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Sustainability and the end activity of HEI

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Abstract

Many studies have explored how universities can improve their role in society by developing new approaches and educational content and providing research support for sustainability goals. However, it tends to report experiences and challenges faced by HEI in the inclusion of environmental issues in their teaching, research, extension and university management activities, considering these activities almost always as watertight. Thus, this study aimed to integrate the dimensions of sustainability with the core activity of Brazilian HEI. Using methods such as bibliographic and documentary review, the research analysis took into account scientific studies and collected data related to sustainability indicators in HEI and in society as a whole.

Keywords: Dimensions and Practices, Fundamental Purposes, Higher Education Institutions (HEI)

Introduction

The debate on how institutions can become more sustainable has grown exponentially over time, emphasizing opportunities for innovation and competitiveness (Bansal, 2005; Sharma & Vredenburg, 1998)^[4, 44]. Based on a different premise, other studies have examined how universities can integrate sustainability concepts as components of their institutional goals (Beynaghi *et al.*, 2016)^[5].

In the United Nations 2030 Agenda for Sustainable Development and its definition of the Sustainable Development Goals (SDGs), the global community expresses its conviction that global challenges can only be solved by working together. It is of great importance to establish targeted networks of actors in politics, business, science and civil society. Increasingly, the scientific community itself, including universities, is emerging as the main organizational actors. In the context of UNESCO's Decade of Education for Sustainable Development, for example, universities are considered central to sustainability. In many ways, universities act as multipliers of sustainability; make important recommendations for policy action on the sustainable regulation of certain industrial sectors and develop sustainable innovations for and with companies and society (Stephens *et al.* 2008)^[48].

For Beynaghi *et al.* 2016^[5], the qualitative analysis of trends reveals the growing convergence of developments in higher education and sustainability. Traditionally elite-oriented, from the 1950s on higher education became a mass phenomenon. A crisis of reputation and legitimacy followed, triggered by social movements in the 1960s. The 1970s witnessed the birth of the environmental movement, which was concerned with limiting human impacts on the natural environment. At the same time, higher education changed as industrial companies emerged as a key stakeholder group, providing private third-party funds to meet the financial demands of expansion, while simultaneously creating new demands for the instrumentalization of universities. In terms of research, there has been a significant observable increase in the extent and depth of university scientific work on sustainability since about 2005 (Figueiró E Raufflet, 2015)^[16]. According to Karatzoglou (2013)^[20], the biggest deficit in this literature (based on a study of 123 publications in journals) is that specific case studies for universities predominate, producing prescriptive findings, but so far there are no generalizable empirical results.

Many studies have explored how universities can improve their role in society by developing new approaches and educational content and providing research support for sustainability goals. Regarding the former, universities are encouraged to update their training programs to include sustainability-related topics in well-established and new educational offerings, to address the competencies now required by the market. More specifically, corporate investment in sustainability increases the need for new jobs related to the environment, not necessarily seen in the existing labor market (OECD, 2018)^[38].

At the same time, the increasing relevance of sustainability to existing business functions (eg, green marketing, sustainable design or circularity in operations) means that professional competencies must be updated (Renwick *et al.*, 2013).

Regarding research support, universities can become important suppliers of knowledge related to sustainability for the industry, in what is considered an increasingly collaborative process (Muff *et al.*, 2013)^[37].

One can observe many studies on sustainability, sustainability in higher education and sustainability assessment, measurement and classification. However, most occur in regional, national or local contexts. There is still relatively little in the literature on global sustainability rankings in higher education (Thompson, 1985; Stubbs & Cocklin, 2008; Rusinko, 2005; Rohweder, 2004) ^[51, 50, 41, 40] and, when available, tends to report experiences and challenges faced by HEI in the inclusion of issues in its teaching, research, extension and university management activities, considering these activities almost always as watertight.

Thus, this study aims to integrate the dimensions of sustainability with the core activity of Brazilian HEI. To this end, the article had the following specific objectives: (1) to discuss the concept and dimensions of sustainability used in the study; (2) present the core activity of Brazilian HEI and (3) integrate the dimensions of sustainability into the core activity and management of HEI.

Methodology

The approach proposed to guide the holistic approach of the study is structured in the following research stages:

A literature review focused on internationally established concepts, recommendations and guidelines, with the aim of leading HEI to fully recognize sustainability;

Thematic, ideological similarities, trends and patterns of concepts; unique perspectives and recommendations; and general agreed concepts that emerge from the literature were identified and processed to support the formulation of the proposed sustainability actions. This effort reflects a synthesis of decades of work and progress in the sustainability of HEI; and

An analysis of scientific studies related to sustainability in HEI and in society as a whole (cross-checking, crossreferencing, conceptual and identifying similarities) was carried out taking into account international initiatives that promote sustainability in education and society, existing assessment structures for sustainability and international publications (normative references, reports and peerreviewed articles), which supported the authors' critical reflections on sustainability in HEI.

The statistical software AMoS Graphics 24^{TM} (Analysis of Moment Structures) was used to present a path diagram, based on variables and constructs identified in the literature. Such methodological precepts reflect a holistic view of sustainability in HEI and an alignment with the recommendations transmitted by international organizations and publications.

Results and discussions

This section discusses the concept and dimensions of sustainability used in the study, presents the core activity of Brazilian HEI and, finally, integrates the dimensions of sustainability and the fundamental purposes of the HEI.

Concept and dimensions of sustainability

Although widely discussed in scientific literature, the terms sustainable, sustainability and sustainable development may

have different interpretations depending on the author or the area in question. Thus, for the study of sustainability and sustainable development they are treated as synonyms, the latter being the one that meets "the current needs without compromising the ability of future generations to meet their own needs" (UN, 1987).

However, the application of such a concept brings real difficulties, since the satisfaction of current needs, such as the search for energy, is resulting in levels of environmental degradation never seen before. On the other hand, the exercise of estimating the needs of future generations is not since the evolution of societies is dynamic. easy. Furthermore, even if we manage to estimate such needs with some efficiency, history shows that development within generations almost always results in actions that future generations are left unattended over a longer time span. For example, it was estimated by previous generations that the current need would be for food, but data from the United Nations (UN) show that, per year, approximately one third of the food produced worldwide is not consumed by the population, being lost at some stage of the production chain or wasted in the final link. Not to mention that there is a series of built-in waste that further aggravates the global scenario. The food production and distribution chain needs water, land, energy and fuel. The food that goes to waste buries with it all these resources that were consumed during its production process and causes impacts in the three dimensions of sustainability, social, economic and environmental. The food production and distribution chain needs water, land, energy and fuel. The food that goes to waste buries with it all these resources that were consumed during its production process and causes impacts in the three dimensions of sustainability, social, economic and environmental. The food production and distribution chain needs water, land, energy and fuel. The food that goes to waste buries with it all these resources that were consumed during its production process and causes impacts in the three dimensions of sustainability, social, economic and environmental.

The current environmental crisis is the result, on the one hand, of the depletion and degradation of many natural resources and, on the other, of the deposition of unwanted substances by the economy (waste). It came to question the rationality and theories that drove and legitimized the previously anticipated economic growth. Sustainability appears as a normative criterion for the reconstruction of the economic order, as a condition for human survival and a support to reach a lasting development, questioning the very bases of production.

Aiming at the integration of sustainability as a whole, we tried to identify the dimensions of sustainability addressed in the literature. Three dimensions were identified: economic, social and environmental (Waas *et al.*, 2011^[53]; Godemann *et al.*, 2014^[17]; Amaral *et al.*, 2015^[3]; Sammalisto *et al.*, 2015^[42]). However, it is increasingly common to find other pillars, mainly institutional (Lozano, 2008; Disterheft *et al.*, 2013; Leal Filho *et al.*, 2015)^[27, 11, 23] and cultural (Lozano, 2008; Disterheft *et al.*, 2013; Leal Filho *et al.*, 2013; Leal Filho *et al.*, 2013; Leal Filho *et al.*, 2015)^[27, 11, 23]. In addition, four dimensions were also proposed for sustainability practices and the implementation of sustainable development in HEI, which will be adopted in this study: environmental, economic, social and institutional (Lozano, 2011; Alonso-Almeida *et al.*, 2015; Larrán Jorge *et al.*, 2015; Aleixo *et al.*, 2016)^[29, 2, 22, 1].

Table 1: Dimensions	and practices	of sustainability	in HEl
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Dimensions	Practices
	Statements and actions related to the involvement of HEI in environmental issues and scarcity of resources (environment and
Environmental	management of natural resources; prevention of pollution; protection of the environment and biodiversity; restoration of
	natural habitats; ecological footprint; non-renewable resources; depletion of materials; degradation).
Economic	Statements and actions related to the direct economic impact and financial sustainability of the IES (financial situation;
	results; efficiency).
Social	Statements and explanations on policies and procedures related to human rights (labor practices; human rights; quality of life,
	occupational health and safety; dimension of equity; employee training, involvement in social issues and action in the HEI
	community).
Institutional	Statements on points of view, values, strategy, transparency in governance, ethical commitments of HEI and letters and
	partnerships on national and international criteria to promote sustainable development. Practices in education, research,
	university operations (eg certifications), outreach and community assessment, and reporting were also considered.

Source: Adapted from Aleixo et al. (2016)^[1]

Main activity of Brazilian HEI

The Federal Constitution of 1988, in its article 207, establishes as its fundamental purpose the core activity of

Brazilian HEI, through the principle of inseparability between teaching, research and extension (Table 5).

Table 2: Main activity of Brazilian HEI

Activity	Practices
Teaching	Practices aimed at learning students for professional training, such as hours for classroom classes, laboratories, monitoring
	activities, among others.
Research	Actions developed with the aim of promoting research activities within HEI. They usually take place in postgraduate courses,
	mainly of the stricto-sensu type, through scientific initiation or projects.
	Actions that extend knowledge to society as a whole, seeking to gather information and demands that help HEI to engage with the
Extension	reality around them. they aim at disseminating the achievements and benefits resulting from cultural creation and the scientific and
	technological research generated, creating a link between society and the HEI.

Source: Self elaboration

Explained, teaching is the transmission of knowledge through abstraction and, when possible, practice of certain subjects, made by a teacher. It is the one that unleashes knowledge capable of transforming the individual's performance as a social being, converging and articulating in a balanced way between scientific, investigative and pedagogical dimensions. Research, on the other hand, is the opportunity to apply and/or develop new concepts from the bases built by the teaching stage. It is the process of materializing knowledge from the production of new knowledge based on emerging problems in social practice. Finally, extension is the direct application of knowledge obtained in the stages of teaching and research in society. It is rich in academic and social learning,

However, the realization of such inseparability between teaching, research and extension in academic practice, in fact, has proved difficult, as what is observed is that, as a rule, the work remains fragmented between teaching, researching and doing extension. In short, this is due to the fact that society is questioning the HEI regarding the usefulness of the knowledge and training produced in them, demanding and assigning new functions. For example, teaching is usually evaluated by the Ministry of Education (MEC), through the General Index of Courses (IGC), which synthesizes in a single indicator the quality of courses, evaluating the student body, faculty and infrastructure of HEI.

In addition, research activities, which culminate in publications, end up being more valued, as they are used in most evaluation criteria of graduate programs, through the concept of Coordination for the Improvement of Higher Education Personnel (CAPES), which assesses the quality of stricto sensu graduate courses and by funding agencies, impacting even the functional progression score of teachers in public HEI.

Added to this, on the one hand, reconfigurations of the public power that imply a decrease in funding resources for public HEI, while on the other hand, privately funded HEI contribute to an internal hierarchy of areas and knowledge, according to their greater or less ease of raising funds. This panorama strengthens internal tensions within HEI, which have historically been consolidated through a rigid and formal structure regarding their role as a producer and holder of knowledge.

These situations show that the association between the functions of teaching, research and extension is an institutional task, not being performed only by the teacher or the student. There is a demand for an organizational structure aimed at overcoming the division that marks the model usually adopted. In this sense, there is still a long way to go, since, if currently the formal presence of teaching, research and extension are guaranteed as a fundamental and constitutional principle of the University's mission, their coexistence does not meanficnecessarily, that they are inseparable.

An indicator that reinforces this argument is the consideration of teaching, research and extension as distinct activities, which should be developed inseparably. Currently, many students are still graduated without even experiencing research activities, nor elements intrinsic to extension. Worse, the possibility for them to participate is formally placed, whether through training activities, scholarships or scientific initiation activities. However, it should not only be possible, but mandatory, providing conditions for this, according to the constitutional principle, in order to dialogue with other knowledge and with interdisciplinarity.

In addition to the core activity: teaching, research and extension, it is necessary to add the management of HEI (Cortese, 2003^[9], Lozano, 2006^[26], Lozano, 2011^[29], Lozano *et al.*, 2013a^[31], Lozano *et al.*, 2013b^[32]). Such activity involves HEI' communication with different stakeholders through teaching, research, campus operations, community outreach and community outreach (eg sustainability assessment and reporting).

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Integration between sustainability, core activity and management of Brazilian HEI

Teaching-related activities should include reviewing learning outcomes and reformulating the curriculum (Disterheft *et al.*, 2016) ^[12] and introducing concepts of sustainability as a subject in the curriculum of all subjects and courses of higher education institutions, as well as workshops, conferences and seminars. The integration of sustainability into curricula can be done vertically (integrated sustainability through specific courses related to sustainability) or horizontally (integrated sustainability into different regular courses in the curriculum) (Stough *et al.*, 2017) ^[49].

Research activities encourage analysis of sustainability issues that address societal challenges, as well as interdisciplinary research groups for a new approach in a sustainable way (POPESCU & BELEAU, 2014)^[39].

The scope of the extension encompasses activities in which higher education institutions are involved in regional and local development and with civil society to promote a more liveable, socially inclusive and resource efficient environment (POPESCU & BELEAU, 2014)^[39]. However, as Dyer and Dyer (2017)^[14] note, interdisciplinary teaching, research and practice are necessary to promote sustainability in society.

Management activities on campuses are related to green campus initiatives and campaigns, with a focus on operational improvements (Disterheft *et al.*, 2016) ^[12]. However, while in the management of private HEI there is financial and structural availability for hiring personal resources to carry out the management, in the management of public HEI, management occurs by the academic community itself (technical-administrative and teachers), with the same basic resources, passed on to its functioning. Table 6 presents some national studies that stand out in terms of environmental management.

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Authors	Article	Focus	Results	
Boff; Oro and Beuren (2008) [6]	Environmental management in a Higher Education Institution in the view of its directors.	Environmental management of a HEI in Santa Catarina.	Encouraging awareness of the amount of garbage produced individually and the damage caused to nature, through environmental education, starting with the importance of environmental resources.	
Bolzan; Weber and Löbler (2010) ^[7]	Environmental alignment in a Public Institution of Higher Education.	Treatment of solid waste in an HEI.	Construction of a mapping of the waste generated at the IES and identification of the main waste, paper and plastic cup, from administrative and pedagogical routines, which required proper treatment.	
Dziedzic and Dziedzic (2010) ^[15]	Diagnosis and proposal for reducing emissions - Campus Universidade Positivo.	Materials flow in a HEI in Curitiba, focusing on minimizing emissions, water and energy consumption and sewage and waste production.	Creation of a worksheet for diagnosing the flow of materials from the calculation of emissions, which include modifications to discharge valves, rainwater collection, sewage treatment by constructed wetland, energy production from waste biogas, installation of photovoltaic panels and changes in equipment efficiency or changes in consumption patterns. For each change, feasibility studies were also carried out by cost-benefit and emission reductions. Finally, a proposal for modifications to the campus was made, based on ecological and economic aspects.	
Lima Jr; Oiko and Cavicchioli (2010) ^[25]	ko li li si ko ko ko ko ko ko ko ko ko ko		Presentation of proposals appropriate to the current panorama of the UEM waste chain, some of which were developed based on some waste management practices implemented in other universities.	

Source: Self elaboration

According to the studies above, it is clear that the HEI became aware of the impacts their activity has on the environment and such environmental concerns acted as a driving force for sustainability. This is because, as stated by Larrán Jorge *et al.* (2015)^[22], HEI leaders must formalize their commitment to sustainability by signing declarations.

For White (2013)^[54], the sustainability of HEI implies the adoption of measurable and manageable objectives and indicators. Sustainability assessment tools (eg AASHE - The Association for the Advancement of Sustainability in Higher Education) can play a strategic role not only in developing a holistic and systemic approach to sustainability, but also as a vital enabler for change towards sustainability. There are numerous sustainability assessment tools for higher education, and an extensive literature review on this can be found in Larrán Jorge *et al.* (2015)^[22].

Popescu and Beleau (2014)^[39] note that there is no single path or commonly used instrument to implement sustainability values or assess their results. They argue, therefore, that the development of unitary models could help improve the effectiveness of the university approach and control the implementation of programs developed at the international, regional and national levels. In recent years, there has been growing discussion about the importance and contributions of HEI rankings (and how this can be a distinctive parameter/advantage for institutions) (Shin & Toutkoushian, 2011; Moura & Moura, 2013)^[46, 36]. The rankings are a way to demonstrate the institutions' commitment to actions aimed at sustainability, or even to motivate internally about the need and importance of such actions. However, as the information is voluntary, the information is self-declared, and not necessarily accompanied by documentary evidence, or others, that allow evaluating its veracity or even the effectiveness of the so-called sustainable actions.

Another possible way for HEI to demonstrate their commitment to sustainability is through voluntary certification. There are already several formal processes at national and international level for the most varied contexts, such as the Forest Stewardship Council (FSC) and Forest Certification (CERFLOR) for products from forests. It is worth noting that voluntary certifications, unlike mandatory standards, are not within the scope of inspection by public bodies, although compliance with mandatory standards is a requirement of many certification systems, such as the FSC CERFLOR. Therefore, the credibility of these systems with consumers of products or services from certified institutions is an essential element. Therefore, among other elements, the certification process is, by definition, conducted by an organization independent of both the "controller" of the certification system and the institution applying for certification (INMETRO, 2021a)^[18]. In Brazil, organizations that conduct certification audits must also be accredited by the National Institute of Metrology, Quality and Technology (INMETRO), which recognizes their competence to assess, based on pre-established rules to perform the conformity assessment.

In the context of sustainability, the best known worldwide certification is perhaps the International Organization for Standardization (IOS) Environmental Management Systems (EMS) certification, ISO 14001. The ISO 14001 certification provides a basic model for establishing an Environmental Management System (EMS), a set of management processes that require companies to identify, measure and control their environmental impacts on the environment in which they operate, including aspects related to air, water, soil, flora, fauna and human beings (Bansal, 2005)^[4].

ISO 14001 does not restrict its scope, it is applicable to both private and public institutions, although it is not common. When consulting the valid certifications of Brazilian HEI (INMETRO, 2021b)^[19], only two are certified by ISO 14001, both in the private category: Universidade Positivo and Universidade do Vale do Rio dos Sinos (UNISINOS).

This is perhaps due, in large part, to the need to demonstrate the benefits resulting from an EMS, such as restructuring the organization, re-establishing organizational priorities and raising awareness of the EMS by all involved. It also requires a level of awareness and motivation among at least the majority of other stakeholders, inside and outside the organization, for the successful application of the EMS and for its continuous improvement. An organization's sense of accomplishment in delivering better environmental performance also needs to be generated by providing feedback and support to encourage the feeling that people really can (and do) make a difference, while encouraging other good ideas.

In the same logic of certifications, within the scope of public entities of the spheres federal, state and municipal, and in the executive, legislative and judiciary powers, currently stands out the federal program, of voluntary adhesion, created by the Ministry of the Environment (MMA) called Environmental Agenda in Public Administration (A3P). The program is designed to encourage public managers to incorporate environmental management principles and criteria into their routine activities. The A3P is based on six thematic axes and aims to reduce institutional expenditures through the rational use of natural resources and public goods, proper waste management, and other principles, focusing on behavior change (MMA, 2017) ^[35]. The author emphasizes that the reduction in expenses is a consequence of socioenvironmental management, and not the objective of the final program.

Unlike ISO14001, the A3P, created at the end of 1999 by the MMA, is not a certification system per se, because it lacks essential elements of this process, such as third-party audits as a guarantee of greater external credibility. Similar to ISO 14001 as a response from the private sector to social pressure, the A3P was the Brazilian government's alternative to the public sector. The HEI that currently adhere to the A3P are shown in Table 7.

Table 4: HEI with A3P membership

HEI	State
Federal Center for Technological Education Celso Suckow da Fonseca (CEFET)	RJ
Ceará State School of Public Management (EGPCE)	EC
National School of Public Administration (ENAP)	DF
School of the Federal Public Ministry (ESMPU)	DF
Federal University of Vale do São Francisco Foundation (UNIVASF)	FOOT
Federal Institute of Education, Science and Technology of Santa Catarina (IFSC - Campus Brusque)	
Federal Institute of Education, Science and Technology of Brasília (IFB)	DF
Federal Institute of Education, Science and Technology of Santa Catarina (IFSC)	SC
Federal Institute of Education, Science and Technology of Acre (IFAC)	B.C
Federal Institute of Education, Science and Technology of Amazonas (IFAM)	AM
Federal Institute of Education, Science and Technology of Espírito Santo (IFES - Campus Guarapari)	ES
Federal Institute of Education, Science and Technology of Piauí (IFPI - Current Campus)	PI
Federal Institute of Education, Science and Technology of Piauí (IFPI - Campus Floriano)	
Federal Institute of Education, Science and Technology of Rio de Janeiro (IFRJ)	
Federal Institute of Education, Science and Technology of Southern Minas Gerais (IFSULDEMINAS)	MG
Goiano Federal Institute of Education, Science and Technology (IFGO)	GO
Federal University of Maranhão (UFMA)	BAD
Federal University of Paraíba (UFPB)	PB
Federal University of Alfenas (UNIFAL)	AL
Federal University of Grande Dourados (UFGD)	MS
Federal University of Pernambuco (UFPE - Campus do Agreste)	FOOT
Federal University of Santa Catarina (UFSC)	SC
Federal University of Santa Maria (UFSM - Palmeira das Missões Campus)	LOL
Federal University of Sergipe (UFS)	IF
Federal University of Uberlândia (UFU)	MG
Federal University of Cariri (UFCA)	EC
Federal University of Rio Grande (UFRG)	LOL
Federal Rural University of the Amazon (UFRA)	PAN

Source: Self elaboration

While only two private HEI are ISO 14001 certified, 28 public ones adhered to the A3P. According to the MMA (2017) ^[35], the A3P is in harmony with the principle of economy, which translates into the cost-benefit ratio and, at

the same time, meets the constitutional principle of efficiency in public administration. Furthermore, it can be considered as the landmark inducing the adoption of socio-environmental management within the scope of the Brazilian public administration. According to the author, with the implementation of the A3P, an exemplary action by the public manager is sought, based on the understanding of what socio-environmental responsibility is, which focuses on behavior change.

It is opportunely reiterated that A3P is not a formal environmental certification. Although the process requires a formal commitment from public entities, especially the voluntary term of adhesion, but the information on environmental performance is made available by the agency that adheres to the program, with no subsequent verification as to its veracity, comprising only documentary evidence . Furthermore, some indicators and criteria important to HEI may not have been sufficiently included or clearly described. Despite all the limitations described on rankings and government socio-environmental programs, they offer opportunities for HEI to demonstrate their commitment towards sustainability.

In general, HEI can significantly contribute to inducing sustainability in society in key ways: by developing and disseminating more sustainable techniques and attitudes through the execution of their core activities of teaching, research and extension; and through the proper management of their own territorial spaces of action, thus serving as an example for other entities, sectors and activities.

In this context, in order to propose the relationships between the core activities of HEI (management, teaching, research and extension) with the precepts of sustainability, it is necessary to identify indicators. An effective approach to this is that of SMART (Specific, Measurable, Attainable, Relevant and Time-bound), which defines five criteria that can be applied to define indicators, they need to be: specific, measurable, achievable, relevant and cover a limit of time (Shahin & Mahbod, 2007)^[43].

In order to identify sustainability indicators for Brazilian HEI, 4 constructs were operationalized: management, teaching, research and extension, through 25 indicators that meet the SMART approach (GES1, GES2, GES3, GES4, GES5, GES6, GES7, ENS1, ENS2, ENS3, ENS4, ENS5, ESN6, PES1, PES2, PES3, PES4, PES5, PES6, EXT1, EXT2, EXT3, EXT4, EXT5 and EXT6), grouped according to the constructs, as shown in Table 8.

Table 5:	Operationa	lization o	f constructs
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Construct	Theoretical definition	Variable
Management (GES)		GES1: The campus configuration and infrastructure information provide basic information on the IES policy regarding the environment.
	Lemos et al.	GES2: IES values the energy efficiency effort of its buildings and is more concerned with nature and energy resources.
	$(2018)^{[24]}$ and	GES3: IES performs waste treatment and has recycling activities.
	Drahein et al.	GES4: IES has a water conservation and habitat protection program.
	(2019) ^[13]	GES5: IES has a transportation policy to limit the number of motorized vehicles on campus, the use of campus buses and bicycles to encourage a healthier environment
		CFS6 . IFS plays an important role in creating the new generation's concern with sustainability issues
		GES0: IES plays an important for in creating the new generation's concern with sustainability issues. GES7: IES has an environmental management/environmental certification system.
Teaching		TEACH1: Number of undergraduate courses that have "sustainability" in their curriculum.
		TEACH2: Number of places offered in courses related to sustainability.
	MEC	TEACH3: Number of people enrolled in courses related to sustainability.
(ENS)	(2019) ^[34]	TEACH4: Number of tickets in the offered places related to sustainability.
		TEACH 5: The ratio of entries/vacancies for courses related to sustainability is close to 1.
		TEACH6: Score in the General Index of Courses (IGC) of undergraduate courses related to sustainability.
		PES1: Number of postgraduate courses related to sustainability.
Research (PES)	CAPES	PES2: Number of students in postgraduate courses related to sustainability.
		ESP3: Number of professors linked to postgraduate programs related to sustainability.
	(2019) ^[8]	PES4: Proportionality between students/professors linked to programs related to sustainability.
		ESP5: Average CAPES score of postgraduate courses related to sustainability.
		PES6: Number of articles published by students/professors of postgraduate courses related to sustainability.
		EXT1: Number of students participating in extension projects related to sustainability.
	Maximiano Jr. (2017) ^[33]	EXT2: Number of graduates with experience in extension projects related to sustainability.
Extension		EXT3: Number of professors participating in extension projects related to sustainability.
(EXT)		EXT4: Number of administrative technicians participating in extension projects related to sustainability.
		EXT5: Annual budget resource focused on extension projects related to sustainability.
		EXT6: Number of extension projects related to sustainability approved in public notices.

Source: Self elaboration

The definitions of the constructs were based on empirical references obtained in the literature review and provided the theoretical basis for selecting and planning the indicator items. The proposed integration further aims to create a validated measurement instrument, determined as follows:

- Management Construct (GES) → measured by variables GES1 to GES7;
- Teaching Construct (ENS) → measured by variables ENS1 to ENS6;
- Research Construct (PES) → measured by variables PES1 to PES6; and
- Extension Construct (EXT) → measured by variables EXT1 to EXT6.

To establish the instrument validity, future research is needed to perform statistical procedures in order to analyze the quality of the model's fit, as well as the evidence of the validity of the constructs.

Conclusion

This article aimed to integrate the dimensions of sustainability with the core activity of Brazilian HEI. This presentation reinforced that all parts of the university system are critical to achieving transformative change, which can only occur by connecting all dimensions. This kind of thinking is fundamental to implement an environmentally sustainable action at local, regional and global scales in short, medium and intergenerational periods of time.

Although sustainability is an innovation within some HEI, it is necessary to incorporate it in an adapted way. Otherwise, the incorporation process will face strong resistance from individuals, leading to unnecessary conflicts and further, it will not lead to de facto sustainability.

Understanding how the environment works, operating with renewable energy, eliminating the concept of waste and living within the limits of natural systems are crucial. HEI managers must recognize that working towards sustainability is a necessity in today's world, where economic processes are rapidly degrading the natural and human resources on which societies are fully and mutually interdependent. For, HEI policies and strategies must be designed to integrate holistically across the university system.

This research sought to develop a theoretical model to integrate the dimensions of sustainability into the core activity and management of HEI. Although current research makes significant contributions, it still has limitations. Such a single country context can restrict the generality of the conclusions. To address this concern, future work needs to better investigate the interaction between public and private regulations.

Thus, to continue the research, it is recommended to complete the stages of Structural Equation Modeling (SEM), through statistical procedures, and the practical application of the definition of the theoretical model proposed in this study.

References

- Aleixo AM, Olive One OIL, Leal S. Toward sustainability through higher education: sustainable development incorporation into Portuguese higher education institutions, In DAVIM, JP; LEAL FILHO, W. (Eds). Challenges in Higher Education for Sustainability, Springer: London, 2016.
- 2. Alonso-Almeida MM, Marimon F, Casani F, Rodriguez-Pomeda J. Diffusion of sustainability reporting universities: Current situation and future perspectives. Journal of Cleaner Production. 2015; 106:144-154.
- Amaral LP, Martins N, Gouveia JB. Quest for a sustainable university: A review. International Journal of Sustainability in Higher Education. 2015; 16(2):155-172.
- 4. Bansal P. Evolving Sustainably: A longitudinal study of corporate sustainable development. Strategic Management Journal. 2005; 26:197-218.
- Beynaghi A, Trencher G, Moztarzadeh F, Mozafari M, Maknoon R, Filho WL. Future Sustainability Scenarios for Universities: Moving beyond the United Nations Decade of Education for Sustainable Development. Journal of Cleaner Production. 2016; 112:3464-3478.
- Boff LM, Oro IM, Beuren IM. Environmental management in a Higher Education Institution in the view of its directors. UFBA Accounting Journal, Salvador. 2008; 2(1):4-13.
- Bolzan LM, Weber JI, Löbler ML. Environmental alignment in a Public Institution of Higher Education. In: International Meeting on Business Management and the Environment. 12., 2010, São Paulo. Annals...São Paulo: FEA/USP, 2010.
- Coordination of Improvement of Higher Level Personnel (CAPES). Open data from Stricto Sensu Graduate Studies in Brazil 2017 to 2019, 2019. Available at: https://metadados.capes.gobr/index.php/catalog/204, Mar 11, 2021.
- 9. Cortese AD. The critical role of higher education in creating a sustainable future. Planning for Higher

Education. 2003; 31:15-22.

- Disterheft A, Caeiro S, Ramos M, Olive Olive AN. Environmental Management Systems (EMS) implementation processes and practices in European higher education institutions and top-down versus participatory approaches. Journal of Cleaner Production. 2012; 31:80-90.
- Disterheft A, Caeiro S, Olive One OIL, Filho WL. Sustainability science and education for sustainable development in Universities: A way for transition, In CAEIRO, S.; LEAL FILHO, W.; JABBOUR, C.; AZEITEIRO, UM (Eds), Sustainability Assessment Tools in Higher Education Institutions: Mapping Trends and Good Practices around the World, Springer International Publishing: Cardiff, 2013.
- 12. Disterheft A, Caeiro SS, Son WL, Azeiteiro UM. The indicare-model: Measuring and caring about participation in higher education's sustainability assessment. Ecological Indicators. 2016; 63:172-186.
- 13. Drahein AD, Lima EP, Costa SEG. Sustainability assessment of the service operations at seven higher education institutions in Brazil. Journal of Cleaner Production. 2019; 212:527-536.
- 14. Dyer G, Dyer M. Strategic leadership for sustainability by higher education: The American College & University Presidents' Climate Commitment. Journal of Cleaner Production. 2017; 140:111-116.
- Dziedzic M, Dziedzic R. Diagnosis and proposal for reducing emissions: Campus Universidade Positivo. In: National Meeting on Business Management and Environment. 12., 2010, São Paulo. Proceedings... São Paulo: FEA/USP, 2010.
- Figueiró PS, Raufflet F. Sustainability in higher education: A systematic review with focus on management education. Journal of Cleaner Production. 2015; 106:22-23.
- Godemann J, Bebbington J, Herzig C, Moon J. Higher education and sustainable development: Exploring possibilities for organizational change. Accounting, Auditing & Accountability Journal. 2014; 27(2):218-233.
- National Institute of Metrology, Quality and Technology (INMETRO). Conformity Assessment, 2021a. Available at: http://www.inmetro.gobr/qualidade/certificacao.asp, March 29, 2021.
- National Institute of Metrology, Quality AND Technology (INMETRO). Consultation of certified companies, 2021b. Available at: https://certifiq.inmetro.gobr/Consulta/ConsultaEmpresa s, March 29, 2021.
- Karatzoglou B. An in-depth literature review of evolving roles and contributions of universities to education for sustainable development. Journal of Cleaner Production. 2013; 49:44-53.
- Koehn PH, Uitto JI. Universities and the Sustainable Development Future: Evaluating Higher-education Contributions to the 2030 Agenda. Routledge: New York, 2017.
- 22. Larrán Jorge ML, Maduene JH, Cejas MYC, Peña F. An approach to the implementation of sustainability practices in Spanish Universities. Journal of Cleaner Production. 2015; 106:34-44.
- 23. Leal Filho W, Manolas E, Pace P. The future we want: Key issues on sustainable development in higher education after Rio and the UN decade of education for sustainable development. International Journal of Sustainability in Higher Education. 2015; 16(1):112-

129.

- Lemos PFI, Brando FR, Almeida P, Mülfarth RCK, Aprilanti TMG, Marques LOA, *et al.* The University of São Paulo on the 2017's GreenMetric Ranking. E3S Web Conf., 2018, 48.
- 25. Lima JR FR, Oiko OT, Cavicchioli FF. Waste management in universities: Characterization and analysis of solid waste disposal. In: National Meeting on Business Management and Environment. 12., 2010, São Paulo. Annals...São Paulo: FEA/USP, 2010.
- Lozano R. Incorporation and institutionalization of SD into universities: Breaking through barriers to change. Journal of Cleaner Production. 2006; 14(9-11):787-796.
- Lozano R. Envisioning sustainability threedimensionally. Journal of Cleaner Production. 2008; 16(17):1838-1846.
- Lozano R. Diffusion of sustainable development in universities curricula: An empirical example from Cardiff University. Journal Clean Production. 2010; 18(7):637-644.
- 29. Lozano R. The state of sustainability reporting in universities. International Journal of Sustainability in Higher Education. 2011; 12(1):67-78.
- Lozano R, Ceulemans K, Alonso-Almeida M, Huisingh D, Lozano FJ, Waas T, *et al.* A review of commitment and implementation of sustainable development in higher education: results from a worldwide survey. Journal of Cleaner Production. 2015; 108:1-18.
- Lozano R, Lozano FJ, Mulder K, Huisingh D, Waas T. Advancing higher education for sustainable development: International insights and critical reflections. Journal of Cleaner Production. 2013a; 48:3-9.
- 32. Lozano R, Lukman R, Lozano FJ, Huisingh D, Lambrechts W. Declarations for sustainability in higher education: becoming better leaders, through addressing the university system. Journal of Cleaner Production. 2013b; 48:10-19.
- 33. Maximiano JR M. Brazilian university extension indicators. EDUFCG: Campina Grande, 2017.
- 34. Ministry of Education (MEC). Higher Education Quality Indicators, 2019. Available at: http://portal.inep.gobr/web/guest/educacaosuperior/indicadores-de-qualidade/resultados, March 21, 2021.
- Ministry of the environment (MMA). Sustainability training course in public administration. Brasília, DF: MMA, 2017.
- 36. Moura BA, Moura LBA. Ranking of universities: reflections on the construction of institutional recognition [Ranking of universities: reflections on the construction of institutional recognition]. Acta Scientiarum. Education. 2013; 35(2):213-222.
- 37. Muff K, Dyllick T, Drewell M, North J, Shrivastava, Haertle J. Management Education for the World: a Vision for Business Schools Serving People and Planet. Edward Elgar Publishing Limited, 2013.
- OECD (Organisation for Economic Co-operation and Development). Reviews of National Policies for Education, OECD Publishing: Paris, 2018.
- Popescu M, Beleau C. Improving management of sustainable development in universities. Bulletin of the Transilvania University of Braşov. 2014; 7:97-106.
- 40. Rohweder L. Integrating environmental education into business schools' educational plans in Finland. GeoJournal. 2004; 60(2):175-181.
- 41. Rusinko CA. Using quality management as a bridge in

educating for sustainability in a business school. International Journal of Sustainability in Higher Education. 2005; 6(4):340-350.

- 42. Sammalisto K, Sundstrom A, Holm T. Implementation of sustainability in universities as perceived by faculty and staff is a model from a Swedish university. Journal of Cleaner Production. 2015; 106:45-54.
- 43. Shahin AE, Mahbod MA. Prioritization of key performance indicators: An integration of analytical hierarchy process and goal setting. International Journal of Operations and Production Management. 2007; 56:226-240.
- 44. Sharma S, Vredenburg H. Proactive corporate environmental strategy and development of competitive and valuable organizational capabilities. Strategic Management Journal. 1998; 9(8):729-753.
- 45. Sharma S, Vredenburg H, Westley DF. Strategic bridging: A role for the multinational corporation in Third World development. Journal of Applied Behavioral Science. 1994; 30(4):458-476.
- Shin J, Toutkoushian R. The past, present, and future of university rankings, In SHIN, RT; TEICHLER, EU (Eds), University Ranking: Theoretical Basis, Methodology and Impacts on Global Higher Education, Springe: Dordrecht, 2011.
- 47. Shriberg M. Institutional assessment tools for sustainability in higher education: strengths, weaknesses, and implications for practice and theory. Higher Education Policy. 2002; 15(2):153-167.
- Stephens JC, Hernandez ME, Román M, Graham AC, Scholz RW. Higher education as a change agent for sustainability in different cultures and contexts. International Journal of Sustainability in Higher Education. 2008; 9(3):317-338.
- 49. Stough T, Ceulemans K, Lambrechts W, Cappuyns P. Assessing sustainability in higher education curricula: a critical reflection on validity issues. Journal of Cleaner Production. 2017; 16:1-11.
- Stubbs W, Cocklin C. Teaching sustainability to business students: Shifting mindsets. International Journal of Sustainability in Higher Education. 2008; 9(3):206-221.
- 51. Thompson GP. New faces, new opportunities: the environmental movement goes to business school. Environment. Science and Policy for Sustainable Development. 1985; 27(4):6-30.
- Veiga JE. Social and environmental indicators: evolution and perspectives. Journal of Political Economy. 2009; 29(4):421-435.
- Waas T, Huge J, Verbruggen A, Wright T. Sustainable development: A bird's eye view. Sustainability. 2011; 3(12):1637-1661.
- 54. White MA. Sustainability: I know it when I see it. Ecological Economics. 2013; 86:213-217.