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Research Management in Higher Education Institutions from Developing Countries: An Analysis for Bolivia and Paraguay

Luis Pacheco [1,*], Fernando Oliveira Tavares [1], Makhabbat Ramazanova [1], Jorge Fuentes Ávila [2], Helena Albuquerque [1,3], Fátima Matos Silva [1,4], Jorge Marques [1,5], Mario Guillo [6], Beatriz Barrera Zuleta [7] and Silvia Marín Guzmán [8]

1 Research on Economics, Management and Information Technologies, Portucalense University, 4200-027 Porto, Portugal; ftavares@upt.pt (F.O.T.); ramazanova@upt.pt (M.R.); helenaa@upt.pt (H.A.); mfms@upt.pt (F.M.S.); jorgem@upt.pt (J.M.)
2 Department of Planning and Institutional Evaluation, Universidad Mayor Real y Pontifica de San Francisco Xavier de Chuquisaca, Sucre 0001, Bolivia; fuentes.jorge@usfx.bo
3 GOVCOPP—Research Unit on Governance, Competitiveness and Public Policies, University of Aveiro, 3810-193 Aveiro, Portugal
4 CITCEM—Transdisciplinary Research Centre Culture, Space and Memory, Faculty of Arts and Humanities, University of Porto, Via Panorâmica s/n, 4150-564 Porto, Portugal
5 CEGOT—Centre of Studies in Geography and Spatial Planning, Humanities Faculty, University of Coimbra, 3004-530 Coimbra, Portugal
6 OGPI—Institutional Projects Management Office, FUTURLAB—The Foresight Laboratory, Department of Sociology II, University of Alicante, 03690 Alicante, Spain; mario.guillo@ua.es
7 Direction of Research, Science, and Technology, Universidad Mayor Real y Pontifica de San Francisco Xavier de Chuquisaca, Sucre 0001, Bolivia; barrera.beatriz@usfx.bo
8 EDUCACIÓN en Fundación Pasos, Universidad Mayor Real y Pontifica de San Francisco Xavier de Chuquisaca, Sucre 0001, Bolivia; marin.silvia@usfx.bo
* Correspondence: luisp@upt.pt

Abstract: Research outputs in higher education institutions (HEIs) are crucially dependent on the research management process. Departing from a SWOT analysis, the main objective of this paper is to analyze the perceptions of stakeholders (researchers, teachers, and senior research managers) regarding the main strengths and weaknesses of HEIs, as well as assess the potential opportunities and threats present in the external environment. It analyzed a total of 462 responses from seven HEIs and two ministries participating in the INNOVA project in Bolivia and Paraguay. The results from the statistical analysis indicate that the respondents tend to identify the traditional obstacles and facilitators to research development, namely, the scarcity and instability of public policies, which permeate the institutions, diminishing the consistency of internal research policies and creating difficulties in access to funding and career development opportunities. Building on the substantial progress made in recent years, the unvirtuous cycle may be halted with political stability and committed action between all the concerned parties.

Keywords: higher education institutions; research management; SWOT analysis; Bolivia; Paraguay; INNOVA project

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1. Introduction

Higher education institutions (HEIs) have a fundamental obligation to conduct high-quality research. Establishing a solid institutional support system that establishes the best practices for concrete research management is critical (Bonaccorsi, 2018). Nonetheless, developing countries, such as Bolivia and Paraguay, have demonstrated poor institutional

capacity in administering higher education research, owing to a mix of underlying factors, either internal or external (Ballas et al., 2018; Donna et al., 2023).

Along with teaching, HEIs are increasingly pressed to present innovative research and secure external funding for that research, thus contributing to their communities and national development. Nevertheless, research outputs in HEIs are crucially dependent on the research management process (Dagnino, 2006). It is necessary that an environment supports researchers, an environment in which internal and external factors are intertwined. Internal factors include the availability of resources (funding, staff, infrastructure, etc.) and external factors include governmental policies and regulations. These factors are even more important in developing countries, such as Bolivia and Paraguay, which face notable challenges related to research and development (R&D) due to their limited available resources. The institutional support for higher education research management in both countries is characterized by insufficiencies, hindering the full realization of their academic potential (Inga et al., 2021; Donna et al., 2023). Despite the wealth of intellectual capital, the lack of adequate resources in terms of funding, technology, and research facilities limits the capacity of Bolivia and Paraguay to engage in and contribute significantly to the global landscape of research and development. Addressing these resource gaps is imperative for unlocking their untapped research potential and fostering research initiatives within their higher education institutions.

The INNOVA project (INNOVA, 2023)[1] is in progress, with the overarching goal of enhancing the research management of HEIs in Bolivia and Paraguay with the collaboration of two European HEIs, Portugal and Spain. The project holds significant value as it seeks to contribute to the formulation and solidification of research and innovation policies in those two Southern American countries, placing a particular emphasis on climate change in alignment with global standards. Additionally, its aim is to create an inventive and forward-thinking platform that guides the development of coherent and sustainable policies in research management, using foresight methods as a foundation.

Departing from a SWOT analysis developed by Ramazanova et al. (2025), a questionnaire was distributed to diverse target groups, including personnel from research and development units, researchers, and senior and mid-level managers within the higher education sector, in addition to policymakers, from Bolivian and Paraguayan HEIs and ministries. The main objective of this paper is to analyze and discuss the perceptions of stakeholders (researchers, teachers, and senior research managers) regarding the main strengths, weaknesses, opportunities, and threats related to research management in HEIs. Potential differences in terms of the respondents' country, gender, age, level of education, and work experience are also analyzed.

To achieve the defined objectives, the paper is divided into five sections. After this introduction, the paper presents a review of the literature, and the following section presents the methodology to process the data collected by the survey. The Section 4 presents the results. It begins by presenting the descriptive statistics of the variables in the analysis, testing statistically significant differences, and extracting the determining factors through principal component analysis of factor analysis. Those results are also discussed and confronted with the previous literature. The Section 5 presents the conclusions of the paper.

2. Literature Review

Bolivia and Paraguay are classified as emerging and developing economies by the International Monetary Fund[2]. Table 1 presents some comparative data for those two countries, together with Portugal and Spain, partners in the INNOVA project.

Table 1. Comparative data for Bolivia, Paraguay, Portugal, and Spain.

	Population (2022)	GDP per Capita (Current USD, 2022)	R&D Expenditure (% of GDP) *	Number of Papers Indexed in Scopus (per 1000 Inhabitants) **	Growth in the Number of Papers Indexed in Scopus (2022 vs. 2010)
Bolivia	12,224,110	3600.1	0.16	0.67	150%
Paraguay	6,780,744	6153.1	0.16	0.79	481%
Portugal	10,409,704	24,515.3	1.68	48.61	133%
Spain	47,778,340	29,674.5	1.43	45.50	66.7%

Source: World Bank Data. (*) Latest year available: Bolivia, 2009; Paraguay, 2020; Portugal and Spain, 2021. (**) From scimago.org; papers with at least one author are affiliated with the country considered. Data were obtained on 31 December 2023.

Table 1 highlights the striking differences between the two Latin American countries versus the Iberian countries regarding available resources for scientific research and publication outputs. Nevertheless, there are some signs of convergence in terms of publications, which constitute a long process.

In recent decades, there has been considerable movement throughout Latin America to expand enrolment in higher education; however, techniques differ by country. Private institutions outnumber public ones in quantity, and private enrolments are growing faster in countries such as Chile, Brazil, El Salvador, Paraguay, and Peru. In other cases, such as Cuba, Bolivia, Uruguay, and Argentina, expansion has been the result of collaborative efforts between governments and state agencies (for Bolivia in particular, see Cuba et al., 2020). Similarly, there are joint public–private initiatives in other countries. As a result of "privatism" and increased enrolments with insufficient public funding, institutions dedicated solely to teaching and certifying technical professionals have expanded, disregarding other university functions, such as research and dissemination (Brunner, 2012).

According to Mercado and Córdova (2018), the Latin American university plays a fundamental role in the cultural development of the region and the consolidation of democratic and solidarity values more than a century after the Cordoba reform. The Argentine University Reform of 1918 (Cordoba reform) was a broad modernization movement aimed at making universities more democratic. The reform began in Cordoba and soon extended across Argentina and much of Latin America, granting universities the autonomy to establish their own curricula and manage their budgets free from government control (Arocena & Sutz, 2005). The expansion of access to higher education has contributed to inclusion and the formation of professional communities in various knowledge areas, with a greater emphasis on traditional disciplines than on scientific and technological ones. Despite notable advancements in areas such as health and nutrition, the Latin American university, in general, has struggled to keep pace with international scientific and technological progress (Vessuri, 2007), perpetuating dependency and a production structure centered on primary activities. Faced with the global sociotechnical transformation and climate-change-induced challenges, there is a crucial need to promote the development of technoscience, directing it toward objectives of social benefit and sovereignty. Emphasis is placed on strengthening the technological capacity of the current industrial structure, adding value to regional strategic resources, minimizing socio-environmental impacts, and ensuring equitable distribution of benefits. Simultaneously, there is an advocacy for the development of local productive vocations that revive traditional and ancestral knowledge to empower communities. This is proposed through the promotion of intercultural education and the dialogue of knowledge (Vessuri, 2007).

While the literature does not extensively address scholars' perspectives on research and the identity of being researchers, there is some literature on the subject. Scholars'

viewpoints on research and their researcher identity have been examined, revealing a spectrum of importance and value attributed to the matter. This ranges from personal interest and professional advancement to recognizing the tangible benefits of research, such as publication, prestige, and financial support (Åkerlind, 2008).

The Bolivian and Paraguayan research units evidence an effort to increase international recognition and budget allocations for scientific endeavors (Donna et al., 2023). The rising trend in peer-reviewed publications is indicative of a positive response to some implemented funding strategies. However, certain weaknesses persist, such as the absence of specific regulations and funding limitations. The scarcity of experienced personnel in academic research should also be prioritized. For Donna et al. (2023), a critical challenge is the absence of a long-term science program to ensure the sustainability of implemented strategies. Political changes and the lack of integrated regional policies for research promotion could impede the continuous growth of scientific research in those two countries. Ciocca and Delgado (2017) have outlined common challenges faced by academic researchers in Argentina, which are also felt in other Latin American countries: limited budget allocation for academic research; lack of transparency in funding allocation processes; excessively bureaucratic requirements for career advancement; and the allure of more lucrative opportunities abroad (Ciocca & Delgado, 2017). These challenges underscore the need for shared lessons and regional collaboration to harmonize science policy agendas across South America.

According to Tünnermann Bernheim (2001), a notable characteristic of the traditional Latin American university is the absence of an effective administrative organization and a lack of awareness regarding the importance of academic and scientific administration. These features impact the management of research systems in Latin America, as stated by Lemasson and Chiappe (1999). Among the situations highlighted by these authors are insufficient research activities and the absence of mechanisms for research development in most Latin American universities. They also point to the weak coordination between state science and technology bodies and universities, the lack of visibility of universities' contributions to traditional scientific and technological activities, and the low number of faculty members with doctoral degrees.

According to Royero (2003), universities play a crucial role in strengthening national structures for scientific production. Universities concentrate on the results of innovation and the development of scientific knowledge along with the infrastructure and qualified personnel to design and execute national-level strategic guidelines. The author suggests that scientific research in Latin America needs to be rethought, especially concerning the relationship between the university, the state, and science and technology systems. This rethinking aims to reconsider the role of science in a world characterized by significant economic and social inequalities. Royero (2003) highlights significant challenges facing scientific research in the region's higher education institutions, such as insufficient resources, the impoverishment of scientific activity leading to brain drain to more developed and private production centers, and marked institutional disorganization. There is an emphasis on the need to establish a comprehensive policy for autonomous Latin American technological development, including management, control, and evaluation systems.

Estévez (2009) also criticized the lack of working conditions for full-time postgraduate professors to conduct research while still assigned to teaching units. The study also raised concerns about the implications of academic advancement, specifically if the increase in the ratio of teachers with postgraduate degrees has had a favorable impact on daily teaching and research responsibilities in various institutions. For Arias (2015), the advancement of research processes within universities is intricately tied to the perceptions and motivations of the academic community regarding the advantages derived from research endeavors

(Jusoh & Abidin, 2012). These advantages encompass various aspects, including but not limited to publishing, prestige, financial support, gaining experience, social recognition, economic benefits, and considerations related to time commitments, maintaining a work–life balance, and defining roles in research (Adedokun & Burgess, 2011). Nevertheless, the establishment of a robust scientific and research culture within HEIs faces challenges, primarily stemming from the inadequate emphasis placed on nurturing scientific and research skills in students (Rojas, 2010).

Robles et al. (2016) examined various factors influencing scientific production, emphasizing the relevance of institutional and rational elements of researchers. They identified that group research, dedicated time, years of experience, and work planning have a positive influence on university scientific production. Additionally, they pointed out that access to bibliographic resources and their utilization contribute to the development of critical thinking in students, enhancing the quality and quantity of academic work (Whitmire, 2002).

According to Ballas et al. (2018), the difficulty of envisioning a better future leads to a predominance of identifying problems and difficulties rather than optimistic visions. The authors highlight the discrepancy between the theoretical functions assigned to institutions, such as the state and universities in Latin America, and the reality of their fulfillment. The perception of accumulated social debt arises when these institutions fail to align with their assigned roles. In the Latin American context, the state and universities are considered essential for the development of science, technology, and innovation. Given the limited involvement of the productive sector, the state emerges as the primary source of funding. Business participation is necessary but insufficient, as it focuses on maximizing its own benefits. The lack of public investment in research and development is identified as a central problem, affecting scientific production and the retention of high-quality researchers. The low coordination between the state, universities, and the productive sector, as well as the lack of long-term public policies, are highlighted as additional obstacles. Internal problems, such as bureaucratization affecting public sector researchers who feel they must dedicate efforts to non-research-related issues, are also emphasized. Additionally, a crisis of confidence emerges among universities, the state, and businesses due to inadequate funding, the underutilization of scientific knowledge, and the perception of contradictions between discourse and practice. According to Ballas et al. (2018), despite the region not lacking doctoral and research candidates, there is a noted weakness in the scientific community. Aspirations include more training, maintaining, or increasing postgraduate scholarship policies, improving researcher resources, and recognizing that research training is a continuous process starting at an early age. There is also an emphasis on the need for highly trained technical staff and support teams in research systems.

Carhuancho Mendoza and Nolazco Labajos (2020), in their study of factors influencing university-level research development, highlighted obstacles such as the limited connection between university institutions and businesses, insufficient access to databases, infrastructure and information problems, and a lack of institutional support beyond economic considerations. For full-time faculty, administrative overload also limits their research activity (Flores et al., 2015). Similarly, it was noted that personal and institutional factors can reduce scientific production (Rietveldt & Vera, 2012). Other grouped elements include the development of analytical thinking, efficient searching in databases and electronic journals, research project management, efficient software handling, innovation, and proper time management (González & Álvarez, 2016). In this context, it is highlighted that the reality of students has similarities with that of faculty, facing challenges, such as a lack of infrastructure and database access, as well as economic and institutional support limitations, which may lead to a preference for work over research.

The study of perceptions and aspirations regarding science, technology, and innovation presented by Ballas et al. (2018) reveals that Latin American development remains a pending issue. The study shows that if the recent course is not changed, the gaps with countries that have more robust and consolidated systems will widen, affecting not only the region's performance but also its development possibilities. As can be seen above, research limitations faced by HEIs in Bolivia and Paraguay are a result of an intertwined set of internal and external factors, reflected in shared strengths, weaknesses, opportunities, and threats already clearly identified.

3. Methodology

This study targets specific groups, including personnel from research and development (R&D) units, academic researchers, and higher and mid-level education managers, along with policymakers in Bolivia and Paraguay. By analytically compiling insights into research policies within higher education at a country level, this study provides contextualization and establishes structural links to enhance future project activities in the involved countries. The survey questionnaire, conducted between July and August 2021, aimed to identify key elements for a SWOT analysis[3]. The total number of respondents amounted to 462, representing institutions in Bolivia (four universities and the Ministry of Education) and Paraguay (three universities and the Ministry of Education and Sciences) that are all actively engaged in projects (INNOVA, 2023).

The data obtained were analyzed using descriptive statistics. The SWOT analysis of seven universities and two ministries of education in Bolivia and Paraguay is estimated based on the evaluation classified on a Likert scale of 1 to 5: 1—totally disagree, 2—disagree, 3—neutral, neither agree nor disagree, 4—agree, and 5—totally agree. The statistical software SPSS version 22 was used to analyze the survey. In the first phase, descriptive statistics—univariate analysis—are used to carry out the analysis. A multivariate analysis, specifically the factorial analysis of key components, is performed afterwards. According to Marôco (2014), this approach entails obtaining a reduced number of variables (factors) from a larger set without losing information. It is a technique that aims to uncover correlations between variables in order to reduce the initial data and obtain new variables (Martinez & Ferreira, 2008).

Validity for the selected variables is required for efficacy and good factor analysis. Using Pestana and Gageiro (2014) interpretation for the Kaiser–Meyer–Olkin (KMO) test ([0.9–1.0]—excellent; [0.8–0.9]—very good; [0.7–0.8]—good; [0.6–0.7]—fair; [0.5–0.6]—poor; KMO < 0.5—inadequate) determined whether a good factor analysis is allowed, and the Bartlett test is used to determine the level of significance. If this is 0.000, we can rule out the possibility that the population correlation matrix is the identity matrix. As a result, it is possible to conclude that the factor analysis is appropriate. If this is not the case, the factorial model's application should be reviewed. Once the correlation between the variables in both prior tests has been confirmed, we may go on to factor analysis, where we will examine Cronbach's Alpha to ensure that the factors are internally consistent. Cronbach's Alpha values are interpreted as follows by George and Mallery (2019): 0.9–1.0—very good; 0.8–0.9—good; 0.7–0.8—reasonable; 0.6–0.7—uncertain; and 0.5–0.6—unacceptable.

Because the original orientation between factors is kept in orthogonal rotation, the factors after rotation remain orthogonal, and the orthogonal factor rotation model is used. We employed the Varimax orthogonal method with Kaiser normalization to rotate the factor axes. According to Marôco (2014), the goal is to obtain a factor structure in which one and only one of the original variables is strongly associated with a single factor while not being associated much with the remaining factors, thereby eliminating intermediate values that make interpretation of the results difficult.

4. Results

4.1. Descriptive Statistics

Table 2 presents statistical information regarding the main characteristics of the participants.

Table 2. Socio-demographic characterization of the participants.

Variables	Descriptive Measurements
Country	Bolivia: n = 250; Paraguay: n = 212
Gender	Male: 246 (Bolivia: n = 133; Paraguay: n = 113); female: 216 (Bolivia: n = 117; Paraguay: n = 99)
Age (years)	Minimum: 23; maximum: 85; average: 46.5; standard deviation: 10.9
Educational level	Professional education: n = 17; undergraduate: n = 61; master: n = 275; PhD (or more): n = 109
Work experience	Minimum: 1 month; maximum: 48 years; average: 13 years; standard deviation: 9.5 years

Authors' elaboration (2024).

The following tables (Tables 3–6) present the results of the survey for each item of the SWOT matrix. The tables present the respective average, median, and standard deviation from the responses made according to a Likert scale from 1 (totally disagree) to 5 (totally agree).

Table 3. Strengths—average, median, and standard deviation.

	Strengths	Average	Median	Standard Deviation
S1	The teaching staff are committed to the research process	3.33	3.00	1.132
S2	There are consolidated teams of research teachers	3.06	3.00	1.144
S3	There are policies and lines of research defined at the institutional level at the university (or faculty)	3.42	3.00	1.120
S4	There is accessibility to bibliographic sources and virtual information systems at the university and national level	3.50	4.00	1.150
S5	There is a team of researchers with a high level of scientific production capacity and competitive at the national level	3.22	3.00	1.122
S6	There is an adequate and equipped physical structure to promote research	2.92	3.00	1.143
S7	There is a database where statistical information on the scientific production of the institution is recorded and generated	2.81	3.00	1.108
S8	There is management capacity to obtain financing for competitive calls at the national level	2.94	3.00	1.095
S9	There is management capacity to obtain financing for competitive calls at an international level	2.91	3.00	1.113
S10	The management staff of the research area are committed to the research policies and goals	3.43	3.00	1.119
S11	There is permanent participation in local, regional, national, and international research projects (international agreements and contracts)	3.10	3.00	1.088
S12	The university's researchers are part of research groups at the national level	3.06	3.00	1.170
S13	There are sufficient scientific–technological resources to promote research	2.73	3.00	1.132
S14	There is support for research from national policies	2.46	2.00	1.101
S15	There is an executive will to strengthen research management at the institutional and national level	3.03	3.00	1.173
S16	There exists an administrative support service for the researcher	2.62	3.00	1.196

Authors' elaboration (2024).

Table 4. Weaknesses—average, median, and standard deviation.

	Weaknesses	Average	Median	Standard Deviation
W1	Limited number of researchers at the university	3.94	4.00	1.093
W2	Policies and research lines that are undefined and not systematized at the institutional level at the university	3.34	3.00	1.145
W3	Little coordination between areas of knowledge and weak linkage of research with postgraduate training	3.64	4.00	1.055
W4	Little integration of the research service with the problems of the local or departmental environment	3.35	3.00	1.118
W5	Little participation of the population and society in general in research activities	3.80	4.00	1.128
W6	Scarce and unstable public funding for research	4.20	5.00	1.126
W7	Limited knowledge of strategies to attract and maintain private financing	3.85	4.00	1.068
W8	Limited capacity (competitiveness) to achieve national and international financing	3.61	4.00	1.064
W9	Limited culture of research leadership and service support from the Research Directorates/Heads	3.44	3.00	1.143
W10	Little interest in teaching staff and students in research	3.38	3.00	1.140
W11	Limited methodological support or administrative and operational support to prepare proposals and execute research projects	3.55	4.00	1.128
W12	Little appreciation and recognition of research activity at the institutional level and with regard to progress in the professional career	3.71	4.00	1.179
W13	Absence of clear, defined, stable, and long-lasting policies to manage research and scientific production at the university	3.64	4.00	1.126
W14	Frequent political changes with changes in priorities and objectives within the university	3.14	3.00	1.292
W15	Management difficulties in establishing collaboration agreements with governmental and non-governmental organizations	3.50	4.00	1.121
W16	Absence of strategies and activities to promote and direct young researchers	3.41	4.00	1.122
W17	Lack of annual calls to promote research (research projects, scholarships, pre- and postdoctoral contracts, stays abroad, acquisition of infrastructure, etc.)	3.45	4.00	1.178
W18	Deficient innovative and research culture in the public sector and the business sector	3.82	4.00	1.070
W19	Little training in R&D&I (research + development + innovation) in university postgraduate degrees	3.73	4.00	1.083
W20	Poor system of communication and dissemination of results	3.59	4.00	1.041

Authors' elaboration (2024).

Table 5. Opportunities—average, median, and standard deviation.

	Opportunities	Average	Median	Standard Deviation
O1	Existence of different research networks at an international level (Latin American and European)	3.68	4.00	1.120
O2	Coordination between national universities through the country's university system	2.96	3.00	1.175
O3	Agreements with institutions and/or some companies for internships by final-year students	3.49	3.00	1.115
O4	Collaborations with companies in specific research and/or consulting projects	3.14	3.00	1.012
O5	International calls in force regarding research in different areas of knowledge	3.26	3.00	1.059
O6	Presence and development of technological platforms at the regional level that support, extend, and reinforce research and innovation and their internationalization	2.99	3.00	1.059
O7	Annual promotions of young professionals with potential research capacity	2.93	3.00	1.158
O8	Motivation and response capacity of professional groups that had fewer opportunities and prominence in research	2.88	3.00	1.051
O9	New technologies and information systems accessible for research	3.15	3.00	1.123
O10	Existence of links and collaboration agreements with other Latin American and European universities	3.40	3.00	1.134
O11	Active presence of a Vice Ministry of Science, Technology, and Innovation/National Council of Science and Technology with national policies and programs around research and decision making and organizational capacity in the sector	2.66	3.00	1.223
O12	Existence of internal and external economic resources to support research	2.61	3.00	1.089
O13	Technological development and growth in research that affects institutional positioning at the national, regional, and international level	2.93	3.00	1.127
O14	Ability to access competitive funds for doctoral scholarships so that national researchers can train at universities of high international prestige	3.12	3.00	1.199

Authors' elaboration (2024).

Regarding the external factors, respondents acknowledge the existence of a commitment and defined policies and lines of research at the institutional level but highlight the scarce and unstable funding and limited internal resources available to perform research activities. In terms of external factors, the respondents underline the existence of links of collaboration with other Latin American and European institutions but consider that the government does not provide the necessary environment and funding to conduct research. Next, we ran the Levene test to test whether there were significant differences in means within the sample, considering differences in terms of country, gender, age, level of education, and work experience. Tables 7–11 present only the items that found significant differences in terms of means.

Table 6. Threats—average, median, and standard deviation.

	Threats	Average	Median	Standard Deviation
T1	Non-compliance with national policies that promote research in universities	3.67	4.00	1.095
T2	Absence of clear regional priorities in research by the departmental government	4.00	4.00	1.084
T3	Little appreciation of research in our country and in the institution itself	3.84	4.00	1.115
T4	Absence of strategic and diverse incentives to promote research and innovation by the government and the institution	3.92	4.00	1.107
T5	Little involvement of companies, institutions, and social organizations in carrying out research with the university	3.98	4.00	1.043
T6	Absence of national or regional calls to participate/compete in the development of research	3.54	4.00	1.113
T7	Little competitiveness in national or international calls to obtain resources for research	3.64	4.00	1.066
T8	Non-use of agreements as external sources of financing	3.62	4.00	1.101
T9	Limited dissemination of research results by national and institutional agencies	3.78	4.00	1.023
T10	Continuous changes in research managers: positions subject to political changes	3.59	4.00	1.123
T11	Low political and financial commitment of the government to research	4.17	5.00	1.089
T12	Research is not a priority for the government in periods of cuts and crises	4.26	5.00	1.121
T13	Insufficient coordination in research between the university, company, and state	4.04	4.00	1.093
T14	Insufficient coordination at the institutional level between the different key actors to organize research (different faculties, rectorates, administrative services, and researchers)	3.68	4.00	1.116
T15	Gap in technology, equipment, human resources, and research support with respect to competing research centers and groups	3.87	4.00	1.111
T16	Little support from research funding programs for young researchers, prioritizing more established and experienced scientists	3.81	4.00	1.110
T17	Global financial restriction following the COVID-19 crisis	3.97	4.00	1.159
T18	Flight of talents and researchers to other countries due to salary regulations and others	4.08	4.00	1.091
T19	Bureaucratic difficulties for the registration of patents and authorship for the results of the university's research	3.74	4.00	1.096
T20	Little research culture in the national educational system	4.21	5.00	1.106

Authors' elaboration (2024).

Table 7. *t*-test for the difference in means—differences according to country (Paraguay vs. Bolivia).

	Item	Z Stat.	*t*-Test
W15	Management difficulties in establishing collaboration agreements with governmental and non-governmental organizations	1.101	2.265 *
O4	Collaborations with companies in specific research and/or consulting projects	0.013	−2.402 *

Source: Authors' elaboration (2024). Note: Levene test for equal variances/means; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 8. *t*-test for the difference in means—differences according to gender (female vs. male).

	Item	Z Stat.	*t*-Test
S1	The teaching staff are committed to the research process	0.618	2.190 *
S2	There are consolidated teams of research teachers	1.243	2.076 *
S5	There is a team of researchers with a high level of scientific production capacity and competitive at the national level	0.221	2.359 *
S6	There is an adequate and equipped physical structure to promote research	0.480	2.072 *
O11	Active presence of a Vice Ministry of Science, Technology, and Innovation/National Council of Science and Technology with national policies and programs around research and decision making and organizational capacity in the sector	0.300	2.174 *
T20	Little research culture in the national educational system	1.993	1.921 *

Source: Authors' elaboration (2024). Note: Levene test for equal variances/means. Z-stat statistic for equal variance and *t*-test for equal means; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 9. *t*-test for the difference in means—differences according to age (under vs. above 46 years old).

	Item	Z Stat.	*t*-Test
W14	Frequent political changes with changes in priorities and objectives within the university	0.061	2.840 *

Source: Authors' elaboration (2024). Note: Levene test for equal variances/means; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 10. *t*-test for the difference in means—differences according to level of education (with/without PhD).

	Item	Z Stat.	*t*-Test
O1	Existence of different research networks at an international level (Latin American and European)	3.389 *	2.021 *
T15	Gap in technology, equipment, human resources, and research support with respect to competing research centers and groups	0.423	2.021 *

Source: Authors' elaboration (2024). Note: Levene test for equal variances/means; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 11. *t*-test for the difference in means—differences according to work experience (under vs. above 10 years).

	Item	Z Stat.	*t*-Test
W5	Little participation of the population and society in general in research activities	5.712 *	−1.946 *
W7	Limited knowledge of strategies to attract and maintain private financing	1.408	−1.920 *
W8	Limited capacity (competitiveness) to achieve national and international financing	0.071	−1.941 *
W13	Absence of clear, defined, stable, and long-lasting policies to manage research and scientific production at the university	0.017	−1.986 *
W20	Poor system of communication and dissemination of the results	0.991	−1.921 *
T13	Insufficient coordination in research between the university, company, and state	2.323	−2.522 **
T17	Global financial restriction following the COVID-19 crisis	0.428	−2.072 *

Source: Authors' elaboration (2024). Note: Levene test for equal variances/means; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

The responses are very similar between the two countries. Compared to Bolivia, Paraguay seems to face a less positive belief in the capability to establish partnerships and collaborations with entities outside of academia.

Globally, women present a more positive tone in their responses than men. The differences are statistically significant in the "Strengths" items. This aspect denotes a more optimistic stance of women regarding the available capabilities and resources necessary to develop research activities.

Surprisingly, younger respondents statistically differ from older ones regarding the perception of frequent political changes in priorities and objectives within the university, with the former considering that to be very frequent.

As can be seen in Table 10, respondents with a PhD tend to give a more positive relevance to the existence of international research networks, albeit recognizing the existence of a handicap towards competing research centers.

As can be seen above, the negative signs imply that individuals with less work experience tend to be less positive in their responses. For instance, regarding the "Weaknesses" items, this means that younger respondents display a more optimistic stance, with higher levels of confidence in the future and a lower tendency to overcriticize the current situation.

Table 12 presents the significant differences found within each country, dividing the respondents according to gender, age, and level of education.

Table 12. *t*-test for the difference in means—differences within Bolivia and Paraguay according to gender, age, and level of education.

			Z Stat.	*t*-Test
Gender		Bolivia		
	W2	Policies and research lines that are undefined and not systematized at the institutional level at the university	0.340	1.923 *
	O14	Ability to access competitive funds for doctoral scholarships so that national researchers can train at universities of high international prestige	1.351	2.066 *
	T8	Non-use of agreements as external sources of financing	1.796	2.214 *
	T14	Insufficient coordination at the institutional level between the different key actors to organize research (different faculties, rectorates, administrative services, and researchers)	2.543	2.136 *
	T15	Gap in technology, equipment, human resources, and research support with respect to competing research centers and groups	2.055	1.995 *
	T16	Little support from research funding programs for young researchers, prioritizing more established and experienced scientists	1.405	2.130 *
	T19	Bureaucratic difficulties for the registration of patents and authorship for the results of the university's research	0.000	1.959 *
	T20	Little research culture in the national educational system	1.264	2.146 *
		Paraguay		
	S5	There is a team of researchers with a high level of scientific production capacity and competitive at the national level	2.016	2.169 *
	S9	There is management capacity to obtain financing for competitive calls at the national level	3.202	2.307 *
	W7	Limited knowledge of strategies to attract and maintain private financing	2.022	−2.044 *
	W8	Limited capacity (competitiveness) to achieve national and international financing	0.000	−2.269 *

Table 12. *Cont.*

			Z Stat.	*t*-Test
Age		Bolivia		
		No significant differences were found		
		Paraguay		
	W14	Frequent political changes with changes in priorities and objectives within the university	2.206	2.589 **
	T9	Limited dissemination of research results by national and institutional agencies	6.698 **	−2.094 *
Level of education		Bolivia		
	S4	There is accessibility to bibliographic sources and virtual information systems at the university and national level	0.092	2.568 *
	O1	Existence of different research networks at an international level (Latin American and European)	5.299	2.714 *
	O3	Agreements with institutions and/or some companies for internships by final-year students	1.180	2.180 *
	O9	New technologies and information systems accessible for research	0.122	2.201 *
		Paraguay		
	S4	There is accessibility to bibliographic sources and virtual information systems at the university and national level	1.785	−2.309 *
	T15	Gap in technology, equipment, human resources, and research support with respect to competing research centers and groups	0.127	1.845 *

Source: Authors' elaboration (2024). Note: Levene test for equal variances/means; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Overall, there seems to exist more significant differences within Bolivia, at least regarding gender and the level of education. The results evidence a larger number of significant gender differences in Bolivia, for instance in the "Threats" items. Women tend to underline threats to research development due to insufficient coordination and institutional support. An interesting result appears in Paraguay, where male respondents present a more pessimistic view regarding access to funding (items W7 and W8). Regarding age, the results confirm that the results previously highlighted in Table 9, for item W14, are characteristic of Paraguayan respondents. When analyzing differences between levels of education, there is an interesting result in item S4, that is, respondents in Bolivia with a PhD strongly agree that bibliographic and information sources are accessible, whereas, in Paraguay, the results point exactly in the opposite direction.

The fact that there are not many statistically significant differences among the respondents indicates that most items tend to be independent of nationality, age, gender, educational level, or professional experience. Similar results can be found in the previous literature (e.g., Robles et al., 2016; Ciocca & Delgado, 2017; Ballas et al., 2018; Donna et al., 2023). These are collective perceptions and aspirations. Desires that are linked to the purposes attributed to scientific research to the expected roles, but that are not necessarily fully fulfilled by the state, universities, and the private sector, are collectively unable to present consistent solutions for recurring problems.

4.2. Factorial Analysis

The factor analysis assumes the existence of a smaller number of unobservable variables underlying the data that express what is shared among the initial variables. The

Kaiser–Meyer–Olkin (KMO) statistic is calculated to determine the suitability of the factor analysis, and Bartlett's sphericity test is conducted. Table 13 presents the KMO measure and Bartlett's test.

Table 13. KMO and Bartlett's test.

Kaiser–Meyer–Olkin measure of sample adequacy		0.934
Bartlett's Test of *Sphericity*	Chi-square aprox.	12,002,109
	Df	741
	Sig.	0.000

Source: Authors' elaboration (2024).

The KMO statistic value is 0.934, which indicates that the variables used allow for an excellent factor analysis. Since Bartlett's test has a significance level of 0.000, it leads to the rejection of the hypothesis that the correlation matrix in the population is the identity matrix, demonstrating that the correlation between some variables is statistically significant. We can conclude the appropriateness of the factor analysis. If this were not the case, a reconsideration of the use of this factorial model would be necessary. Once the correlation between variables is confirmed in both previous tests, we can proceed with the factor analysis for the SWOT items, where we will analyze Cronbach's Alpha to assess the internal consistency of the factors.

Table 14 presents the factors' extraction for the SWOT items. We can also verify that the eigenvalues are all above 1 (Kayser's criterium). The factor analysis yielded the extraction of four factors responsible for 60.247% of the total variance. The unexplained variance of 39.753% could be related to other less relevant factors, resulting from other variable combinations.

Table 14. Total variance explained.

Component	Extraction of the Sum of the Squared Values			Rotation of the Sum of the Squared Values		
	Total	% of the Variance	% Accumulated	Total	% of the Variance	% Accumulated
1	10.227	26.224	26.224	7.877	20.197	20.197
2	8.586	22.015	48.238	6.016	15.425	35.622
3	2.460	6.307	54.545	5.971	15.311	50.933
4	2.224	5.702	60.247	3.632	9.314	60.247

Source: Authors' elaboration (2024)—SPSS output.

Table 15 presents the principal components matrix for the factorial analysis.

In Table 15, Cronbach Alphas indicate that there is a very good internal consistency in factors 1, 2, and 3 (Cronbach Alphas of, respectively, 0.945, 0.921, and 0.914) and a good consistency in factor 4 (0.861).

In relation to factor 1, we can see that all except one of the variables that contribute to explaining that factor belong to the "Threats" part of the SWOT analysis. For instance, the relevance of items, such as the fact that "research is not a priority for the Government in periods of cuts and crises" (T12) or the existence of "low political and financial commitment of the Government to research" (T11), lead us to conclude that in the respondents' opinion, governmental support is scarce. Other highlighted items are associated with a lack of connection between universities and other stakeholders. These findings suggest that although research has been integrated into the national policies of Bolivia and Paraguay, it remains underdeveloped. This conclusion aligns with previous studies (e.g., Inga et al., 2021). The key stakeholders in this study acknowledge the government's crucial role in fostering, advancing, and supporting research but also highlight the limitations in its efforts (Ciocca & Delgado, 2017; Ballas et al., 2018).

Table 15. Principal components matrix for the factorial analysis.

	Component				
	1	**2**	**3**	**4**	
T12	0.905				THREATS
T11	0.870				
T20	0.847				
T13	0.839				
T5	0.783				
T2	0.764				
T18	0.752				
W6	0.748				
T17	0.730				
T4	0.724				
T16	0.660				
T19	0.638				
O7		0.780			OPPORTUNITIES
O6		0.763			
O8		0.759			
O10		0.747			
O5		0.744			
O14		0.723			
O9		0.717			
O13		0.715			
O2		0.698			
O11		0.609			
S5			0.758		STRENGHTS
S8			0.738		
S7			0.736		
S11			0.729		
S9			0.719		
S12			0.702		
S2			0.680		
S13			0.672		
S6			0.658		
S10			0.633		
S4			0.553		
W14				0.756	WEAKNESSES
W15				0.745	
W16				0.694	
W17				0.682	
W12				0.657	
W9				0.649	
Cronbach Alphas	0.945	0.921	0.914	0.861	

Source: Authors' elaboration (2024)—SPSS output. Notes: Extraction method—principal components analysis. Rotation method—Varimax with Kaiser normalization after 6 iterations.

Regarding factor 2, all the items belong to the "Opportunities" part of the SWOT analysis. For instance, items such as the existence of "annual promotions of young professionals, with potential research capacity" (O7) or the "motivation and response capacity of professional groups that had fewer opportunities and prominence in research" (O8), both with low values in terms of responses, are very influential variables. As argued by Ciocca and Delgado (2017), focusing on the skills and competencies of human resources and making investments in this area are crucial for driving research progress and development

at all levels. Partnerships and collaboration agreements with other Latin American and European universities present valuable opportunities, but they must be fully leveraged to benefit HEIs. The active cooperation of all stakeholders plays a crucial role in effective research management, enabling universities to position themselves as leading research hubs (Carhuancho Mendoza & Nolazco Labajos, 2020). This, in turn, helps attract talent, foster partnerships with other institutions and industries, and secure funding for future research initiatives.

Regarding factor 3, all items belong to the "Strengths" area, allowing us to identify that the lack of "a team of researchers with a high level of scientific production capacity and competitive at the national level" (S5) and low the "management capacity to obtain financing for competitive calls at the national level" (S8) are two of the most influential variables. Despite the dedication of key stakeholders involved in managing research policies and objectives, the main challenges to advancing research are the limited number of researchers and the insufficient and unstable public funding. Finally, factor 4 is related to the "Weaknesses" area of the SWOT matrix. The most influential variables are also strongly associated with the lack of political guidance, internal strategy, and consistency in research policies (Donna et al., 2023).

In sum, Bolivian and Paraguayan universities require strategic leadership that fosters coordination, establishes supportive working environments, and enhances collaboration with key stakeholders. This also calls for broadening universities' external engagement beyond the traditional "Triple Helix" model of collaboration between academia, industry, and government (Leydesdorff, 2013; Ciocca & Delgado, 2017). These interactions should extend beyond universities, the public sector, and private enterprises to include trade unions, cooperatives, the entire education system, communication networks, and other relevant institutions. While higher education institutions are undoubtedly striving to meet international standards and engage with the global academic community, there is still room for improvement in research management practices across the region.

5. Conclusions

Universities are primary sources of innovation and scientific research and are part of an ecosystem essential to promoting economic development, reducing inequalities, and dealing with climate change challenges. The objective of this paper was to analyze the results of a questionnaire distributed to personnel from research and development units, researchers, and senior and mid-level staff from seven HEIs and two ministries in Bolivia and Paraguay.

In our view, this study offers valuable insights into key issues in these countries, which could also be applicable to other emerging nations. The analysis of the results leads us to confirm the previous literature since the respondents tend to identify the traditional obstacles and facilitators to research development. These perceptions help us identify gaps and encourage reflection on ways to enhance research management in HEIs. The national political context directly influences the development of research strategies within these institutions and affects the overall performance of researchers. Specifically, the scarcity and instability of public policies permeate the institutions, diminishing the consistency of internal research policies and creating difficulties in access to funding and career development opportunities. An aspect that deserves further attention from all stakeholders is gender issues. The differences found in terms of gender may be the result of gender inequality, particularly in Bolivia, in access to research funding, institutional support, and career development. These issues should be addressed in future research, adopting a micro-analysis based on interviews or studying specific cases. Future work should also focus on tracking the progress of research policies to assess whether they contribute

to improving the performance of researchers and institutions. On an institutional level, strengthening research infrastructure is vital for supporting the advancement of scientific endeavors. On an individual level, providing opportunities and incentives to enhance staff research skills and capabilities is crucial for producing high-quality research and fostering a dynamic research environment.

It is possible to conclude that the existence of an unvirtuous circle is an important element of developing countries. Suboptimal investment and a lack of clear regulatory frameworks result in low scientific output, a scarcity of competent academic researchers, and insufficient research infrastructure. Under these conditions, it is reasonable to assume a continued lack of private investment. However, this circular logic can be broken. Coordinated efforts between all the involved stakeholders (government, HEIs, private firms) are needed to break the unvirtuous cycle. Most of the identified weaknesses and threats require central organization and regional cooperation to address the lack of articulation between public and private research areas, the scarcity of international projects, and the need for clearer regulations to ensure transparency. We believe that significant progress has been made in recent years. However, all relevant actors, including decision makers, researchers, and regulatory agents, must work together to achieve a cultural shift in how we think about science policymaking, with a focus on long-term goals and regional collaborative research.

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Notes

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2 https://www.imf.org/en/Publications/WEO/weo-database/2023/April/groups-and-aggregates#lac (accessed on 8 January 2025).

3 The survey questionnaire is available from the authors upon request.

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