ARTICLE

New model to evaluate innovation in Higher Education institutions

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Abstract

Measuring innovation in Higher Education Institutions (HEIs) is challenging due to the existing rankings' reliance on limited indicators like publications and patents. This study proposes a comprehensive model for HEI innovation evaluation. It identifies four key dimensions: management processes, academic programs, partnerships, and marketing. Over 60 indicators within these dimensions provide a thorough assessment of the HEI innovation capacity. This model enables benchmarking against similar institutions, tracking innovation progress over time, and informing decision-making for enhancing innovation within HEIs. It offers a more accurate and useful approach for evaluating and strengthening innovation in Higher Education.

Keywords: Educational Innovation. Educational Planning. Educational Administration. Educational Management. Educational Evaluation.

1 Introduction

Why is the current evaluation of innovations in Higher Education Institutions (HEIs) deemed inefficient? This study addresses this question by proposing a new model that offers a fairer assessment for younger, private HEIs, stakeholders, businesses, and regional networks.

A key aspect of this evaluation is the ability of innovation in HEIs to meet the needs of the training process and stakeholders' expectations, as outlined by

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Received: Apr. 1, 2024
Accepted: Feb. 3, 2025

Lacleta, Blanco, and Penalvo (2014 as cited in Betancur *et al.*, 2022). Their argument underscores the importance of sustainability, ensuring that results are transferable across various contexts. Building on this, Betancur *et al.* (2022) defined the concept of the Innovative Educational Organization System, which reflects the degree to which an institution aligns its leadership, values, beliefs, and resources with the evolving needs and expectations of stakeholders. This alignment is achieved through technological advancements, processes, content, methodologies, pedagogical practices, and other resources and capabilities, all of which contribute to improving student outcomes and institutional performance. The drive for such innovations is further fueled by the growing importance of knowledge societies, the globalization of services, the scientific-technical revolution, and the pursuit of economic well-being, particularly in competitive economies. As emphasized by (Bricall 2000; Martin and Etzkowitz 2000; European Commission, 2006 and Gulbrandsen, Slipersaater, 2007 as cited in Palomares-Montero and García-Aracil, 2009), the emergence of a new university model that incorporates the third mission—focusing on entrepreneurship, innovation, and social responsibility— is shaping the future of HEIs. Even though this literature review study on institutional and program indicator systems shows that the organization's mission is present in 12 out of 15 reviewed studies, third mission activities are only found in three of them.

This gap highlights the limitations of current rankings based on innovation indicators, such as "The Most Innovative Universities in the World" by Reuters (Ewalt, 2019) in collaboration with Clarivate Analytics, the "SCImago Ranking of Innovation at Ibero-American Universities" by Spanish National Research Council (CSIC) in Spain, and the "*Folha de Sao Paulo* University Ranking" from Brazil, which primarily focus on patents and publications, as well as *Universidades Empreendedoras* in Brazil based on the number of citations per article, patents, and incubated companies (Ranking Universitario Folha, 2019; SCImago Lab, 2019: Universidades Empreendedoras, 2023). While these indicators are useful, they fail to capture the broader spectrum of innovation activities that are crucial to institutional transformation. To bridge this gap, the fourth edition of the Oslo Manual (Organisation for Economic Co-Operation and Development, 2018) offers valuable insights into how innovation should be measured, particularly in companies, which can be adapted to educational institutions. Understanding the scale of innovation activities, the characteristics of innovative companies, and the internal and systemic factors influencing innovation based on the experience gained in innovation research in Organisation for Economic Co-Operation and Development (OECD) countries and associated countries. In light of this, this study proposes a framework that defines, monitors,

and evaluates the outcomes of innovation in HEIs, drawing on the literature review to identify four key dimensions and their associated indicators.

1.1 Innovation Management

Innovation management in Education integrates organizational structures that foster research, sustainability, and entrepreneurial diversity with digital transformation through information and communication technologies (ICT), artificial intelligence (AI), and Learning Analytics. It emphasizes an innovative culture, interdisciplinary collaboration, idea and innovation project competitions, continuous training, participation in professional communities, and digital tools.

1.1.1 Organizational Structure; Departments, organizational culture, projects/idea contests

This initial stage of innovation management systems establishes the foundations of the strategic direction (Garnica Estrada, Franco Calderón, 2020). It includes the configuration of centers, departments, or research areas in institutions and vice-rectorates and is based on the design of academic training, considering curricular, pedagogical, and institutional aspects. All this must be developed within a framework that promotes formative research and innovation in institutions. Universities play a fundamental role in promoting the Sustainable Development Goals (SDGs) by integrating aspects of entrepreneurship, innovation, and sustainability (Voldsund, Hasleberg, Bragelien, 2020). They argue that to advance sustainable development, it is crucial to adopt a broad perspective on entrepreneurship, including intrapreneurship, social entrepreneurship, green entrepreneurship, and digital entrepreneurship. This multifaceted approach to innovation is essential for addressing the current social and environmental challenges. In addition, institutional conditions, especially organizational culture, play a crucial role in the sustainability of this educational innovation (Caliskan, Zhu, 2020). Educational institutions face a dual challenge: not only do they have to create conditions to promote innovative leadership, but they also have to transform themselves to become more innovative in the structure of their organizational culture (Banerjee and Ceri, 2016 cited in Parejo JL *et al.,* 2022). According to a recent analysis (Parejo JL *et al.,* 2022), carried out by a Delphi panel of experts, innovation often arises from small teams of teachers and faces resistance during its institutionalization. Furthermore, the perceived climate of innovative teaching influences the exchange of ideas in educational innovation networks (Stasewitsch, Dokuka, Kauffeld, 2022).

1.1.2 Digital Transformation; Integration of ICTs into teaching-learning processes, technological laboratories, and data analysis

The results indicate that it is not enough to implement technology at the level of teachers and students; its development must be comprehensive throughout the institution (Cardenas-Gutierrez *et al*., 2017 as cited by Deroncele-Acosta *et al*., 2021). It is necessary to dynamize educational innovation processes, emphasizing digital competencies and new concepts in the co-creation of virtual teaching-learning environments (Palacios Núñez, Toribio López, Deroncele Acosta, 2021). Three critical success factors include participation in professional communities of good practices, continuous training in innovative methodologies with ICT, and the implementation and equipping of laboratories with current technologies and internet connectivity in universities (Deroncele-Acosta *et al*., 2021). The integration of these critical success factors with advanced educational technologies and platforms enhances the teaching-learning experience, bridging institutional innovation with practical tools that empower educators and students alike. To facilitate teaching-learning processes, Okoye *et al*. (2023) mentioned tools such as augmented reality, virtual reality, and learning management systems (Moodle, Canvas, Blackboards, Massive Open Online Courses (MOOCs), as well as learning elements such as Serious Games and gamified learning platforms. Google Classroom, a digital platform integrated into an ecosystem of Education applications and tools, also plays a fundamental role in enabling the efficient management of courses and educational resources (Saura, Díez-Gutiérrez, Rivera-Varga, 2021). This author also mentions Workspace for Education, which includes communication spaces (Meet, Gmail), organization (Calendar), collaboration (Drive, Google Forms, Jamboard), and multimedia resources videos on YouTube. Classroom is intended for virtual classes that allow the management of courses, assignments, comments, evaluations, and linking other EDTech tools with Google.

The use of various technological tools to search and organize information, communicate, gamify learning, present information, create knowledge, and assess learning is essential. Tools for searching information: Google, Duckduckgo, Google Scholar, Redacly, Dialnet, Diigo, Feedly, Paper.ly, Reddit, Scoop.it. Management and organization: Doodle, ClassroomScreen, Gantter, ProjectLibre, Trello, Google Drive, OneDrive, Symbaloo, Clipix, Moodle. Communication: Telegram, Hangout, BB Collaborate, Jitsi, Teams, Google Meets, Gmail, Outlook, Slack. Edmod. Gamification: Classdojo, Classcraft. Information presentation: Slideshare, PowerPoint, Genial.ly, Prezzi. Blogger, WordPress, WIX, Pinterest. Knowledge creation: IdeaFlip, Padlet, Canva, Mindmeister, Visme, Office Timeline. Assess knowledge: Kahoot, Socrative, Quizzizz. Edpuzzle. Google

Forms, SurveyMonkey (Ruipérez, 2023). In addition to ICTs to create resources with Artificial Intelligence images, Microsoft Designer, DALL-E, Janus-Pro-7B, videos Veo, Sora, Capcut, Filmora.

The use of virtual/augmented reality and personalized learning based on data generated by the subject in their digital activity (Morales, Angona, López-Ornelas, 2021). The analysis of educational data, through tools such as Learning Analytics, offers significant opportunities for improving Education and innovation. Okoye *et al*. (2020) cited in Palacios Núñez, Toribio López, Deroncele Acosta (2021) highlight the opportunities and benefits of using Learning Analytics to improve Education and innovation processes, specifically in terms of technological advantages and support for strategic decision-making. However, educational institutions face challenges in effectively leveraging the information and educational data sets being recorded at an unprecedented rate in the databases of different institutions (Okoye *et al*., 2023). Rincon-Flores *et al*. (2020) describe Learning Analytics as a process that collects and analyzes student data to improve the teaching-learning process. Despite computational technological advances, machine learning has limitations, and the application of these analyses focuses mainly on distance Education and when students complete the course. However, according to these authors, with the help of artificial intelligence, the use of algorithms can create innovative models in educational processes, being accessible to most educational institutions due to their combination of statistical, probabilistic methods, and forecasting models. Overall, AI's integration into innovation management frameworks offers significant benefits, including enhanced decision-making, process automation and strategic foresight (Proença, 2024).

1.2 Academic Programs

Academic programs integrate innovation through curricular design and active methodologies (e.g., gamification, prototyping), fostering entrepreneurial thinking and real-world problem-solving. Co- and extracurricular activities, such as internships, bootcamps, and mentorship programs, further enhance student engagement and skill development. Partnerships with industry, government, and nonprofits, along with digital marketing strategies, prepare students to meet market demands.

1.2.1 Curricular

In the field of teaching, there are identified opportunities for innovation in various aspects, such as mission, vision, institutional objectives, educational

model, and curriculum structure (Gómez Ortíz, Lona Rocha, Jiménez Salazar, 2016). It is essential for educational institutions, especially universities, to foster an environment of innovation and support that enables the effective transfer of educational research to the curriculum and pedagogical practice in the classroom (Trimmer, Donovan, Flegg, 2020, as cited by Deroncele-Acosta *et al.*, 2021).

This integration of innovative practices into teaching and curriculum design is complemented by the adoption of active methodologies such as gamification and hands-on approaches like final projects and prototypes, which not only engage students but also prepare them to apply entrepreneurial thinking to real-world challenges.

The promotion of entrepreneurial thinking has become a crucial skill that goes beyond traditional soft skills (Braga *et al*., 2022) in undergraduate and graduate courses. Universities must integrate entrepreneurship into both teaching and research (Paiva, Alves, Sampaio, 2019 cited by Paños-Castro, Arruti, 2020). According to García and Redondo (2010), also cited by the same authors, an innovative teacher must be able to design and develop curricula with the aim of promoting innovation, creativity, and entrepreneurship, using interactive methodologies.

Gamification is an active methodology based on the application of game mechanics and elements to improve the learning experience (Kapp, 2012). By combining game elements with design in didactic content, the aim is to maintain student motivation, using tools such as rankings and medals based on effort rather than achievements (Seaborn, Fels, 2015; Parra-González *et al*., 2022). Although game-based approaches can enhance business Education, it is important to note that many games focus on business management, without specifically developing the entrepreneurial mindset, motivation, and innovation skills necessary to identify and meet market needs (Casau, Dias, Amorim, 2023).

Tutors and final projects play a pivotal role in integrating entrepreneurship into Education, as exemplified by the method employed at the College of Engineering at Texas A&M University. In this approach, students are challenged to create and prototype solutions within 48 h, culminating in presentations to a jury composed of representatives from various companies and institutions (Braga *et al*., 2022). Final projects, as Selznick *et al*. (2021) emphasize, are typically designed to incorporate and evaluate integrative learning. Strengthening their connection to innovation, these projects can

encourage students to propose novel solutions or applications. This emphasis on innovation aligns with the indicators of the TBP manual issued by the OECD, which evaluate and analyze technology transfer processes through aspects such as patents, licenses, know-how, brands, and prototypes, highlighting the importance of hands-on, innovative Education in preparing students for real-world challenges.

1.2.2 Co-curricular

According to Selznick *et al.* (2021), promoting student integration can be a direct result of prioritizing connection and application throughout the curriculum and co-curriculum. Additionally, Mayhew and Selznick (2018) highlight that double majors are not only additive but also opportunities that can drive integration and innovation among students.

1.2.3 Extra-curricular

Entrepreneurship is a fundamental component of the Master's program in Science, Business, and Innovation at VU Amsterdam University, which incorporates lectures, group and individual work, article discussions, tutoring, and consultancy (Blankesteijn, Bossink, Van Der Sijde, 2021). To disseminate educational innovation effectively, universities often organize conferences, symposia, and networking events, which can have an immediate impact (Stasewitsch, Dokuka, Kauffeld, 2022). Complementing these are technical reports that serve as key dissemination tools for research, including theses, books, journal articles, and reports tailored for the public, social, and private sectors (Gómez Ortíz, Lona Rocha, Jiménez Salazar, 2016).

Practical experiences such as internships allow students to contribute to regional innovation systems by applying their knowledge and skills to market-oriented projects (Blankesteijn, Bossink, Van Der Sijde, 2021). Study visits to innovative countries further enrich this learning process by illustrating the influence of cultural contexts on business activities (Blankesteijn, Bossink, Van Der Sijde, 2021). Bootcamps like the Innovation Boot Camp have demonstrated success in teaching and implementing structured innovation processes through multidisciplinary collaboration and activity-driven curricula (West *et al*., 2012).

The University of Dundee (UoD) has established the Center for Entrepreneurship to enhance the self-sufficiency and employability of students, graduates, and staff. This initiative focuses on developing entrepreneurial skills and supporting those interested in starting their own businesses (Mission of the UoD Center

for Entrepreneurship, cited in Latter, Bruce, Mcnicoll, 2021). One of its key programs is the Enterprise Challenge, a seven-week biennial extracurricular business training initiative (Latter, Bruce, Mcnicoll, 2021). In a broader context, innovation and entrepreneurship are closely linked in Education. According to Spanish experts, innovation involves introducing changes in the classroom and school through new methodologies and technology, while educational entrepreneurship emphasizes creating businesses or projects related to Education (Paños-Castro, Arruti, 2020). To further support entrepreneurial activities, the UoD Center for Entrepreneurship organizes an annual business competition that offers substantial financial prizes to support new business ideas (Latter, Bruce, Mcnicoll, 2021).

Complementing this effort, university incubators provide a wide array of resources, including mentorship, business plan development, laboratory access, and connection with other startups (Braga *et al.,* 2022). Additionally, the UoD Center runs acceleration programs lasting two to three months in collaboration with external partners, focusing on preparing business ideas for investment and scaling (Latter, Bruce, Mcnicoll, 2021).

In addition to the guidance provided in idea and prototype development, mentorship plays a vital role in fostering entrepreneurship (Braga *et al.,* 2022). For example, at the Faculty of Engineering and Science at the Western Norway University of Applied Sciences, peer mentors were introduced to monitor students' progress on assigned tasks and facilitate group composition, dynamics, and subsequent progress —a strategy emphasized by Voldsund, Hasleberg, and Bragelien (2020). This focus on mentorship not only enhances student performance but also lays the foundation for further entrepreneurial outcomes, such as the creation of spin-offs. The role of students in creating spin-offs is an understudied area, although their contribution to the development of derivative projects through projects and theses is recognized (Rasmussen, Wright, 2015).

1.3 Partnerships

Professors participating in the Master's program in Science, Business, and Innovation have an extensive network of professional contacts (Blankesteijn, Bossink, Van Der Sijde, 2021). Peripheral developments, such as spin-offs, which focus on strengthening the relationship between the business and academic environments, are part of a broader approach to integrating a culture based on the entrepreneurial and innovative ethos of the institution. Examples of this integration include programs designed to encourage entrepreneurial activities within the

academic environment. These initiatives are incorporated into the scheme used to assess the regional impact of entrepreneurial universities (Garcia-Aracil and Villarreal, 2009, cited in Palomares-Montero, García-Aracil, 2009).

Miranda, Rosas-Fernández, and Molina (2020) highlight a significant government partnership exemplified in a case study involving Tecnológico de Monterrey University and the Government of Mexico City. Together, they orchestrated the design, development, and execution of a new boot camp-style program aimed at cultivating innovation and entrepreneurship within society. This collaborative effort underscores a proactive approach to address societal needs and foster a culture of innovation through strategic partnerships between academia and government entities.

Collaboration with various stakeholders is essential for providing quality learning and generating value. In this sense, external cooperation networks are a key element. For example, collaboration is established with other universities where visiting professors participate twice a year. These professors not only give lectures but also supervise students in seeking technical solutions and developing business plans. This network goes beyond the triple helix, as it also includes partners from society, such as nonprofit organizations (Voldsund, Hasleberg, Bragelien, 2020).

In order to modernize universities and improve regional innovation systems, Jonkers *et al*. (2018), through the Joint Research Centre of the European Commission, proposed the participation of companies in curriculum design and/or involvement of regional companies in the selection and supervision of bachelor's, master's and doctoral theses (industrial doctoral programs), as well as the sharing of R&D facilities.

1.4 Marketing

Romero-García *et al*. (2020) considered web content evaluation, social networks, learning communities for information sharing, and educational content. Additionally, tools for shared or collaborative learning, such as blogs and podcasts, are considered integral to improving academic performance and developing digital skills. Stathopoulou Siamagka and Christodoulides (2019) emphasized the mutual recognition among educators and students regarding the significance of integrating social media into course delivery and assessment. They underscored its positive impact on deepening students' learning experiences, fostering engagement, and enhancing collaborative and organizational skills.

Through structural equation modeling analysis, Lou and Yuan (2019) revealed that factors such as the informative value of influencer-generated content, trustworthiness, attractiveness, and similarity to followers contribute to followers' trust in influencers' branded posts, subsequently influencing brand awareness and purchase intentions.

Furthermore, university students perceive blogs as a valuable tool for acquiring professional competencies, enriching the teaching-learning process, and promoting reflective practices (Pinya, Rosselló, 2016). Additionally, podcasts serve as accessible resources for teaching and research, supplementing lectures and facilitating engagement with diverse audiences while stimulating critical discussions on contemporary issues (Scriven, 2019).

2 Methodology

This paper employs a conceptual framework design to address the challenge of measuring innovation in HEIs. Existing models do not adequately account for the multi-dimensional innovation in HEIs. This research organizes the evaluation into four distinct dimensions—Management Processes, Academic Programs, Partnerships, and Marketing—accompanied by over 60 specific indicators. Table presents the complete list of dimensions, subdimensions, and indicators.

Table - Dimensions and indicators of Higher Education Institutions' innovation

Main Category	Subcategory	Additional Subcategory	Indicator	Metric
Internal Innovation	Structure		Existence of Vice-rectorate of Innovation	Yes/No
			Existence of Innovation Directorate	Yes/No
			Existence of Innovation Leadership	Yes/No
	Strategy		Sustainable Development Goals	Number of innovation objectives aligned with the SDGs
			Existence of outcome-based funding models for innovation	Yes/No
			Trends	Degree of adaptation to the external context and trends (scale of 1 to 5)
	Resources	Faculty innovation expertise	Faculty Innovation areas	Number of professors with doctorate
			Faculty Innovation areas	Number of professors with master's
			Postgraduate Programs	Number of innovation postgraduate programs
		Establishment of new centers or institutes focused on specific areas of innovation	Innovation Lab	Yes/No
			Entrepreneurship Center	Yes/No
			Observatories and Institutes	Yes/No
		Funded Innovation Projects	Total amount of external funding (in thousands of dollars)	External over $125,000
				External under $125,000
			Internal projects	Number of internal projects
	Culture		Faculty and staff incentives to experiment and take risks	Percentage of faculty and staff applying
			Projects using Agile Methodologies to seek solutions	Percentage of projects using Agile Methodologies
			Entrepreneurial Orientation	Degree of entrepreneurial orientation (scale of 1 to 5)

Continue

Continuation

Internal Innovation	Digital Transformation	Integration and use of ICT in teaching and learning methodologies	Learning Analytics, Artificial Intelligence (AI), Blockchain	Number of technologies implemented
			Gamification, Virtual Reality (VR), Augmented Reality (AR)	
			Online learning platforms	Moodle, Canvas, Blackboard
		Digital Processes	Virtual and/or hybrid learning	Percentage of programs
			Administrative Processes Efficiency and Service Quality	Number of online and/or automated administrative processes
			Time Saving Efficiency	Percentage reduction in time needed to complete degrees or innovation projects
Commercial Innovation	Academic	Curricular	Innovation Courses	Number of innovation courses at the postgraduate level
				Number of innovation courses at the undergraduate level
				Number of innovation courses in extension programs
				Number of educational programs, study modules, NTM new to the market courses
				Enrollment rate in new programs vs. traditional ones
			Prototyping	Number of prototypes with market fit
				Number of functional prototypes
				Number of conceptual prototypes
		Co-curricular	Double and multidisciplinary degrees	Number of external double and multidisciplinary degrees
				Number of internal double and multidisciplinary degrees
				Number of co-curriculum users
		Extracurricular	Entrepreneurship	Number of spin-offs created

Continue

Continuation

Commercial Innovation	Academic	Extracurricular	Entrepreneurship	Number of students receiving acceleration mentoring
				Number of students receiving incubation mentoring
			Intellectual Property	Number of registered patents
				Number of registered copyrights
				Number of published technical reports
			Conferences on innovation subject	Number of international conferences organized
				Number of national conferences organized
			Others	Number of bootcamps organized
				Number of students completing internships
				Number of study trips conducted
	Partnerships	Companies		Number of joint innovations and solutions for the market developed
				Number of technology transfer and licensing agreements signed
				Number of startups created in collaboration with companies
				Number of consultancies conducted for companies
				Number of projects with company sponsorship, acting as investment partners

Continue

Continuation

Commercial Innovation	Partnerships	Institutions	Projects/contracts	Number of projects/contracts with universities
				Number of projects/contracts with public institutions
				Number of projects/contracts with non-profit organizations
		Regional Integration		Number of research/teaching personnel holding temporary positions in non-academic organizations and vice versa
				Number of bachelor's, master's, doctoral theses conducted in cooperation with organizations (industry, public, non-profit) in the region
				Number of customized academic programs in collaboration with companies and industry sponsorship for postgraduation education
				Degree of access to technology parks and innovation hubs (scale of 1 to 5)
				Degree of access to seed funding and venture capital for projects (scale of 1 to 5)
	Marketing			Number of public recognitions and awards received for innovative practices
				Social media reach (number of followers, interactions)
				Website traffic (visits, dwell time)
				Number of blog and podcast subscribers and downloads
				Impact of collaborations with influencers (reach, engagement)

Source: Own elaboration (2024)

The proposed model is built through qualitative analysis, focusing on interpreting and synthesizing existing knowledge to create a comprehensive evaluation framework. Conceptual analysis was used to define and categorize indicators through an extensive literature review. As an inclusion criterion, articles published mostly within the last five years were considered, drawing data from sources such as Scopus, existing models, ranking systems (e.g., SCImago, Reuters, *Folha de Sao Paulo*), and the adaptation of innovation metrics from the Oslo Manual (Organisation for Economic Co-Operation and Development, 2018).

Once the relevant articles were collected, they were systematically analyzed to identify the categories and subcategories related to innovation in HEIs. Content analysis techniques were applied to identify patterns, recurring themes, and areas of common interest in the reviewed literature. From this inductive analysis, the key dimensions and indicators that form the structure of the measurement model for innovation in Higher Education were developed. Although the study primarily employs qualitative methods, it also has quantitative potential: the proposed measurable indicators enable future statistical applications in comparative studies or institutional benchmarking.

This study is classified as theoretical and applied research. It proposes a novel conceptual framework for evaluating innovation in HEIs, introducing practical indicators and dimensions that can be implemented in real-world assessments of educational institutions. Furthermore, the study generates a practical framework that stakeholders in academia, industry, and government can use to benchmark innovation progress, inform strategic planning, and foster institutional improvements.

3 Results

The Oslo Manual (Organisation for Economic Co-Operation and Development, 2018) provides a framework for measuring innovation, and several metrics are directly applicable to HEIs, with certain necessary adaptations at the level of organizational, process, product, and marketing innovations. This study, following the latest edition of the Oslo Manual, defines these adaptations as types of internal and commercial innovations. In internal innovation, we have organizational innovation or innovation management, while in commercial innovation, we include educational innovation related to academic products or services, new or improved, provided by institutions to educational and labor markets, as well as innovation in the third mission. Dimensions such as partnerships and marketing, which have received less attention in the literature on innovation in HEIs, have

been added to commercial innovation. Partnerships or alliances could be included in the business model innovation.

The dimensions are the components of a concept, in this case, the types of innovation. The categories are the groups within a dimension; for example, in the academic dimension, curricular, co-curricular, and extra-curricular. Indicators are the measures used to quantify dimensions or categories. This classification of innovation in the context of HEIs proposes parameters that go beyond rankings measurements such as Reuters, SCImago, and *Folha de Sao Paulo*, which focus on patents and scientific articles. We believe that the publication of scientific articles should not be included in a multidimensional framework for evaluating the progress of innovation.

Categorized dimensions based on thematic clustering of the internal (management) and commercial (academic, partnerships, marketing) innovation theoretical framework. The internal dimension focuses on the internal capabilities of HEIs to foster innovation across various domains. The commercial dimension focuses on external outputs and partnerships to drive market-relevant innovation.

The Vice-Rectorate and Directorate of Innovation reflect the institution's formal commitment to prioritizing innovation. This dedicated administrative structure not only facilitates the effective implementation of innovative initiatives but also ensures integrated and efficient governance to foster an innovation-driven culture within the organization.

Aligning innovation objectives with the SDGs underscores the institution's commitment to sustainable and socially responsible practices. The development of outcome-based funding models for innovation ensures the long-term relevance of its strategies.

The innovative expertise of the faculty is a critical resource, with doctorates and master's degrees in innovation areas strengthening the institution's ability to conduct advanced research and train students in cutting-edge practices. The establishment of new centers or institutes dedicated to specific innovation areas further affirms this commitment.

Incentivizing faculty and staff to experiment and take risks translates into a more dynamic and innovation-prone working environment. The use of Agile methodologies in projects indicates readiness to embrace modern problem-solving frameworks.

The adoption of innovative technologies such as AI, Blockchain, Gamification, and Virtual and Augmented Reality showcases the institution's leadership in integrating innovations into educational curricula and teaching-learning processes.

The variety and number of innovation courses offered across different levels and extension programs reflect the institution's curricular flexibility and readiness to adapt to changing job market demands. Emphasis on prototyping and entrepreneurial orientation indicates a hands-on learning ecosystem where ideas are transformed into tangible products.

Collaborations with companies, startups, public institutions, and nonprofit organizations in joint innovations and technology transfer agreements amplify the institution's external impact, positioning it as a catalyst for applied learning and market innovation.

The number of public recognition and awards for innovative practices is a valuable metric, representing external feedback on the success and relevance of initiatives. Additionally, social media reach and website traffic reveal the effectiveness of communication and public engagement with the institution's innovations.

4 Discussion and conclusions

The aim of this study was to create a measurement system, specifically a ranking system, to evaluate innovation in HEIs. The four dimensions and indicators were derived from an exhaustive literature review, analyzing the relevant variables to measure innovation.

While this research provides a standardized evaluation framework, it also facilitates future comparisons with other HEIs, allows tracking of progress over time, and informs strategic decision-making by identifying areas for improvement and investment. Furthermore, it fosters collaboration and knowledge exchange among institutions.

However, it is important to recognize certain limitations. First, the specific circumstances and challenges faced by HEIs when applying the model and interpreting the results in a complex and diverse environment must be taken into account. Regarding specific limitations, no pilot test of the model was conducted to assess its reliability and feasibility with internal users of the institutions. Other stakeholders were also not addressed.

A study conducted by Vidicki *et al*. (2023) showed that the surveyed faculties showed better results in curricular and research innovation, less in third mission and organizational innovation, and little interest in process innovation, outside of the teaching and research process. This study shows that partnerships and organizational innovation have shown better results.

On the other hand, Jain, Sharma, and Ilavarasan (2018) developed a hierarchical model that includes indicators such as patents, publications, collaborative efforts, industrial consulting, funded projects, research-related incentives, and training serve as significant connection points that link fundamental research inputs—including government funding, project hours, research facilities, institutional location, and intellectual property policies—to ultimate outcomes like entrepreneurial development and contributions to national development objectives.

The construction of this model offers benefits to various stakeholders, including users, HEIs, students, businesses, and providers. By analyzing the results within the specific context of each institution, including its type and mission, both for-profit private institutions and public institutions, it would be possible to obtain a comparative ranking of innovation at regional, national, or international levels.

Future research lines are suggested to determine the relationship or association between the variables. Is there a connection between a university's level of innovation and its attractiveness to students? How does the innovation capacity of HEIs influence their ability to form alliances with businesses? Expand the study to include a comparison between public and private institutions regarding their levels of innovation. Include universities' social media activities analysis to identify the reach and impact of their innovation initiatives. The 'Metrics' in Table - Dimensions and indicators of Higher Education Institutions' innovation provide measurable indicators that can be used in quantitative studies to gain further insights. Additionally, future research could explore how these indicators align with the Sustainable Development Goals (SDGs) from Agenda 2030, examining the role of HEIs in fostering innovation that contributes to global priorities.

Modelo para avaliação da inovação nas Instituições de Ensino Superior

Resumo

Medir a inovação nas Instituições de Ensino Superior (IES) é desafiador devido à dependência dos rankings existentes em indicadores limitados a publicações e patentes. Este estudo propõe um modelo abrangente para avaliação da inovação nas IES e identifica quatro dimensões-chave: processos de gestão, programas acadêmicos, parcerias e marketing. Mais de 60 indicadores dentro dessas dimensões fornecem uma avaliação completa da capacidade de inovação das IES. Esse modelo possibilita a comparação com instituições similares, o acompanhamento do progresso da inovação ao longo do tempo e a tomada de decisões para aprimorar a inovação nas IES, além de oferecer uma abordagem mais precisa e útil para avaliar e fortalecer a inovação no Ensino Superior.

Palavras-chave: *Inovação Educacional. Planejamento Educacional. Administração Educacional. Gestão Educacional. Avaliação Educacional.*

Modelo para evaluar la innovación en las Instituciones de Educación Euperior

Resumen

Medir la innovación en las instituciones de educación superior (IES) es un desafío debido a la dependencia de los rankings existentes en indicadores limitados a publicaciones y patentes. Este estudio propone un modelo integral para la evaluación de la innovación en las IES. Identifica cuatro dimensiones clave: Procesos de Gestión, Programas Académicos, Alianzas y Marketing. Más de 60 indicadores dentro de estas dimensiones proporcionan una evaluación exhaustiva de la capacidad de innovación de las IES. Este modelo permite la comparación con instituciones similares, el seguimiento del progreso de la innovación a lo largo del tiempo y la toma de decisiones para mejorar la innovación dentro de las IES. Ofrece un enfoque más preciso y útil para evaluar y fortalecer la innovación en la educación superior.

Palabras clave: *Innovación Educativa. Planificación Educativa. Administración Educativa. Gestión Educativa. Evaluación Educativa.*

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Contribution of the authors: Joaquim Jose Carvalho Proença – Project coordinator, conceptualisation and development of the article; data collection and analysis; manuscript writing and final revision. Carmen Ramos Vera – Conceptualisation and development of the article; data collection and analysis; manuscript writing and final revision.

Data: The entire dataset supporting this study's findings has been published within the article.

Conflict of interest: The authors declare that they have no commercial or associative interests that represent a conflict of interest concerning this manuscript.

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Ensaio: Avaliação e Políticas Públicas em Educação
vol. 33, no. 126, e0254898, 2025
Fundação CESGRANRIO,
ISSN: 0104-4036
ISSN-E: 1809-4465

DOI: https://doi.org/10.1590/S0104-40362025003304898