

Sustainability Assessment: The Role of Indicators

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

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

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Introduction

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

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

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

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

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

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

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

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

Sustainability Indicators Approaches and Frameworks

Approaches for Developing Indicators

It is possible to say that the current era of assessing development progress began in the 1920s in the United States, when economic indicators started to be developed to guide economic decision making (Hardi and Zdan 1997). Traditional indicator grouping, based on the main categories of economic, social, and environmental

indicators, was discrete until the 1980s (Seasons 2003). They were developed and applied separately to assess trends of specific policy areas. What we can see, from this decade on, is the upcoming of multidisciplinary approaches, replacing monodisciplinary views on the design of indicators (Briassoulis 2001). This situation changed under the influence of three powerful integrative conceptual models born at the time: sustainable development, quality of life, and healthy cities (Seasons 2003). Since then, sustainability indicators have been at the forefront of extremely rich political, academic, scientific, and community debates. Innumerable proposals for specific indicators, conceptual frameworks, methodologies, development criteria and principles, presentation and communication methods, participative tools, among others, have been discussed to structure the process for indicator creation.

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

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

As a criticism to this linearity, several authors started to question: have sustainability indicators been so helpful as this approach assumes? Are they being

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

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

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

As such, the ‘governance’ approach (Pastille 2002; Gudmundsson 2003; Morel Journal et al. 2003; Astleithner et al. 2004; Hezri and Dovers 2006; Rosenström 2006; Terry 2008; Yli-Viikari 2009; Moreno Pires and Fidélis 2012, among others) goes further into detail in the study of the effects of indicators in governance for

sustainable development. This approach seeks to understand and explain the way sustainability indicators change or steer institutional arrangements for sustainable development and how they are limited or facilitated by these arrangements. Indicators are considered as processes with potential to shape new networks, bring new stakeholders to sustainability debates, promote new institutional arrangements, or new communication channels that steer policy integration horizontally and vertically (Holman 2009; Moreno Pires 2011).

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

Conceptual Frameworks for Indicator Organization and Application

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

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

society. Despite the large variety of frameworks developed, many of them are quite similar in their methodological approaches and are mostly adaptations of the PSR model, based on causality chains.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 1 Examples of sustainability indexes

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

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

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

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

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

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

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

A less explored approach has been devoting by other scholars that tend to focus on the participatory dimensions and effective communication strategies of sustainability indicators (e.g., Djordjevic and Cotton 2011) and how indicators or reporting can promote real change. Interestingly, Tilbury (2011) assumes that although universities and colleges have committed to multiple international

declarations and agreements toward sustainability (such as the Bologna Charter, The Halifax Declaration, the Talloires Declaration, or the Copernicus Charter for Sustainable Development) practice shows that they are still failing to reach the core of staffs, students, and stakeholders or indeed influence the culture of institutions. In the same way argues the study of Fonseca et al. (2011) but regarding sustainability reporting, particularly in Canadian universities. They sustain that although practice of sustainability reporting is still uncommon, diverse in contents, rationales, frameworks, and indicators, with a restricted scope (emphasizing eco-efficiency and green architecture), the major problem remains in their scarce ability to inform sustainability-oriented decisions (Fonseca et al. 2011). Furthermore, it is argued that since those projects in Canada are mostly bottom-up processes (with the impetus of sustainability offices or student groups) they lack commitment and accountability from the top, they are not largely communicated, and their potential value has been weakened. This is why they sustain the need to explore research deeper into the way indicators can be effectively communicated and debated widely (Fonseca et al. 2011).

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

Final Remarks

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

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

Higher education institutions have here a critical dual role. In one way, they are decisive stakeholders to influence and strengthen the development and use of sustainability indicators by society, at different scales and scope. In another way, they must be leading model institutions where sustainable development practices should be embedded and where sustainability indicators, more than empty

assessment tools, need to be developed aiming to promote real change. Critical dilemmas emphasized in this chapter, such as the harmonization versus context-specific indicators, ranking and comparison versus specific and tailored indicator systems, or the frameworks and approaches to consider, will certainly frame future studies and debates. However, more than this is needed. Facing the development of sustainability indicators as processes that can deliver change, implies to consider them as framed by specific institutional contexts, where new communication channels, the inclusion of new stakeholders to sustainability debates or the need to strength decision making are critical issues to explore.

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