available to change agents for integrating sustainability principles in the various dimensions of higher education practice.

The study further reports – for the first time – on the use of an integrated change agentry toolset developed for supporting change management processes – the Accelerator – in a variety of university settings worldwide. Based on responses from 17 higher education institutions located in 13 countries on 4 continents we conclude that the Accelerator is a versatile change agentry toolset suitable for promoting sustainability integration in all dimensions of higher education practice. One observation is that Accelerator is often not deployed in all the uses it is designed for. Just as the owner of a "Swiss Army Knife" with 20 implements may only use one or two of the tools with regularity, or only use the Swiss Army Knife itself in certain special circumstances, Accelerator appeared to be used in more limited (or perhaps focused) ways, when compared to the toolset's potential capabilities. Understanding why this is the case could be a focus of further research as well as a design question for the Accelerator developers.

Additional research questions stemming out of our study point towards more detailed exploration among HEI change agents and practitioners of what TMFAs have been actually used in what dimensions of higher education practice and how successful the use of these TMFAs has been in the particular context (in order to capture also TMFAs that might not have been reported in the academic literature to this date). The focus of such investigations should encompass all stakeholders including: university leaders, management staff, academic staff and students. Another area of research interest would pertain to an assessment of the importance of/activity in cross-institutional engagement and how TMFAs are supporting whole-of-institution processes. As noted in the opening of the paper, change agent effectiveness in enabling and accelerating sustainability integration is dependent on understanding of the change management process; access to effective tools, and possessing personal mastery. TMFAs are integral to his change process; however, the choice of the TMFA relative to the application context and the effectiveness of the application of TMFAs is highly dependent on the change agents personal mastery and understanding of change management processes. Defining the range of attributes within personal mastery and change management are an important area of further research.

Scholars across the world are invited to make further use of the Accelerator toolset along with other sustainability TMFAs and to report on both successes and drawbacks in applying the tools and methods in their particular institutional context. Sharing of such experience is crucial to enhance our understanding of the complex processes at HEIs, as well as to support further developments towards integrated sustainability in higher education.

Acknowledgements

We would like to thank all respondents of the Accelerator survey for taking their time to complete their responses. This includes respondents who expressed their wish to be acknowledged by their name in alphabetical order: Clifford Guest, Christine Jakobsson, Mike Kensler, Kenneth S. Moore, Wayde Morse, Ronny H. Mustamu, Prae Piromya, Nick Pisalyaput, Ben Roche, Isak Stoddard, Kristin Vala Ragnarsdottir, Natalia P. Tarasova; as well as several respondents who chose not to disclose their name in acknowledgements. Dana Kapitulčinová is grateful for financial support from her home institution (see Funding below).

Funding

The research itself did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. Dana Kapitulčinová received internal institutional funding from the Charles University Environment Center, Czech Republic, for the writing of the article.

Declaration regarding conflict of interest

Dana Kapitulčinová, Alan AtKisson and Markus Will are all members of the AtKisson Group, a network of sustainability professionals licensed to use the Accelerator toolset (see AtKisson.com). AtKisson, Inc., a US company which is owned by Alan AtKisson, receives some income from the sales of the Accelerator toolset but also offers versions of the toolset free of charge for non-commercial and educational purposes. Dana Kapitulčinová, Markus Will, and Joanne Perdue (who is not a member of AtKisson Group) would not realize any gain (financial or other) from any increased use of the Accelerator toolset and therefore declare no conflict of interest.

Appendix 1. Terminology used in this article

Change agent	individual, group or network within or outside the organization that engage in an active and conscious effort to change organizational structures (this paper focuses on individual change agents)(Spira et al., 2013)
Sustainability	a state of the world that humanity aspires to reach where long-term stability in environmental, social and economic dimensions is ensured (i.e. the current generations not compromising on the abilities of future generations to meet their needs) (based on the

Sustainable development Sustainability integration	definitions of the Brundtland Report (WCED, 1987 in Amador et al., 2013) and Figueiró and Raufflet (2015) the development of human society towards sustainability the entire process of moving from a "business-as-usual university" to a "sustainable university" including all stages of the process
Transformational change	along a certain time the change (i.e. difference in characteristics) in the state from "business-as-usual university" to a "sustainable university" when sustainability has been fully integrated
TMFAs:	
Approach	a way of dealing with certain tasks <u>without</u> precisely set sequence of steps
Method	a way of dealing with certain tasks <u>with</u> precisely set sequence of steps
Framework/Model	a system of concepts, terms, and diagrams used to illustrate a complex but integrated idea (slight difference might be similar to the difference between a table [= framework] and a figure [= model], but in this study used as synonyms)
Tool	a practical item ready to be used by a practitioner (based on any of the above)
Toolset	a set of tools and/or methods ready for practical use
Abbreviations:	
AISHE	Assessment Instrument for Sustainability in Higher Education
AMAS	Adaptable model for assessing sustainability in HEIs
AUA	Alternative University Appraisal
DESD	UN Decade of Education for Sustainable Development
ESD	Education for Sustainable Development
ESDGC	Education for Sustainable Development and Global Citizenship
GASU	Graphical Assessment of Sustainability in Universities
GRI	Global Reporting Initiative
HE	Higher education
HEI(s)	Higher education institution(s)
GAP	Global Action Programme on ESD
MESA	Mainstreaming Environment and Sustainability into African Universities
MDGs	Millennium Development Goals
SCAT for HE matrix	Sustainability change agents' toolset for higher education matrix
SDGs	Sustainable Development Goals
STAUNCH	Sustainability Tool for Assessing UNiversities' Curricula Holistically
STARS	Sustainability Tracking and Assessment Rating System
TMFAs	Tools, Methods, Frameworks/Models, and Approaches

uD-SiM model	Uncertainty-based quantitative assessment of sustainability for
	HEIs
UNEP	United Nations Environment Programme
USAT	Unit-Based Sustainability Assessment Tool

References

- Alonso-Almeida, M. del M., Marimon, F., Casani, F., Rodriguez-Pomeda, J., 2015. Diffusion of sustainability reporting in universities: current situation and future perspectives. J. Clean. Prod., Bridges for a more sustainable future: Joining Environmental Management for Sustainable Universities (EMSU) and the European Roundtable for Sustainable Consumption and Production (ERSCP) conferences 106, 144–154. doi:10.1016/j.jclepro.2014.02.008
- AtKisson, A., 1991. The Innovation Diffusion Game. In Context, Spring 1991, 58-60.
- AtKisson, A., 1996. Developing indicators of sustainable community: Lessons from sustainable Seattle. Environ. Impact Assess. Rev., Managing Urban Sustainability 16, 337–350. doi:10.1016/S0195-9255(96)00025-X
- AtKisson, A., Hatcher, R.L., 2001. The Compass Index of Sustainability: Prototype for a comprehensive sustainability information system. J. Environ. Assess. Policy Manag. 3, 509–532. doi:10.1142/S1464333201000820
- AtKisson, A., 2010a. Believing Cassandra: How to be an Optimist in a Pessimist's World (2nd edition; 1st edition 1999). Routledge.
- AtKisson, A., 2010b. The Sustainability Transformation: How to Accelerate Positive Change in Challenging Times (2nd edition; first edition 2008). Routledge.
- Barth, M., 2013. Many roads lead to sustainability: a process-oriented analysis of change in higher education. Int. J. Sustain. High. Educ. 14, 160–175. doi:10.1108/14676371311312879
- Beringer, A., Adomßent, M., 2008. Sustainable university research and development: inspecting sustainability in higher education research. Environ. Educ. Res. 14, 607–623. doi:10.1080/13504620802464866
- Brundiers, K., Wiek, A., 2013. Do We Teach What We Preach? An International Comparison of Problemand Project-Based Learning Courses in Sustainability. Sustainability 5, 1725–1746. doi:10.3390/su5041725
- Bullock, C., Hitzhusen, G., 2015. Participatory Development of Key Sustainability Concepts for Dialogue and Curricula at The Ohio State University. Sustainability 7, 14063–14091. doi:10.3390/su71014063
- Caeiro, S., Leal Filho, W., Jabbour, C., Azeiteiro, U.M., 2013. Sustainability Assessment Tools in Higher Education Institutions: Mapping Trends and Good Practices Around the World. Springer Science & Business Media.
- Cebrián, G., Grace, M., Humphris, D., 2013. Organisational learning towards sustainability in higher education. Sustain. Account. Manag. Policy J. 4, 285–306. doi:10.1108/SAMPJ-12-2012-0043
- Cortese, A.D., 2003. The critical role of higher education in creating a sustainable future. Plan. High. Educ. 31, 15–22.
- Daly, H., 1973. Toward a Steady-State Economy, illustrated edition. ed. W.H.Freeman & Co Ltd, San Francisco.
- Disterheft, A., Ferreira da Silva Caeiro, S.S., Ramos, M.R., de Miranda Azeiteiro, U.M., 2012. Environmental Management Systems (EMS) implementation processes and practices in European higher education institutions – Top-down versus participatory approaches. J. Clean. Prod. 31, 80–90. doi:10.1016/j.jclepro.2012.02.034
- Disterheft, A., Caeiro, S.S., Leal, F., Azeiteiro, U.M., 2016. The INDICARE-model Measuring and caring about participation in higher education's sustainability assessment. Ecol. Indic. 63, 172–186. doi:10.1016/j.ecolind.2015.11.057
- Dlouhá, J., Barton, A., Janoušková, S., Dlouhý, J., 2013. Social learning indicators in sustainabilityoriented regional learning networks. J. Clean. Prod. 49, 64–73. doi:10.1016/j.jclepro.2012.07.023
- Du, X., Su, L., Liu, J., 2013. Developing sustainability curricula using the PBL method in a Chinese context. J. Clean. Prod., Special Volume: Green Universities and Environmental Higher Education for Sustainable Development in China and Other Emerging Countries 61, 80–88. doi:10.1016/j.jclepro.2013.01.012
- Figueiró, P.S., Raufflet, E., 2015. Sustainability in higher education: a systematic review with focus on management education. J. Clean. Prod., Bridges for a more sustainable future: Joining Environmental Management for Sustainable Universities (EMSU) and the European Roundtable for Sustainable Consumption and Production (ERSCP) conferences 106, 22–33. doi:10.1016/j.jclepro.2015.04.118

- Glover, A., Jones, Y., Claricoates, J., Morgan, J., Peters, C., 2013. Developing and Piloting a Baselining Tool for Education for Sustainable Development and Global Citizenship (ESDGC) in Welsh Higher Education. Innov. High. Educ. 38, 75–86. doi:10.1007/s10755-012-9225-0
- Glover, A., Peters, C., 2013. A Whole Sector Approach: Education for Sustainable Development and Global Citizenship in Wales, in: Caeiro, S., Filho, W.L., Jabbour, C., Azeiteiro, U.M. (Eds.), Sustainability Assessment Tools in Higher Education Institutions. Springer International Publishing, pp. 205–222.
- Hargroves, K. and Smith, M., 2005. The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century. The Natural Edge Project, Earthscan, London.
- Holm, T., Sammalisto, K., Grindsted, T.S., Vuorisalo, T., 2015. Process framework for identifying sustainability aspects in university curricula and integrating education for sustainable development. J. Clean. Prod., Bridges for a more sustainable future: Joining Environmental Management for Sustainable Universities (EMSU) and the European Roundtable for Sustainable Consumption and Production (ERSCP) conferences 106, 164–174. doi:10.1016/j.jclepro.2015.04.059
- Holm, T., Sammalisto, K., Caeiro, S., Rieckmann, M., Dlouhá, J., Wright, T., Ceulemans, J., Lozano, R. (2016) Developing sustainability into a golden thread throughout all levels of education. J. Clean. Prod., http://dx.doi.org/10.1016/j.jclepro.2016.01.016
- Hoover, E., Harder, M.K., 2015. What lies beneath the surface? The hidden complexities of organizational change for sustainability in higher education. Journal of Cleaner Production, Bridges for a more sustainable future: Joining Environmental Management for Sustainable Universities (EMSU) and the European Roundtable for Sustainable Consumption and Production (ERSCP) conferences 106, 175–188. doi:10.1016/j.jclepro.2014.01.081
- Khalili, N.R., Duecker, S., Ashton, W., Chavez, F., 2015. From cleaner production to sustainable development: the role of academia. J. Clean. Prod., Integrating Cleaner Production into Sustainability Strategies 96, 30–43. doi:10.1016/j.jclepro.2014.01.099
- Klimek, A., and AtKisson, A., 2016. Parachuting Cats into Borneo and other lessons from the Change Café. Chelsea Green, USA.
- Lambrechts, W., Van Liedekerke, L., 2014. Using ecological footprint analysis in higher education: Campus operations, policy development and educational purposes. Ecol. Indic. 45, 402–406. doi:10.1016/j.ecolind.2014.04.043
- Leal Filho, W., 2011. About the Role of Universities and Their Contribution to Sustainable Development. High. Educ. Policy 24, 427–438. doi:10.1057/hep.2011.16
- Leal Filho, W., Shiel, C., Paço, A., 2016. Implementing and operationalising integrative approaches to sustainability in higher education: the role of project-oriented learning. J. Clean. Prod. 133, 126– 135. doi:10.1016/j.jclepro.2016.05.079
- Leal Filho, W., Manolas, E., Pace, P., 2015. The future we want: Key issues on sustainable development in higher education after Rio and the UN decade of education for sustainable development. Int. J. Sustain. High. Educ. 16, 112–129. doi:10.1108/JJSHE-03-2014-0036
- Lozano, R., 2006. Incorporation and institutionalization of SD into universities: breaking through barriers to change. J. Clean. Prod. 14, 787–796. doi:10.1016/j.jclepro.2005.12.010
- Lozano, R., Ceulemans, K., Alonso-Almeida, M., Huisingh, D., Lozano, F.J., Waas, T., Lambrechts, W., Lukman, R., Hugé, J., 2015. A review of commitment and implementation of sustainable development in higher education: results from a worldwide survey. J. Clean. Prod. 108, Part A, 1– 18. doi:10.1016/j.jclepro.2014.09.048
- Lozano, R., Llobet, J., Tideswell, G., 2013a. Developing a University Sustainability Report: Experiences from the University of Leeds, in: Caeiro, S., Filho, W.L., Jabbour, C., Azeiteiro, U.M. (Eds.), Sustainability Assessment Tools in Higher Education Institutions. Springer International Publishing, pp. 189–203.
- Lozano, R., Lozano, F.J., Mulder, K., Huisingh, D., Waas, T., 2013b. Advancing Higher Education for Sustainable Development: international insights and critical reflections. J. Clean. Prod., Environmental Management for Sustainable Universities (EMSU) 2010European Roundtable of Sustainable Consumption and Production (ERSCP) 2010 48, 3–9. doi:10.1016/j.jclepro.2013.03.034
- Lozano, R., Lukman, R., Lozano, F.J., Huisingh, D., Lambrechts, W., 2013c. Declarations for sustainability in higher education: becoming better leaders, through addressing the university

system. J. Clean. Prod., Environmental Management for Sustainable Universities (EMSU) 2010European Roundtable of Sustainable Consumption and Production (ERSCP) 2010 48, 10– 19. doi:10.1016/j.jclepro.2011.10.006

- Lozano, R., Peattie, K., 2011. Assessing Cardiff University's Curricula Contribution to Sustainable Development Using the STAUNCH(RTM) System. J. Educ. Sustain. Dev. 5, 115–128. doi:10.1177/097340821000500114
- Lukman, R., Glavič, P., 2006. What are the key elements of a sustainable university? Clean Technol. Environ. Policy 9, 103–114. doi:10.1007/s10098-006-0070-7
- Meadows, D., 1998. Indicators and Information Systems for Sustainable Development. The Sustainability Institute, US, 78 pp.
- Newman, J., 2007. An Organisational Change Management Framework for Sustainability. Greener Manag. Int. 2007, 65–75. doi:10.9774/GLEAF.3062.2007.sp.00006
- Rogers, E. R., 2003. Diffusion of Innovations. Free Press (Fifth Edition).
- Rammel, C., Velazquez, L., Mader, C., 2015. Sustainability Assessment in Higher Education Institutions: What and how?, in: Barth, M., Michelsen, G., Rieckmann, M., Thomas, I. (Eds.), Routledge Handbook of Higher Education for Sustainable Development. Routledge, pp. 331–346.
- Razak, D.A., Sanusi, Z.A., Jegatesen, G., Khelghat-Doost, H., 2013. Alternative University Appraisal (AUA): Reconstructing Universities' Ranking and Rating Toward a Sustainable Future, in: Caeiro, S., Filho, W.L., Jabbour, C., Azeiteiro, U.M. (Eds.), Sustainability Assessment Tools in Higher Education Institutions. Springer International Publishing, pp. 139–154.

Sammalisto, K., Sundström, A., Holm, T., 2015. Implementation of sustainability in universities as perceived by faculty and staff – a model from a Swedish university. J. Clean. Prod., Bridges for a more sustainable future: Joining Environmental Management for Sustainable Universities (EMSU) and the European Roundtable for Sustainable Consumption and Production (ERSCP) conferences 106, 45–54. doi:10.1016/j.jclepro.2014.10.015(Verhulst and Lambrechts, 2015)

- Sherry, L. 2003. Sustainability of innovations. J.Interact. Learn. Res. 13 (3), 2009–36.
- Sipos, Y., Battisti, B., Grimm, K., 2008. Achieving transformative sustainability learning: engaging head, hands and heart. Int. J. Sustain. High. Educ. 9, 68–86. doi:10.1108/14676370810842193
- Spira, F., Tappeser, V., Meyer, A., 2013. 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?, in: Caeiro, S., Filho, W.L., Jabbour, C., Azeiteiro, U.M. (Eds.), Sustainability Assessment Tools in Higher Education Institutions. Springer International Publishing, pp. 175–187.
- Steele, R., 2015. Compass Education:Whole School Strategies and Approaches to ESD. AtKisson, Inc., available from: http://atkisson.com/compass-educations-whole-school-approach-to-sustainability/
- Steffen, W., Richardson, K., Rockström, J., Cornell, S.E., Fetzer, I., Bennett, E.M., Biggs, R., Carpenter, S.R., Vries, W. de, Wit, C.A. de, Folke, C., Gerten, D., Heinke, J., Mace, G.M., Persson, L.M., Ramanathan, V., Reyers, B., Sörlin, S., 2015. Planetary boundaries: Guiding human development on a changing planet. Science 347, 1259855. doi:10.1126/science.1259855
- Stephens, J.C., Hernandez, M.E., Román, M., Graham, A.C., Scholz, R.W., 2008. Higher education as a change agent for sustainability in different cultures and contexts. Int. J. Sustain. High. Educ. 9, 317–338. doi:10.1108/14676370810885916
- Stephens, J.C., Graham, A.C., 2010. Toward an empirical research agenda for sustainability in higher education: exploring the transition management framework. J. Clean. Prod., Going beyond the rhetoric: system-wide changes in universities for sustainable societies 18, 611–618. doi:10.1016/j.jclepro.2009.07.009
- Togo, M., Lotz-Sisitka, H., 2013a. Exploring a systems approach to mainstreaming sustainability in universities: a case study of Rhodes University in South Africa. Environ. Educ. Res. 19, 673–693. doi:10.1080/13504622.2012.749974
- Togo, M., Lotz-Sisitka, H., 2013b. The Unit-Based Sustainability Assessment Tool and its use in the UNEP Mainstreaming Environment and Sustainability in African Universities Partnership, in: Caeiro, S., Filho, W.L., Jabbour, C., Azeiteiro, U.M. (Eds.), Sustainability Assessment Tools in Higher Education Institutions. Springer International Publishing, pp. 259–288.
- Townsend, J., Barrett, J., 2015. Exploring the applications of carbon footprinting towards sustainability at a UK university: reporting and decision making. J. Clean. Prod. 107, 164–176. doi:10.1016/j.jclepro.2013.11.004

United Nations, 2015. Transforming our world: the 2030 Agenda for Sustainable Development, Resolution adopted by the General Assembly on 25 September 2015, A/RES/70/1.

Urquiza Gómez, F., Sáez-Navarrete, C., Rencoret Lioi, S., Ishanoglu Marzuca, V., 2015. Adaptable model for assessing sustainability in higher education. J. Clean. Prod. 107, 475–485. doi:10.1016/j.jclepro.2014.07.047

- Vagnoni, E., Cavicchi, C., 2015. An exploratory study of sustainable development at Italian universities. Int. J. Sustain. High. Educ. 16, 217–236. doi:10.1108/IJSHE-03-2013-0028
- Velazquez, L., Munguia, N., Platt, A., Taddei, J., 2006. Sustainable university: what can be the matter? J. Clean. Prod., Sustainability In Higher Education: What is Happening? Sustainability In Higher Education: What is Happening? 14, 810–819. doi:10.1016/j.jclepro.2005.12.008
- Verhulst, E., Lambrechts, W., 2015. Fostering the incorporation of sustainable development in higher education. Lessons learned from a change management perspective. J. Clean. Prod., Bridges for a more sustainable future: Joining Environmental Management for Sustainable Universities (EMSU) and the European Roundtable for Sustainable Consumption and Production (ERSCP) conferences 106, 189–204. doi:10.1016/j.jclepro.2014.09.049
- Waas, T., Verbruggen, A., Wright, T., 2010. University research for sustainable development: definition and characteristics explored. J. Clean. Prod., Going beyond the rhetoric: system-wide changes in universities for sustainable societies 18, 629–636. doi:10.1016/j.jclepro.2009.09.017
- Waheed, B., Khan, F.I., Veitch, B., Hawboldt, K., 2011. Uncertainty-based quantitative assessment of sustainability for higher education institutions. J. Clean. Prod. 19, 720–732. doi:10.1016/j.jclepro.2010.12.013
- Winter, J., Cotton, D., 2012. Making the hidden curriculum visible: sustainability literacy in higher education. Environ. Educ. Res. 18, 783–796. doi:10.1080/13504622.2012.670207
- Wright, T.S.A., 2002. Definitions and frameworks for environmental sustainability in higher education. High. Educ. Policy, Sustainability and Higher Education: Initiatives and Agendas 15, 105–120. doi:10.1016/S0952-8733(02)00002-8



Fig. 1. Terminology through time: Number of Scopus search results found pertaining to "sustainability [...] in higher education" with the [...] terms being "implementation", "integration", "embedding", "mainstreaming", "institutionalisation"; the searched period included 2005 - 2015; the results displayed include academic articles, conference papers, and book chapters after sorting out relevant returns only (see text in **section 2.1** for method applied).



Fig. 2. A conceptual model for defining "sustainability integration throughout all levels of HE", this article deals primarily with LEVEL 3 and 4; based on the concepts and models of: Beringer and Adomßent (2008), and Alonso-Almeida et al. (2015).



Fig. 3. Conceptual model for defining the term "sustainability integration in higher education" and "transformational change" from a whole-of-institution perspective at HEIs (LEVEL 3 in **Fig. 2**), the process is also referred to as the "sustainability maturation curve" in this article. S = sustainability; based on the concepts and models of: Lukman and Glavič (2007), Newman (2007), Rogers (2003), Sharp and Newman (2011), Sherry (2003, in Lozano, 2006), Velazquez et al. (2006).



Fig. 4. Graphic representation of the Accelerator toolset for sustainability change agentry comprising four tools (Compass, Pyramid, Amoeba, StrateSphere) and the VISIS Method; further explanation in **Table 2** and **Section 3.1**.



Fig. 5. Geographical location of the responding HEIs where the Accelerator toolset has been used



Fig. 6. Overall picture of the use of the tools and methods comprising the Accelerator toolset at the responding HEIs



Fig. 7. Overall picture of the **type of institutional practice** in which the Accelerator toolset has been used at the responding HEIs; "cross-institutional" means use by academics and operations in joint efforts



Fig. 8. Overall picture of the *scale of use* of the Accelerator toolset has been used at the responding HEIs



Fig. 9. Overall picture of the *frequency of use* of the Accelerator toolset has been used at the responding HEIs; some institutions have chosen multiple answers to this question



Fig. 10. Overall picture of the *period of use* of the Accelerator toolset has been used at the responding HEIs; as of September 2014

Table 1

The sustainability change agents' toolbox for sustainability in higher education matrix (the "SCAT for HE" matrix) focusing on the change agent position within the HEI ("People dimension") and the institutional practice area where change should occur ("Target dimension") (structure based on the models and concepts by Alonso-Almeida et al. (2014) and Gomez et al (2015); X = marks areas of university practice where the respective TMFAs have been used (i.e. reported in an academic article, based on the references provided); the list is by no means exhaustive and should be taken as a selection of representative examples of existing TMFAs (see **Section 2.2** for methods and terminology used).

"TARGET DIMENSION":						"PEOPLE DIMENSION":			
Existing Tools, Methods, Models, Fra	meworks and Approaches (TMFAs)		Change agent position/ Resp				esponsibility		
		Academic staff		Management staff					
Category/ Name (Reference)	Description	Туре	Teaching	Research	Operations	Engagement & outreach	Administration incl. Assessment & reporting		
Education & Research: Pedagogica									
The case method (1)	Discussion-based teaching requiring active participation of students discussing concrete real-world problems and challenges	Approach	X						
Action and experiential learning (1)	Activities in which students learn by doing including e.g. teamwork, case studies, games, discussions	Approach	Х						
Service learning (SL)(1)	Engaging in active service ("learning with community")	Approach	Х						
Project /and Problem/ Based Learning (PBL/PPBL) (1, 2, 3, 4)	Pedagogic approach in which students work in small groups and solve complex real-world problems (typically involving multi- stakeholder scenarios and conflicts of interest and span disciplinary boundaries)	Approach	X						
Transformative Sustainability Learning (TSL)(5)	Framework based on the "head-hands-heart model" as an organizing principle by which to integrate transdisciplinary study (head); practical skill sharing and development (hands); and translation of passion and values into behavior (heart)	Framework/ Model	Х						
Education & Research: Developing	staff competences TMFAs								
Model for SD competence development and institutionalization (6)	A model for tracking internal and external SD competence development of staff at HEI	Framework/ Model					X		

Education & Research: Research T	MFAs						
Action research (7, 8)	Research approach linking research with interventions in practice in a participatory way	Approach	Х	Х			
Operations: Environmental managen	nent TMFAs						
Carbon Footprinting (9, 10)	Environmental accounting method for calculating greenhouse gas emissions (in CO_2 equivalents)	X		Х			
Ecological Footprinting (11)	Componential method developed by the Global Footprint Network for accounting for environmental impact of land use and greenhouse gas emissions (covering daily consumption needs in global hectares)	Method	X	X	X		X
Environmental Management Systems (EMS, e.g. ISO 14001 and EMAS) (12)	Formal environmental management standards leading to certification of institutions	Method		х	Х		X
Engagement: Outreach and participa	tion TMFAs						
Participatory development (PD) methods (13)	Approaches and methods for participatory processes in HE	Approach, Method	Х	X	X	X	х
Administration/Governance (whole-	-of-institution): Expression of commitment TMFAs						
HE declarations on sustainability (e.g. Talloires Declaration, etc.) (14, 15)	Written expression of commitment to addressing sustainable development by the HEI – typically on international level	Approach					X
Administration/Governance (whole	-of-institution): Change management TMFAs						
Deming spiral - Sustainable University (16, 17)	Spiral model based on the Deming cycle (Plan-Do-Check-Act, PDCA) seeking improvements as an never-ending process for achieving small improvements	Framework/ Model					X
Managerial model - Sustainable University (18)	Model comprises four phases in a strategic management process and four diverging strategies (based on the PDCA)	Framework/ Model					x
Organizational learning towards sustainability model (19)	Model reflecting 4 areas in 4 dimensions of university practice (Teaching & learning, Operation, Research, Outreach) and SD principles	Framework/ Model					Х
Process framework for integrating ESD with management systems (7)	A process framework for integration of quality management and assurance systems to support ESD implementation in HE using the Deming cycle (PDCA).	Framework/ Model					X
Cleaner Production Infused Academic Program for SD (CPIAP- SD) methodology (20)	A methodology via which leaders in higher education could assess the necessity and the urgency for designing training programs that could assist with developing human capital needed to support SD	Method					x

Accelerator (this study)	A set of change agentry tools and method based on sustainable development principles and theories (see Section3 for details)	Method + Tools	X	x	x	x	X**
Administration/Governance (whole	e-of-institution): Sustainability assessment & reporting TMAFs						
Assessment Instrument for Sustainability in Higher Education (AISHE) 1.0 and 2.0 (21, 22)	A star system, enabling universities to acquire 1, 2, 3 or 4 stars, based on participatory assessment at HEIs (first developed in the Netherlands)	Method/ Tool	X	х	Х	х	X
Adaptable model for assessing sustainability in HEIs (AMAS) (21)	A model for sustainability assessment based on a four tiered hierarchy, with three main criteria: institutional commitment, example setting, and advancing sustainability	Method/ Tool					X
Alternative University Appraisal (AUA) (21, 22, 23)	An assessment system comprising three components: Self- Awareness questions, Dialogue and Benchmark Indicator Questions focusing on Governance, Education, Research and Outreach (developed by the ProSPER Network)	Method/ Tool	X	Х	Х	Х	X
Education for Sustainable Development and Global Citizenship (ESDGC) Framework (24)	Scoring system for HEIs in 5 areas (Commitment and Leadership, Teaching and Learning, Institutional Management, Partnerships, Research and Monitoring) using a four-level categorization system based upon an intuitive "traffic light system" (specific for Wales)	Method, Tool					X
Graphical Assessment of Sustainability in Universities (GASU) (21, 25)	Holistic scoring system in Economic, Environmental, Social, Educational, and Inter-linked issues and dimensions and Profile (Radar chart); based on GRI guidelines and adapted for HEIs	Method/ Tool					X
Global Reporting Initiative (GRI) reporting standards (26)	International standards for sustainability reporting	Method/ Tool					x
INDICARE model (27)	A model developed from a qualitative framework aiming to assist in the assessment of participatory processes for sustainability implementation in HEIs	Framework/ Model				Х	X
Sustainability Tool for Assessing UNiversities' Curricula Holistically (STAUNCH) (21, 28)	Auditing tool for sustainability in university curricula, it evaluates course descriptions by grading them against 40 criteria	Method/ Tool	X				X
Sustainability Tracking and Assessment Rating System (STARS) (21, 22)	A self-reporting 'framework' for HEIs to measure their sustainability performance where institutions acquire Bronze, Silver, Gold, Platinum and Reporter rating based on performance (offered by AASHE)	Method/ Tool	X	Х	Х	Х	X

^{**} Questions on Assessment and reporting were not part of the survey, however, the use of the Accelerator in this dimension was revealed from the respondent comments in the extended survey

Uncertainty-based quantitative assessment of sustainability for HEIs (uD-SiM model) (21, 29)	Sustainability assessment index for HEIs based on a decision- making model	Method/ Tool	X
Unit-Based Sustainability Assessment Tool (USAT) (21, 30, 31)	A tool for 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 (supported by UNEP and MESA)	Method/ Tool	X

References: (1) Figueiró and Raufflet (2015); (2) Brundiers and Wiek (2013); (3) Du et al. (2013); (4) Leal Filho et al. (2016); (5) Sipos et al. (2008); (6) Sammalisto et al. (2015); (7) Holm et al. (2015); (8) Waas et al. (2010); (9) Townsend and Barrett (2015); (10) Lozano and Peattie (2011); (11) Lambrechts and Van Liedekerke (2014); (12) Disterheft et al. (2012); (13) Bullock and Hitzhusen (2015); (14) Lozano et al., (2013b); (15) Wright (2002); (16) Lukman and Glavič (2006); (17) Vagnoni and Cavicchi (2015); (18) Velazquez et al. (2006); (19) Cebrián et al. (2013); (20) Khalili et al. (2015); (21) Urquiza Gómez et al. (2015); (22) Rammel et al, (2015); (23) Razak et al. (2013); (24) Glover et al. (2013); (25) Lozano et al. (2013a); (26) Alonso-Almeida et al. (2015); (27) Disterheft et al. (2016); (28) Glover and Peters (2013); (29) Waheed et al. (2011); (30) Togo and Lotz-Sisitka (2013a); (31) Togo and Lotz-Sisitka (2013b)

Table 2

Overview of the tools and methods comprising the Accelerator toolset.

Tool/Method name	Background concept/theory	Practical uses
Compass (Sustainability Compass, or The Compass of Sustainability)	Daly's triangle reinterpreted by Meadows (Daly, 1973; Meadows, 1998)	Visual conceptualisation tool for: - introducing people to sustainability - leading discussion - reviewing indicators and trends
Pyramid Sustainability Pyramid, or The VISIS Pyramid)	System dynamics concepts (Meadows, 1998) combined with group process and consensus building	Framework & group process tool for: - learning about SD - supporting groups in SD strategic planning - building consensus on new goals and directions
moeba The Amoeba Game, or The nnovation Diffusion Game)	Innovation diffusion (Rogers, 2003) modified by AtKisson (1991)	Practical model/game for: - thinking about change and innovation - understanding how SD ideas are adopted by groups
strateSphere	Strategic planning, consulting practice	Strategic planning tool for: - developing a formal strategic analysis, plan, and relevant performance metrics
VISIS Method	Vision – Indicators – Systems – Innovation – Strategy (integrates all of the above)	Conceptual method for: - mapping, analyzing and approaching integrated SD processes

Table 3.Examples of primary uses of the Accelerator toolset at the responding HEIs.

Dimension of institutional practice	Uses of the Accelerator toolset								
Teaching	 Teaching programs and courses (both undergraduate and graduate level) Learning activities for students as part of workshops Part of student assignment (analysis of a sustainable development case study) 								
Research	Basis of action research projects								
Operations	 Framework for strategic planning (campus operations, community engagement) Management of organizational change processes (university sustainability policies) 								
Outreach	 Eased communication/discussions (internal, external) via common framing of sustainability Structuring of events (conference, workshop) 								
Assessment and reporting	Use of Compass as organising structure for sustainability reporting at the university level								

Table 4.

Detailed overview of the use of the Accelerator toolset across the various dimensions of institutional practice at the individual responding HEIs (use marked by 'X');

"11 - 117" = HE institution 1– 17 that responded to the survey; "CA" = Canada, "US" = United States, "TH" = Thailand, "ID" = Indonesia, "AU" = Australia, "CZ" = Czechia, "DE" = Germany, "IS" = Iceland, "IE" = Ireland, "PL" = Poland, "SE" = Sweden, "RU" = Russia, "UK" = United Kingdom; "T" = teacher (lecturer, professor), "R" = researcher (research staff without teaching commitments), "M" = manager (university operations officer), "T; M" = response from two individuals (teacher and manager), "T/M" = teacher/manager in one person (e.g. former dean), "M/T" = manager of teaching programme/network

	Ameri	cas	Asia			Aust	ralia	Europ	е								
Institution (Country)	I1 (CA)	I2 (US)	I3 (TH)	I4 (ID)	I5 (ID)	I6 (AU)	I7 (AU)	I8 (CZ)	I9 (DE)	I10 (IS)	I11 (IE)	l12 (PL)	I13 (PL)	I14 (SE)	I15 (SE)	l16 (RU)	I17 (UK)
Respondent position	М	Т; М	Т; М	Т	Μ	Μ	Т; М	R	Т	T/M	т	т	т	M/T	M/T	Т	Т
Teaching		х	Х	х		х	Х		Х	Х	Х	Х	Х	Х	Х	х	Х
Research		Х				Х				х				Х			
Campus operations	х	х	Х		Х		Х			Х							
Internal outreach	х	х	х				х			Х	Х						
External outreach		Х	х			Х	х	Х		Х							
Cross- institutional		х								Х							