WIRTSCHAFTS
UNIVERSITÄT
WIEN VIENNA
UNIVERSITY OF
ECONOMICS
AND BUSINESS

EFMD
EQUIS
ACCREDITED

# ePub^WU Institutional Repository

Florian Findler and Norma Schönherr and Rodrigo Lozano and Daniela Reider and Robert-Andre Martinuzzi

The impacts of higher education institutions on sustainable development: A review and conceptualization

Article (Published)
(Refereed)

http://epub.wu.ac.at/

# International Journal of Sustainability in Higher Education

The impacts of higher education institutions on sustainable development: A review and conceptualization

Florian Findler, Norma Schönherr, Rodrigo Lozano, Daniela Reider, André Martinuzzi,

## Article information:

## For Authors

If you would like to write for this, or any other Emerald publication, then please use our Emerald
for Authors service information about how to choose which publication to write for and submission
guidelines are available for all. Please visit www.emeraldinsight.com/authors for more information.

## About Emerald www.emeraldinsight.com

Emerald is a global publisher linking research and practice to the benefit of society. The company
manages a portfolio of more than 290 journals and over 2,350 books and book series volumes, as
well as providing an extensive range of online products and additional customer resources and
services.

Emerald is both COUNTER 4 and TRANSFER compliant. The organization is a partner of the
Committee on Publication Ethics (COPE) and also works with Portico and the LOCKSS initiative for
digital archive preservation.

# The impacts of higher education institutions on sustainable development

## A review and conceptualization

Florian Findler and Norma Schönherr
*Vienna University of Economics and Business, Vienna, Austria*

Rodrigo Lozano
*University of Gävle, Gävle, Sweden, and*

Daniela Reider and André Martinuzzi
*Vienna University of Economics and Business, Vienna, Austria*

## Abstract

**Purpose** – This paper aims to conceptualize impacts of higher education institutions (HEIs) on sustainable development (SD), complementing previous literature reviews by broadening the perspective from what HEIs do in pursuit of SD to how these activities impact society, the environment and the economy.

**Design/methodology/approach** – The paper provides a systematic literature review of peer-reviewed journal articles published between 2005 and 2017. Inductive content analysis was applied to identify major themes and impact areas addressed in the literature to develop a conceptual framework detailing the relationship between HEIs' activities and their impacts on SD.

**Findings** – The paper identifies six impact areas where direct and indirect impacts of HEIs on SD may occur. The findings indicate a strong focus on case studies dealing with specific projects and a lack of studies analyzing impacts from a more holistic perspective.

**Practical implications** – This systematic literature review enables decision-makers in HEIs, researchers and educators to better understand how their activities may affect society, the environment and the economy, and it provides a solid foundation to tackle these impacts.

**Social implications** – The review highlights that HEIs have an inherent responsibility to make societies more sustainable. HEIs must embed SD into their systems while considering their impacts on society.

**Originality/value** – This paper provides a holistic conceptualization of HEIs' impacts on SD. The conceptual framework can be useful for future research that attempts to analyze HEIs' impacts on SD from a holistic perspective.

**Keywords** Higher education institutions, Sustainability, Impact, Review, Sustainable development

**Paper type** Literature review

## Introduction

Since the UN Conference on the Human Environment in 1972, higher education institutions (HEIs) have increasingly undertaken active measures to contribute to sustainable development

(SD) (Amaral *et al.*, 2015). SD in HEIs has been promoted, for example, through declarations and charters (Lozano *et al.*, 2013b), the redesign of curricula (Du *et al.*, 2013; Qian, 2013), regional and global partnerships (Kawabe *et al.*, 2013) and sustainable campus initiatives (Vaughter *et al.*, 2016). HEI engagement with SD has significantly increased since 1987 (Lozano *et al.*, 2013b) and was further promoted through the UN Decade of Education for Sustainable Development (DESD, 2005-2014), which aimed to integrate the principles of SD into all aspects of HEIs (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2014).

Several literature reviews have been published, providing a comprehensive picture of the state of knowledge on the implementation of initiatives and commitments for SD and the motivations of HEIs to engage with the topic. For example, Wiek *et al.* (2011) reviewed the significant body of literature on education for SD and identified key competencies in sustainability for academic program development. Wu and Shen's (2016) systematic review notes that an integrated understanding of SD in higher education curricula (beyond environmental and engineering-related topics) has only recently emerged. Other issues that have received significant attention include the implementation of sustainability initiatives (Velazquez *et al.*, 2005), regional partnerships for SD (Karatzoglou, 2013) and emerging practices such as sustainability reporting and assessment in HEIs (Ceulemans *et al.*, 2015). Within this discourse, campus operations have received the largest share of scholarly attention (Lozano *et al.*, 2015).

While these reviews have greatly improved our understanding of what HEIs do in pursuit of SD, less is known about what they actually achieve by their various activities for society, the natural environment and the economy, i.e. what impact they have on SD. Vaughter *et al.* (2013) note this research gap in their examination of comparative empirical research. They find that the literature on SD in HEIs remains mostly focused on case studies within institutional operations, with little examination of broader SD policies or impacts on SD. Koehn and Uitto (2014, p. 624) similarly highlight the impacts on SD as an under-researched aspect in the discourse, which has tended to neglect that "impact involves real-world changes in ecological sustainability, policies, and people's well-being".

This poses two problems: First, for many HEIs, the communication of their impacts on SD is becoming an essential part of satisfying emerging accountability expectations from public and private funders, policymakers, accreditation agencies, students and faculty (Bonaccorsi *et al.*, 2010). Second, there is a lack of clarity and a divergent understanding of the concept (Gooch *et al.*, 2017; Koehn and Uitto, 2014). Greater clarity on and deeper knowledge of such impacts is a prerequisite for well-informed strategic decisions and improved contribution to SD (Lozano *et al.*, 2013a).

The purpose of this article is to systematically review the existing literature on impacts in higher education to provide an integrative conceptualization of the impacts of HEIs on SD. In this context, the impacts are understood to be the effects an HEI has on its stakeholders, the natural environment, the economy and society. This article addresses the following two research questions:

*RQ1.* What themes are addressed within the literature of the impacts of HEIs on SD?

*RQ2.* What are the impact areas outside the HEI system in which change occurs?

This literature review is organized as follows. The second section provides insights into the conceptual basics of the impacts of HEIs on SD. The third section presents the method and the approach to the systematic literature review. The fourth section lays out the quantitative and qualitative results, and the fifth section discusses these results and provides a conceptual framework of HEIs' impacts on SD. The last section concludes the review.

**The impacts of higher education institutions on sustainable development**
According to Maas and Liket (2011), impacts generally refer to the effects caused by an organization or an intervention (policy, program, project, product, technology or measure) that occur outside the organization in society or the natural environment. Several definitions of "impact" have been advanced for the HEI context. The UK's Research Excellence Framework (REF) describes research impact as "an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia" (REF, 2016, para. 1). For Koehn and Uitto (2014, p. 624), the impacts of sustainability initiatives of HEIs consist of "real-world changes in ecological sustainability, policies, and people's well-being." Thomas and Ormerod (2017) differentiate between traditional academic impacts (e.g. scholarly influence) and nonacademic impacts on civil society, public policies or media.

According to Gupta and Singhal (2017), impacts arise from the core elements of the HEI system (as proposed by Lozano *et al.*, 2013b). Sustainability activities in these core elements cause overall social, environmental and economic impacts (Gupta and Singhal, 2017). Impacts on SD materialize along complex pathways, particularly in the area of research and education (Koehn and Uitto, 2014). They can be direct and indirect, intended and unintended and positive and negative; they may present themselves after a significant time lag, at a distance from the HEI's location, or at a systems level (Lebeau and Cochrane, 2015). As Bowen (2018, p. 26) notes, "For individuals, the outcomes of higher education are harvested over adult lifetimes averaging fifty to sixty years after graduation from college. For society the impacts may persist through centuries." This complexity makes the measurement of impacts challenging, and, consequentially, impacts are usually not systematically considered part of sustainability assessments in higher education (Yarime and Tanaka, 2012).

Impacts in this article are, therefore, to be understood as the effects that an HEI has outside of its organizational or academic boundaries – namely, on its stakeholders, the natural environment, the economy and society. This includes the impacts of the HEI as an organization, and the impacts caused by activities in the core elements (Lozano *et al.*, 2013b): education, research, campus operations, outreach, campus experiences, institutional framework and assessment and reporting. Outreach activities (e.g. community teaching) are not regarded as impacts because they take place within the sphere and under the direct control of the HEI and should not be confused with their potential effects (e.g. contribution to school and career achievements).

**Methods**
This article follows the systematic review process proposed by Denyer and Tranfield (2009) and applied by several other studies (Ceulemans *et al.*, 2015). This process consists of five consecutive steps:

(1) question formulation;
(2) locating studies;
(3) study selection and evaluation;
(4) analysis and synthesis; and
(5) reporting and applying the results.

Building on the research questions provided in the Introduction (Step 1), this article used the ProQuest and the ScienceDirect electronic databases to find studies to review. The articles were all written in English and published in peer-reviewed, scholarly journals, which are

regarded as the most useful sources for literature reviews (Saunders *et al.*, 2012). The publication time span ranged from 2005, the starting year of the DESD, to 2017.

Due to the lack of clarity in understanding impacts in the literature, a combination of several keywords was searched among the publication titles and abstracts. The keywords included the concept of sustainability in HEIs and related terminology and the term "impact" in different application contexts (e.g. research impact). The keyword search aimed to identify relevant articles within and beyond the sustainability literature. In the first step, a tag cloud was created to identify relevant studies in the fields of HEIs and SD; it consisted of the following search terms: *("higher education" OR "campus" OR "universit*" OR "academia" OR "college*") AND ("sustainab*" OR "sustainable development" OR "Green") AND ("outreach" OR "impact*" OR "assessment")*. The same approach was followed in the second step of the search to capture additional impact-relevant articles with the following search terms: *("higher education" OR "universit*") AND ("research impact*" OR "economic impact*" OR "social impact*" OR "ecological impact*" OR "impact assessment" OR "outreach")*.

After the exclusion of duplicates, book reviews, editorials, commentaries and keynotes, the studies were manually and independently checked for appropriate content to ensure that all articles dealt with SD issues in HEIs. This resulted in a sample of 429 articles. In the next step, the sample was screened in light of the understanding of "impact" provided in the previous section, namely, as the effects an HEI has outside of its organizational boundaries on its stakeholders, the natural environment, the economy and society. Building on this distinctive characteristic, all articles addressing the impacts of an HEI on SD were included, while articles solely addressing sustainability activities within organizational boundaries were eliminated. The final sample consisted of 113 articles, which were analyzed in the review.

The studies in the final sample were subjected to inductive content analysis using the MAXQDA 12 qualitative analysis software (Verbie, 2016). Content analysis allows for the systematic reduction of sources and analyzes document characteristics in quantitative and qualitative manners to identify themes (Berg, 2001; Krippendorff, 2004). The articles were coded for journal distribution, date of publication and applied research method to support the quantitative analysis. The content analysis of the impacts of HEIs on SD used a concept-centric approach (Webster and Watson, 2002).

As with other reviews in higher education (Bizerril *et al.*, 2018), the basis of the content analysis was the concept of the seven core elements by Lozano *et al.* (2013b): education, research, campus operations, outreach, campus experiences, institutional framework and assessment and reporting. Each paper was classified into one, or, in a few cases, more than one core element. Studies that did not fit into this categorization were classified as "generalist papers." This category included papers dealing with impacts of the entire HEI. The major findings were systemized for each category and synthesized into a set of themes emerging from the literature. Based on this, a conceptual framework of the impacts of HEIs on SD was derived.

The first two authors independently conducted all steps of the analysis to ensure reliability (Seuring and Müller, 2008). Inter-coder reliability was high (Kappa value of 0.877), and any differences among the coders were resolved through discussion until consensus was achieved.

Like other systematic literature reviews (Ceulemans, *et al.*, 2015), this study also has limitations. First, the focus on peer-reviewed journals excluded conference papers, reports, book chapters and sources from grey literature. Second, ProQuest and ScienceDirect are not the only databases available. To ensure that all relevant journals in the research area were considered, the results were crosschecked with recent literature reviews in the field of higher

education (Blanco-Portela *et al.*, 2017; Ceulemans *et al.*, 2015). To identify all relevant studies, the term "universit*" was used as a search term. This led to some irrelevant results, due to authors' affiliations, which usually included "university." Inappropriate papers were excluded by manually checking all articles for appropriate content. Third, content analysis can sometimes be prone to the misinterpretation of documents. The use of MAXDAQ 12 and performing the review as a team reduced the likelihood of such flaws and enhanced the reliability of the results.

## Findings of the literature review

The literature reviewed consisted of 113 articles representing the state of knowledge on HEIs and impacts on SD. There was a steady increase in publications between 2005 and 2017, which shows this relatively recent field of study is still emerging. The largest number of articles was published within the past four years (56.64 per cent of the sample). Papers published between 2005 and 2009 were primarily case studies; qualitative and quantitative studies mainly occurred since 2010. Overall, the sample consisted mostly of case studies (48.67 per cent) and quantitative studies (20.35 per cent). Theoretical contributions (14.16 per cent), mixed methods (8.85 per cent), qualitative empirical research (6.20 per cent) and literature reviews (1.77 per cent) are rather limited, having been published only in the later years of the sample period.

The discourse on the impacts of HEIs on SD remains relatively fragmented and spread over a wide range of journals, with 72.57 per cent of the sample from journals with not more than three contributions. *Journal of Cleaner Production* had the largest number of contributions (13.27 per cent of the sample). Other strongly represented journals in the sample are *Journal of Higher Education Outreach and Engagement* presenting 7.08 per cent of the sample, and *International Journal of Sustainability in Higher Education,* which has published 3.54 per cent of the contributions in the sample. *Journal of Cleaner Production* and *International Journal of Sustainability in Higher Education* are the most prominent journals in other literature reviews of sustainability in HEIs (as discussed by Blanco-Portela *et al.*, 2017 and Ceulemans *et al.*, 2015).

As shown in Figure 1, the results of the inductive content analysis reveal a strong focus on the core elements outreach (21.99 per cent) and assessment and reporting (19.86 per cent). None of the articles was classified under the core element institutional framework. Thirty articles (21.28 per cent) were classified into the category generalist papers. Some articles dealt with crosscutting themes and were categorized into two core elements. Selected findings of each core element are presented in detail below.

The *outreach* activities of HEIs are discussed in 31 articles. This category consists of a large part of case studies reporting on specific local outreach projects and their impacts. The main emphasis of these studies is on school collaborations and the support of small
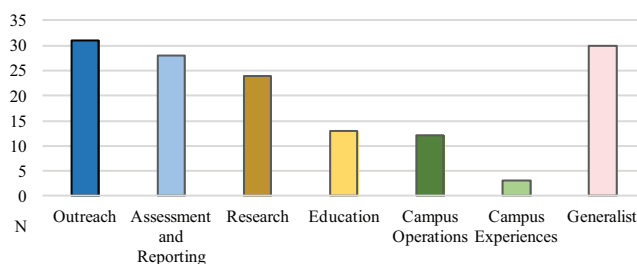


**Figure 1.**
Distribution of articles among the core elements

businesses and the local community. Anand *et al.* (2015) illustrated how students' understanding of SD can be fostered by their participation in a regional education initiative aimed at integrating SD into the member institutions. Other studies exemplified the support of HEIs to establish a high school archival program (Fernekes and Rosenberg, 2008), to reopen a closed school (Officer *et al.*, 2011), and to educate high school students (Lynch, *et al.*, 2005). The support of local businesses is described by Hill *et al.* (2016), who analyzed the process of knowledge exchange from an HEI to rural businesses, and Riebe (2012), who studied the benefits of university-based entrepreneur centers for women. These works show positive impacts of outreach engagement, which is confirmed by MacPherson and Zilokowski (2005) for university-based industrial extension services. The increasing importance of outreach activities and their contribution to economic development is highlighted by Rubens *et al.* (2017), who examined the benefits of policies that reward staff engagement in outreach activities. Several studies illustrate the impacts of local outreach activities on different populations. For example, Anstadt (2009) demonstrated how a community connection program managed to reduce the social isolation of seniors, caregivers and international students, while providing foreign students the opportunity to practice the local language and to learn about local culture. Scull and Cuthill (2010) examined a project that supports access to higher education for people from marginalized socioeconomic backgrounds and highlight the importance of a long-term strategy as success factor for the project. Patterson *et al.* (2014) analyzed the effects of community-based research and outreach to the reduction of homelessness. There is also a variety of other studies focusing on outreach projects that aim to foster SD in local communities (Trencher *et al.*, 2014). Other studies such as Lehmann *et al.* (2009) emphasized the positive impacts of outreach activities on the HEI itself. They concluded that HEIs benefit from such engagement by improving their ability to cope with emerging SD problems and developing more successful SD education programs.

Twenty-eight studies address the core element *assessment and reporting*. These articles applied a variety of different approaches, such as simulations (Pastor *et al.*, 2013) and input–output models (Agiomirgianakis *et al.*, 2017) to examine socioeconomic impacts of HEIs. Roessner *et al.* (2013) used an input–output model to evaluate the economic impacts of licensed commercialized research inventions. Pienaar-Steyn (2012) proposed the millennium development goals (MDGs) as framework for the development of monitoring tools for the evaluation of community outreach engagement, while Lynch-Alexander (2017) discussed the Lynch Outreach Assessment model (LOAM) as a tool for HEIs to assess their outreach engagement. Carteron *et al.* (2014) analyzed the potential of a sustainability literacy test for students as a monitoring system for tracking educational impacts. The reviewed studies also used footprint and inventory analyses to assess greenhouse gas (GHG) emissions (Li *et al.*, 2015) or combined life cycle assessments with material flow analysis to evaluate the metabolism of HEIs (Lopes Silva *et al.*, 2015).

Twenty-four articles focused on the nonacademic impacts of *research*. These articles addressed impacts on policy, research uptake in business practice, societal impacts and the impacts of co-creation research. Aguinis *et al.* (2014) argued for the adoption of a pluralistic concept of research impacts that considers also nonacademic stakeholders and fosters engaged scholarship to increase the relevance of research. In the same vein, Bozeman and Youtie (2017) studied the socioeconomic impacts of government funded research through a case analysis of four publicly funded research projects and provide a framework to compare such projects and their impacts. Marcella *et al.* (2016) concluded that the REF increases awareness of nonacademic impacts among researchers. The interview data of Smith and Stewart (2017), however, revealed certain concerns about how the REF works in practice.

Research impacts on the national economy are estimated based on a national input–output model with licensing of research inventions to industry by Roessner *et al.* (2013). Their estimates indicate a significant impact on gross domestic product (GDP) and employment. Regarding economic impacts, it is argued that most university spin-off companies remain small, as most of them are "technology lifestyle businesses not dynamic high-growth potential start-ups" (Harrison and Leitch, 2010, p. 1241). The uptake of research by policymakers and other practitioners is examined in the case of medical (Balas and Elkin, 2013), social science (Cherney *et al.*, 2015) and tourism research (Thomas and Ormerod, 2017). Thomas and Ormerod (2017) pointed out that research with high academic citation scores is also likely more cited by policymakers and practitioners. Impacts of action research (Banks *et al.*, 2017; Haigh, 2006) and co-creation (Greenhalgh *et al.*, 2016) are also discussed. For instance, Greenhalgh *et al.* (2016) identified key principles for the success of co-creation activities and highlighted the importance of metrics apt to capture complex impact pathways linking such activities and their potential societal impacts.

The impacts of *education* on SD are exemplified in 13 articles that have their thematic focus on sustainable lifestyles, economic impacts, distance learning and impacts on culture. Rodríguez-Barreiro *et al.* (2013) highlighted the relationship between the conversation perspective in education programs and students' sustainability intentions and behaviors. Rauch and Hulsink (2015) and Fretschner and Weber (2013) examined the impact of entrepreneurship education on entrepreneurial attitudes, intentions and behavior. Their studies indicated an effect of program or course participation on willingness to engage in entrepreneurial activities. Jones *et al.* (2017) concluded that entrepreneurship education helps to foster business start-ups and fosters employability. Escobar-Tello and Bharma (2013) described an education project that resulted in the reduction of students' energy consumption and the enhancement of their happiness to promote sustainable lifestyles. Crucial for the project's success was the implementation of a reward system and a social network platform for information sharing among the participants. The reduction of GHG emissions was discussed in the context of distance learning (Roy *et al.*, 2008) and online education (Versteijlen *et al.*, 2017). Both studies concluded that distance learning contributes to the reduction of student GHG emissions by reducing travel and energy consumption on campus. GHG emissions of e-learning are slightly lower than those associated with print-based distance learning (Roy *et al.*, 2008). Yao and Bai (2008) studied the economic and cultural impacts of international students. They concluded that student exchange is particularly beneficial for cultural diversity and exchange in rural areas.

The category of *campus operations* comprised 11 case studies and one theoretical contribution. These studies mainly addressed impacts on the natural environment. Three case studies solely discussed the impacts of GHG emissions of campus operations with a particular focus on the indirect emissions caused by the consumption of staff (Gómez *et al.*, 2016), student behavior (Li *et al.*, 2015) and institutional purchases (Thurston and Eckelman, 2011). All three studies highlighted the significance of indirect GHG emissions, which comprise a significant share of the overall carbon footprint of HEIs (up to 80 per cent in the case of the University of Castilla-La Mancha, see Gómez *et al.*, 2016). Hancock and Nuttman (2014) identified staff and student transport as an important contributor to indirect GHG emissions and highlighted the importance of behavior change toward sustainable modes of transport. To achieve behavior change and a reduction of individual staff and student transport, Rotaris and Danielis (2015) considered bus subsidies and parking restrictions as effective. Two articles examined the impacts of land and water use (Chen *et al.*, 2016) and generated waste and water use (Strasburg and Jahno, 2017) in relation to campus cafeterias and restaurants. Chen *et al.* (2016) argued that environmental impacts of ingredients

strongly vary depending on their provenance and that the adoption of a lacto-vegetarian diet can have both positive and negative environmental impacts. In this context, Barlett (2011) highlighted the importance of campus sustainable food projects to foster alternative food systems. Another aspect of campus operations is the relationship between the campus and its surrounding area. Muller and Tempelhoff (2016) pointed out the relevance of the environmental status of the campus in the context of local communities. Lee (2014) concluded that campus noise emissions not only negatively affect on-campus activities (e.g. student learning) but also the surrounding area.

Three articles address *campus experiences* and discuss societal challenges. Orme and Coghill (2014) explored how sensible drinking patterns are facilitated on UK campuses. Their study highlights the importance of alcohol policies, staff training and community involvement to promote sensible drinking habits among students. The second paper in this category examines the impacts of green campuses on students' health (Hipp *et al.*, 2016). This study indicated a relationship between the campus greenness that students perceive and the quality of their lives. In the third article, Kermath (2007) examined the impacts of a campus and urban landscape project aiming to foster biodiversity and ecological literacy by expressing sustainability values.

Thirty papers were classified within the *generalist* category, which included papers that could not be assigned to one of the core elements. Such studies discuss impacts caused by the entire HEI (rather than a single core element). Ten of these studies analyze the regional economic impacts of HEIs (Alves *et al.*, 2015), while other studies focus on contributions to regional socioeconomic development (see Robinson and Adams; Saúde *et al.*, 2014). The local economic impacts of HEIs are caused by spending on goods and services and spending by staff and students, as well as by indirect effects on local supply chains, e.g. via job creation (Alves *et al.*, 2015). Estimates of GDP contributions vary between 2 and 11 per cent (Alves *et al.*, 2015). Robinson and Adams (2008) examined how HEIs contribute to regional regeneration and neighborhood renewal. They concluded that in the UK many HEIs contribute to regeneration, but there is still untapped potential to strengthen deprived areas. Hubbard (2008) analyzed the impacts of HEIs on demographics. He considered policies as an instrument to integrate students into the local community to prevent social and cultural problems caused by "studentification," i.e. the effect of growing student populations in the area around an HEI. Orme and Dooris (2010) emphasized the enormous potential of HEIs to influence society. They introduced the concept of a "healthy university" that follows a whole system approach and aims to leverage the synergies between SD, public health and climate change mitigation.

## Discussion

The growing number of publications on the impacts of HEIs on SD since 2014 illustrates the increasing relevance of the growing field of study, in practice and academia (Bonaccorsi *et al.*, 2010; Wals, 2014). The review shows that the literature on the SD impacts of HEIs have been mostly case studies that largely focus on specific HEIs and their impacts on society (Anstadt, 2009; Escobar-Tello and Bharma, 2013), the economy (Alves *et al.*, 2015) or the natural environment (Chen *et al.*, 2016; Thurston and Eckelman, 2011). The reviewed single case studies provide rich narratives on individual HEIs in the context of SD impacts, but there remains a lack of whole institution and holistic approaches and perspectives. This is confirmed by the fact that none of the contributions addresses the institutional framework, despite the importance of broad-scale policies to facilitate the implementation of SD across all core elements of HEIs (Lozano *et al.*, 2013b). A whole institution approach, as called for by the DESD (UNESCO, 2014), would require a shift of attention from activities

implemented in specific core elements to a focus on the natural environment and a sustainable society as integrative going concern.

Across the reviewed literature, there is an apparent focus on specific projects and economic impacts. Due to predefined tasks, a comprehensive examination of project impacts is less challenging compared with an assessment of the complex pathways between research and educational activities and their impacts on SD. Studies on economic impacts can make use of a variety of methods to determine and aggregate the effects of HEIs' activities on local, regional and national economies (e.g. input–output systems proposed by Agiomirgianakis *et al.*, 2017). The difficulty of systematically accounting for the impacts of HEIs on SD is exacerbated by many impacts occurring with significant time lags and cannot always be directly attributed to specific core elements. Such indirect impacts (GHG emissions caused by students, Gómez *et al.*, 2016; entrepreneurial activities of graduates, Jones *et al.*, 2017) pose significant assessment challenges. In contrast, direct, short-term impacts can be much more easily observed, described and quantified (GHG emissions caused by operations, contribution to local economy). Tackling the complexity of causal pathways between activities and indirect impacts would be an important step toward fulfilling the requirements of the whole institution approach (UNESCO, 2014).

The impacts of HEIs on SD must account for two fundamental dimensions. First, impacts can be conceptualized depending on the extent to which they are specific to a core element or integrative in nature. Second, impacts must be considered whether they are directly (short term effects) or indirectly (long-term effects) attributable to HEIs' activities. This paper proposes a framework conceptualizing the impacts of HEIs on SD under consideration of these two dimensions (Figure 2).

The core elements (Lozano *et al.*, 2013b) in which different organizational and individual activities take place may cause a variety of influences on SD impact areas: economy, societal challenges, natural environment, policies, culture, and demographics. Within these impact areas, this review has resulted in a set of specific themes that further specify direct and
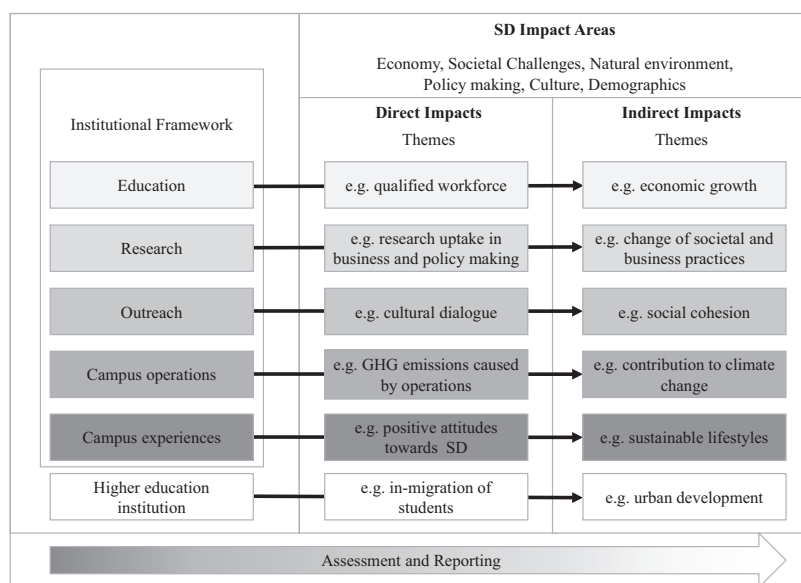


Figure 2.
The SD impact
framework of HEIs

indirect impacts on SD, which may be plausibly attributed to HEIs. Systematic and reliable assessment of the impacts of HEIs is a crucial premise for managing and improving the contribution of HEIs to SD. The framework not only highlights the assessment and reporting as a cross-cutting requirement but also identifies it as one of the fundamental challenges to more systematic consideration of impacts. This is because many assessment approaches focus on SD performance within HEIs (Yarime and Tanaka, 2012) but appear not to have been designed to assess impacts from the perspective of a whole institution approach, particularly regarding indirect impacts.

## Conclusions

This paper systematically reviewed the existing literature on impacts of HEIs on SD with a view to providing an integrative conceptualization of core themes and SD impact areas. It complements previous reviews of the integration of SD issues in the context of higher education by specifically eliciting the impacts of HEIs on SD.

The SD impact framework of HEIs highlights direct and indirect impacts on SD arising from the activities of HEIs. The framework can provide a useful framing for reflecting on and mapping the potential impacts of HEIs, thereby contributing to a more holistic understanding of how HEIs affect their stakeholders, the natural environment, the economy, and society. This can help to identify and prioritize SD impact areas of HEIs.

Two major gaps in the literature provide ample space for future research in this rapidly evolving field of inquiry. First, more research with a holistic perspective that considers the impacts of all core elements would be a fruitful addition to the many in-depth case studies available. This would allow for a comprehensive understanding of the impacts of HEIs on SD. Such a whole institution approach would also help identify impact areas and stakeholder groups that are currently underrepresented in the literature. For instance, cultural impacts and impacts on policy, social cohesion, individual behavior and life paths of alumni are currently underexplored and merit further attention. Second, the lack of holistic assessment approaches for the impacts of HEIs on SD offers a major avenue for future research. Existing sustainability assessment tools in higher education could be analyzed regarding their ability to effectively examine the direct and indirect impacts of HEIs on SD. Given the difficulty of quantifying long-term indirect impacts, it might be of interest to explore how far qualitative approaches that use narratives can capture impacts that are difficult to measure with quantitative indicators.

## References

Agiomirgianakis, G., Serenis, D. and Tsounis, N. (2017), "A distance learning university and its economic impact in a country's peripheries: the case of hellenic open university, international", *Journal of Operational Research*, Vol. 17 No. 1, pp. 165-186.

Aguinis, H., Shapiro, D.L., Antonacopoulou Gnosis, E.P. and Cummings, T.G. (2014), "Scholarly impact: a pluralist conceptualization", *Academy of Management Learning and Education*, Vol. 13 No. 4, pp. 623-639.

Alves, J., Carvalho, L., Carvalho, R., Correia, F., Cunha, J., Farinha, L., Fernandes, J., Ferreira, M., Lucas, E., Mourato, J., Nicolau, A., Nunes, S., Nunes, S., Oliveira, P., Pereira, C., Pinto, S. and Silva, J. (2015), "The impact of polytechnic institutes on the local economy", *Tertiary Education and Management*, Vol. 21 No. 2, pp. 81-98.

Amaral, L.P., Martins, N. and Gouveia, J.B. (2015), "Quest for a sustainable university: a review", *International Journal of Sustainability in Higher Education*, Vol. 16 No. 2, pp. 155-172.

Anand, C.K., Bisaillon, V., Webster, A. and Amor, B. (2015), "Integration of sustainable development in higher education – a regional initiative in Quebec (Canada)", *Journal of Cleaner Production*, Vol. 108, pp. 916-923.

Anstadt, S.P. (2009), "Community connections: An intergenerational and multicultural community group program", *Journal of Intergenerational Relationships*, Vol. 7 No. 4, pp. 442-446.

Balas, E.A. and Elkin, P.L. (2013), "Technology transfer from biomedical research to clinical practice: measuring innovation performance", *Evaluation and the Health Professions*, Vol. 36 No. 4, pp. 505-517.

Banks, S., Herrington, T. and Carter, K. (2017), "Pathways to co-impact: action research and community organizing", *Educational Action Research*, Vol. 25 No. 4, pp. 541-559.

Barlett, P.F. (2011), "Campus sustainable food projects: critique and engagement", *American Anthropologist*, Vol. 113 No. 1, pp. 101-115.

Berg, B.L. (2001), *Qualitative Research Methods for the Social Sciences*, Allyn and Bacon, Boston.

Bizerril, M., Rosa, M.J., Carvalho, T. and Pedrosa, J. (2018), "Sustainability in higher education: a review of contributions from portuguese speaking countries", *Journal of Cleaner Production*, Vol. 171, pp. 600-612.

Bowen, H. (2018), *The Individual and Social Value of American Higher Education*, Routledge, New York, NY.

Bozeman, B. and Youtie, J. (2017), "Socio-economic impacts and public value of government-funded research: lessons from four US national science foundation initiatives", *Research Policy*, Vol. 46 No. 8, pp. 1387-1298.

Blanco-Portela, N., Benayas, J., Pertierra, L.R. and Lozano, R. (2017), "Towards the integration of sustainability in higher education institutions: a review of drivers of and barriers to organisational change and their comparison against those found of companies", *Journal of Cleaner Production*, Vol. 166, pp. 563-578.

Bonaccorsi, A., Daraio, C. and Geuna, A. (2010), "Universities in the new knowledge landscape: tensions, challenges, change – an introduction", *Minerva*, Vol. 48 No. 1, pp. 1-4.

Carteron, J.-C., Haynes, K. and Murray, A. (2014), "Education for sustainable development, the UNGC PRME initiative, and the sustainability literacy test: Measuring and assessing success", *S.A.M. Advanced Management Journal*, Vol. 79 No. 4, pp. 51-58.

Ceulemans, K., Molderez, I. and van Liedekerke, L. (2015), "Sustainability reporting in higher education: a comprehensive review of the recent literature and paths for further research", *Journal of Cleaner Production*, Vol. 106, pp. 127-143.

Chen, D.M., Tucker, B., Badami, M.G., Ramankutty, N. and Rhemtulla, J.M. (2016), "A multi-dimensional metric for facilitating sustainable food choices in campus cafeterias", *Journal of Cleaner Production*, Vol. 135, pp. 1351-1362.

Cherney, A., Head, B., Povey, J., Boreham, P. and Ferguson, M. (2015), "The utilisation of social science research – the perspectives of academic researchers in Australia", *Journal of Sociology*, Vol. 51 No. 2, pp. 252-270.

Denyer, D. and Tranfield, D. (2009), "Producing a systematic review", in Buchanan, D. and Bryman, A. (Eds), *The Sage Handbook of Organizational Research Methods*, Sage, London, pp. 671-689.

Du, X., Su, L. and Liu, J. (2013), "Developing sustainability curricula using the PBL method in a Chinese context", *Journal of Cleaner Production*, Vol. 61, pp. 80-88.

Escobar-Tello, M. and Bharma, T. (2013), "Happiness as a harmonising path for bringing higher education towards sustainability", *Environment, Development and Sustainability*, Vol. 15 No. 1, pp. 177-197.

Fernekes, W.R. and Rosenberg, H.Z. (2008), "Building a high school archives program: a case study in school–university collaboration", *Journal of Archival Organization*, Vol. 6 No. 3, pp. 151-168.

IJSHE

Fretschner, M. and Weber, S. (2013), "Measuring and understanding the effects of entrepreneurial awareness education", *Journal of Small Business Management*, Vol. 51 No. 3, pp. 410-428.

Gómez, N., Cadarso, M.-Á. and Monsalve, F. (2016), "Carbon footprint of a university in a multiregional model: the case of the university of Castilla-La Mancha", *Journal of Cleaner Production*, Vol. 138, pp. 119-130.

Gooch, D., Vasalou, A. and Benton, L. (2017), "Impact in interdisciplinary and cross-sector research: opportunities and challenges", *Journal of the Association for Information Science and Technology*, Vol. 68 No. 2, pp. 378-391.

Greenhalgh, T., Jackson, C., Shaw, S. and Janamian, T. (2016), "Achieving research impact through co-creation in community-based health services: literature review and case study", *Milbank Quarterly*, Vol. 94 No. 2, pp. 392-429.

Gupta, H. and Singhal, N. (2017), "Framework for embedding sustainability in business schools: a review", *Vision: The Journal of Business Perspective*, Vol. 21 No. 2, pp. 195-203.

Haigh, M.J. (2006), "Promoting environmental education for sustainable development: the value of links between higher education and non-governmental organizations (NGOs)", *Journal of Geography in Higher Education*, Vol. 30 No. 2, pp. 327-349.

Hancock, L. and Nuttman, S. (2014), "Engaging higher education institutions in the challenge of sustainability: sustainable transport as a catalyst for action", *Journal of Cleaner Production*, Vol. 62, pp. 62-71.

Harrison, R.T. and Leitch, C. (2010), "Voodoo institution or entrepreneurial university? Spin-off companies, the entrepreneurial system and regional development in the UK", *Regional Studies*, Vol. 44 No. 9, pp. 1241-1262.

Hill, A., Scott, J., Moyes, D. and Smith, R. (2016), "Supporting knowledge exchange in rural business – a case story from dumfries and galloway, Scotland", *Local Economy: The Journal of the Local Economy Policy Unit*, Vol. 31 No. 7, pp. 812-824.

Hipp, J.A., Betrabet Gulwadi, G., Alves, S. and Sequeira, S. (2016), "The relationship between perceived greenness and perceived restorativeness of university campuses and student-reported quality of life", *Environment and Behavior*, Vol. 48 No. 10, pp. 1292-1308.

Hubbard, P. (2008), "Regulating the social impacts of studentification: a loughborough case study", *Environment and Planning A*, Vol. 40 No. 2, pp. 323-341.

Jones, P., Pickernell, D., Fisher, R. and Netana, C. (2017), "A tale of two universities: graduates perceived value of entrepreneurship education", *Education + Training*, Vol. 59 Nos 7/8, pp. 689-705.

Karatzoglou, B. (2013), "An in-depth literature review of the evolving roles and contributions of universities to education for sustainable development", *Journal of Cleaner Production*, Vol. 49, pp. 44-53.

Kawabe, M., Kohno, H., Ikeda, R., Ishimaru, T., Baba, O., Horimoto, N., Kanda, J., Matsuyam, M., Moteki, M., Oshima, Y., Sasaki, T. and Yap, M. (2013), "Developing partnerships with the community for coastal ESD", *International Journal of Sustainability in Higher Education*, Vol. 14 No. 2, pp. 122-132.

Kermath, B. (2007), "Why go native? Landscaping for biodiversity and sustainability education", *International Journal of Sustainability in Higher Education*, Vol. 8 No. 2, pp. 210-223.

Koehn, P.H. and Uitto, J.I. (2014), "Evaluating sustainability education: lessons from international development experience", *Higher Education*, Vol. 67, pp. 672-635.

Krippendorff, K. (2004), *Content Analysis: An Introduction to Its Methodology*, Sage, Thousand Oaks.

Lebeau, Y. and Cochrane, A. (2015), "Rethinking the 'third mission': UK universities and regional engagement in challenging times", *European Journal of Higher Education*, Vol. 5 No. 3, pp. 250-263.

Lee, H.Y. (2014), "Long-term evolution of campus noise emissions: a case of new university development", *Journal of Environmental Planning and Management*, Vol. 57 No. 8, pp. 1169-1182.

Lehmann, M., Christensen, P., Thrane, M. and Jørgensen, T.H. (2009), "University engagement and regional sustainability initiatives: some danish experiences", *Journal of Cleaner Production*, Vol. 17 No. 12, pp. 1067-1074.

Li, X., Tan, H. and Rackes, A. (2015), "Carbon footprint analysis of student behavior for a sustainable university campus in China", *Journal of Cleaner Production*, Vol. 106, pp. 97-108.

Lopes Silva, D., de Oliveira, A.J., Saavedra, Y.M.B., Ometto, A.R., Rieradevall i Pons, J. and Gabarrell Durany, X. (2015), "Combined MFA and LCA approach to evaluate the metabolism of service polygons: A case study on a university campus", *Resources, Conservation and Recycling*, Vol. 94, pp. 157-168.

Lozano, R., Lozano, F.J., Mulder, K., Huisingh, D. and Waas, T. (2013a), "Advancing higher education for sustainable development: international insights and critical reflections", *Journal of Cleaner Production*, Vol. 48, pp. 3-9.

Lozano, R., Lukman, R., Lozano, F.J., Huisingh, D. and Lambrechts, W. (2013b), "Declarations for sustainability in higher education: becoming better leaders, through addressing the university system", *Journal of Cleaner Production*, Vol. 48, pp. 10-19.

Lozano, R., Ceulemans, K., Alonso-Almeida, M., Huisingh, D., Lozano, F.J., Waas, T., Lambrechts, W., Lukman, R. and Hugé, J. (2015), "A review of commitment and implementation of sustainable development in higher education: results from a worldwide survey", *Journal of Cleaner Production*, Vol. 108, pp. 1-18.

Lynch, M., Zovinka, E.P., Zhang, L., Hruska, J.L. and Lee, A. (2005), "Rural outreach chemistry for kids (R.O.C.K.): the program and its evaluation", *Journal of Higher Education Outreach and Engagement*, Vol. 10 No. 3, pp. 125-141.

Lynch-Alexander, E. (2017), "Defying the definition of insanity: assessing the robust nature of university outreach in the community using carnegie community engagement classification and lynch outreach assessment model (LOAM)", *Journal of Academic Administration in Higher Education*, Vol. 13 No. 1, pp. 19-24.

MacPherson, A. and Zilokowski, M. (2005), "The role of university-based industrial extension services in the business performance of small manufacturing firms: case-study evidence from Western New York", *Entrepreneurship and Regional Development*, Vol. 17, pp. 431-447.

Maas, K. and Liket, K. (2011), "Social impact measurement: Classification of methods", in Burritt, R.L., Schaltegger, S., Bennett, M., Pohjola, T. and Csutora, M. (Eds), *Environmental Management Accounting and Supply Chain Management*, Springer, Berlin, pp. 171-202.

Marcella, R., Lockerbie, H. and Bloice, L. (2016), "Beyond REF 2014: the impact of impact assessment on the future of information research", *Journal of Information Science*, Vol. 42 No. 3, pp. 369-385.

Muller, I. and Tempelhoff, J. (2016), "The application of a resilience assessment approach to promote campus environmental management", *International Journal of Sustainability in Higher Education*, Vol. 17 No. 2, pp. 228-245.

Officer, S.D., Bringle, R.G. and Grim, J. (2011), "Indiana university–Purdue university indianapolis and george Washington community high school: educating their communities together", *Journal of Higher Education Outreach and Engagement*, Vol. 15 No. 3, pp. 75-86.

Orme, J. and Coghill, N. (2014), "Wasted potential: The role of higher education institutions in supporting safe, sensible and social drinking among students", *Health Education Journal*, Vol. 73 No. 2, pp. 192-200.

Orme, J. and Dooris, M. (2010), "Integrating health and sustainability: the higher education sector as a timely catalyst", *Health Education Research*, Vol. 25 No. 3, pp. 425-437.

Pastor, J.M., Pérez, F. and de Guevara, J.F. (2013), "Measuring the local economic impact of universities: an approach that considers uncertainty", *Higher Education*, Vol. 65 No. 5, pp. 539-564.

Patterson, D.A., Cronley, C., West, S. and Lantz, J. (2014), "Social justice manifest: a university – community partnership to promote the individual right to housing", *Journal of Social Work Education*, Vol. 50 No. 2, pp. 234-246.

Pienaar-Steyn, S. (2012), "The millennium development goals as a conceptual framework for enabling and evaluating community engagement", *South African Review of Sociology*, Vol. 43 No. 2, pp. 40-57.

Qian, W. (2013), "Embracing the paradox in educational change for sustainable development: a case of accounting", *Journal of Education for Sustainable Development*, Vol. 7 No. 1, pp. 75-93.

Rauch, A. and Hulsink, W. (2015), "Putting entrepreneurship education where the intention to act lies: an investigation into the impact of entrepreneurship education on entrepreneurial behavior", *Academy of Management Learning and Education*, Vol. 14 No. 2, pp. 187-204.

REF (2016), "REF impact", available at: www.hefce.ac.uk/rsrch/REFimpact/ (accessed 10 May 2018).

Robinson, C. and Adams, N. (2008), "Unlocking the potential: the role of universities in pursuing regeneration and promoting sustainable communities", *Local Economy: The Journal of the Local Economy Policy Unit*, Vol. 23 No. 4, pp. 277-289.

Riebe, M. (2012), "A place of her own: the case for university-based centers for women entrepreneurs", *Journal of Education for Business*, Vol. 87 No. 4, pp. 241-246.

Roessner, D., Bond, J., Okubo, S. and Planting, M. (2013), "The economic impact of licensed commercialized inventions originating in university research", *Research Policy*, Vol. 42 No. 1, pp. 23-34.

Rodríguez-Barreiro, L.M., Fernández-Manzanal, R., Serra, L.M., Carrasquer, J., Murillo, M.B., Morales, M.J., Calvo, J.M. and del Valle, J. (2013), "Approach to a causal model between attitudes and environmental behaviour. A graduate case study", *Journal of Cleaner Production*, Vol. 48, pp. 116-125.

Rotaris, L. and Danielis, R. (2015), "Commuting to college: The effectiveness and social efficiency of transportation demand management policies", *Transport Policy*, Vol. 44, pp. 158-168.

Roy, R., Potter, S. and Yarrow, K. (2008), "Designing low carbon higher education systems: environmental impacts of campus and distance learning systems", *International Journal of Sustainability in Higher Education*, Vol. 9 No. 2, pp. 116-130.

Rubens, A., Spigarelli, F., Cavicchi, A. and Rinaldi, C. (2017), "Universities' third mission and the entrepreneurial university and the challenges they bring to higher education institutions", *Journal of Enterprising Communities: People and Places in the Global Economy*, Vol. 11 No. 3, pp. 354-372.

Saúde, S., Borralho, C., Féria, I. and Lopes, S. (2014), "The impact of a higher education institution on socioeconomic development – The study case of the polytechnic institute of Beja, Portugal", *Copernican Journal of Finance and Accounting*, Vol. 3 No. 2, pp. 151-166.

Saunders, M., Lewis, P. and Thornhill, A. (2012), *Research Methods for Business Students*, Pearson Education Ltd., Essex.

Scull, S. and Cuthill, M. (2010), "Engaged outreach: using community engagement to facilitate access to higher education for people from low socioeconomic backgrounds", *Higher Education Research and Development*, Vol. 29 No. 1, pp. 59-74.

Seuring, S. and Müller, M. (2008), "From a literature review to a conceptual framework for sustainable supply chain management", *Journal of Cleaner Production*, Vol. 16 No. 15, pp. 1699-1710.

Smith, K.E. and Stewart, E. (2017), "We need to talk about impact: why social policy academics need to engage with the UK's research impact agenda", *Journal of Social Policy*, Vol. 46 No. 1, pp. 109-127.

Strasburg, V.J. and Jahno, V.D. (2017), "Application of eco-efficiency in the assessment of raw materials consumed by university restaurants in Brazil: a case study", *Journal of Cleaner Production*, Vol. 161, pp. 178-187.

Thomas, R. and Ormerod, N. (2017), "The (almost) imperceptible impact of tourism research on policy and practice", *Tourism Management*, Vol. 62, pp. 379-389.

Thurston, M. and Eckelman, M.J. (2011), "Assessing greenhouse gas emissions from university purchases", *International Journal of Sustainability in Higher Education*, Vol. 12 No. 3, pp. 225-235.

Trencher, G., Bai, X., Evans, J., McCormick, K. and Yarime, M. (2014), "University partnerships for co-designing and co-producing urban sustainability", *Global Environmental Change*, Vol. 28, pp. 153-165.

UNESCO (2014), "*Shaping the Future we Want", UN Decade of Education for Sustainable Development (2005-2014) Final Report*, (Paris, France), p. 198.

Vaughter, P., McKenzie, M., Lidstone, L. and Wright, T. (2016), "Campus sustainability governance in Canada: a content analysis of post-secondary institutions' sustainability policies", *International Journal of Sustainability in Higher Education*, Vol. 17 No. 1, pp. 16-39.

Vaughter, P., Wright, T., McKenzie, M. and Lidstone, L. (2013), "Greening the ivory tower: a review of educational research on sustainability in post-secondary education, sustainability", Vol. 5 No. 5, pp. 2252-2271.

Velazquez, L., Munguia, N. and Sanchez, M. (2005), "Deterring sustainability in higher education institutions: an appraisal of the factors which influence sustainability in higher education institutions", *International Journal of Sustainability in Higher Education*, Vol. 6 No. 4, pp. 383-391.

Verbie (2016), "MAXDQA – The art of data analysis", available at: www.maxqda.com/ (accessed 22 November 2016).

Versteijlen, M., Perez Salgado, F., Janssen Groesbeek, M. and Counotte, A. (2017), "Pros and cons of online education as a measure to reduce carbon emissions in higher education in The Netherlands", *Current Opinion in Environmental Sustainability*, Vol. 28, pp. 80-89.

Wals, A.E. (2014), "Sustainability in higher education in the context of the UN DESD: a review of learning and institutionalization processes", *Journal of Cleaner Production*, Vol. 62, pp. 8-15.

Webster, J. and Watson, R.T. (2002), "Analyzing the past to prepare for the future: writinga literature review", *MIS Quarterly*, Vol. 26 No. 2, pp. 13-23.

Wiek, A., Withycombe, L. and Redman, C.L. (2011), "Key competencies in sustainability: a reference framework for academic program development", *Sustainability Science*, Vol. 6 No. 2, pp. 203-218.

Wu, Y.-C.J. and Shen, J.-P. (2016), "Higher education for sustainable development: a systematic review", *International Journal of Sustainability in Higher Education*, Vol. 17 No. 5, pp. 633-651.

Yao, L.J. and Bai, Y. (2008), "The sustainability of economic and cultural impacts of international students to regional Australia: the case of bendigo", *Humanomics*, Vol. 24 No. 4, pp. 250-262.

Yarime, M. and Tanaka, Y. (2012), "The issues and methodologies in sustainability assessment tools for higher education institutions – a review of recent trends and future challenges", *Journal of Education for Sustainable Development*, Vol. 6, pp. 63-77, doi: 10.1177/097340821100600113.

**About the authors**

Florian Findler is a Teaching and Research Associate at the Institute for Managing Sustainability (www.sustainability.eu) at the Vienna University of Economics and Business. He studied management at the University of Marburg, the University of Hohenheim, and at the BI Norwegian Business School in Oslo. Prior to his work at the institute, Florian gained working experience in the IT and automotive sector and as a Research Assistant at the Chair for Marketing and Business Development at the University of Hohenheim. His main research interests are sustainability in higher education, corporate social responsibility and impact assessment. Florian Findler is the corresponding author and can be contacted at: florian.findler@wu.ac.at

Norma Schönherr is a Research Fellow and Project Manager at the Institute for Managing Sustainability (www.sustainability.eu) at the Vienna University of Economics and Business. Before joining the institute, she held positions in an international environmental NGO, a development agency and a free research institute. She is an expert in impact measurement and management. Her main areas of expertise are corporate social responsibility, international sustainability governance and corporate impacts on global sustainable development.

Rodrigo Lozano is a Professor (full) at the University of Gävle, Sweden and former Editor-in-Chief for the Journal of Cleaner Production. He was previously an Assistant Professor at the Copernicus

Institute of Sustainable Development, Utrecht University, the Netherlands, and a Program Leader of the BA Environment and Business at the Sustainability Research Institute, University of Leeds, UK. For over 20 years, Rodrigo has been working toward sustainability in NGOs, universities and corporations. His projects have ranged from chemical leasing, indoor-air quality and energy efficiency, to sustainability assessment and reporting and to organizational change management.

Daniela Reider is a graduate of the master's program "Supply Chain Management" at the Vienna University of Economics and Business. In addition, she also studied at LUISS Guido Carlì, Rome and the City University of Hong Kong. Besides her studies, she worked at the Institute for Managing Sustainability as a Research Assistant. In this function, her main focus was on a project concerning the impact of higher education institutions. Furthermore, she participated in the preparation of an EU research proposal (Horizon 2020) on Responsible Research and Innovation in the ICT sector.

André Martinuzzi is the Founding Director of the Institute for Managing Sustainability (www. sustainability.eu) and an Associate Professor at the Vienna University of Economics and Business. His areas of research are sustainable development, corporate social responsibility, and knowledge management. For 20 years, he has co-ordinated projects and networks funded by the EU Framework Programmes, on behalf of six different EU Directorates General, Eurostat, UN organizations and for several national ministries. He currently carries out research on how corporations manage their impacts on the sustainable development goals and on responsible research and innovation in the areas of smart homes and smart health.