

The influence of management's entrepreneurial orientation on innovation in a public higher education institution

A influência da orientação empreendedora da gestão sobre a inovação em uma instituição pública de ensino superior

La influencia de la orientación empresarial de la gestión en la innovación en una institución pública de educación superior

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ABSTRACT

Goal: to analyze the influence of entrepreneurial orientation on the perception of innovation in a public HEI (Higher Education Institution). **Methodology/approach:** A quantitative study was conducted at a HEI located in the state of Pará, in the northern region of Brazil, characterized by the promotion of innovations and entrepreneurial orientation. As a form of data collection, a structured questionnaire was applied to managers of the HEI studied, obtaining a total of 101 responses. Descriptive analysis, exploratory factor analysis and regression analysis were used as data analysis techniques. **Originality/relevance:** the public sector has been increasingly charged by civil society, responsible for “financing” its activities, to offer more efficient and quality deliveries. This study narrows the discussion and analysis of the relationship between the promotion of innovations and the entrepreneurial orientation of leaders and managers, proposing it as a way to meet these social demands more effectively. **Main findings:** innovation through cooperation can be highlighted as the most prominent type among the different types of innovations analyzed. In addition, the positive and direct influence of the factors risk-taking and competitiveness, proactivity, autonomy and innovativeness on innovations was verified. **Theoretical contributions:** proposal of an adapted model (instrument) for assessing entrepreneurial orientation in the public sector, as well as a deeper understanding of the types of innovation in public HEIs. This narrows the academic debate between the two themes at a managerial level in the public sector, also exploring the particularities of a region of Brazil still developing in the field of higher education. **Management contributions:** need for leaders and managers to encourage entrepreneurial orientation through initiatives such as co-production with communities, the creation of new courses or new research partnerships. These actions can encourage the development of practices and innovations by employees, promoting improvements in public services.

Keywords: Entrepreneurial Orientation. Innovation. Higher Education Institution. Public service.

RESUMO

Objetivo: analisar a influência da orientação empreendedora sobre a percepção de inovação em uma Instituição de Ensino Superior (IES) pública. **Metodologia/abordagem:** foi realizada uma pesquisa quantitativa em uma IES localizada no estado do Pará, na região norte do Brasil, caracterizada pela promoção de inovações e orientação empreendedora. Como forma de coleta de dados, foi aplicado um questionário estruturado com os gestores da IES estudada, obtendo-se um total de 101 respondentes. Como técnicas de análise dos dados utilizou-se análise descritiva, fatorial exploratória e análise de regressão. **Originalidade/relevância:** o setor público tem sido cada vez mais cobrado pela sociedade civil, responsável por “financiar” suas atividades, para oferecer entregas mais eficientes e de qualidade. Este estudo estreita a discussão e análises da relação entre a promoção de inovações e a orientação empreendedora de líderes e gestores, propondo-a como caminho para atender essas demandas sociais de forma mais efetiva. **Principais resultados:** a inovação por cooperação pode ser destacada como o tipo mais proeminente entre os diversos tipos de inovações analisados. Além disso, verificou-se a influência positiva e direta dos fatores assunção de riscos e competitividade, proatividade, autonomia e inovatividade sobre as inovações. **Contribuições teóricas:** proposição de um modelo (instrumento) adaptado de avaliação da orientação empreendedora no setor público, bem como uma compreensão mais aprofundada dos tipos de inovação em IES públicas. Com isso, estreita-se o debate acadêmico entre as duas temáticas em nível gerencial no setor público, explorando também as particularidades de uma região do Brasil ainda em desenvolvimento no campo da educação superior. **Contribuições para a gestão:** necessidade de líderes e gestores estimularem a orientação empreendedora por meio de iniciativas como a coprodução com comunidades, a criação de novos cursos ou o estabelecimento de novas parcerias em pesquisa. Essas ações podem fomentar o desenvolvimento de práticas e inovações pelos servidores, promovendo melhorias nos serviços públicos.

Palavras-chave: Orientação Empreendedora. Inovação. Instituição de Ensino Superior. Serviço Público.

RESUMEN

Objetivo: analizar la influencia de la orientación emprendedora en la percepción de la innovación en una IES (Institución de Educación Superior) pública. **Metodología/enfoque:** La investigación cuantitativa se realizó en una IES ubicada en el estado de Pará, en la región norte de Brasil, caracterizada por la promoción de innovaciones y orientación emprendedora. Como forma de recolección de datos, se aplicó un cuestionario estructurado a directivos de las IES estudiadas, obteniendo un total de 101 encuestados. Como técnicas de análisis de datos se utilizaron el análisis descriptivo, el análisis factorial exploratorio y el análisis de regresión. **Originalidad/relevancia:** el sector público ha sido cada vez más encargado por la sociedad civil, responsable de “financiar” sus actividades, de ofrecer entregas más eficientes y de calidad. Este estudio acota la discusión y análisis de la relación entre la promoción de innovaciones y la orientación emprendedora de líderes y directivos, proponiéndola como una forma de satisfacer estas demandas sociales de manera más efectiva. **Principales resultados:** entre los distintos tipos de innovación analizados, se puede destacar la innovación a través de la cooperación como el tipo más destacado. Además, hubo una influencia positiva y directa de los factores asunción de riesgos y competitividad, proactividad, autonomía e innovación en las innovaciones. **Contribuciones teóricas:** propuesta de un modelo (instrumento) adaptado para evaluar la orientación emprendedora hacia el sector público, así como una comprensión más profunda de los tipos de innovación en las IES públicas. Esto estrecha el debate académico entre los dos temas a nivel de gestión en el sector público, explorando también las particularidades de una región de Brasil aún en desarrollo en el campo de la educación superior. **Contribuciones a la gestión:** necesidad de que líderes y directivos estimulen la orientación emprendedora a través de iniciativas como la coproducción con las comunidades, la creación de nuevos cursos o el establecimiento de nuevas alianzas de investigación. Estas acciones pueden incentivar el desarrollo de prácticas e innovaciones por parte de los empleados, promoviendo mejoras en los servicios públicos.

Palabras clave: Orientación Emprendedora. Innovación. Institución de educación superior. Servicio público.

■ INTRODUCTION

The public sector in various countries is facing intense pressure due to recent changes, such as the digital transformation accelerated by the Covid-19 pandemic (Costa et al., 2023; Klein et al., 2024), and structural challenges, including the gradual aging of the population, political extremism, and difficulties in controlling public debt (Clausen et al., 2020). Additionally, society increasingly demands that public institutions deliver new and/or improved services, as well as more efficient solutions in key areas such as transportation, infrastructure, healthcare, and education. In this context, the demand for innovations, ecosystems, and alternative forms of interaction and service delivery to citizens plays a central role in the public sphere and in the generation of public value.

In Brazil, this scenario is no different. There is a constant demand for more advanced, faster, more efficient, and less costly solutions in the provision of basic services to the population, across all social classes. The president of the Brazilian Agency for Industrial Development (ABDI) states that the Brazilian public sector must overcome its fear of investing in innovation (Agência Econômica, 2024), highlighting the importance of innovation in the activities carried out by institutions across different sectors. This discussion also permeates academia and scientific debates, as well as public policy-making spaces, including environmental policy (Araújo et al., 2022).

In the field of education, Higher Education Institutions (HEIs) play a prominent role in training professionals, extension activities, and research and development (R&D) outcomes. However, since they receive more investment than other levels of education, HEIs are frequently held accountable by society for the quality and impact of their deliverables. Furthermore, although teaching and learning, scientific research, and services provided to society have historically guided the development of HEIs, it is necessary to investigate how innovation emerges and operates in administrative and participatory processes (Owusu-Agyeman, 2021).

The need for innovation—in its various forms—is a fundamental requirement to meet demands and justify the investments made in these institutions (Salajan, 2018). According to Haneda and Ito (2018), there is a close relationship between management and human resources practices, R&D, and innovation in products and processes. Beyond these more “traditional” forms of innovation, other types—such as administrative, service, cooperative, and social innovations—have also been debated and studied as drivers of continuous improvement in public institutions (Brandão & Faria, 2013; Bloch & Bugge, 2013; De Vries et al., 2016; Silva & Fernandez, 2021; Santo & Voks, 2021).

However, innovation in the public sector and in HEIs does not emerge solely from social pressure or academic debate. It depends on various actors and a set of institutional structures (Jugend et al., 2020). Among these “actors,” the role of public servants—especially those in management positions—is essential for the implementation of ideas and execution of activities that foster innovation. Recent studies highlight a strong relationship between the

promotion of innovations and the entrepreneurial orientation of managers and decision-makers in public administration (Usman & Mat, 2017; Cvijić et al., 2019; Al-Dhaafri & Alosani, 2020; Tjahjadi et al., 2022).

In this sense, entrepreneurial orientation in the public sector can be understood as the set of thoughts and attitudes that lead to innovative practices and activities, such as the development of new services and/or improvement of existing ones, the adoption of technologies, implementation of new administrative techniques and enhanced strategies, risk-taking, and proactiveness (Kearney & Meynhardt, 2016). When fostered, these entrepreneurial attitudes and practices create an environment conducive to innovation in the daily routines of public servants (Emmendoerfer, 2019), even if these are small improvements or incremental changes in their ways of working. This connection sparks both practical interest from institutions and theoretical interest from academia, leading to the following research question: What is the relationship between the entrepreneurial orientation of managers in leadership roles at a HEI and the innovations promoted within the institution?

To answer this research question and guide the development of this study, the general objective was defined as: to analyze the influence of entrepreneurial orientation on managers' perceptions of innovation in a public HEI. Entrepreneurial orientation is investigated as a predictor of innovation through the different attitudes and behaviors that embody it—namely, innovativeness, proactiveness, risk-taking, autonomy, and competitive aggressiveness.

A quantitative study was conducted with managers (those holding leadership and coordination positions) at a HEI located in the state of Pará, in the northern region of Brazil. This institution was selected due to its characteristics related to innovation and entrepreneurial orientation. Specifically, this institution was chosen because it celebrated its 10th anniversary in 2023 and has since demonstrated features aligned with innovation, entrepreneurial orientation, and social engagement. Notable aspects include: (1) an established Pro-Rectorate for Technological Innovation, (2) an internal innovation policy, (3) a portfolio of patents, projects, and software, (4) the implementation of social technology projects in the Amazon region, (5) assessments of technology's impact on the workforce, and (6) the establishment of a committee for intellectual property protection and technology transfer. These are just a few of the actions that highlight the entrepreneurial and innovative orientation of the HEI studied, and which therefore guided the data collection process.

With this study, we seek to advance the understanding of the concept of entrepreneurial orientation and its relationship with innovation within public HEIs. Innovations are essential to enhance universities' capacity to educate and deliver graduates to society who meet market and industry expectations (Peschl et al., 2020; Abbas et al., 2021) and who possess critical and reflective thinking skills (Zhoc et al., 2018), in addition to addressing the strategic challenges faced by these institutions (Al-Awlaqi et al., 2021). In this regard, beyond cooperation between universities and other organizations, an entrepreneurial orientation plays a central role in supporting organizational development within HEIs and strengthening their collaboration with external entities (Prihandono et al., 2023).

In addition to this introduction, which presents the research topic, problem, and objective, the structure of this paper includes a theoretical framework on innovation in public organizations and its various types, along

with the definition and dimensions of entrepreneurial orientation. The following sections describe the methodological procedures adopted in the study. After that, the results obtained from the data analysis are presented and discussed. Finally, the concluding section presents the contributions, advancements, and limitations of the research, along with suggestions for future studies.

■ THEORETICAL FRAMEWORK

Innovation in public services and organizations

Innovation can be defined as the implementation of a new or significantly improved product (good or service), process, marketing method, or organizational method or practice in the workplace, the organization, or in external relations (OECD, 2018). Schumpeter (1934) defines innovation as the introduction of a new or improved product, a new method of production, the opening of a new market, new sources of raw materials or semi-manufactured products, or even a new form of industrial organization.

In the context of public organizations, innovation is characterized by the implementation of changes in how the organization operates, carries out its activities, or provides services (Bloch & Bugge, 2013). According to these authors, innovations encompass new or significant changes in services and goods, improvements in operational processes, or new ways of communicating with users. More broadly, innovation in the public sector can be understood as the ability to develop new services, organizational processes, and institutional strategic changes based on knowledge, behavior, skills, routines, processes, and mechanisms of learning and governance in local public administrations (Silva et al., 2021).

Contrary to the belief that innovation is always linked to the advent of new technologies, different types of innovation can be conceived and implemented in the organizational environment. These include innovations related to internal structure and processes (organizational innovation) or associated with leadership, behavior, and human capital (managerial innovation) (Damanpour, 2017; Alves et al., 2018; Sciarrelli et al., 2020). Other innovations are directly linked to the products or services provided (De Guimarães et al., 2020; Abdallah et al., 2021; Alkhatib & Valeri, 2024). In the article by Noronha, Ferraro, and Silva (2023), the authors used the dimensions of process, product, and organizational innovation to study sustainable innovation practices.

Furthermore, public organizations frequently implement innovations in new services and service delivery methods as a response to changes in the external environment, such as deregulation, resource scarcity, and customer demands. These innovations can also arise from internal organizational choices, motivated by performance gaps or the pursuit of greater service reach and quality (Walker, 2017). In this study, the definitions presented are adapted to the nature of public services, with a user-centered focus, and aligned with the definitions commonly used in business environments. The different types of innovation applicable to public administration and HEIs are presented and defined in Table 1 and serve as guiding variables for the development of the data collection instrument used in this research.

The influence of management's entrepreneurial orientation on innovation in a public higher education institution

Table 1.

Types of innovation

Types of innovation	Definition	Explanation and characteristics	References
Product innovation	A product innovation is the introduction of a good that is new or significantly improved compared to existing ones in the organization. They refer to tangible results obtained from activities.	This type of innovation includes significant improvements in the characteristics of the asset, its intended uses, customer access or the way it is used. It involves, for example, products with differentiated characteristics, functionalities and applications; products that incorporate technological trends.	OECD (2018); De Guimarães et al. (2020).
Service innovation	Its definition is similar to product innovation, but focused on the provision of a service. It consists of a new or significantly improved service that respects its characteristics or purposes.	These are services with differentiated characteristics, functionalities and applications or that incorporate technological trends, which benefit the user of the service provided.	Damanpour & Schneider (2009); PINTEC (2017); De Guimarães et al. (2020).
Administrative/ Organizational innovation	It is defined as the implementation of a new method of organizing or managing work that differs from the existing methods in the organization.	It involves new or significant improvements in management systems, workplace organization, business practices, administrative routines or external relations.	OECD (2018); Bloch & Bugge (2013).
Process innovation	It consists of implementing a method for the production and supply of services and goods, which is new or significantly improved compared to the existing processes in the organization.	It may involve significant improvements, for example in equipment and/or skills, in support functions such as IT and accounting processes. It also aims to continually review processes to increase efficiency, agility, flexibility and/or quality, and/or to reduce costs.	OECD (2018); Bloch & Bugge (2013).
Conceptual innovation	Defined by changes in people's thinking, freedom to develop new views and "challenge" existing assumptions.	It includes new concepts, new references and paradigm shifts that will solve specific problems for appropriate solutions within the established reality.	Windrum (2008); Al Ahababi et al. (2019).
Systemic innovation	They consist of improved or new ways of interacting with other organizations, seeking new sources of knowledge and alternatives that expand those already existing and disseminated.	(new/improved ways of interacting with other universities in the "production chain" and sources of knowledge)	Windrum (2008); Al Ahababi et al. (2019).
Cooperation innovation	It is defined by the strengthening of cooperation/collaboration relations with other institutions, whether through the establishment of agreements, partnerships or joint projects.	It involves the implementation of cooperative projects, agreements, and cooperation agreements to obtain capital, human, or knowledge resources. They are established with different types of institutions, organizations, entities, or technology centers.	PINTEC (2017); De Guimarães et al. (2020)

These different types of innovation can be fostered in the public service through the actions and attitudes of public servants. In places where public services are provided, Campos et al. (2017) argue that public servants should not be in a position to dictate what must be done, but rather act as facilitators of public experiences and enablers of learning processes. In this sense, it is essential to balance facts and intuition, know how to trust the latter, respect differing—even conflicting—opinions, and turn problems into opportunities. Additionally, it is important to understand why and how to listen, demonstrating interest by asking "why?", to have clarity about the outcomes being delivered, and to ensure that those outcomes are acceptable to the people seeking solutions to their problems (Forester, 2013).

In the case of Higher Education Institutions (HEIs), some factors contribute to promoting service innovations, whether internally or for end clients/users. In this regard, Faedo, da Silva, Resch, and de Carvalho Figueiredo (2019) conducted research in three public HEIs considered the most innovative in the Brazilian National Ranking and identified essential factors that facilitate innovation in universities. Among these factors, the role of human resources and the innovative actions promoted within their respective sectors stand out. Given this, the next subsection will address aspects inherent to entrepreneurial orientation in the public service.

Entrepreneurial orientation in the public service

Entrepreneurial orientation has its origins in the concept of “entrepreneurial firms” introduced by Miller (1983), which explains that these organizations, in their pursuit of innovation, are prone to risk but act proactively and aggressively in the markets in which they operate. In the public sector, entrepreneurial orientation refers to the process of undertaking initiatives at the organizational level and is directly related to the behavior of public servants in the performance of their duties (Lumpkin & Dess, 1996; Dias et al., 2022). This orientation, along with entrepreneurial and innovative behaviors, can stem from distinct personal characteristics—as seen in so-called born entrepreneurs—or be stimulated by the positions and sectors in which individuals work (Valadares & Emmendoerfer, 2015).

In public sector organizations, public servants can be encouraged to develop entrepreneurial practices and dedicate energy to innovative initiatives, especially when supported by their supervisors and senior management (Dal Soto et al., 2021). The literature widely explores the relationship between entrepreneurial orientation and topics such as technology transfer (Blankesteijn et al., 2021), digital transformation (Garcez et al., 2022), and patents (Ar et al., 2021). However, the connection with the managerial perspective is still less addressed, making it relevant for research purposes and for the prospecting of innovations (Mehmood et al., 2021).

The intrinsic stimuli and characteristics of entrepreneurial orientation are studied through different dimensions and theoretical models. In this study, we use the five dimensions proposed by Lumpkin and Dess (1996), explored in subsequent research (Diaz & Sensini, 2020; Perera & Samarakoon, 2021), namely: Innovativeness, Proactiveness, Risk-Taking, Autonomy, and Competitive Aggressiveness.

1. Innovativeness represents an organization's intention to promote, encourage, and capture new ideas, transforming them into innovative processes that result in new products, processes, and/or services (Lima et al., 2018). This concept is often interpreted as the tendency of an organization to adopt new technologies or methods that transcend its already established normative and organizational practices (Priestley & Simperl, 2022). Innovativeness reflects the tendency of an organization or workgroup to engage in and support new ideas, innovative ideologies, experimentation, and creative processes that may lead to new products, services, or technological processes (Lumpkin & Dess, 1996).
2. Proactiveness, within the public sphere, is characterized by the active pursuit of responsiveness to end users by those who provide public services

to the population (Scholta et al., 2019; Scholta & Lindgren, 2023). Another definition indicates that proactiveness is an organization's ability to anticipate future needs (Corrêa et al., 2022). A proactive stance in public administration can bring benefits not only to the government agent but also to the community affected by this behavior (Linders et al., 2018). In other words, citizens benefit more effectively, receiving public services with ease, even without full knowledge of their rights or access possibilities (Boost et al., 2021). This factor improves public perception of the public sector's performance.

3. Risk-Taking, in turn, can be understood as an organization's willingness to take risks in processes and in the implementation of new projects, even when there is a possibility of failure (Corrêa et al., 2022). The tendency of organizations to allocate significant and calculated resources to risky initiatives, despite the chance of them being ineffective, can create space and opportunities for learning and future innovative actions (Priestley & Simperl, 2022). Other authors define risk-taking as the ability to make decisions even in the face of limited available information (Adeniyi et al., 2024). Additionally, Gabriel and Kobani (2022) point out that this concept may also be understood as individuals' willingness to take substantial commitments, justifying the nature of an entrepreneur engaging in bold, non-cautious actions.
4. Autonomy refers to individuals' desire to take an active role in conducting their work activities within organizational structures (Martela et al., 2021). Autonomy relates to the level of power granted to employees to independently decide how their duties should be performed, including control over time and methods employed (Debus et al., 2020). This autonomy enhances the perception of responsibility for work performance, encouraging employees to take greater responsibility for intraorganizational activities (Sørli et al., 2022).
5. Finally, Competitive Aggressiveness is defined as the extent of efforts undertaken by an organization to operate and perform its activities with assertive behavior (Hernández-Linares et al., 2020). The entrepreneurship literature suggests that while proactiveness and autonomy involve actions by an organization to influence trends and create demand, competitive aggressiveness is fundamentally related to how organizations interact with other entities operating in the same field (Guerra et al., 2020). Competitive aggressiveness reflects a willingness to be unconventional, opting for strategies that deviate from traditional organizational and management methods (Lumpkin & Dess, 1996).

All these aspects, together with initiatives of proactiveness, commitment, and idea generation, can be stimulated by public managers to promote innovation, regardless of the type or size of the organization. According to Drucker (2016), the entrepreneur who creates and acts with the aforementioned characteristics is not necessarily confined to private organizations and behaves as such regardless of the sector in which they operate. Shane and Venkataraman (2000) argue that entrepreneurial individuals take actions to meet individual, collective, or public interest needs as soon as they identify opportunities, which drives innovation. Therefore, entrepreneurial orientation plays an important role in organizations that not only seek to stand out but

also aim to strategically integrate entrepreneurial initiatives, transforming them into essential organizational practices (Lima et al., 2018).

METHOD OF THE STUDY

To carry out this study, a quantitative research approach was adopted using primary data collected through the application of a structured questionnaire. The research was conducted at a public higher education institution (HEI) located in the state of Pará, chosen due to the attributes, characteristics, and reasons previously described in the introduction of this paper. Given the nature and objective of the study, the defined population consisted of active civil servants who, at the time of data collection, held management positions, received additional compensation for specific functions, or occupied leadership roles (such as direction, coordination, or advisory roles) within the institution. This definition resulted in a total population of 332 individuals. The final valid sample comprised 101 respondents, corresponding to a response rate of 30.42%.

The sample is composed of senior management personnel at the HEI (Rectorate, Pro-Rectories, Directorate, etc. – 28.4%) and other management-level staff across different institutional levels (Heads of Departments, Division Chiefs, and Coordinators – 71.6%). The majority of respondents are female (51.5%), hold administrative technical positions (67.3%), and have a specialization degree (35.6%).

The average age of respondents is 39 years, ranging from 20 (youngest reported) to 61 years (oldest reported). On average, respondents have worked for 6.5 years at the institution, with a minimum of 1 year and a maximum of 20 years of public service at the HEI. It is worth noting that those who reported more than 10 years of work had been transferred from another institution when the studied HEI ceased to be a campus of UFPA. For this reason, some civil servants have more than 10 years of experience at the current physical institution. The positions held by respondents cover the areas of Teaching, Research, Extension, and Administration more broadly.

Data collection was carried out using a structured questionnaire consisting of 30 items. Responses were measured using a 5-point Likert scale, as shown in Table 2. Additionally, six questions were included to characterize the respondents' profiles, addressing aspects such as gender, age, job type, education level, and administrative function (as previously described in the paragraph above).

Table 2.

Dimensions and organization of the research instrument

Dimensions evaluated	Number of questions	References	Scale used
Innovativeness	4	■ Lumpkin e Dess, 1996; ■ Silveira e Silveira-Martins, 2016; ■ dos Santos, Alves e Bitencourt, 2015; ■ De Oliveira, 2021.	1 = Strongly Disagree 2 = Partially Disagree 3 = Neither Disagree nor Agree 4 = Partially Agree 5 = Strongly Agree
Proactiveness	5		
Risk-Tasking	4		
Autonomy	5		
Competitive Aggressiveness	4		
Types of innovations	7	Referenced in Table 1	Zero to 10 (ten)*
Innovation degree*	1	Own preparation	

Note: *Respondents were asked to rate on a scale from **0 (not at all innovative)** to **10 (extremely innovative)** how innovative they considered the institution to be, compared to other HEIs they knew in the northern states of the country.

For the development of the data collection instrument, the questions sourced from the studies listed in the reference column of Table 2 were initially translated by one of the authors, who is fluent in English. Subsequently, the questions were adapted to the context of the public HEI under study. The structured questionnaire was then submitted for evaluation by two expert researchers in the field. The purpose of this step was to validate the content of the questionnaire and gather feedback regarding the clarity and appropriateness of the questions in relation to the study's objectives. Following the suggested adjustments, the instrument underwent a pretest with three potential respondents from the target population. This stage helped identify ambiguously interpreted questions and yielded new suggestions for improvement, which were reviewed and incorporated into the instrument. Finally, the study was approved by the Ethics Committee – CAAE: 62718922.0.0000.5346.

Data collection took place between January and March 2023, using a hybrid format (online and in-person). Two versions of the questionnaire were developed: an electronic version, which was distributed to the target population via email invitation, and a printed version, which was administered in person by undergraduate research assistants. A test was conducted to compare responses obtained through the online and in-person formats, and no significant differences were found in the measured items. The responses were stored in an Excel spreadsheet, and data analysis was conducted using IBM SPSS v.23 software.

The data analysis procedures began with a descriptive analysis of the respondents' profiles and the variables included in the questionnaire. Subsequently, Exploratory Factor Analysis (EFA) was performed. This technique is used to estimate the underlying structure of correlations among a set of variables, aiming to define a smaller number of factors that group together highly correlated variables (Hair et al., 2019). To assess the suitability of the data for factor analysis, Bartlett's Test of Sphericity and the Kaiser-Meyer-Olkin (KMO) measure were applied.

Next, the communalities of the variables were examined, and those with values below 0.5 were excluded. The EFA was conducted using the principal components method, with Varimax rotation used to estimate factor

loadings. To determine the number of factors, the Eigenvalue criterion (>1) and the explained variance threshold ($>60\%$) were applied (Hair et al., 2019). Cronbach's Alpha was calculated as a measure of the internal reliability of the resulting factors, with values above 0.7 considered acceptable for exploratory analyses (Hair et al., 2019).

Finally, a multiple regression analysis was conducted to evaluate the dependency of one variable on one or more explanatory (independent) variables (Gujarati & Porter, 2009). In this study, the dependent variable was the "degree of innovation," while the independent variables were the factors identified in the exploratory factor analysis. To verify the assumptions of the model, the following measures were used: (a) Multicollinearity: tolerance (TOL) values greater than 0.10 and variance inflation factor (VIF) values less than 10 were required; (b) Normality of residuals: the Kolmogorov-Smirnov (KS) test was applied under the null hypothesis that the residuals follow a normal distribution; and (c) Homoscedasticity: the Pesaran-Pesaran test was used to assess whether the variance of the residuals remains constant across the range of independent variables used in the model (Hair et al., 2019).

RESULTS AND ANALYSIS

Descriptive analysis of questionnaire items

At this stage of the work, a descriptive analysis of the instrument variables was carried out. Table 3, presented below, shows the response percentages and the averages for each item in the questionnaire.

Table 3.

Descriptive Analysis of Researched Items

Innovativeness Dimension	Items	Average	1	2	3	4	5
Since the creation of this HEI, new services have been provided to meet the most diverse internal demands of the academic community or society.	Item 1	4,42	0	1,0	6,9	40,6	51,5
This HEI is creative in its methods of operation*.	Item 2	3,88	1,0	6,9	16,8	53,5	21,8
This HEI looks for new ways to do and offer services that are needed.	Item 3	3,99	0	6,9	14,9	50,5	27,7
In this HEI, errors are tolerated, as long as they generate new results.	Item 4	3,28	7,9	9,9	38,6	33,7	9,9
Dimension of Proactiveness	Itens	Média	1	2	3	4	5
This HEI starts new actions/services faster than other universities.	Item 5	3,24	6,9	13,9	40,6	25,7	12,9
In many situations, this HEI is the first to introduce new products/services, administrative techniques, operational technologies, etc.	Item 6	3,21	7,9	14,9	37,6	27,7	11,9
This HEI is agile in understanding (copying) new services from others and offering similar services.	Item 7	3,51	3,0	10,9	29,7	44,6	11,9
This HEI closely monitors technological trends to try to implement them.	Item 8	3,78	1,0	9,9	23,8	40,6	24,8
I realize that this HEI stands out in identifying opportunities.	Item 9	3,56	4,0	7,9	31,7	40,6	15,8

The influence of management's entrepreneurial orientation on innovation in a public higher education institution

Risk Taking Dimension	Itens	Média	1	2	3	4	5
This HEI invests in high-risk projects, but with a very high chance of return for the academic community and society.	Item 10	3,10	10,9	11,9	39,6	31,7	5,9
This HEI is bold in achieving its goals.	Item 11	3,57	5,0	11,9	25,7	35,6	21,8
In decision-making situations involving uncertainty, this HEI adopts a bold stance.	Item 12	3,15	6,9	15,8	38,6	32,7	5,9
This IES encourages employees to take risks to explore new ideas.	Item 13	2,90	14,9	18,8	33,7	26,7	5,9
Autonomy Dimension	Itens	Média	1	2	3	4	5
This IES encourages employees' freedom in their decision-making.	Item 14	3,51	5,0	14,9	19,8	44,6	15,8
At this HEI, the best results occur when individuals and/or teams decide for themselves which opportunities to pursue.	Item 15	3,27	7,9	15,8	33,7	26,7	15,8
In this HEI, there are established practices/guidelines for employees to adopt entrepreneurial behavior.	Item 16	2,48	20,8	19,8	38,6	17,8	3,0
This IES, the initiatives and contributions of employees play an important role in identifying and selecting entrepreneurial opportunities.	Item 17	3,17	7,9	14,9	39,6	27,7	9,9
This IES supports the efforts of individuals and/or teams that work autonomously in their actions, as long as they follow the requirements of legality.	Item 18	3,43	6,9	17,8	21,8	32,7	20,8
Competitive Aggressiveness Dimension	Itens	Média	1	2	3	4	5
This HEI is intensely competitive in its actions and projects.	Item 19	3,10	9,9	14,9	38,6	27,7	8,9
This HEI responds "aggressively" to the needs that arise.	Item 20	2,92	10,9	18,8	41,6	24,8	4,0
This IES uses the most current and advanced tools and methods for problem-solving and decision-making.	Item 21	3,20	5,0	15,8	39,6	33,7	5,9
This HEI carries out competitive benchmarking (copying successful practices, well-executed actions, etc.).	Item 22	3,32	6,9	15,8	28,7	35,6	12,9
Description of variables	Itens	Média	1	2	3	4	5
Product innovation (e.g.: Products with differentiated features, functionalities and applications; Products that incorporate technological trends)	Item 23	3,03	4,0	17,0	53,0	24,0	2,0
Service innovation (e.g.: Services with differentiated features, functionalities and applications; services that incorporate technological trends; changes to improve an existing service)	Item 24	3,24	4,0	13,9	42,6	33,7	5,9
Administrative/organizational innovation (changes or improvements in organizational structures and/or administrative routines)	Item 25	3,23	5,0	17,8	35,6	32,7	8,9
Process innovation (Continuous review of processes to increase efficiency, agility, flexibility and/or quality; and/or to reduce costs)	Item 26	3,28	8,9	12,9	33,7	29,7	14,9
Conceptual innovation (changes in thinking, freedom to develop new views and "challenge" existing assumptions)	Item 27	3,19	6,9	13,9	38,6	34,7	5,9
Systemic innovation (new/improved ways of interacting with other universities in the "production chain" and sources of knowledge)	Item 28	3,34	4,0	10,9	42,6	32,7	9,9
Cooperation innovation (implementation of cooperative projects with other universities; obtaining resources from funding agencies through funding notices, relationship with government institutions or technology centers).	Item 29	3,84	4,0	6,9	27,7	33,7	27,7

Note: 1 = Strongly disagree; 2 = Partially disagree; 3 = Neither disagree nor agree; 4 = Partially agree; 5 = Strongly agree

Table 3 shows that most items have average scores around three, indicating that respondents “neither disagree nor agree” with the content of the questions. However, some items stand out when a more detailed analysis is conducted on each evaluated dimension. In the first dimension, innovativeness, the items are closer to a four, meaning that respondents tend to agree with the statements. Item 1 stands out not only within this dimension but among all items surveyed, with an average of 4.42. Additionally, most respondents (51.5%) fully agree that the HEI (Higher Education Institution) delivers services to meet a wide range of internal demands from the academic community or from society at large.

In the proactiveness dimension, items 7, 8, and 9 have the highest averages, highlighting the HEI's agility in understanding and adapting services and opportunities from other institutions, as well as closely monitoring technological trends for implementation. This gives the studied HEI agility and readiness in implementing innovative actions. This behavior is closely aligned with item 11, which stands out most in the risk-taking dimension (“This HEI is bold in achieving its goals” – average = 3.57). This practice is also corroborated by item 22 (average = 3.32), which refers to competitive benchmarking and has the highest average in the competitive aggressiveness dimension.

In the autonomy dimension, the items with the highest averages are item 14 (average = 3.51) and item 18 (average = 3.43). These items directly address the freedom and support offered by the HEI to staff for decision-making and teamwork in an autonomous manner, respecting the legality of their actions. On the other hand, item 16 stands out for having the lowest average (2.48), indicating disagreement regarding the existence of practices/guidelines that encourage staff to adopt entrepreneurial behavior.

Finally, in the innovation dimension, the highest average is observed for cooperation innovations (average = 3.84), which reveals respondents' agreement regarding the implementation of cooperative projects with other universities, resource acquisition from funding agencies, and interaction with government institutions or technology centers. This type of innovation is the one most aligned with activities traditionally carried out by HEIs, particularly in the scope of research and extension, which is confirmed by this study's results.

On the other hand, the other types of innovation evaluated had average scores around three, indicating that respondents “neither disagree nor agree” with the content of the items. At first glance, one could conclude that the studied HEI is not as innovative as suggested in the introduction of this paper, which initially justified its selection for the study. However, it is important to highlight that innovation in the public sector is often difficult to create, implement, and execute due to various internal obstacles, limitations, bureaucracy, laws, and governmental instances to which institutions are subject.

Ferraris, Santoro, and Pellicelli (2020) exemplify some of these difficulties and barriers, such as the lack of an integrated vision, inadequacy of administrative styles, poor interdepartmental coordination and communication, disincentives, risk aversion, data availability, rigid public procurement rules, as well as scarcity of resources and technological capacities.

Exploratory factor analysis (EFA)

The second data analysis procedure carried out in this study was Exploratory Factor Analysis (EFA), aiming to verify the grouping of questionnaire items into sets of factors, based on the collected sample. The EFA results showed that the values obtained for the KMO test (value = 0.869) and Bartlett's test of sphericity (Chi-square value = 1710.993; sig = 0.00) were satisfactory, indicating the factorability of the data.

Based on the analysis of item communalities, item 14 (value = 0.444) was removed from subsequent analyses because it presented a value lower than 0.5. Regarding factor loadings, item 9 (loading = 0.439) was excluded for presenting an unsatisfactory loading. Additionally, items 4 and 15 were initially grouped into a single factor. However, this factor showed an unsatisfactory Cronbach's Alpha (value = 0.384) and, for this reason, it was also excluded from further analyses.

Table 4 presents the EFA results, detailing the values of communalities, factor loadings for each variable, Cronbach's Alpha, explained variance, and the average of each identified factor.

Table 4.

Results of exploratory factor analysis

Factor 01 – Risk-taking and competitiveness					
Observed variables	Commonality	Factor loading	Variance explained	Cronbach's Alpha	Factor mean
Item 10	0,737	0,789	16,75%	0,903	3,16
Item 12	0,731	0,783			
Item 11	0,676	0,676			
Item 19	0,688	0,661			
Item 13	0,641	0,650			
Item 21	0,682	0,646			
Item 20	0,643	0,573			
Item 22	0,661	0,503			
Factor 02 – Innovations					
Observed variables	Commonality	Factor loading	Variance explained	Cronbach's Alpha	Factor mean
Item 25	0,777	0,837	16,30%	0,894	3,30
Item 24	0,731	0,737			
Item 26	0,678	0,651			
Item 27	0,684	0,649			
Item 28	0,687	0,628			
Item 29	0,525	0,617			
Item 23	0,629	0,579			

The influence of management's entrepreneurial orientation on innovation in a public higher education institution

Factor 03 – Proactiveness					
Observed variables	Commonality	Factor loading	Variance explained	Cronbach's Alpha	Factor mean
Item 6	0,825	0,877	12,37%	0,861	3,54
Item 5	0,783	0,871			
Item 7	0,663	0,693			
Item 8	0,601	0,553			

Factor 04 – Autonomy					
Observed variables	Commonality	Factor loading	Variance explained	Cronbach's Alpha	Factor mean
Item 16	0,790	0,786	9,48%	0,801	3,09
Item 17	0,745	0,763			
Item 18	0,604	0,720			

Factor 05 – Innovativeness					
Observed variables	Commonality	Factor loading	Variance explained	Cronbach's Alpha	Factor mean
Item 3	0,827	0,831	9,41%	0,835	4,10
Item 2	0,770	0,800			
Item 1	0,585	0,568			

The results presented in Table 4 show that the organization of the variables resulted in five factors, with a total cumulative explained variance of 64.31%. It is also observed that the Cronbach's Alpha values are satisfactory (> 0.7) for all identified factors. The factor loadings of the variables were also considered satisfactory, as all values were above 0.5, as were the communalities. Regarding the composition of the factors, it can be verified that all items grouped very closely to their original dimensions, with the exception of the factor labeled "risk-taking and competitiveness", which combined two distinct dimensions.

With respect to factor means, the factor with the highest mean was "innovativeness" (= 4.10), which, according to the adopted scale, indicates that respondents agree with the existence of the items composing this factor in the institution studied. On the other hand, the factor "autonomy" presented the lowest mean (= 3.09), which is generally associated with the characteristics of a public higher education institution (HEI) that must comply with strict national rules and regulations, typically limiting the autonomy of civil servants.

Regression Analysis

In order to verify the influence of the factors obtained through the exploratory factor analysis on the perception of the degree of innovation at the studied HEI, a regression analysis was conducted, building a model based on the perceptions of the institution's surveyed managers. For this analysis, it is

important to note that the “Degree of Innovation” was evaluated through a question that asked respondents how innovative they considered the institution to be compared to other HEIs in the region. This variable was measured on a scale from 0 (not innovative at all) to 10 (extremely innovative).

For the estimation of the linear regression model, the “enter” method was used. The resulting model is presented in Table 5. The adjusted R-squared value was 0.664, meaning that the variables explain 66.4% of the model's dependent variable, in this case, the degree of innovation.

Table 5.

Causal relationships on the dependent variable Degree of Innovation

Variables	Coefficients (Beta)	t	Sig.	Tolerance	VIF
Factor 1 – Risk-taking and competitiveness	0,238	2,679	0,009	0,426	2,346
Factor 2 – Innovations	0,490	5,441	0,000	0,413	2,419
Factor 3 – Proactiveness	0,096	1,323	0,189	0,634	1,576
Factor 4 – Autonomy	0,045	0,611	0,542	0,607	1,647
Factor 5 – Innovativeness	0,097	1,366	0,175	0,659	1,516

The model presented in Table 5 demonstrates that two factors are significant ($\text{sig} \leq 0.05$) in explaining the degree of innovation, namely: “Risk-taking and competitiveness” and “Innovations”. The influence of both factors is positive, with the second having a greater impact on the dependent variable (Beta = 0.490). This relationship of influence was expected, since the perception of the degree of innovation is influenced by the quantity and types of innovations generated and fostered in the institution.

Regarding the model's assumptions, it was found that there are no multicollinearity problems (Tolerance below 1; and VIF below 10). Regarding the normality of the residues, the result of the K-S (Kolmogorov-Smirnov) test presented a sig greater than 0.05 ($\text{sig} = 0.201$), indicating that the model also does not present problems regarding this assumption. Finally, the model also did not present heteroscedasticity problems, since the result of the Pesarán-Pesarán test presented $\text{sig} = 0.932$ (> 0.05), allowing the acceptance of the hypothesis of homoscedasticity of the residues.

Considering that the degree of innovation is largely influenced by the perception of the innovations generated in the institution studied, it was decided to evaluate the causal relationship between the entrepreneurial orientation factors on these innovations. In other words, we sought to identify which factors influence the generation of innovations and which of them exert the greatest influence? To this end, a new regression analysis was performed, in which the “innovations” factor was analyzed as a dependent variable, and the other factors arising from the factor analysis were placed as independent variables. The degree of explanation of this model is 59.9% (adjusted $R^2 = 0.569$). The results are presented in Table 6.

Table 6.

Causal relationships on the dependent variable Innovations

Variables	Coefficients (Beta)	t	Sig.	Tolerance	VIF
Factor 1 – Risk-taking and competitiveness	0,413	4,531	0,000	0,517	1,933
Factor 3 – Proactiveness	0,243	2,540	0,013	0,677	1,477
Factor 4 – Autonomy	0,167	2,027	0,045	0,633	1,579
Factor 5 – Innovativeness	0,178	2,261	0,026	0,695	1,440

Note: Dependent variable – Innovations

Regarding the model validation assumptions, it was observed that it did not present multicollinearity problems. The applied normality test (K-S) resulted in sig. = 0.200, which indicates that the model's residuals follow a normal distribution. Finally, the model did not present heteroscedasticity problems, since the result of the Pesarán-Pesarán test presented sig greater than 0.05 (sig = 0.553), confirming the acceptance of the hypothesis of homoscedasticity of the model's residuals.

In this regression model, it was found that all factors are significant in explaining the dependent variable and exert a positive influence. Among them, the factor “risk-taking and competitiveness” has the greatest influence (Beta = 0.413). This result highlights the importance of actions that go beyond traditional procedures for implementing projects and meeting the needs of the HEI. It involves aspects such as boldness in achieving goals, willingness to take risks when exploring new ideas, competitiveness in actions and projects, and the use of the most current and advanced tools and methods for problem-solving and decision-making—all of which are encompassed by the “risk-taking and competitiveness” factor. The implementation of such attitudes and efforts is supported by the studies of Hernández-Linares et al. (2020), Gabriel and Kobani (2022), and Al-Mamary and Alshallaqi (2022). Furthermore, according to Silva et al. (2021), innovations are often generated by assertive behaviors that “break the mold” in individuals' activities. These behaviors include being responsible for one's tasks, being committed to their completion, and striving to do them correctly to avoid mistakes or rework, thereby reducing various types of waste in HEIs (Klein et al., 2021; Klein et al., 2023). Although such attitudes may seem simple, they are often absent among public HEI staff, but as they become more frequent, they can create an innovative environment with great potential.

The second most influential factor on innovations is “proactivity” (Beta = 0.243). This factor relates to elements such as monitoring technological trends for implementation, the ability to identify opportunities, and being a pioneer in introducing new products/services, administrative techniques, and operational technologies, among others. Proactivity is characterized by the active pursuit of efficiency in services (Scholta & Lindgren, 2023) and is closely associated with the promotion of various types of innovations (Liu et al., 2017). Examples of proactive behaviors include organizational practices such as proper document completion, timely and appropriate process handling, care for infrastructure, and eco-friendly actions that promote sustainability—such as saving water and energy in routine activities (Okřęglicka et al., 2023).

Finally, the factors “innovativeness” and “autonomy” also demonstrated an influence on the promotion of innovations. This is related to the continuous pursuit of new ways to deliver services that meet demands, generate results, and, even when mistakes occur, encourage employee freedom in decision-making and foster entrepreneurial behavior. Some actions and practices can be promoted by using key themes to foster innovation, such as social engagement and design thinking education (problem-focused) (Graciano et al., 2023). These characteristics, actions, and practices—when present and encouraged by HEI managers—foster both innovative attitudes and broader innovative projects and actions (Perera & Samarakoon, 2021), considering the various types of innovation explored in this study.

In conclusion, the results of this research support the perspective of Lima et al. (2018), who argue that entrepreneurial orientation is essential for institutions aiming to incorporate strategic entrepreneurial actions and translate them into organizational behavior and practices. This creates an environment conducive to co-creation and idea development, thus fostering innovation (Costa et al., 2023).

■ FINAL REMARKS

The role and activities developed by Higher Education Institutions (HEIs) are fundamental for local and regional development, innovation within organizations, individuals' social growth, and the transformation of knowledge, thinking, and actions in society. Several other factors could be listed to describe the importance of universities as transformative institutions in addressing the economic, social, and cultural issues of a nation. However, in order to continually develop and enhance this transformative role in society, universities must create value for their main stakeholders. One of the pathways to achieve this objective is the constant pursuit of innovation. In this regard, the role, attitude, and performance of public servants become essential when they are encouraged and guided to seek out different types of innovation. In light of this, the present article was developed with the aim of analyzing the influence of entrepreneurial orientation on the perception of innovation in a public HEI.

The results of this article were initially outlined through a descriptive analysis of the investigated variables, which highlighted elements such as the continuous fulfillment of internal and societal demands, new ways of delivering services, and creativity—components of the innovativeness dimension, which presented the highest average among the analyzed dimensions. Another notable result was cooperation innovation, which obtained the highest average among the types of innovation assessed.

Subsequently, an exploratory factor analysis (EFA), which resulted in five factors, was followed by a regression analysis to verify the influence of these factors on the degree of perceived innovation by the survey respondents at the studied HEI. The results of this regression demonstrated that the factors “Risk-taking and Competitiveness” and “Innovations” influence the degree of innovation, with the “Innovations” factor having a greater impact on this relationship. A second regression analysis was then conducted to assess the influence of factors related to entrepreneurial orientation on

innovations. The results indicated a positive and direct influence of all four analyzed factors: risk-taking and competitiveness, proactiveness, autonomy, and innovativeness—with emphasis on the first two, which most strongly influence innovation.

These results demonstrate that the continuous efforts and encouragement by managers toward entrepreneurial practices and attitudes—such as monitoring and implementing technological trends, identifying opportunities, benchmarking, boldness in achieving goals, calculated risk-taking, and idea prospecting—directly influence the innovations implemented within the institution. It is worth highlighting that the research was conducted solely with managers, leaders, and administrators of the HEI, meaning that the identified influence stems from their perceptions and views. This underscores the importance of the role they play in disseminating this entrepreneurial vision and attitude to other staff members and institutional collaborators.

The findings of this study provide relevant theoretical contributions to the field. First, this research deepens the understanding of the relationship between entrepreneurial orientation and innovation in the context of public organizations (Deslatte & Swann, 2020), especially in HEIs, which serve as knowledge disseminators and promoters of innovative behaviors and attitudes (Marques et al., 2018; da Cruz et al., 2021). Second, the results highlight the causal effect of entrepreneurial orientation elements on different types of innovations. Lastly, this study advances the definition and analysis of types of innovation in organizational settings—in this case, a public HEI.

As for practical and managerial contributions, the studied HEI's tendency toward collaborative innovation stands out. This practice is not only important for establishing partnerships and cooperation agreements with various entities and institutions but also becomes essential for shaping other types of innovation. The HEI can adopt a co-production perspective, developing project alternatives together with local communities (associations, entities, etc.) to promote the university-society interface. Examples include the promotion of specific training courses, technical assistance, and improvements in productive processes. The interaction between social actors (individuals in the community who experience social problems or civil society), organizational actors (managers and staff members), and institutional actors (representatives of State institutions, governments, and regulatory and legislative bodies) becomes crucial (Roschel et al., 2024).

The interpretation of this study's results must, however, consider some limitations. The main limitation refers to the fact that the innovation degree and types of innovation metrics are based on perception scales. No direct and absolute quantitative measures were used for these two variables. Another limitation lies in the adaptation of the scale used to measure the dimensions of entrepreneurial orientation to the context of a public HEI, since a specific scale for public servants was not found. Given these limitations, the following directions for future research are suggested: the development of a specific scale for evaluating entrepreneurial orientation in public organizations; and an in-depth analysis of each type of innovation addressed in this study, considering characteristics of decision-makers (managers) such as transformational leadership behavior, staff empowerment, and encouragement of continuous improvement. This perception could be further investigated by expanding the research to the operational level, focusing on “front-line” HEI employees, especially professors, considering their role in innovation and entrepreneur-

ial education (Uemura et al., 2023). These suggestions may contribute to advancing the literature on entrepreneurial orientation and its relationship with different types of innovation, a topic that remains underexplored both in the national and international contexts.



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