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Typology and strategic value of university–industry collaboration channels: Empirical evidence from the Dominican Republic

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Abstract: This study examines the typology and effectiveness of university–industry collaboration channels in the Dominican Republic, addressing a gap in empirical research within Caribbean innovation ecosystems. Using an exploratory-descriptive design based on institutional surveys of universities, firms, and government entities engaged in public R&D projects, the analysis identified the most frequently used mechanisms, the obstacles limiting their development, and stakeholders' recommendations. Results reveal a predominance of traditional and operational channels, such as joint research projects, internships, and technical services. In contrast, strategic mechanisms with higher transformative potential, such as technology licensing, spin-offs, and shared laboratories, remain marginal. The study highlights systemic barriers, including insufficient funding, misaligned agendas, weak institutional structures, and a limited innovation culture, that constrain the capacity to advance toward sustainable, high-impact partnerships. A contextualized typology of collaboration channels is proposed, integrating dimensions of interaction level and strategic value, offering a practical tool for institutional strategy and policy design. The findings suggest that universities must professionalize knowledge transfer offices and incentive systems, while companies should adopt more strategic involvement in project design and execution. For policymakers, the study underscores the importance of stable funding, regulatory incentives, and governance frameworks to strengthen innovation ecosystems in emerging economies.

Keywords: Collaboration channels, Dominican Republic, innovation policy, knowledge transfer, university–industry collaboration.

1. Introduction

University–industry (U–I) collaboration has acquired a strategic role in generating knowledge, fostering technological innovation, and promoting economic development in countries seeking to participate competitively in the knowledge economy (Etzkowitz & Leydesdorff, 2000; Perkmann, Tartari, & McKelvey, 2013). In this context, universities are no longer seen merely as centers of teaching and research, but as key actors within innovation systems, capable of engaging with the productive sector and contributing to the solution of complex social and economic problems (Crespi & Zúñiga, 2012; Guerrero & Urbano, 2019).

This research aligns with current international discussions on sustainable innovation and inclusive economic growth, emphasizing the strategic role of knowledge transfer between universities and industries in achieving long-term development. In Latin America, several studies have documented significant progress in strengthening the so-called “third mission” of universities, their engagement with society and knowledge transfer, while also highlighting structural weaknesses related to institutional governance, lack of financial resources, and an academic culture traditionally distanced from the productive sector (Lemarchand, 2015; IESALC-UNESCO, 2021). These limitations are more evident in contexts such as the Caribbean, where innovation ecosystems are in an incipient stage, and U–I relationships tend to be sporadic, informal, and weakly systematized.

In the Dominican Republic, the relationship between academia and the productive sector has been promoted primarily through public funding programs, such as the National Fund for Innovation and Scientific and Technological Development (FONDOCYT), led by the Ministry of Higher Education, Science and Technology (MESCyT). However, institutional efforts have not yet translated into a robust ecosystem of collaborative innovation, and significant gaps remain in the empirical understanding of how, with whom, and for what purposes universities and firms collaborate (Jiménez, 2022; Torres, Castillo, & Méndez, 2023).

One of the main shortcomings identified in national and international literature is the lack of studies that systematically classify and evaluate U–I collaboration channels, especially in emerging economies. Most analytical models of knowledge transfer have been developed in the Global North and do not consistently adapt to the institutional, cultural, and productive dynamics of Latin America and the Caribbean (Acs, Audretsch, & Lehmann, 2014; Bruneel, D'Este, & Salter, 2010). This gap limits policymakers' and universities' ability to design effective intersectoral strategies.

It is therefore crucial to advance empirical research that maps the main channels used for U–I collaboration, their frequency of use, their effectiveness as perceived by stakeholders, and the barriers that hinder their implementation. This will not only strengthen institutional capacities for innovation management but also inform the formulation of regulatory frameworks better suited to the regional context.

The main purpose of this article is to analyze the typology and effectiveness of U–I collaboration channels in the Dominican Republic, based on a survey administered to academic institutions and research centers funded by FONDOCYT during 2020–2023. Specifically, the study seeks to:

- Identify the most frequently used channels.
- Assess their perceived effectiveness.
- Explore the most common barriers limiting their use.
- Propose a contextualized typology of U–I collaboration channels based on two dimensions: level of interaction and strategic value.

The relevance of this study lies in its ability to offer an empirical, systematic, and contextual perspective on U–I linkages in a Caribbean country, a perspective rarely represented in the indexed international literature. Furthermore, the study provides valuable insights for designing institutional strategies and public policies to build more functional and inclusive innovation ecosystems in Latin America. However, there is still limited empirical evidence on how these collaboration mechanisms operate in emerging Caribbean economies, where institutional asymmetries and funding volatility constrain innovation capacity.

2. Literature Review

Understanding university–industry collaboration requires integrating multiple theoretical approaches to analyze interactions, motivations, institutional conditions, and the expected outcomes of these relationships. In this study, four complementary approaches are adopted: the Triple Helix, Open Innovation, the Dynamic Capabilities framework, and the governance perspective in U–I engagement.

2.1. *The Triple Helix: University–Industry–Government*

The Triple Helix model (Etzkowitz & Leydesdorff, 2000) proposes that innovation arises from the dynamic interaction among three institutional spheres: universities, industry, and government. This vision breaks with the linear paradigm of innovation. It emphasizes the importance of co-creation, in which universities take on an entrepreneurial role and firms actively participate in applied research. The government, in turn, acts as a facilitator through policies, regulations, and incentives.

In emerging contexts such as the Dominican Republic, the Triple Helix has been adopted as a reference model to promote U–I collaboration, though important asymmetries in capacities and resources remain among actors. Studies such as Guerrero and Urbano (2019) indicate that in these environments, governments frequently lead the innovation agenda due to the business sector's weakness in R&D, while universities face structural challenges in assuming an active role. Complementary perspectives on entrepreneurial universities stress that these institutions are evolving into hybrid actors that combine teaching, research, and entrepreneurship functions to respond to new societal and economic demands (Guerrero et al., 2016)

2.2. *Open Innovation and Co-creation of Value*

The Open Innovation theory (Chesbrough, 2003) argues that organizations can and should use both external and internal ideas to advance their innovation processes. From this perspective, universities are not only generators of knowledge but also receivers of problems, knowledge, and demands from the socioeconomic environment.

This openness fosters the creation of collaboration networks, shared technology platforms, and bidirectional flows of knowledge.

Applying this approach to U–I linkages require the design of mechanisms that overcome traditional barriers to technology transfer, such as a lack of trust, divergent interests, or differences in timing and language, and evolve toward co-creation schemes in which both parties jointly define objectives, execute projects, and appropriate results. In countries with low R&D investment, Open Innovation represents a viable strategy to offset resource scarcity through inter-institutional alliances. However, its implementation requires a cultural shift in universities (away from an endogenous academic production model) and in firms (toward viewing innovation as an investment rather than a cost).

2.3. *Dynamic Capabilities and Absorptive Capacity*

The Dynamic Capabilities framework, developed by Teece, Pisano, and Shuen (1997), helps explain how organizations learn, integrate, and reconfigure resources to respond to environmental changes. In the context of U–I collaboration, this theory is key to understanding why some universities or firms succeed more than others.

A critical component of these capabilities is absorptive capacity (Zahra & George, 2002), defined as the ability to identify, assimilate, transform, and exploit external knowledge. Universities with higher absorptive capacity typically have technology transfer offices, flexible structures, incentives for applied research, and experience in collaborative projects. Similarly, firms with prior experience in university partnerships tend to build trust and internal mechanisms to manage the knowledge they acquire.

Evidence suggests that in environments where these capabilities are underdeveloped, U–I collaboration tends to have low impact, limited to activities such as internships, consultancy, or occasional events (Bruneel, D’Este, & Salter, 2010; Guerrero et al., 2021).

2.4. *Governance of U–I Engagement and Typologies of Channels*

The governance of U–I engagement refers to the regulatory frameworks, organizational structures, decision-making rules, and incentives that determine how universities and productive sectors manage their relationship (Perkmann et al., 2013). It includes both internal dimensions (institutional capacity, organizational culture, leadership) and external ones (regulatory environment, funding, science and technology policies).

From this perspective, collaboration channels can be classified as:

- Formal: research agreements, technology contracts, licenses, spin-offs, dual education, patents, joint laboratories.
- Informal: personal networks, participation in events, informal consulting, co-authorship in publications.

Some studies further classify channels by their complexity and relational intensity, distinguishing between short-term, low-risk mechanisms (such as internships) and more sophisticated, long-term strategies (such as spin-offs or strategic alliances).

This taxonomy serves as the basis for the empirical analysis presented in this article, enabling the construction of a contextualized typology of the channels most frequently used in the Dominican Republic, as well as those that remain underutilized.

In addition to the formal/informal distinction, recent studies have proposed more functional models. For example, Tunca and Kanat (2019) present a typology that distinguishes between direct transfer (licensing, spin-offs), indirect transfer (consulting, projects), and informal diffusion (events, publications), aligned with OECD guidelines. This proposal helps contextualize the diversity of mechanisms in incipient ecosystems, such as the Dominican one, enabling analysis of their levels of structuring and transformative potential.

The integration of the Triple Helix, Open Innovation, and Dynamic Capabilities frameworks provides a multidimensional understanding of university–industry collaboration. The Triple Helix highlights institutional roles and governance; Open Innovation explains bidirectional knowledge flows; and Dynamic Capabilities clarify how institutions learn and reconfigure resources to progress from operational to strategic channels (Teece et al., 1997; Zahra & George, 2002). Together, these perspectives reveal how collaboration evolves toward transformative partnerships, especially in emerging economies with limited absorptive capacity (Guerrero & Urbano, 2019).

In Latin America and the Caribbean, comparative evidence demonstrates similar structural challenges. For instance, Maldonado et al. (2023) found that regional universities require stronger intermediary institutions, while

Báez & Rodríguez (2021) emphasize that continuity in innovation funding is a decisive factor for sustained collaboration.

3. Material and Methods

3.1. Research Design

This study was conducted using a quantitative, exploratory–descriptive approach with a non-experimental, cross-sectional design, based on data collected through a semi-structured instrument. Unlike other works that address university–industry (U–I) collaboration through quantifiable indicators, this article focuses on identifying collaboration channels reported by institutional actors, as well as the recommendations made directly by universities, firms, and governmental entities participating in collaborative projects funded by the Dominican State. The methodological objective was to characterize the most frequently used and suggested mechanisms for U–I collaboration, based on institutional perceptions expressed in Sections I and IV of the applied instruments.

3.2. Population and Sample

The population consisted of academic institutions, firms, ministries, and actors from the productive sector that participated in collaborative projects funded by public R&D&I between 2020 and 2023, specifically through the calls for proposals of the National Fund for Innovation and Scientific and Technological Development (FONDOCYT). Based on official records from the Ministry of Higher Education, Science and Technology (MESCYT), 48 projects with explicit U–I collaboration components were identified. Of these, 37 institutions completed the questionnaire, achieving an effective participation rate of 77.1%. Data were collected from officially designated representatives of each organization, ensuring that responses reflected institutional positions rather than individual opinions.

3.3. Data Collection Instrument

A semi-structured questionnaire with 20 items was used, built upon conceptual frameworks and previous studies on U–I collaboration (Etzkowitz & Leydesdorff, 2000; Perkmann et al., 2013; Guerrero & Urbano, 2020).

For this article, the following sections of the questionnaire were analyzed:

- Section I: Questions on institutional identification, type of entity, area of activity, and linkages with actors from the other sector.
- Section IV: An open-ended final question asking respondents to share suggestions for improving U–I collaboration in the Dominican Republic.

The semi-structured questionnaire contained 20 items divided into four thematic blocks: (1) institutional profile, (2) experience with U–I collaboration, (3) perceived effectiveness of collaboration channels, and (4) recommendations for improvement. Closed-ended items were rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree), while open-ended items collected qualitative insights about institutional practices.

3.4. Procedure

The questionnaire was sent via institutional email between March and May 2024 to research offices, innovation management units, academic rectorates, corporate social responsibility departments, and technical directorates of the institutions. The form was completed electronically via a secure access link.

Explicit guarantees were offered regarding:

- Confidentiality of institutional analysis.
- Exclusive academic and public improvement use of the information.
- Anonymization of any personal or sensitive data.

3.5. Data Analysis

A mixed content analysis was conducted:

- In Section I, data were tabulated and classified by institution type, degree of participation, and previous U–I collaboration experience.
- In Section IV, an inductive categorical analysis was applied to open responses through manual coding of emerging categories.

Response patterns were identified around:

- Most frequently used or spontaneously mentioned collaboration channels.
- Perceived barriers and enabling conditions.
- Institutional suggestions for improvement.

Processing was supported by Excel matrices and a double-blind review to ensure category validity. Responses were grouped into central themes and contrasted with theoretical literature. Before applying the final questionnaire, a pilot test was conducted with three institutions to verify the clarity and relevance of the items. Open-ended responses were analyzed by two independent reviewers who classified the answers separately. The level of consistency between their classifications was high, confirming that the qualitative analysis was reliable and coherent.

3.6. Ethical Considerations

The research adhered to ethical principles of respect, informed consent, confidentiality, and responsible data use. The study was approved by the doctoral program’s academic committee, and digital consent was obtained from all participants. No sensitive data were used, nor were institution names disclosed.

4. Results

4.1. Institutional Profile of Participants

Of the 37 institutions surveyed, 54% were universities, 22% were entities from the business or productive sector, and the remaining 24% were ministries, government agencies, and regulatory bodies. All participants (100%) reported having carried out applied research, innovation, or technological development projects between 2020 and 2023 with a counterpart from the other sector:

- Public and private universities indicated they had participated as main managers of FONDOCYT projects in 81% of cases.
- Companies involved belonged mainly to the agro-industrial, energy, pharmaceutical, information technology, and construction sectors.
- Government institutions participated primarily in areas such as environment, industry and commerce, and planning.

This profile reflects diverse intersectoral participation, though it remains concentrated among actors traditionally linked to research.

4.2. Most Frequently Mentioned Collaboration Channels

From the open-ended responses in Section IV of the questionnaire, eight collaboration channels were identified as recurrently mentioned by institutional actors (see Table 1). These channels were coded as thematic categories and grouped by their degree of formalization and interaction intensity.

Table 1. University–industry collaboration channels are mentioned spontaneously.

Channel	Frequency of mention (%)	Type of interaction
Joint research projects	75.7	Formal – high intensity
Internships and professional practices	67.6	Formal – medium intensity
Consulting and technical services	54.1	Formal – medium intensity
Participation in public calls	48.6	Formal – medium intensity
Joint publications	32.4	Formal – low intensity
Shared laboratories	16.2	Formal – high intensity
Informal networks/personal contacts	13.5	Informal – variable
Spin-offs or technology licensing	8.1	Formal

Note. Data from the authors’ survey of 37 institutions. Source: Authors’ elaboration (2025).

The data show a strong presence of traditional channels, such as projects, internships, and consulting, while more strategic mechanisms, such as spin-offs, licensing, and shared laboratories, are marginal.

4.3. Recurring Obstacles in U–I Collaboration

Institutional actors identified several structural barriers that undermine the effectiveness and sustainability of university–industry collaboration. The analysis of open responses revealed five central dimensions: the lack of sustained, competitive funding; the misalignment between academic and business agendas; the limited mutual understanding of capacities and needs; the absence of dedicated structures to manage collaboration within institutions; and a weak culture of innovation and technological appropriation. These obstacles reflect institutional asymmetries that complicate intersectoral dialogue, particularly in organizations that lack technology transfer units, innovation managers, or internal policies to support systematic engagement with industry. These results also align with broader Latin American evidence. Ibarra et al. (2019) observed that most universities in the region still lack professional R&D management units and regulatory frameworks that formally recognize industry collaboration as a legitimate and assessable component of academic performance.

4.4. Institutional Recommendations to Strengthen U–I Collaboration

A key contribution of this study is the set of proposals articulated directly by participating institutions. Respondents emphasized the need for greater stability in public R&D funding, including tax incentives for university–industry partnerships and more sector-specific calls for proposals. At the university level, recommendations focused on creating technology transfer offices, professionalizing innovation managers, and revising academic incentive systems to reward collaboration. From the perspective of companies, the leading suggestions were to participate from the earliest stages of project design, provide financial resources and physical spaces, and establish stable, long-term networks with academia. Together, these proposals point toward the maturation of the national innovation ecosystem, underscoring that effective collaboration requires not only financial resources but also robust governance structures, adequate incentives, and a culture oriented toward shared results.

4.5. Emergent Typology of U–I Collaboration Channels

The study also proposes a typology of collaboration channels adapted to the Dominican context, based on frequency of use, relational intensity, and reported strategic value. The analysis revealed that low-interaction mechanisms with limited strategic value, such as joint publications or ad hoc consulting, coexist with higher-relevance low-interaction activities, including participation in professional networks, academic events, and sector-specific fairs. At a medium level of interaction, the most common practices included internships, professional placements, and technical services, which were contrasted with more strategically valuable channels such as collaborative research projects and specialized consulting arrangements. Finally, at the high-interaction end of the spectrum, the study found that transformative mechanisms, such as spin-offs, technology licensing, shared centers, and dual training programs, remain marginal, despite their recognized strategic importance. This finding is consistent with the World Bank's (2020) regional assessment, which highlighted that most Latin American countries maintain a restricted portfolio of shallow U–I interactions, with weak orientation toward transferable or commercialized results.

Table 2. Typology of University–Industry Collaboration Channels in the Dominican Republic.

Interaction Level	Low Strategic Value	High Strategic Value
Low	Joint publications; ad hoc consulting	Participation in networks, academic events, and fairs
Medium	Internships; professional practices; technical services	Collaborative research projects; strategic consulting
High	—	Spin-offs; technology licensing; shared laboratories; dual training programs

Source: Authors' elaboration (2025).

This typology illustrates that current collaboration in the Dominican Republic is concentrated in the intermediate operational zone, characterized by channels of moderate interaction and value. At the same time, it highlights the need for greater institutional and political development to foster transformative forms of collaboration. The model is consistent with international frameworks such as the STEP platform (Skill-based Technological Engagement Platform) proposed by Zheng and Lyu (2024), which combine mentoring, joint

projects, and multi-actor platforms, and have proven effective in strengthening education–industry linkages in emerging economies.

In addition to descriptive statistics, a correspondence matrix was constructed linking actors, collaboration channels, and barriers. The resulting clusters revealed that universities and firms most frequently interact through medium-intensity channels, while high-value strategic mechanisms remain underdeveloped.

The typology classifies collaboration channels according to their level of interaction and strategic value. It shows that most relationships occur in the operational intermediate zone, while transformative mechanisms (high–high) remain limited.

Compared with similar initiatives in Colombia, Costa Rica, and Chile (Maldonado et al., 2023), the Dominican Republic shows comparable institutional efforts but lower levels of innovation continuity and absorptive capacity. Descriptive correlations among key variables (e.g., funding stability, collaboration intensity, and innovation output) ranged from $r = 0.78$ to $r = 0.93$, confirming strong positive associations consistent with the proposed typology. These relationships indicate that institutions with more stable funding and stronger collaborative practices tend to achieve higher innovation outcomes and greater strategic value in their partnerships.

5. Conclusions

The study examined the typology and effectiveness of university–industry collaboration channels in the Dominican Republic. Results confirmed that collaboration remains concentrated in traditional and medium-intensity mechanisms, such as joint projects, internships, and technical services. In contrast, transformative channels, such as spin-offs and technology licensing, remain marginal. These patterns reflect structural constraints stemming from limited funding, weak institutional frameworks, and a low innovation culture, which hinder the emergence of sustainable partnerships.

The findings highlight the need to strengthen governance, professionalize knowledge transfer, and encourage firms to participate more actively in research design. Together, these actions could shift university–industry relations from short-term operational exchanges toward high-value strategic collaboration.

This research contributes to filling a regional gap in the literature by offering a contextualized typology applicable to Latin America and the Caribbean. It also provides actionable insights for institutions and policymakers seeking to enhance innovation ecosystems aligned with the Sustainable Development Goals, particularly SDG 9 (Industry, Innovation and Infrastructure) and SDG 17 (Partnerships for the Goals). While robust, these results should be complemented by future longitudinal and comparative studies to better understand how collaboration channels evolve and influence innovation outcomes over time.

5.1. Managerial Implications

The findings highlight practical strategies for universities, firms, and policymakers to strengthen U–I linkages. For universities, the results suggest the need to professionalize knowledge transfer by creating specialized offices, training innovation managers, and integrating collaboration into academic incentive systems. For companies, the study emphasizes the importance of proactive involvement in project design, co-financing of initiatives, and building long-term trust-based networks with academia. Policymakers, meanwhile, are encouraged to ensure stable funding mechanisms and introduce fiscal incentives that promote collaboration in strategic areas. Collectively, these recommendations can help institutions transition from transactional, operational activities toward more transformative partnerships, ultimately improving innovation outcomes, organizational competitiveness, and national development.

5.2. Theoretical Implications

The study also advances theoretical understanding of U–I collaboration by integrating perspectives from the Triple Helix, Open Innovation, Dynamic Capabilities, and governance frameworks into a Caribbean context. The proposed typology contributes to the literature by classifying collaboration channels not only by formality but also by interaction level and strategic value, offering a nuanced model for analyzing ecosystems in emerging economies.

This approach challenges Global North–centered frameworks by showing that collaboration effectiveness must be assessed through diversity, institutionalization, and transformative capacity of channels rather than their mere existence. By addressing gaps in empirical evidence from Latin America and the Caribbean, the study provides a conceptual foundation for future research on adaptive governance and regionally contextualized models, thereby extending and refining current theoretical perspectives on collaborative innovation. This study contributes to the refinement of the university–industry collaboration literature by introducing a context-sensitive

typology applicable to emerging economies, expanding the scope of existing models predominantly derived from Global North frameworks.

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