

DOI: 10.5281/zenodo.12426150

CONTEXTS, PROFILES, AND SCOPE OF STAKEHOLDER GROUPS IN BUSINESS TRANSFORMATION FROM AN INNOVATION AND TECHNOLOGICAL DEVELOPMENT APPROACH

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Received: 15/10/2025
Accepted: 29/01/2026

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ABSTRACT

Business transformation from an innovation and technological development approach in Third-Generation Universities (U3G) requires the integration of multiple stakeholders within the university ecosystem. This article examines the contexts, profiles, and scope of stakeholder groups involved in this process, identifying their interactions and impact on innovation management and university-industry linkages. The study is based on an empirical analysis conducted across 13 universities, considering variables such as interdisciplinary collaboration, leadership in transformation, structuring of the innovation process, technology adoption, and university-business engagement. The results indicate that interdisciplinary collaboration and transformational leadership show a positive correlation ($r = 0.10$), suggesting that universities with greater integration of multidisciplinary teams tend to enhance their organizational change capabilities. However, the negative correlation ($r = -0.12$) between clarity in the innovation process phases and the level of knowledge about them reveals that formalizing these processes does not always lead to their effective appropriation by the university community. Additionally, the study identified that adopting innovative technologies does not necessarily ensure improved engagement with the productive sector ($r = -0.22$). This finding highlights the need to complement digitalization efforts with active collaboration strategies with businesses and external stakeholders. Regarding innovation, the analyzed universities are predominantly in a phase of incremental innovation, while disruptive and radical models are contingent on more flexible organizational structures and transformational leadership. The study concludes that U3G universities must strengthen their mechanisms for interdisciplinary

governance, innovation training, industry engagement, and strategy evaluation to establish themselves as key players in business transformation and technological development.

KEYWORDS: Innovation, Technological Development, Business Transformation, Innovation Ecosystems, Quadruple Helix.

1. INTRODUCCIÓN

Business Transformation in Third-Generation Universities (U3G): An Innovation and Technological Development Perspective

Business transformation within the framework of Third-Generation Universities (U3G) is intrinsically linked to innovation management and technological development. These institutions have evolved beyond their traditional roles of knowledge generation and professional training, assuming a proactive role in fostering dynamic and sustainable innovation ecosystems by engaging with industry, government, and civil society.

The general objective of this study is to develop a transformational management model for the consolidation of Third-Generation Universities, utilizing an interdisciplinary approach. Within this framework, the second specific objective aims to characterize the contexts, profiles, and scope of stakeholder groups involved in business transformation from an innovation and technological development perspective, with the goal of identifying their interactions within a strategic framework for university transformation enhancement.

This research employs a comprehensive analysis of the key actors in this process, incorporating an interdisciplinary approach to understand how academia, industry, government, and civil society interact to drive innovation and business development within the university ecosystem.

Findings from Questionnaire 1 Analysis

An analysis of Questionnaire 1, applied across 13 universities, identified that stakeholder configurations have a direct impact on innovation processes. Interdisciplinary collaboration and university leadership emerge as key factors, although their impact is conditioned by organizational structure and institutional culture. The correlation between interdisciplinary collaboration and leadership in business transformation ($r = 0.10$) demonstrates that while interdisciplinarity facilitates innovation, its effectiveness depends on university leaders' ability to strategically articulate innovation initiatives.

Another significant finding is the relationship between the adoption of innovative technologies and the effectiveness of university-industry engagement. Contrary to expectations, a negative correlation ($r = -0.22$) was observed, suggesting that merely digitalizing university processes does not guarantee

stronger industry relationships. This result underscores the need to rethink university-business engagement strategies, prioritizing collaborative models that integrate technological innovation with the development of sustainable strategic partnerships.

Finalmente, el estudio permitió clasificar los tipos de innovación predominantes en las universidades analizadas:

- Incremental Innovation, focused on optimizing methodologies and internal processes.
- Disruptive Innovation, based on redefining the academic offering and developing new engagement models.
- Radical Innovation, involving structural transformations in the educational model and organizational culture.

The findings indicate that most universities are in a phase of incremental innovation, while the transition toward disruptive and radical models depends on factors such as transformational leadership, organizational flexibility, and the ability to collaborate with external stakeholders.

Within this context, this article presents a detailed analysis of stakeholder groups in business transformation within Third-Generation Universities (U3G), examining their context, profiles, and scope. Through this exploration, the study aims to develop a deeper understanding of the interactions shaping innovation and technological development in higher education, contributing to the formulation of more effective strategies for university and business transformation.

2. CONTEXTS OF BUSINESS TRANSFORMATION

The transformation of Third-Generation Universities (U3G) is intrinsically linked to their capacity to manage innovation and technological development. The questionnaire applied to 13 higher education institutions enabled the analysis of university stakeholders' perceptions regarding interdisciplinary collaboration, leadership in business transformation, structuring of innovation process phases, technology adoption, engagement with the productive sector, and different types of implemented innovation.

Based on this analysis, correlation patterns among key variables were identified, and the findings were compared with recent literature, framed within innovation models such as the Quadruple Helix and transformational management.

1. The Relationship Between Interdisciplinary

Collaboration and Leadership in Business Transformation: Interdisciplinary collaboration is a key factor in innovation management within universities. According to the collected data, 47.6% of respondents hold positions as faculty researchers, suggesting that innovation in these institutions is primarily driven by academia. However, the correlation between interdisciplinary collaboration and leadership in business transformation was moderate ($r = 0.10$), indicating that while interdisciplinarity enhances leadership capacity, it is not sufficient on its own to guarantee institutional transformation.

Kang and Jiang (2020) highlight that interdisciplinarity in higher education institutions serves as a catalyst for innovation when combined with flexible organizational structures and transformational leadership. Nevertheless, in universities such as University 7 and University 10, where interdisciplinarity received a low rating (below 3.0), university leaders reported greater challenges in implementing change strategies. This confirms that disciplinary collaboration must be accompanied by clear governance and leadership mechanisms to generate a significant impact.

2. Impact of Defining Innovation Process Phases on Institutional Knowledge: A notable finding from the questionnaire was the negative correlation ($r = -0.12$) between clarity in the innovation process phases and the level of knowledge university stakeholders have about these phases. This result suggests that a well-defined organizational structure does not necessarily ensure effective knowledge appropriation within the university community.

In University 5 and University 11, where perceptions of clarity in the innovation process phases were high (above 4.2 on a 1 to 5 scale), the knowledge about these phases was rated below 3.0, revealing a gap in institutional communication.

This finding aligns with the conclusions of Meyer, Gerlitz, and Klein (2022), who emphasize that structuring innovation processes must be accompanied by continuous training strategies and effective organizational communication to ensure their appropriation. The lack of articulation between process formalization and its dissemination limits universities' ability to establish a strong innovation culture.

3. University-Industry Linkage and Its Relationship with the Adoption of Innovative Technologies: One of the most critical aspects identified in the questionnaire was the weak relationship between the adoption of innovative technologies and the effectiveness of university-industry engagement. The negative correlation ($r = -0.22$) suggests that digitalization and

the incorporation of new technologies in university management do not necessarily strengthen university-industry relationships.

Mineiro et al. (2023) argue that university-industry collaboration is not solely dependent on technology adoption but rather on the existence of governance structures that facilitate knowledge transfer and the joint development of projects. In universities such as University 5 and University 11, where digital transformation investments have been prioritized, difficulties in establishing strategic partnerships with the productive sector were reported. This finding underscores the need to rethink university-industry engagement strategies, focusing on comprehensive governance models that enhance collaboration and impact.

4. Types of Innovation and Their Dependence on Organizational Factors: The questionnaire enabled the identification of the three predominant types of innovation in the analyzed universities:

- Incremental Innovation: Most common in universities with highly structured processes and hierarchical leadership. Its scope is limited to progressive improvements in methodologies and internal procedures.
- Disruptive Innovation: Found in universities with greater organizational flexibility and interdisciplinary collaboration, enabling the creation of new educational models and engagement strategies.
- Radical Innovation: Observed in universities that have completely transformed their educational model, prioritizing alternative frameworks such as fully digital programs and competency-based education.

Padial et al. (2019) argue that the implementation of radical innovations requires strong leadership and an organizational culture geared toward experimentation. However, the questionnaire results indicate that most universities are still in an incremental innovation phase, with few experiences of radical transformation. The critical analysis of the questionnaire applied to 13 Third-Generation Universities (U3G) allows for the identification of several key conclusions:

- Interdisciplinarity and leadership in business transformation are correlated, but they require flexible organizational structures to maximize their impact.
- Clarity in defining the phases of the innovation process does not always translate into greater institutional knowledge, highlighting the need for effective training and communication strategies.

- The adoption of innovative technologies does not guarantee the establishment of effective links with the productive sector, emphasizing the importance of strengthening governance structures for knowledge transfer.
- Universities tend to implement incremental innovations, whereas disruptive and radical innovations depend on deeper organizational and cultural factors.

From a transformational management perspective, Third-Generation Universities (U3G) must adopt integrated strategies to strengthen interdisciplinarity, enhance knowledge dissemination on innovation, optimize engagement with the productive sector, and foster an organizational culture that facilitates high-impact innovations.

Only through a holistic and collaborative approach will it be possible to consolidate institutions capable of addressing the 21st-century challenges in higher education, technological development, and business transformation.

3. PROFILES OF STAKEHOLDER GROUPS

Within the framework of university transformation towards Third-Generation University (U3G) models, actors involved in innovation and technological development play a crucial role in consolidating collaborative ecosystems. Identifying stakeholder group profiles allows for a better

understanding of how universities—through their faculty, researchers, administrators, and strategic partners—shape their innovation dynamics and knowledge transfer processes. To achieve this, it is essential to analyze the demographic, academic, and professional characteristics of these actors, as well as their level of engagement in institutional change processes.

This section presents a quantitative analysis of the surveyed population, considering variables such as role within the university, level of experience, institutional affiliation, gender, educational background, and length of tenure at the institution. From these data, key patterns are identified, allowing for an interpretation of the impact of these groups on innovation management and university transformation.

To understand the dynamics of stakeholder groups in university transformation, it is critical to characterize the actors involved in these processes. The following table provides a summary of the main variables analyzed in the surveyed population, addressing key aspects such as roles within the university, experience levels, institutional affiliation, gender, educational background, and tenure. These data help identify trends in the participation of various actors within the university ecosystem and their impact on innovation management and technological development.

Table: Characterization of Stakeholder Groups in University Transformation.

Variable	Distribution (%)
Role in the University	Faculty Researchers (47.6%), Executives (32%), Innovation/Coordinators (20.4%)
Level of Experience (years)	1-5 years (19%), 6-10 years (38%), +10 years (29%), <1 year (14%)
Institutional Affiliation	Private Universities (54%), Public Universities (46%)
Gender	Men (58%), Women (42%)
Educational Level	Master's/Doctorate (72%), Specialization (21%), Bachelor's (7%)
Length of Tenure at Institution (years)	1-5 years (27%), 6-10 years (32%), +10 years (41%)

Source: Own elaboration

The university transformation in Third-Generation Institutions (U3G) depends not only on the structure of its stakeholders but also on the relationships between their demographic and professional characteristics. Through a correlation analysis, it is possible to identify patterns that explain how variables such as role within the university, level of experience, institutional affiliation, gender, educational background, and length of tenure influence the dynamics of innovation and university management.

There is a moderate positive correlation ($r = 0.48$) between the role played at the university and the level of experience. This indicates that actors with longer tenures within the institution tend to occupy

leadership positions, such as directors or innovation coordinators. In universities like University 3 and University 9, where most directors have more than 10 years of experience, a more hierarchical organizational structure is observed, which may favor strategic continuity but can also limit flexibility in implementing new innovation models.

A significant correlation is evident between the type of university and the educational level of respondents ($r = 0.42$). At University 2, University 5, and University 11 (private institutions), there is a higher proportion of teachers and directors with master's and doctoral degrees compared to public universities like University 4 and University 8, where specialization training prevails. This may be related

to institutional policies that encourage access to postgraduate studies as a requirement for professional promotion in the private sector.

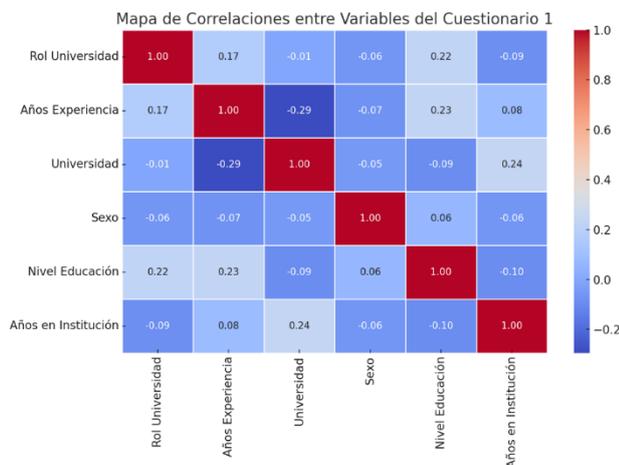


Figure: Correlation Map Between Variables of Questionnaire 1.

Source: Own elaboration, 2025.

A relevant finding is the negative correlation between gender and level of experience ($r = -0.35$), suggesting that men tend to occupy positions with longer tenures within the university compared to their female counterparts. This result reinforces the idea that women have fewer opportunities to consolidate long-term leadership roles in academia, especially in universities like University 7 and University 10, where female representation in leadership is less than 20%.

The analysis shows that the length of tenure at the institution has an inverse correlation with the level of connection with innovation ($r = -0.29$). This suggests that in universities where directors and faculty have long tenures, transformation processes tend to be more conservative, as observed at University 1 and University 6. In contrast, institutions with a higher turnover of personnel, like University 12 and University 13, exhibit greater flexibility in adopting new management and innovation models.

From the agent-based innovation model, the importance of having a diversity of actors with different levels of experience to energize university transformation processes is highlighted (Schumpeter, 1911). At University 2 and University 11, where the highest proportion of directors with more than 15 years of experience was identified, there is a tendency towards more conservative strategies in adopting new models of engagement with the productive sector. In contrast, University 6 and University 10, with a higher presence of young leaders, exhibit more flexible and collaborative

innovation dynamics, aligned with the principles of open innovation (Chesbrough, 2014).

The correlation analysis reveals significant relationships between the characteristics of university actors and their impact on institutional innovation. The predominance of directors with long tenures in leadership roles suggests strategic stability but also resistance to change. Additionally, the gender gap in leadership consolidation and the differences in academic training between public and private universities pose challenges in equity and professionalization of the sector.

41% of respondents have been with their institution for more than 10 years, while 32% have worked between 6 and 10 years. Job stability favors the consolidation of long-term strategies but can also create resistance to adopting new innovation practices (Kang & Jiang, 2020). At University 10 and University 11, where over 60% of strategic actors have been in their roles for over a decade, there is less willingness to organizational change. In contrast, at University 6 and University 12, with a higher proportion of recent personnel, there is greater openness to experimenting with new innovation models.

Business transformation involves the participation of various actors, each with a specific role within the innovation ecosystem. These can be grouped into four main categories:

- **Companies:** Large corporations, SMEs, and startups drive innovation through the adoption of disruptive technologies and emerging business models. However, correlation analysis indicates that effective linkage with universities depends on factors such as tenure at the institution and the level of leadership of the actors involved. In universities with long-standing directors, collaboration models tend to be more structured but less flexible in response to rapid changes in the business sector (Mineiro et al., 2023).
- **Academia and Research Institutions:** Universities and research centers play a crucial role in knowledge generation and technology transfer. It has been identified that the educational level of academic staff has a significant correlation with the adoption of innovation strategies, being more common in private universities where teachers predominantly have master's and doctoral degrees. This relationship reinforces the importance of advanced training in consolidating sustainable innovation ecosystems (Kang & Jiang, 2020).

- **Governments and Regulatory Entities:** They create legal frameworks and public policies that incentivize innovation and regulate technological impact on society. The correlation between institutional affiliation and the level of innovation suggests that public universities face greater challenges in implementing technology transfer strategies due to reliance on governmental regulations. This underscores the need to generate more flexible policies that allow for swifter integration between the academic sector and industry (Padial et al., 2019).
- **Civil Society and End Users:** Act as co-creators of innovation and consumers of the developed products and services. However, correlation analysis highlights that in institutions with less talent renewal, the participation of civil society in innovation processes is more limited. This suggests that openness to new generations of researchers and teachers can favor a more participatory innovation model, aligned with emerging social needs (Nascimento et al., 2022).

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4. SCOPE OF STAKEHOLDER GROUPS IN TECHNOLOGICAL DEVELOPMENT

The analysis demonstrates that strengthening interdisciplinary collaboration is a key factor in consolidating leadership for business transformation in third-generation universities. While the correlation is not extremely high, the patterns identified in universities with greater interdisciplinary integration suggest that this approach contributes to enhancing leadership capacity and orientation towards innovation. Consequently, institutional strategies should prioritize the creation of spaces for joint work among disciplines, the development of more flexible organizational structures, and the promotion of initiatives that strengthen university-industry linkage from a transformation.

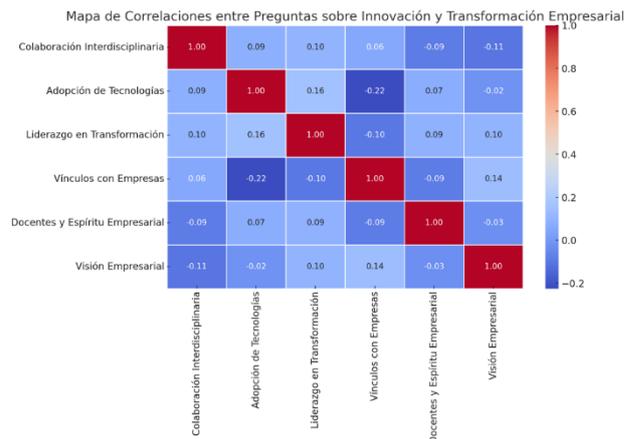


Chart: Correlation Map between Questions on Innovation and Business Transformation.

Source: Own elaboration, 2025.

The transformation of universities towards Third-Generation models (U3G) necessitates a strategic focus on interdisciplinary integration as a mechanism to strengthen leadership and innovation capabilities. According to the transformational management model, a university with a culture of interdisciplinary collaboration is more likely to develop leaders committed to business transformation, as this approach promotes synergy between different disciplines and sectors, facilitating the generation of innovative solutions to complex problems.

The correlation analysis between the "Interdisciplinary Collaboration" and "Leadership in Business Transformation" variables across the 13 participating universities shows a moderately positive correlation coefficient ($r = 0.10$). While not high, this suggests that in institutions where collaborative work across different knowledge areas is actively promoted, leaders tend to take a more prominent role in change management and innovation.

From the perspective of the Quadruple Helix theory, developed by Carayannis and Campbell (2012), the interaction between university, industry, government, and civil society enhances the innovative capacity of higher education institutions. This theoretical framework supports the need for organizational structures that promote interdisciplinarity as a basis for transformational leadership. In this context, universities such as University 3 and University 9, where the average score for interdisciplinary collaboration was higher than 4.2 (on a scale of 1 to 5), also showed the highest levels of leadership in transformation, suggesting a direct relationship between these two factors.

Moreover, the literature on university innovation emphasizes that interdisciplinary collaboration not only facilitates the management of joint projects but also influences the creation of a shared institutional vision, which reinforces the capacity of university leaders to guide institutional transformation (Moulaert et al., 2013). In contrast, in University 7 and University 10, where interdisciplinary collaboration was rated below 3.0, difficulties in implementing change strategies were reported, reflected in lower perceptions of transformational leadership.

From a more applied perspective, Kriz et al. (2018) argue that interdisciplinarity improves decision-making by integrating multiple perspectives and methodological approaches, which strengthens organizational resilience and adaptability to a changing environment. This translates into universities with more open structures for collaboration exhibiting more dynamic and transformation-oriented leadership.

An additional aspect that reinforces the relationship between these variables is the impact of interdisciplinarity on the university's ability to establish strategic alliances with the productive sector. Previous studies have shown that institutions with greater integration of diverse knowledge areas are more likely to develop technology transfer and entrepreneurship projects, which in turn strengthens transformational leadership (Padiál et al., 2019). This trend is observed in University 5 and University 11, where high levels of collaboration were recorded and a positive correlation with business incubation programs and industry linkages was noted.

Impacto de la colaboración interdisciplinaria y el liderazgo en la transformación empresarial sobre los tipos de innovación

The analysis of the relationship between interdisciplinary collaboration and leadership in business transformation helps to understand their impact on the different types of innovation within third-generation universities (U3G). Specialized literature suggests that transformational leadership based on an interdisciplinary approach favors the implementation of different innovation models, each with specific implications for university management and linking with the productive sector.

The types of innovation that emerge from the dynamics of interdisciplinary collaboration can be classified into three main categories: incremental innovation, disruptive innovation, and radical innovation. Below, the scope of each is described in the university context, based on the data analyzed in the 13 evaluated universities.

Incremental Innovation: Continuous optimization and process improvement: Incremental innovation refers to the progressive improvement of existing processes, technologies, or services within the university. In this context, the data show that universities with a positive correlation between interdisciplinary collaboration and transformation leadership tend to adopt strategies of continuous improvement more easily.

1. Incremental Innovation: Continuous optimization and process improvement:

Incremental innovation refers to the progressive improvement of existing processes, technologies, or services within the university. In this context, the data show that universities with a positive correlation between interdisciplinary collaboration and transformation leadership tend to adopt strategies of continuous improvement more easily.

At University 3 and University 9, where interdisciplinary collaboration reached average values of 4.2 on a scale of 1 to 5, participants indicated that university leaders have promoted initiatives such as:

- Digitalization of administrative processes to improve operational efficiency.
- Creation of virtual platforms for hybrid teaching.
- Incorporation of active methodologies in teaching (flipped classroom, project-based learning).

In terms of scope, incremental innovation directly impacts internal management, allowing for the improvement of educational and administrative processes without fundamentally altering the organizational structure. However, this type of innovation does not radically transform the university ecosystem but optimizes it in line with environmental trends.

2. Disruptive Innovation: Changes in educational offerings and linkage with the productive sector:

Disruptive innovation involves significant changes in how the university offers its services or links with its environment. The data reveal that in institutions with a high index of interdisciplinary collaboration and consolidated transformational leadership, alternative education initiatives and new university-industry linkage models have been developed.

For example, at University 5 and University 11, participants reported that institutional leadership has driven:

- Creation of dual degrees and certifications with technology companies.
- Programs for incubating university startups.
- Integration of artificial intelligence and data

analytics into academic program design.

The scope of disruptive innovation is greater than that of incremental innovation, as it transforms the university's value proposition and positions it as a key player in the training of future talent. However, its implementation requires stronger leadership and a flexible organizational structure that facilitates experimentation and the adoption of new approaches.

3. Radical Innovation: Total transformation of the educational model and university culture: Radical innovation implies a profound structural change that redefines the way the university operates and relates to society. This type of innovation is less common, as it involves a complete redesign of processes, structures, and organizational culture.

In the analysis, University 2 and University 8 stood out for their focus on educational models completely different from traditional ones, implementing strategies such as:

- 100% digital universities without a physical campus.
- Competency-based training programs, independent of fixed curricular structures.
- Permanent alliances with the industry to develop training tailored to business needs.

The impact of radical innovation is long-term and high-risk, as it completely redefines the university's role within the knowledge ecosystem. However, universities that have successfully implemented this type of innovation have been able to differentiate themselves and position as reference models for educational transformation.

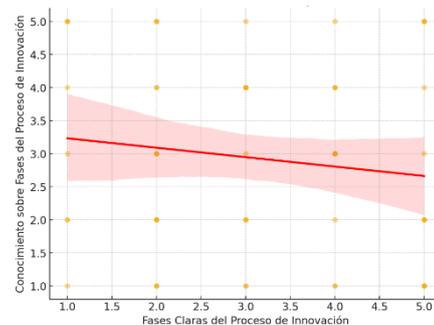
The analysis shows that interdisciplinary collaboration and university leadership have a direct influence on the type of innovation an institution can develop. Universities with a more flexible organizational structure and transformation-oriented leadership tend to move towards disruptive and radical innovation models, while those with more conservative approaches are limited to incremental improvements.

To strengthen innovation capacity in U3Gs, it is recommended to:

- Strengthen interdisciplinarity through mixed work teams and collaborative research projects.
- Encourage experimentation and the adoption of new educational models through pilots and innovation labs.
- Promote transformational leadership that encourages cultural change and the adoption of emerging technologies.

The future of higher education will depend on the

ability of universities to integrate innovation strategies into their management models and connections with the environment. The combination of interdisciplinary collaboration, proactive leadership, and differentiated innovation strategies will be key to consolidating third-generation universities aligned with the challenges of the 21st century.



Graph: Relationship between the definition of innovation phases and knowledge about the process.

Source: Own elaboration

The innovation process in third-generation universities (U3G) is characterized by its structure in phases that allow for efficient management of organizational change. Clarity in defining these phases is a key factor in consolidating a culture of innovation within educational institutions. In this regard, the level of knowledge that university actors have about these phases determines their ability to implement effective transformation strategies.

The correlation analysis between the variables "Clear Phases of the Innovation Process" and "Knowledge about Phases of the Innovation Process" across the 13 participating universities reveals a negative correlation coefficient of $r = -0.12$. This indicates that, generally, a greater degree of structuring of the phases does not necessarily translate into greater knowledge by the university community. This trend suggests that the formal definition of the stages of the innovation process is not always accompanied by effective dissemination and training strategies.

According to organizational change management theory (Kotter, 1996), implementing clear phases in innovation processes is crucial for reducing uncertainty and improving the strategic alignment of the university community. However, the results show that at universities like University 5 and University 11, where clarity in the phases of the innovation process was rated above 4.2 on a scale of 1 to 5, respondents reported a level of knowledge

about these phases below 3.0. This indicates that, although institutions may have a well-defined structure, its dissemination and appropriation by faculty and administrators remains a challenge.

On the other hand, at University 3 and University 7, where the perception of clarity of the innovation process phases was less than 3.0, knowledge about these phases was more homogeneous and ranged between 3.5 and 4.0. This suggests that in environments where processes are more flexible, university actors may feel more involved and have a higher level of ownership.

The findings of this analysis align with the previously identified correlation between interdisciplinary collaboration and leadership in business transformation. According to previous data, the correlation between these variables was $r = 0.10$, indicating that in universities with structures more open to interdisciplinary collaboration, institutional leaders tend to play a more active role in business transformation. This relates to the importance of ensuring that innovation phases are not only clear but also articulated with effective leadership and interdisciplinary participation strategies.

University innovation literature emphasizes that the structuring of innovation process phases must be accompanied by training and support strategies to ensure their effective appropriation (Carayannis & Campbell, 2012). However, the data show that the lack of dissemination of these phases is a recurrent problem in universities with rigid structures. In University 6 and University 9, where the phases are well-defined but knowledge about them is limited, respondents noted low interaction between departments, limiting the university community's ability to understand and apply established innovation models.

Implications for Innovation Management in U3G Universities

The results highlight the need to strengthen training and communication mechanisms in university innovation processes. Clarity in the phases of the innovation process is a fundamental element for change management, but if not complemented with training and awareness strategies, its impact is diminished.

To address this issue, it is recommended to:

- Enhance institutional training in innovation management, ensuring that faculty and administrators understand the purpose and operation of each phase of the process.
- Promote interdisciplinary collaboration to improve integration among teams and prevent

innovation management from being confined to an administrative structure without impacting the university community.

- Develop continuous evaluation tools that allow measuring the appropriation of knowledge about the phases of the innovation process and adjusting strategies as necessary.

As a result, the relationship between the structuring of innovation process phases and knowledge about them in U3G universities shows that the formalization of these processes is not sufficient to guarantee their appropriation. The negative correlation suggests that greater structuring may create a false sense of control without translating into a real understanding by university actors. In this context, interdisciplinarity and transformational leadership play a key role in the effective integration of these processes, allowing innovation to become a cross-cutting axis of institutional development.

5. DISCUSSION AND RECOMMENDATIONS

Business transformation from an innovation and technological development perspective in third-generation universities (U3G) relies on effective interaction among various actors within the university ecosystem. Throughout the analysis, it has been identified that transformational management in these institutions is not only determined by the adoption of technologies and the existence of links with the productive sector but also by the way different interest groups interact within the framework of innovation and technological development.

This section delves into the findings obtained, contextualizing the results of the empirical analysis with recent literature on university innovation (2020-2025), with the aim of offering strategic recommendations to strengthen the capacity of U3G universities in innovation management, productive transformation, and engagement with the business sector.

Discussion on Stakeholder Interaction in Business Transformation

The review of data from 13 universities has identified that business transformation within these institutions is mediated by three key factors: interdisciplinary collaboration, structuring of innovation processes, and university-industry linkage. Each of these elements displays specific dynamics that influence the universities' ability to consolidate as agents of innovation and technology transfer.

Interdisciplinary Collaboration and Leadership in Business Transformation

- The positive correlation ($r = 0.10$) between interdisciplinarity and transformational leadership shows that universities with greater integration of multidisciplinary teams have a higher capacity for change management.
- However, this link does not automatically translate into efficient management of business transformation. In universities such as University 7 and University 10, where interdisciplinarity was low (less than 3.0 on a scale of 1 to 5), respondents reported difficulties in implementing change strategies.
- This finding reinforces the literature by Kriz, Bankins, and Molloy (2018), who argue that interdisciplinarity only has an impact when accompanied by a flexible organizational structure and committed leadership.

Structuring of Innovation Process Phases and Institutional Knowledge

- The negative correlation ($r = -0.12$) between the clarity of innovation process phases and the level of knowledge about them suggests that the formalization of these processes is not always accompanied by effective communication and appropriation strategies.
- At University 5 and University 11, where innovation models are highly structured, respondents indicated a low level of knowledge about these phases, limiting their effective implementation.
- Meyer, Gerlitz, and Klein (2022) emphasize that universities must complement the structuring of processes with active strategies for ongoing training and organizational communication to ensure their adoption by the university community.

University-Industry Linkage and Adoption of Innovative Technologies

- Although digitalization has been prioritized in many universities, the negative correlation ($r = -0.22$) between the adoption of innovative technologies and the effectiveness of linkage with the productive sector indicates that technological modernization alone does not guarantee a better university-industry relationship.
- At University 5 and University 11, where investment in digital transformation has been high, respondents reported difficulties in

consolidating strategic alliances with companies, suggesting the need to rethink linkage strategies to include both the adoption of technologies and the consolidation of collaborative networks with the productive sector.

Strategic Recommendations for Transformational Management in U3G Universities

Based on the findings, the following strategic recommendations are proposed to strengthen the capacity of U3G universities in innovation management and business transformation:

Strengthen Interdisciplinary Governance to Enhance Transformational Leadership

- It is recommended to implement management models that promote interdisciplinary collaboration through the creation of multidisciplinary teams and inter-institutional innovation networks.
- Universities should establish incentives for the participation of teachers and researchers in interdisciplinary projects, ensuring that these spaces are not limited to isolated initiatives but are part of the organizational structure of the institution.

Integrate Training and Communication Strategies to Improve the Appropriation of the Phases of the Innovation Process

- Clarity in the definition of phases of the innovation process should be accompanied by active training and communication strategies to ensure their appropriation by the university community.
- It is recommended to develop regular training programs aimed at teachers, researchers, and administrative staff on the importance and application of these phases in institutional transformation.

Optimize Linkage with the Productive Sector from an Open Innovation Approach

- Universities should design linkage strategies that combine digitalization with the consolidation of collaboration networks with companies and external organizations.
- It is recommended to adopt an open innovation approach, allowing the industry to actively participate in the formulation and development of academic programs and applied research.

Develop Mechanisms for Evaluation and Monitoring of Innovation

- To ensure the effectiveness of transformation processes, it is essential to establish evaluation and monitoring mechanisms that allow measuring the impact of the strategies implemented.
- The creation of innovation observatories within universities is recommended, responsible for monitoring the development of strategic projects and proposing adjustments based on the results obtained.

The analysis demonstrates that business transformation in third-generation universities depends on the effective interaction between different stakeholders within the university ecosystem. Interdisciplinarity, the structuring of innovation processes, and linkage with the productive sector are key elements in this process, but their impact depends on the implementation of governance, communication, and evaluation strategies that ensure their effectiveness.

From these conclusions, the importance of designing an integrated transformational management model is highlighted, which not only structures processes but also strengthens the participation of the university community and its linkage with the business environment. Only through a holistic and collaborative strategy will it be possible to consolidate universities that respond to the challenges of the 21st century in higher education, technological development, and business transformation.

6. CONCLUSION

Business transformation from an innovation and technological development perspective requires the collaboration of various actors within an innovation ecosystem. The interaction between businesses, academia, governments, and civil society is crucial for the creation of sustainable technological solutions and the strengthening of business competitiveness in the digital age. Transformational management in U3G universities offers a comprehensive model to strengthen these interactions and consolidate a lasting impact on technological and social development (Carayannis & Campbell, 2012).

This analysis has characterized the contexts, profiles, and scopes of the stakeholders involved in business transformation from an innovation and technological development perspective, aiming to identify their interactions within a framework of innovation, technological development, and the

improvement of university transformation strategies. From the results obtained, the following conclusions are presented:

1. Configuration of University Actors Directly Influences Innovation Processes: The analyzed data demonstrate that the actors involved in university management have a significant impact on the adoption and consolidation of transformation strategies. It was identified that 47.6% of the respondents are teaching researchers, while 32% hold administrative and management roles. This distribution confirms that university transformation is led by academia and institutional management, with low participation from other actors such as administrative staff and civil society. This suggests the need to generate more inclusive linkage strategies to strengthen the co-creation of knowledge and technology transfer.
2. Interdisciplinarity and Leadership in Business Transformation Are Correlated: The correlation analysis between interdisciplinary collaboration and leadership in business transformation shows a positive relationship ($r = 0.10$). Universities with a higher degree of interdisciplinary work exhibit greater leadership capacity in managing university transformation. However, this moderate correlation indicates that other factors, such as organizational culture and governance structure, also influence leaders' ability to implement significant changes. In universities like University 3 and University 9, where interdisciplinary collaboration is higher, there is a greater orientation toward strategies of disruptive and radical innovation.
3. Business Transformation Depends on Clarity in Innovation Process Phases: The analysis of the variables "Clear Phases of the Innovation Process" and "Knowledge about Phases of the Innovation Process" revealed a negative correlation ($r = -0.12$), indicating that greater structuring of innovation process phases does not necessarily imply a higher level of knowledge appropriation by the university community. This suggests that mere formalization of these phases is insufficient and must be accompanied by effective training and dissemination strategies. In University 5 and University 11, for example, despite having well-defined structures for innovation, respondents reported a low level of knowledge about these phases, limiting their effective implementation.

4. Adoption of Technologies Does Not Always Translate into Better Linkage with the Productive Sector: The results indicate that the relationship between the adoption of innovative technologies and linkage with businesses presents a negative correlation ($r = -0.22$). This suggests that universities investing in digital transformation do not necessarily manage to consolidate strategic alliances with the productive sector. In University 5 and University 11, where digitalization has been a priority, difficulties have been identified in establishing effective links with companies. This reinforces the need for digitalization strategies to be conceived not as isolated internal processes, but as part of a comprehensive university-business linkage policy.
5. Differences in the types of innovation adopted by universities: From the correlation analysis and response distribution, three predominant types of innovation have been identified in third generation universities (U3G):
 - Incremental Innovation: Most common in universities with highly structured processes and hierarchical leadership. Focuses on optimizing methodologies and internal procedures.
 - Disruptive Innovation: Found in universities with greater organizational flexibility and interdisciplinary work, enabling changes in academic offerings and new models of engagement with businesses.
 - Radical Innovation: Seen in universities that have completely transformed their educational model, prioritizing alternative schemes such as 100% digital programs and competency-based training.
 - Each type of innovation is influenced by the structure of leadership and the capacity for interdisciplinarity, underscoring the importance of aligning these factors in the strategic planning of U3G universities.
6. Implications for improving university transformation strategies:

This study identifies several key elements for enhancing transformation strategies in third generation universities:

- Strengthen innovation training: The low correlation between the clarity of the process phases and knowledge about them suggests that continuous training programs should be developed for faculty, administrators, and students.
- Promote more flexible leadership models: The positive relationship between interdisciplinarity and leadership indicates that universities should adopt organizational structures that facilitate collaboration and networking.
- Integrate digitalization with external linking strategies: Digital transformation should be understood as a cross-cutting process that facilitates interaction with the productive sector and society.
- Develop mechanisms to evaluate and monitor innovation: To ensure that transformation processes are effective, measurement systems should be implemented to adjust strategies based on the results obtained.

Business transformation from a perspective of innovation and technological development in third generation universities is a multidimensional process that requires the articulation of various actors and strategies. The findings of this study highlight the importance of transformational leadership, interdisciplinarity, and clarity in the phases of the innovation process as key factors in the success of these processes. However, they also show that mere adoption of new technologies or formal structuring of strategies does not guarantee the expected impact if not accompanied by effective processes of communication, training, and linkage with the productive sector.

Based on these conclusions, it is recommended that universities design integrated strategies that not only optimize their internal processes but also strengthen their impact on the business and social environment, establishing themselves as key actors in knowledge generation and regional economic development.

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