The Academic Spin-Off Ecosystem: a comparative analysis between Colombia and Global Trends

[1]Alexander Romero-Sánchez, [1] Maria Stephania Aponte-Garcia, [1]Jorge Hernán Victoria Duque,

[1]Rodrigo Herrera Hoyos

[1]Unidad Central del Valle del Cauca – Colombia.
E-mail Corresponding author: aromero@uceva.edu.co

Abstract

Academic entrepreneurship and the formation of spin-offs from educational institutions have been consolidated as essential elements to promote innovation and stimulate economic growth worldwide. However, the evolution of these initiatives shows marked differences between developed countries and emerging economies, such as Colombia. This study focuses on analyzing how research in this area has progressed, identifying the key factors that determine the success of spin-offs and suggesting a framework for action for Colombia in comparison with international dynamics. The findings reveal a shift in research attention from prioritizing the creation of spin-offs to a greater focus on their long-term performance and sustainability. At the international level, the relevance of technology transfer, strategic alliances between universities and industry and the efficient management of technological resources are highlighted. On the other hand, in the Colombian context, research tends to focus on institutional aspects, cultural factors and support regulations, underestimating the analysis of the performance of spin-offs after their creation. This paper aims to contribute to the formulation of policies and strategies that promote not only the emergence but also the sustainability of academic spin-offs in Colombia, seeking to align their practices with international standards in order to maximize their impact on the economic and social development of the country.

Keywords: Academic Spin Off, Academic Entrepreneurship, Technology Transfer, University-Industry Relationship, Entrepreneurship Intention, Funding, Incentives, Performance, Creation, Knowledge.

1. Introduction

For a long time, knowledge was perceived as a social luxury, an ornament without a relevant practical function (Varela, 2008). However, it is now recognised as a fundamental and valuable resource for society, becoming an industrial asset that provides essential inputs for productive processes. In this context, knowledge has acquired a crucial role in contemporary economies, characterized by intense global competition and unstable but highly dynamic environments, driven by accelerated technological development. Organizations, in order to remain relevant, must rapidly adjust their capabilities and resources, continuously seeking to innovate in both processes and products, in order to achieve and sustain lasting competitive advantages (Barney, 1991; Barney, 2021; Peteraf, 1993). Research in recent decades has highlighted the central role

of knowledge in sustaining these advantages (Lyles and Salk, 1996; McEvily and Chakravarthy, 2002). In this scenario, the key to preserving these advantages lies not only in the accumulation of knowledge, but in the ability to integrate it, since specialized knowledge resides in people and can be transferred to organizations to generate value (Grant, 1996).

Organizations must therefore continuously acquire and transfer knowledge in order to develop innovations that will ensure their sustainability in this dynamic environment (Henderson and Cockburn, 1994; Kogut and Zander, 1992). Universities also have a key role to play in this context, as their mission encompasses both entrepreneurship and innovation. Knowledge management becomes a key tool to facilitate the creation of new knowledge, to identify and exploit strategic knowledge within the institution and to disseminate it effectively (Barney, 1991; Grant, 1996). However, beyond the technology and tools available, it is necessary to promote a cultural change in the way people interact and share knowledge. Fostering a culture of collaboration and continuous learning, where knowledge is openly shared and the constant acquisition of new knowledge is valued, is fundamental to the success of these processes (Radko et al., 2002).

Knowledge transfer refers to the process by which experience and knowledge are exchanged and assimilated between different organizational actors, be they teams, internal units or entire organizations. This exchange aims to integrate different types of knowledge, which can lead to improvements in the performance of the receiving units (Argote et al., 2000). In general, the aim of this transfer is to take advantage of the skills and experience accumulated within the organization, allowing members to share what they have learned in order to generate collective value (Zhou & Tang, 2020).

In the context of universities, knowledge transfer is fundamental to the development of knowledge-based economies. In this context, academic entrepreneurship is a key strategy for transferring knowledge generated in educational institutions into practical applications through the creation of academic spin-offs. These initiatives are supported by various stakeholders, such as local and national governments, the private sector and civil society (Civera et al., 2020). Spin-offs not only stimulate the economy through the commercialisation of innovations, but also promote local growth through the creation of jobs and wealth (Carlsson et al., 2009).

As a key technology transfer mechanism, academic spin-offs play a crucial role in transforming the results of university research into products and services that can be commercialized. According to Dahlstrand (2008), these companies not only act as a bridge between universities and industry, facilitating the flow of technology, but also stimulate economic development by creating jobs and new innovations. In this sense, Romero et al. (2023) state: "University spin-offs are a common mechanism in universities and research centers for transferring applied scientific knowledge to the community, and are determined by a constantly evolving legal framework" (p. 835).

Academic spin-offs are seen as a key driver of regional and local development, as they enable the commercialisation of knowledge generated in universities. According to Ndonzuau et al. (2002), the creation of spin-offs is one of the most promising ways of bringing research results to the market, thereby promoting economic growth and fostering innovation at regional level.

In addition to their impact on the economy, spin-offs also strengthen the innovation capacity of both the universities and the companies involved in these initiatives. Festel (2013) highlights that spin-offs help bridge the gap between the research and development phase and the commercialisation of scientific results, especially in cases where additional funding is needed to advance technology development.

Technology transfer offices (TTOs) play a crucial role in promoting and supporting the creation of academic spin-offs. Research by Iacobucci et al. (2020) shows that investment in TTOs by universities is positively correlated with the number of spin-offs created, although this does not always translate into better spin-off performance. This underlines the need for a strong supportive environment for spin-offs to flourish.

Several studies have identified factors that influence the creation and success of academic spin-offs. O'Shea et al. (2005) point to the entrepreneurial intent of researchers, university-industry cooperation and effective technology transfer as essential elements for their development. In addition to technical and scientific knowledge, these companies need institutional and financial support to overcome the barriers they face in their early stages.

Access to finance and incentives play a key role in the spin-off creation process. According to Clarysse et al. (2011), venture capital, government grants and institutional support programmes are essential for spin-offs to start operations, develop prototypes and access the market. In addition, tax incentives and innovation-oriented public policies help to mitigate financial risks and create an enabling environment for academic entrepreneurship.

2. Investigation question

Academic entrepreneurship is an essential driver for the creation of academic spin-offs, facilitating the transfer of knowledge and technology from universities to the productive sector. However, there are notable differences in the performance of these firms between different regions of the world and Colombia, a disparity that responds to both contextual and structural factors.

With the advance of globalization (Aponte and Sanchez, 2024a, Aponte and Sanchez 2024b), academic spin-offs have proven to be effective tools for promoting innovation and economic development. In regions such as Europe and the United States, universities enjoy well-established support infrastructures, including robust technology transfer offices and public policies that encourage the creation and consolidation of these firms (Wright et al., 2012). In addition, these areas benefit from mature innovation ecosystems that facilitate seamless collaboration between academia and industry, a crucial element for the success of spin-offs (Wright et al., 2012).

In contrast, the Colombian context presents significant challenges for the creation and development of these enterprises (Llano and Aponte, 2024). Reyes Reina et al. (2023) note that the interaction between universities and industry in Colombia is less consistent, with lower levels of collaboration and institutional support for academic entrepreneurship. In turn, support policies

and economic incentives are limited (Victoria et al., 2023), which limits the sustainability and growth of spin-offs in the country.

The lack of resources and effective structural support is also reflected in institutional barriers that hinder the creation of spin-offs. Calderón-Hernández et al. (2020) highlight that a limited understanding of the spin-off concept, coupled with an academic culture that prioritizes scientific publication over the commercialisation of research, constitute significant obstacles to academic entrepreneurship in Colombia. These structural and cultural constraints reduce the opportunities for spin-offs to thrive and compete in international markets.

However, international experience shows that the adoption of strategic policies and the strengthening of innovation ecosystems could significantly improve the performance of spin-offs in Colombia. Priority should be given to promoting initiatives that encourage collaboration between universities and businesses, increasing funding for applied research, and establishing training and support programmes for entrepreneurial academics. Previous research has shown that institutional support and investment in technology transfer offices are closely related to the creation and success of spin-offs (Sciarelli et al., 2020), a model that could be adapted to the Colombian context (Sciarelli et al., 2020).

Although the literature on academic spin-offs is growing, it is still fragmented and requires a more comprehensive approach (Pérez, 2020). Although progress has been made in studying the context of their creation, there is still a gap in understanding their development, expansion and performance (Mathisen, 2019). The growing interest in the creation of spin-offs generates the need to further explore the management strategies and university policies that support them (Miranda, 2018). Moreover, the literature tends to classify these firms in terms of their organizational performance, which is evidence of the need to expand research in this area.

RQ1: What is the horizon suggested by the literature on academic spin-offs in Colombia compared to global trends on the concept?

3. Methodology

A literature review is a methodological approach that allows for the rigorous and comprehensive synthesis of existing evidence on a specific topic. According to Dixon-Woods et al. (2005), these reviews integrate qualitative techniques to provide a critical and comprehensive perspective of the research body, facilitating the identification of patterns and the understanding of complex phenomena (Aponte et al., 2024). Robinson et al. (2011) add that a systematic review not only organizes and evaluates the available evidence but also identifies research gaps. These gaps may arise from insufficient, biased, inconsistent, or inaccurate information, highlighting the importance of an explicit framework to help characterize these deficiencies. A systematic review thus offers a holistic view of the field, identifying patterns, gaps, and controversial areas within the relevant literature.

Applied to the context of academic spin-offs, a literature review allows researchers to address fundamental questions about the factors that motivate academics to engage in entrepreneurship, the barriers they face during venture creation, and the critical elements for the success of these

initiatives. Hossinger et al. (2020), in their review of 193 articles, concluded that individual factors, such as personal motivation and prior experience, play a significant role in the entrepreneurial behavior of academics. However, they also found that the entrepreneurial process and the performance of spin-offs are influenced by factors at the micro, meso, and macro levels, including relationships with parent organizations and the regional context in which they operate.

Moreover, literature reviews help identify areas requiring further research. Domingues et al. (2022) conducted a metadata analysis of systematic reviews on academic spin-offs, highlighting that although studies have focused on empirical models and technology transfer, further research is needed on the viability of academic intellectual property as a marketable product. These findings are essential for guiding future research and formulating more effective policies in academic entrepreneurship.

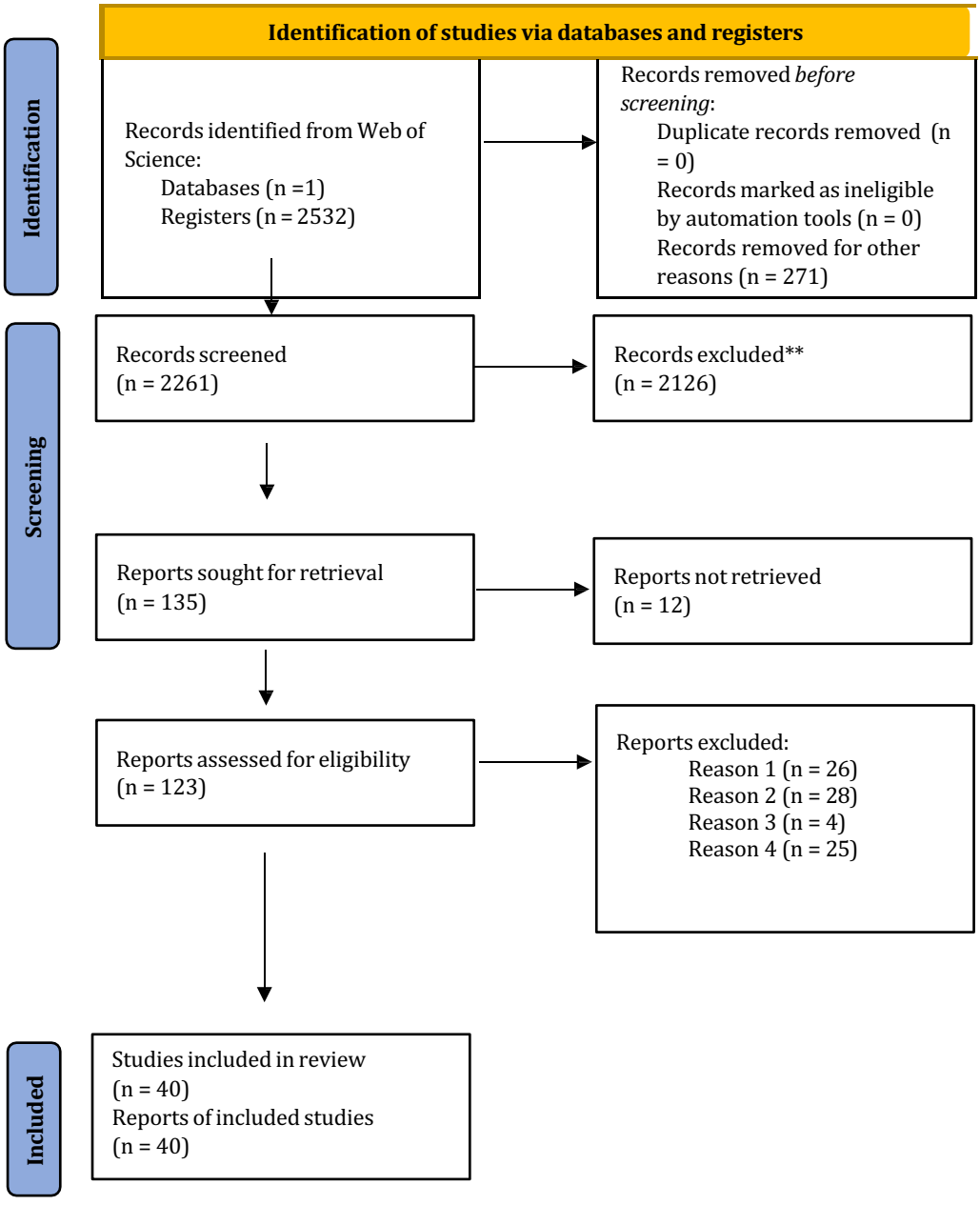
Beyond academic impact, literature reviews also have practical and public policy implications. According to Mathisen and Rasmussen (2019), reviews help develop conceptual frameworks that integrate various findings on the development, growth, and performance of academic spin- offs. These frameworks can be used by managers and policymakers to design more effective strategies that promote academic entrepreneurship and improve the performance of these ventures.

Finally, a well-structured review ensures greater transparency and replicability in research. Kraus et al. (2020) argue that literature reviews provide a methodical and rigorous approach to evaluating and synthesizing existing knowledge, which is essential to avoiding bias and ensuring the reliability and validity of results. This is especially relevant in emerging fields, such as academic spin-offs, where evidence can be diverse and scattered.

3.1. Criteria for Selecting Relevant Studies

The identification process is a crucial step in the PRISMA methodology, as its purpose is to ensure a comprehensive and systematic search of all potentially relevant studies (Page et al., 2021). In this phase, 2,532 documents were initially identified through a detailed search defined by a Boolean equation. Complete and accurate identification of studies is essential to avoid selection bias. According to Delgado-Rodríguez and Sillero-Arenas (2017), conducting an exhaustive search in databases, complemented by manual reference checks, is vital to minimize bias and ensure the inclusion of all relevant evidence.

Figure 1. Diagram of the PRISMA statement and the steps involved in identifying bibliographic data and refining searches. Source: Modified from Haddaway et al. (2020).



Source: Own elaboration from Romero et al., (2024) a

Our review rigorously follows the methodological protocol outlined by Donthu et al. (2021), who emphasize the importance of establishing clear inclusion and exclusion criteria, developing detailed search strategies, and applying rigorous methods for evaluating and synthesizing evidence (Romero et al., 2024b). By adopting this approach, we ensure not only the scientific integrity of the process but also the identification and critical analysis of the most relevant and high-quality studies available in the literature.

During the screening phase, a filtering process is conducted to eliminate studies that do not meet the basic criteria established (Aponte and Sanchez, 2024b). In the first screening stage, 271 documents were excluded as they consisted of books, book chapters, or conference proceedings, reducing the set to 2,261 articles for more detailed evaluation. This step is essential to focus the review on publications that typically contain original research and relevant empirical data.

In the second screening phase, an additional filter was applied, excluding articles that did not align with the thematic areas of Management, Business, Business Theory, Economics, or Management Science. As a result, 2,126 articles were discarded, leaving a total of 135 articles. This specific selection ensures that the included studies are directly relevant to the analysis of academic entrepreneurship and spin-offs, which is essential for maintaining the relevance and accuracy of the review's focus. The distribution and details of the selected studies are presented in Table 1.

Table 1. Criteria for the retrieval of cited documents in our data set.

Items	Criteria
Time horizon:	2014-2023
Database:	Clarivate Analytics' Web of Science Core Collection™
Citation Index:	SSCI (Social Sciences Citation Index)
The keywords combination and Booleans/Search Equation†:	"Academic spin off" (All Fields) OR "University Spin Off" OR "Entrepreneurship in public universities"(All Fields) AND "University-Industry collaboration" (All Fields) AND "Third mission of the university" (All Fields) AND "Entrepreneurial intention" (All Fields) AND "Technology transfer" (All Fields) AND "Incentives" (All Fields) OR "ACADEMIC INCENTIVES" OR "Rewards" (All Fields) AND "Financing" (All Fields) OR "Research funding" (All Fields).
Seriation by Web of Science Categories:	Management, Business, Business Theory, Economics, o Management Science.
Quick filters by Web of Science:	Highly cited papers; hot papers; open access; Enriched cited references
Seriation by type of document:	Only original research articles

Source: Modified from Romero et al. (2024c)

3.2. Refined selection criteria

In the third screening phase, 12 articles that were not open access were excluded, leaving 123 documents for analysis. Open accessibility is an essential criterion to ensure that the selected studies can be consulted and verified by other researchers and stakeholders without restrictions, thus promoting transparency and replicability in research.

During the fourth screening, 97 articles that specifically contained the term "spin-off" were selected, while 26 articles were excluded (Reason 1) for not mentioning this concept. This step

was crucial to ensure that the included studies directly addressed the core topic of the review, enhancing the relevance and specificity of the findings.

In the fifth screening, a temporal filter was applied, excluding 28 articles (Reason 2) that were not published within the 2014–2024 range. This temporal criterion ensures that the systematic review reflects the most recent and relevant research, capturing the latest trends and significant advances in the field of academic spin-offs.

The sixth screening focused on further refining the selection, ensuring that the studies not only used the term "spin-off" but specifically addressed "academic spin-offs." As a result, 65 articles were included, and 4 (Reason 3) were excluded for not meeting this requirement. This additional screening stage was critical to ensure that the review concentrated on the specific type of spin-offs that constitute the object of study.

Finally, in the seventh and last screening, 25 articles (Reason 4) were excluded because, despite mentioning "academic spin-offs," the topic was not the central focus of their research. This process resulted in a final selection of 40 articles forming the basis of the systematic review. These studies reflect “the importance of developing such scenarios and the relevance of technologies” (Urriago et al., 2023), highlighting the impact and significance of academic spin-offs in innovation and academic entrepreneurship.

4. Theoretical frameworks for understanding the university agenda for Spin Off Academic

The literature has identified the factors that influence the creation of academic spin-offs, which are the following: (i) university-industry relationship, (ii) technology transfer, (iii) entrepreneurial intention, (iv) funding, (v) incentives, each of which is fundamental to understanding and promoting the creation, development and performance of academic spin-offs.

4.1 University-industry collaboration (UI)

Interaction between universities and industry is a key component for the success of academic spin-offs. Wright et al. (2012) note that effective collaboration and mutual trust between these two sectors facilitates knowledge transfer and stimulates innovation, creating a favourable environment for the emergence of new technology companies. This synergy not only strengthens the links between academia and industry, but also allows knowledge generated in universities to find practical applications in the marketplace.

University-industry collaboration has been shown to be a key factor in the success of spin-offs. According to Hayter (2015), social networks beyond the academic environment - such as investors, researchers from external companies and advisors - provide academic entrepreneurs with access to diverse resources and knowledge that are essential for the development of these companies. This dynamic contributes to regional economic growth through the commercialisation of technological innovations originating in academia.

In addition, collaborative innovation between established industries and academic spin-offs appears to be an effective channel for the transfer of disruptive innovations. In a study conducted at the Swiss Federal Institute of Technology Zurich (ETHZ), Hess et al. (2013) concluded that

strategic alliances between spin-offs and industrial companies can significantly increase the probability of success through collaborative models that promote the development of new technologies.

Through a systematic literature review, Rybnicek and Königsgruber (2019) identified several factors that influence the success of these collaborations. These include the quality of the linkages, the content of the collaboration, and the institutional openness to university-industry interaction. Their findings suggest that the quality of the relationships and the relevance of the content of the collaboration are more important predictors of success than the quantity of links between the parties.

Fischer et al. (2018) also investigated university-industry collaboration in the context of innovation systems in developing countries. Their results reinforce the idea that the quality of collaborative relationships is a more important determinant of the creation of knowledge-based spin-offs than the sheer quantity of interactions. This highlights the importance of fostering strong and meaningful collaborations to maximize the impact of academic spin-offs on economic development.

4.2 Technological Transfer

Technology transfer is an essential process for the successful commercialisation of innovations generated in universities. Markman et al. (2005) developed a model that analyzes how the strategies and structures of university technology transfer offices (TTOs) influence the creation of new firms. The model highlights the importance of licensing and intellectual property management, suggesting that a strategic approach to these aspects is key to the formation of successful spin-offs.

Similarly, Festel (2013) emphasizes that technology transfer plays a crucial role in the consolidation of academic spin-offs, arguing that spin-offs bridge the gap between the research and development (R&D) phase and the commercialisation of results. Spin-offs act as intermediaries in the marketplace of ideas, facilitating the introduction of new technological innovations to the market, especially in cases where additional funding is needed to scale up the technology.

Van Norman and Eisenkot (2017) highlight that TTOs play a critical role in the management and commercialisation of intellectual property within universities. These offices are responsible for transforming academic innovations into marketable products through licensing or the creation of start-ups. This underlines the need for efficient IP management to ensure that technologies developed in academia can have a commercial impact.

Lockett and Wright (2005) argue that both the resources and capabilities of TTOs are critical factors in the creation of academic spin-offs. Their research shows that investment in intellectual property protection and business development is directly related to the success of these firms. These findings highlight not only the importance of sufficient resources, but also the need to develop specialized skills within transfer offices.

In addition, Siegel et al. (2007) stress the importance of coordinating institutional and government policies to optimize performance in the commercialisation of university intellectual

property. They suggest that both universities and regions should develop coherent and workable policies to promote technology transfer in order to maximize the impact of these activities. Creating an enabling environment for technology transfer requires the alignment of institutional policies and government frameworks.

Finally, Domingues et al (2022) conducted a metadata analysis of systematic reviews on academic spin-offs and found that many studies focused on technology transfer models and the feasibility of commercializing academic intellectual property. Their work suggests that a better understanding of these models could improve the efficiency of technology transfer and increase the success of spin-offs.

4.3. Entrepreneurial intention

Entrepreneurial intention has emerged as a relevant indicator of future entrepreneurial behavior. Di Paola (2013) highlights that Ajzen's model of planned behavior provides a solid theoretical framework for analyzing entrepreneurial intentions among university students. This model emphasizes the role of normative, control and behavioral beliefs in shaping such intentions, highlighting the need to understand the factors that motivate individuals to be entrepreneurial in the academic environment.

The theory of planned behavior has proven to be widely applicable and reliable in entrepreneurship research. Kautonen et al. (2015) tested the relevance of this theory using longitudinal data collected in Austria and Finland, confirming that intentions are the strongest predictor of planned behavior, especially in situations where the behavior is infrequent or takes place over uncertain time horizons (Kautonen et al., 2015).

Krueger et al (2000) compared two models based on entrepreneurial intention: Ajzen's theory of planned behavior and Shapero's entrepreneurial event model. Both models were found to be effective in predicting entrepreneurial intentions. However, while Ajzen's theory emphasizes perceived personal attractiveness, social norms and feasibility, Shapero's model focuses on personal desirability, feasibility and propensity to act. These findings highlight the versatility and robustness of intention-based approaches to understanding and predicting entrepreneurship (Krueger et al., 2000).

Other studies have shown that both perceived self-efficacy and normative beliefs play a key role in the formation of entrepreneurial intentions. Shook and Bratianu (2010) found that self-efficacy and the desirability of starting a business were positively related to entrepreneurial intention. However, their research revealed an unexpected finding: support from family and friends may have a negative impact on students' entrepreneurial intentions, suggesting the need for a more nuanced analysis of these factors (Shook & Bratianu, 2010).

Kautonen et al. (2011) reinforced these findings with an econometric analysis that supports the predictions of the theory of planned behavior. Their research revealed that attitude, perceived behavioral control and subjective norms are key factors for entrepreneurial intention. Furthermore, their results suggest that both intention and perceived behavioral control are significant predictors of subsequent entrepreneurial activity.

4.4. Funding

Funding is a determining factor for the feasibility and success of academic spin-offs. Patzelt and Shepherd (2009) highlight that access to funding is an essential component that enhances the benefits of support policies, such as access to non-financial resources and the reduction of administrative burdens. These findings underscore the importance of establishing robust financing structures to foster academic entrepreneurship.

University networks also play a crucial role in the ability of spin-offs to attract investment for innovation activities. According to Soetanto and Geenhuizen (2015), relationships with universities not only provide knowledge and resources but also facilitate access to financial capital. Their research shows that network characteristics, such as size, density, and the strength of ties, improve spin-offs' capacity to secure funding, emphasizing the importance of building well-connected networks that include both academic and external contacts.

Lenzer and Kulczakowicz (2021) highlight that, to maximize opportunities for attracting private investment, university spin-offs must complement their technological teams with business management experts from the early stages. Although these companies can access non-dilutive funding for product development, building relationships with investors and preparing for investment rounds significantly increases their chances of success.

Hayter (2015) reinforces this idea by noting that extra regional social networks, which include investors and external advisors, expand academic entrepreneurs' opportunities by providing access to additional knowledge and resources. This connection is essential for regional economic development, as it facilitates the commercialization of technological innovations originating from academia.

On the other hand, Munari and Toschi (2011) investigated whether venture capitalists are reluctant to invest in academic spin-offs. Their findings revealed that factors such as the scientific reputation of the originating university, intellectual property rights, and collaborations between academia and industry are crucial for attracting venture capital investment. Furthermore, public venture capitalists tend to place greater importance on the scientific reputation of the university compared to their private counterparts.

Finally, Carlesi et al. (2017) point out that academic spin-offs have a significant impact on local economies, particularly through job creation. However, these companies often face financial challenges that may limit their growth. Promoting “innovation funding” and developing a capital market that fosters the creation of new businesses are key measures to stimulate the sustainable growth of academic spin-offs.

4.5. Incentives

Incentives, both financial and non-financial, play a key role in fostering academic entrepreneurship. Markman et al. (2004) demonstrated that incentive systems, such as monetary payments to inventors and staff at technology transfer offices (TTOs), significantly influence entrepreneurial activities within universities. These incentives can motivate researchers to become more actively involved in the commercialization of their research outcomes, thereby promoting the creation of spin-off companies (Markman et al., 2004).

Han and Heshmati (2016) found that collaboration between universities and industries can generate substantial financial rewards for academic institutions. However, their study revealed that revenues derived from the commercialization of technology through TTOs and the incentives granted to developers are not always substantial, suggesting the need for more strategic and effective management of incentives to maximize their benefits.

Graff, Heiman, and Zilberman (2002) describe TTOs as essential institutional innovations designed by universities to serve as bridges between academic research and industry. These offices not only generate income through technology licensing but also drive the creation of startups based on university technology. However, the economic incentives provided by TTOs still have a modest impact on the overall university budget, highlighting the need to strengthen and expand these support mechanisms.

Walter et al. (2018) found that both direct and indirect financial incentives are fundamental drivers for university scientists to patent and commercialize their research. They also suggest that policies such as grace periods, allowing simultaneous publication and patenting, and including patents in academic performance evaluation criteria, can effectively promote research commercialization. However, the effectiveness of these incentives varies significantly depending on the academic discipline and the researcher's experience.

Finally, Gan (2023) explored the relationship between research incentive mechanisms and the commercialization of outcomes in private higher education institutions. His study showed that both financial incentives and academic recognition positively impact researcher productivity and the effectiveness of TTOs in facilitating commercialization. This finding underscores the importance of a balanced combination of incentives to maximize the impact of academic research and promote more efficient technology transfer.

5. Results and Discussion

To answer the research question RQ1: What horizon does the literature suggest for academic spin-offs in Colombia when confronted with global trends on the concept?, we begin by identifying global trend topics and applying a cluster factorial analysis using a Conceptual Structure Map based on the Multiple Correspondence Analysis (MCA) method. This approach allows us to identify dominant themes in the international literature and analyze the connections between them, providing a global perspective on the development and priorities in the field of academic spin-offs.

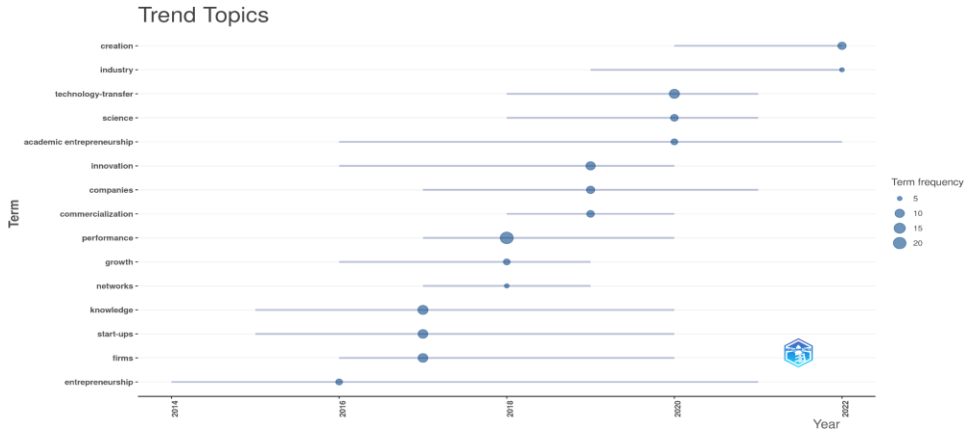
5.1. Evolution of Trend Topics in the Field of Academic Spin-offs (2014–2023)

The MCA analysis reveals the main areas of global research interest related to academic spin-offs. This method identifies conceptual patterns by grouping frequently occurring, thematically related terms into clusters. Figure 2 shows the evolution of research interests in the field of academic entrepreneurship and the performance of academic spin-offs over the 2014–2023 period. This analysis demonstrates a progressive shift in the complexity and focus of the field, indicating how it has matured over time.

In 2014, the term “entrepreneurship” emerged as the conceptual foundation, reflecting an initial interest in entrepreneurship as a broad discipline. Over time, the themes began to diversify, indicating increasing specialization and the integration of new areas of research.

During the early years of the analysis, terms such as “academic entrepreneurship” and “technology transfer” gained prominence. This trend suggests growing interest in how academic institutions can foster the creation of spin-offs and bring their innovations to market. In this context, concepts such as “science” and “innovation” also stand out, emphasizing the direct relationship between scientific research and the development of innovative solutions.

Figure 2. Trend Topic Spin-off Academicas in the World



Source: Author's elaboration using the bibliometric tool

Between 2016 and 2018, the literature reflects a shift toward topics related to “knowledge,” “growth,” and “networks.” These terms suggest that research increasingly focuses on how to leverage the knowledge generated in academia to foster the growth of spin-offs and how collaborative networks can influence their success. This phase highlights the importance of strategic connections and innovation ecosystems for the performance of these ventures.

From 2018 onward, there is a consolidation of interest in terms such as “performance,” “companies,” “commercialization,” and “creation.” This indicates a shift toward analyzing the performance of spin-offs, their integration into industry, and the commercialization process of their innovations. The continued relevance of terms like “innovation” and “technology transfer” confirms that these processes remain essential for the development of academic spin-offs.

The trend topic analysis points to a significant evolution in the field, transitioning from a focus on the foundational aspects of entrepreneurship to a growing interest in the performance, growth, and commercialization of academic spin-offs (Romero et al., 2024b). This progression underscores the maturation of the field toward the practical application of knowledge generated within universities, with a continuous emphasis on technology transfer and innovation as key drivers of success.

5.2. Factor analysis of clusters in the world

The cluster factorial analysis, based on the 40 articles selected after the rigorous application of screening criteria, reveals four main clusters that synthesize the key concepts in research on academic entrepreneurship and university spin-offs. These clusters help identify how emerging topics are organized and the predominant approaches in this field, providing a deeper understanding of the impact and dynamics of academic spin-offs across different contexts.

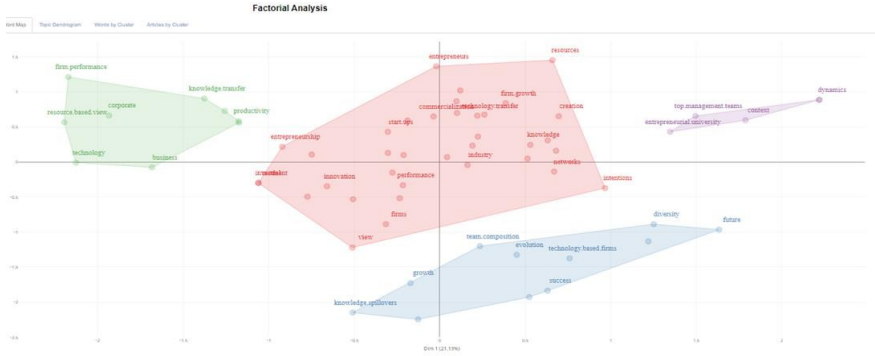
The green cluster, illustrated in Figure 3, groups terms such as "firm performance," "resource-based view (RBV)," and "technology." This highlights the importance of technological resources and internal capabilities for the business performance of academic spin-offs. This cluster reflects how research focuses on the strategic capabilities that spin-offs, derived from academia, must develop to ensure their growth and competitiveness in the market. The resource-based view (RBV) theory emerges as one of the fundamental perspectives in the literature, emphasizing that both tangible resources (e.g., technological infrastructure) and intangible resources (e.g., knowledge and expertise) are essential for achieving sustainable competitive advantages.

Academic spin-offs benefit particularly from the combination of advanced scientific knowledge generated within universities and access to emerging technologies. However, their success does not solely depend on possessing these resources but on their ability to efficiently mobilize them through market strategies. In this context, the resource-based view becomes a powerful tool to understand how spin-offs can strategically position themselves by leveraging their differentiating resources, such as intellectual property or patents developed within academic environments (Romero et al., 2024b).

Academic spin-offs act as vehicles for technology transfer from universities to the market, connecting scientific knowledge with commercial applications. This technology transfer process not only drives innovation in productive sectors but also strengthens the regional entrepreneurship ecosystem by creating new companies based on advanced technologies. The green cluster reflects this dynamic, emphasizing the importance of spin-offs not only in developing innovative products but also in mastering the organizational capabilities necessary to successfully commercialize them.

The literature in this cluster also highlights that the performance of spin-offs depends on their ability to integrate disruptive technologies with viable business models. This is particularly relevant in a global context where emerging companies compete in highly dynamic and technological markets. Academic spin-offs, operating at the intersection of science and the market, must efficiently manage both their technological capabilities and business competencies to ensure sustainable growth.

Figure 3. Cluster factorial analysis based on the MCA method



Source: Author's elaboration using the bibliometric tool

The red cluster groups terms such as “entrepreneurship,” “firms,” and “start-ups” (see Figure 3), reflecting a focus on entrepreneurial processes and the early stages of business creation. This cluster highlights the importance of entrepreneurship for the commercialization of academic knowledge and emphasizes how the initial stages of development are critical for the survival of spin-offs. The literature suggests that these companies must navigate challenges related to transitioning from the academic environment to the market, combining scientific skills with business competencies. During this phase, access to funding, institutional support, and the development of sustainable business models are fundamental to ensuring their consolidation and growth.

The blue cluster includes terms such as “team composition,” “growth,” and “success” (see Figure 3), focusing on the human and organizational factors that influence the performance of spin-offs. Research in this area underscores that the success of these ventures relies not only on technological resources but also on internal structure and team dynamics. The integration of business and technical skills within teams is essential for efficiently managing market risks and opportunities. Additionally, team cohesion and leadership capacity greatly determine the effectiveness of business strategy execution. Spin-offs that maintain healthy organizational dynamics are more likely to secure investments, achieve sustainable growth, and establish themselves in highly competitive markets.

The purple cluster groups terms such as “entrepreneurial university,” “diversity,” and “future” (see Figure 3), indicating an emerging interest in the role of universities within entrepreneurial ecosystems and how diversity can influence long-term business outcomes. Entrepreneurial universities not only generate knowledge but also serve as platforms for creating spin-offs and transferring technology to the market. Diversity, both in team composition and in the perspectives embedded in projects, has proven to be a key driver of innovation, although its specific impact on spin-off success requires further exploration. The literature suggests that fostering inclusion and diversity within entrepreneurial teams can enhance creativity and decision-making, increasing the resilience of spin-offs in competitive environments.

From a future research perspective, the identified clusters show that while areas such as entrepreneurship and resource management are well-covered, topics such as the impact of diversity and the role of universities as innovation incubators could benefit from deeper exploration (Romero et al., 2024c). The interaction between universities and industries remains a research area with significant potential, as optimizing these links could substantially improve technology transfer and innovation commercialization. Academic spin-offs represent a convergence point between science and the market, and gaining a better understanding of their internal dynamics and external relationships is essential to maximizing their economic and social impact.

5.3. Colombia and the Advancement of Scientific Research on Academic Spin-offs

In Colombia, the analysis of academic spin-offs has focused more on their creation than on their subsequent performance. Of the 14 articles selected for discourse analysis, four focus on the influence of institutional and governmental policies on the generation of spin-offs, though they adopt different methodological approaches.

Morales Gualdrón (2024) compared the development of spin-offs in Spain and Colombia through literature reviews and case studies. The findings indicate that Spain benefits from stronger institutional support and a more favorable regulatory framework, enabling more advanced development compared to Colombia. The author suggests that adopting successful policies from international contexts could strengthen academic entrepreneurship in Colombia, although the research does not provide measurable variables, relying instead on technology transfer models to guide future studies.

Bravo-García et al. (2024) proposed an ideal model for academic spin-offs replicable in Colombian universities, combining bibliographic reviews with surveys. Their research emphasizes that the success of spin-offs largely depends on internal policies fostering a supportive research environment and consistent institutional support. The model is based on entrepreneurship and technology transfer theories, highlighting the importance of a favorable university environment for the creation of these ventures.

Romero et al. (2023) analyzed the dynamics of spin-offs in Colombian universities through surveys conducted at 24 out of 90 institutions consulted. The study concludes that the university's strategic direction is crucial for generating spin-offs, though it did not identify specific research gaps. The authors recommend strengthening internal policies and using university management variables alongside knowledge transfer theories as theoretical frameworks for future studies.

Flórez Martínez and Cárdenas (2024) identified key practices and policies that promote the successful creation of spin-offs in Colombia, emphasizing the importance of institutional support and the seamless integration of research and innovation to facilitate knowledge transfer. Their study highlights that combining these practices is essential for spin-offs to thrive and consolidate in competitive environments.

These studies converge on the importance of institutional support and internal policies for the success of academic spin-offs in Colombia. There is a consensus on the need for universities to

adopt a more proactive and strategic approach to promoting entrepreneurship and innovation, integrating best practices observed in international contexts.

A crucial aspect of understanding the development of academic spin-offs in Colombia, and their global context, is the impact of institutional support structures. In their systematic review, Romero et al. (2024c) highlight that, while Europe and the United States have prioritized the development of technology transfer offices (TTOs) and favorable public policies, Colombian universities still face significant barriers in consolidating efficient innovation ecosystems. These barriers range from a lack of financial resources to limited cooperation between academia and industry. Despite these challenges, the study emphasizes that strategic alignment between universities, government, and industry actors can potentially overcome these limitations and foster sustainable growth for spin-offs in the country.

A key element in this process is the implementation of the triple helix model, where collaboration between universities, industry, and government becomes the core of innovation. This approach has proven effective in other regions, driving both the creation of spin-offs and their integration into the market. In Colombia, however, adopting this model requires additional efforts in terms of coherent policies, clear incentives, and funding strategies, all aimed at strengthening TTOs and increasing private sector involvement in technology transfer initiatives.

Romero et al. (2024c) also highlight the importance of adopting applied research approaches, linking academic outcomes with concrete market needs. Creating spin-offs that address local challenges could not only foster knowledge transfer but also generate positive socioeconomic impacts in communities. In this sense, shifting toward a performance-oriented focus for spin-offs, beyond their creation, is essential to align academic efforts with the challenges and opportunities of national and international markets.

Authors such as Arrieta et al. (2024) and Castrillón-Muñoz et al. (2020) agree on the need to promote academic spin-offs through the triple helix model, which emphasizes collaboration between universities, industry, and government. Both articles explore how improving support structures and optimizing institutional cooperation can enhance the university entrepreneurship ecosystem in Colombia.

The synergy between these studies lies in recognizing the value of intersectoral collaboration for the development and success of academic spin-offs. Arrieta et al. (2024) identify a gap in the availability of continuous, structured programs that facilitate this type of cooperation, suggesting that this limits the growth of academic entrepreneurship. Meanwhile, Castrillón-Muñoz et al. (2020) propose that the University of Cauca could play a leading role in this field by leveraging its research infrastructure and institutional support to spearhead spin-off initiatives. Both studies conclude that robust cooperation between universities, industry, and government is essential to overcome institutional barriers and maximize the commercial potential of university research.

From a complementary perspective, Calderón-Hernández et al. (2023) and Jiménez-Zapata and Calderón-Hernández (2023) explore the impact of cultural and institutional factors on the creation of academic spin-offs. Both studies analyze how cultural barriers and perceptions within universities can affect their ability to develop a favorable environment for entrepreneurship and innovation.

Calderón-Hernández et al. (2023) identify several institutional obstacles hindering spin-off creation, such as universities' conservative outlook, the prioritization of academic publishing over knowledge commercialization, and the lack of clear incentives. These factors underscore the need for a cultural shift toward a more entrepreneurial orientation within universities, enabling spin-offs to flourish in a more supportive environment.

Jiménez-Zapata and Calderón-Hernández (2023) focus on cultural factors that facilitate spin-off creation, such as universality, trust, and interdisciplinarity. Their study suggests that fostering these elements within universities could be crucial for creating a stronger entrepreneurial ecosystem. The authors propose a theoretical model connecting organizational culture with spin-off creation, emphasizing that an open and collaborative institutional environment can serve as a key catalyst for academic entrepreneurship success.

Both articles underscore the importance of transforming organizational culture within universities to encourage greater entrepreneurial activity and spin-off creation. While Calderón-Hernández et al. (2023) focus on identifying barriers and the need for cultural change to overcome institutional obstacles, Jiménez-Zapata and Calderón-Hernández (2023) analyze how specific cultural attributes, such as interdisciplinarity and trust, can be cultivated to promote a more favorable entrepreneurial environment. Together, these studies offer a comprehensive framework suggesting that, to enhance the effectiveness of universities as incubators of spin-offs, it is not enough to adjust policies and incentives; a profound cultural transformation is also necessary, one that supports and values innovation and entrepreneurship.

Authors such as Castro-Rodríguez et al. (2023) and Naranjo Africano (2024) adopt a more structural focus, emphasizing the need to develop theoretical and practical models that align with the specific challenges of the Colombian context in academic entrepreneurship and technology transfer. Castro-Rodríguez et al. stress the importance of understanding how different contextual factors interact to either facilitate or hinder spin-off creation, while Naranjo Africano proposes implementing a viable systems model to manage these ventures more efficiently by proactively addressing structural and organizational challenges.

Similarly, Romero-Rueda et al. (2022), focusing on the role of Higher Education Institutions (HEIs) in promoting technology-based ventures, align with previous studies by emphasizing the need to strengthen these institutions as catalysts for economic development. Their proposal to integrate academic capacities into innovation and entrepreneurship processes resonates with the ideas of Castro-Rodríguez et al. and Naranjo Africano regarding the importance of improving support structures and fostering knowledge transfer.

In contrast, López (2023) takes a more practical approach, focusing on project management as a tool for creating spin-offs. Although his approach is more methodological and centers on the early stages of the entrepreneurial process, there is an implicit connection with the other studies regarding the need for structured, well-defined approaches to ensure the success of these ventures. However, his connection to the broader studies is more tangential, as his work concentrates on project management without delving into the theoretical models or broader organizational structures discussed by other authors.

In Colombia, academic literature has predominantly focused on analyzing the factors that facilitate spin-off creation, with relatively less attention paid to their post-creation performance. This orientation can be attributed to contextual and methodological reasons. Firstly, Colombia's institutional framework and innovation policies are still developing, directing research efforts toward the early stages of the entrepreneurial process: the creation of knowledge-based ventures (Calderón-Hernández et al., 2020; Reina et al., 2023; Castrillón et al., 2019; Mosquera and Vega, 2021). As a result, the focus on consolidating and assessing spin-off performance remains underexplored, leaving room for future studies to address these challenges and maximize the impact of spin-offs within Colombia's entrepreneurial ecosystem.

5.4. Challenges in Academic Spin-Off Research: A Comparative Approach Between the Global Context and Colombia

Global literature on academic spin-offs has evolved significantly, focusing on multiple essential aspects that contribute to the success and sustainability of these ventures. A systematic analysis identifies four main clusters: business resources and performance, entrepreneurial processes, internal dynamics of firms, and the role of universities and diversity (Rasmussen et al., 2014; Visintin and Pittino, 2014; Rasmussen et al., 2015; Fini et al., 2017). These clusters reflect a multidimensional understanding of the spin-off phenomenon, emphasizing the importance of technological resources, the management of early entrepreneurial stages, team composition, growth, and the institutional role of universities in venture creation (Sternberg, 2014; Rasmussen and Wright, 2015; Berbegal-Mirabent et al., 2015; Fuster et al., 2019).

In contrast, academic production in Colombia shows a different trend, primarily focusing on factors that facilitate the creation of academic spin-offs, with less attention given to post-creation performance (Calderón-Hernández et al., 2023; Castro-Rodríguez et al., 2023). This focus aligns with the early development of the country's institutional framework and innovation policies, directing research efforts toward the initial stages of the entrepreneurial process. Colombian literature emphasizes understanding cultural and institutional barriers that affect spin-off creation, including university perceptions and the lack of economic and non-economic incentives to foster academic entrepreneurship (Jiménez-Zapata and Calderón-Hernández, 2023). These priorities reflect the current needs of the Colombian context, where a robust innovation ecosystem is still under construction.

5.4.1. Differences Between Global and Colombian Research Focuses

The comparison with global trends reveals notable differences in research areas. Internationally, the focus has shifted toward an integrated approach that encompasses both the creation and performance of spin-offs (Rasmussen et al., 2014; Fini et al., 2017). In contrast, research in Colombia remains more concentrated on the early stages of academic entrepreneurship (Sternberg, 2014), driven by the need to strengthen institutional capabilities and develop more effective policies to support academic entrepreneurship (Rasmussen and Wright, 2015; Berbegal-Mirabent et al., 2015).

Collaboration between universities and industry, essential for technology transfer, is still developing in Colombia, limiting opportunities for growth and sustainability of spin-offs (Visintin and Pittino, 2014). Globally, research has delved deeper into managing technological

resources and leveraging them strategically to gain competitive advantages. In Colombia, however, universities face significant structural challenges in creating a conducive environment for academic entrepreneurship. These include an academic culture that prioritizes scientific publication over knowledge transfer and the absence of a robust regulatory framework and policies (Romero et al., 2022).

5.4.2. Addressing Gaps in Colombian Spin-Off Research

These challenges highlight the need for a strategic, coordinated approach to promote both the creation and sustainable growth of spin-offs in the country (Arrieta et al., 2024; Castrillón-Muñoz et al., 2020). Furthermore, while international literature has advanced in understanding the internal dynamics of spin-offs, such as team composition and growth factors (Rasmussen et al., 2014; Visintin, 2014), these aspects have received less attention in Colombia. Research in Colombia has primarily focused on overcoming the initial barriers to spin-off creation (Romero et al., 2023), leaving a gap in understanding the factors that facilitate their consolidation and long-term expansion.

This lack of research on the complete life cycle of spin-offs presents a significant opportunity for future studies to address these overlooked areas. Internationally, the interaction between universities and industries has been extensively studied, demonstrating that these connections are essential to optimize technology transfer and commercialize innovations. In Colombia, while this collaboration is still in progress, its importance is recognized as a fundamental pillar to enhance the viability of spin-offs and maximize their economic impact.

5.4.3. Aligning Colombian Research with International Trends

For research in Colombia to align with international trends, it will be necessary to strengthen the innovation ecosystem through more favorable policies, economic incentives, and greater integration between academic research and market demands (Romero et al., 2022; Solano and Jaramillo, 2024; Flórez Martínez and Cárdenas, 2024). Addressing structural challenges and cultural barriers will also be crucial to building a sustainable academic entrepreneurship ecosystem, fostering the development and performance of spin-offs aligned with both national and international markets.

5.5. Future Research Agenda

Based on the comparative analysis between global trends and the Colombian context in academic spin-off research, several opportunities emerge for future studies that could contribute to the development of the academic entrepreneurship ecosystem in Colombia and advance knowledge in this field.

First, it is essential to deepen the understanding of post-creation performance of academic spin-offs. While most studies in Colombia have focused on the initial creation stages (Calderón-Hernández et al., 2023; Romero et al., 2023), more detailed research is needed on the factors that drive the growth, sustainability, and economic and social impact of these ventures over time. Understanding the complete life cycle of spin-offs will enable the design of more effective policies and strategies for their consolidation, as suggested by Fini et al. (2017) in their global analysis of business performance.

Second, exploring the impact of organizational culture and incentives within universities presents a relevant research avenue. Calderón-Hernández et al. (2023) identified that a culture exclusively focused on scientific publication poses a barrier to academic entrepreneurship. Further research is needed to understand how cultural change within universities could foster attitudes oriented toward innovation and knowledge transfer. Additionally, it is crucial to investigate the types of financial and non-financial incentives, such as those proposed by Jiménez-Zapata and Calderón-Hernández (2023), that could motivate academics to actively engage in spin-off creation.

Another area of interest is university-industry collaboration, which, according to Visintin and Pittino (2014), has been fundamental for technology transfer in international contexts. In Colombia, where such collaboration is still emerging, future research could focus on identifying the specific obstacles hindering these partnerships (Castrillón-Muñoz et al., 2020) and developing models based on the triple helix framework to strengthen ties between academia and the productive sector (Arrieta et al., 2024; Romero et al., 2024a).

Furthermore, research on the adaptation of successful international models to the Colombian context offers significant potential. As Morales Gualdrón (2024) highlights in his comparison of Spain and Colombia, future studies should focus on tailoring conceptual frameworks and strategies tested abroad to Colombia's institutional and cultural particularities. This line of inquiry could include evaluating government support programs and financing schemes that have proven effective in other countries.

Another future research avenue, identified by Romero et al. (2024), involves analyzing how the dynamics and composition of founding teams affect the long-term performance of academic spin-offs. In addition to overcoming initial barriers to creation, it will be critical to explore how team heterogeneity impacts the adaptability and growth of these ventures in changing environments. This approach could provide new insights into the sustainability and success of spin-offs as they navigate challenges throughout their life cycle.

Finally, it is necessary to examine the role of diversity and interdisciplinarity in entrepreneurial teams. This approach, highlighted by Jiménez-Zapata and Calderón-Hernández (2023), has proven to be a key driver of innovation. Future research could focus on how to promote and manage diverse teams within Colombian universities to foster the creation of more successful spin-offs.

These lines of inquiry would not only help bridge existing gaps between Colombia and global trends but also strengthen the national innovation ecosystem, facilitating the creation of more competitive and sustainable academic spin-offs.

6. Conclusions

Our analysis of the literature on academic spin-offs reveals a clear evolution in how this phenomenon is understood and addressed, both globally and within the Colombian context. Internationally, the integration of technology, business management, and internal dynamics has emerged as a critical factor for the sustainable success of these ventures. The ability to mobilize

technological resources, combined with effective team management and growth strategies, enables spin-offs to navigate competitive markets successfully.

The findings also highlight that collaboration between universities, industry, and government is essential for creating an environment conducive to academic entrepreneurship. This approach, aligned with the triple helix model, has facilitated the rapid consolidation of spin-offs in other contexts through effective technology transfer and innovation commercialization. In contrast, Colombia still faces challenges in building intersectoral alliances, limiting access to broader resources and markets.

The review further indicates that in Colombia, research remains largely focused on the early stages of spin-off creation, with limited attention to post-creation performance. This focus reflects the early development stage of the country's innovation policies and institutional infrastructure. However, the lack of systematic tracking of the spin-off life cycle represents a significant research opportunity to identify factors that foster their growth and sustainability.

Additionally, the literature suggests that academic culture and university incentives play a crucial role in promoting entrepreneurship. In Colombia, the predominance of a culture oriented toward scientific publication over knowledge transfer poses a significant barrier. Studies recommend transforming this focus by promoting interdisciplinarity and diversity within entrepreneurial teams, which has proven to be a driver of innovation in other contexts.

To close the identified gaps, it is essential for Colombian universities to adopt a proactive approach, not only focused on creating spin-offs but also on their long-term consolidation. This will require the development of stronger regulatory frameworks, economic incentives, and training programs that align academic research with market demands. Only through an integrated and coordinated approach can the impact of spin-offs on Colombia's economy and society be maximized, aligning the country with international best practices and strengthening its innovation ecosystem.

Funding

This work was funded by the Unidad Central del Valle del Cauca- UCEVA, through the project entitled "Promoviendo la Innovación y el Desarrollo Regional: El Rol de las Spin-Offs Universitarias y la Integración de Ecosistemas en la Unidad Central del Valle del Cauca', with the project code PI-1300-50.2-2024-13.

WORKS CITED

Aponte, M & Sanchez, S. (2024)a. Globalization, Human Rights And Colombian Armed Conflict. Migration Letters, 21(S5), 1237-1251. https://doi.org/10.59670/ml.v21iS6.8109

Aponte García, M. S., Restrepo Pimienta, J. L., & Valencia-Jiménez, W. G. (2024). Social justice against the simulation of the employment relationship in health entities. Contemporary Readings in Law and Social Justice, 16(1), 941-947. https://doi.org/10.52783/crlsj.219

Aponte García, C. A., Lozano Hurtado, A. M., Arcila Montoya, L. J., Muñoz González, L. C., & Garcia Valdes, M. P. (2024). Medical responsibility in the Colombian context: A review of negligence from the legal framework and ethical perspective. Evolutionary Studies in Imaginative Culture, 1884–1897. https://doi.org/10.70082/esiculture.vi.1603

Aponte-García, M. S., & Sánchez-Arteaga, S. (2024)b. Transitional justice in Colombia: A systematic literature review. Evolutionary Studies in Imaginative Culture, 500–531. https://esiculture.com/index.php/esiculture/article/view/1867

Berbegal-Mirabent, J., Enrique Ribeiro-Soriano, D., & Sanchez Garcia, J. L. (2015). Can a magic recipe foster university spin-off creation? JOURNAL OF BUSINESS RESEARCH, 68(11), 2272–2278. https://doi.org/10.1016/j.jbusres.2015.06.010

Bravo-García, S., Benavides-Bustos, J., Wagner-Martínez, M. & Londoño-Cardozo. J. (2019). Perspectivas de las spin-off académicas, como modelo de emprendimiento en las universidades colombianas. Desarrollo Gerencial, 11(1), 131-156. DOI: https://doi.org/10.17081/dege.11.1.3443

Calderon-Hernandez, G., Andrea Jimenez-Zapata, Y., & Mauricio Serna-Gomez, H. (2020). Barriers to University Spin-Off Creation in an Emerging Context: An Institutional Theory of Organizations Approach. MINERVA, 58(4), 625–650. https://doi.org/10.1007/s11024-020-09407-4

Carlesi, A., Mariani, G., & Scarfò, A. (2017). ACADEMIC SPIN-OFFS FOR THE LOCAL ECONOMY GROWTH. Corporate Ownership and Control, 14, 350-359. https://doi.org/10.22495/COCV14I2C2P8.

Carlsson, B., Acs, Z., Audretsch, D., & Braunerhjelm, P. (2009). Knowledge creation, entrepreneurship, and economic growth: a historical review. Industrial and Corporate Change, 18, 1193-1229. https://doi.org/10.1093/ICC/DTP043.

Castrillón, A.J., Infante, A., Zuñiga, A., Martinez, F. (2019). University Spin-Off: A Literary Review for Their Application in Colombia. Journal of Environmental Management and Tourism, (Volume X, Spring), 1(33): 73-86. DOI:10.14505/jemt.v10.1(33).08

Castrillón-Muñoz, Andrés José, Infante-Moro, Alfonso, Zuñiga-Collazos, Alexander, & Martínez-López, Francisco José. (2020). Capacities of the Research Groups at UNICAUCA, (Colombia) to Develop Spin-Off-type Undertakings. Journal of technology management & innovation, 15(1), 64-75. https://dx.doi.org/10.4067/S0718-27242020000100064

Castro-Rodríguez, A., Martínez-Ardila, H., Camacho-Pico, J (2020). “Factores determinantes en la creación de Spin-off Universitarias”, Aibi revista de investigación, administración e ingeniería, vol. 8, no. 2, pp. 62-75, 2020, doi: 10.15649/2346030X.845

Civera, A., Meoli, M., & Vismara, S. (2020). Engagement of academics in university technology transfer: Opportunity and necessity academic entrepreneurship. European Economic Review, 123, 103376. https://doi.org/10.1016/j.euroecorev.2020.103376.

Clarysse, B., Wright, M., & Van de Velde, E. (2011). Entrepreneurial Origin, Technological Knowledge, and the Growth of Spin-Off Companies. Journal of Management Studies, 48(6), 1420-1442.

Dahlstrand, Å. (2008). University knowledge transfer and the role of academic spin-offs. , 235-254. https://doi.org/10.1787/9789264044104-12-EN.

Delgado-Rodríguez M, Sillero-Arenas M. Systematic review and meta-analysis. Med Intensiva (Engl Ed). 2018 Oct;42(7):444-453. English, Spanish. doi: 10.1016/j.medin.2017.10.003. Epub 2017 Nov 21. PMID: 29169792.

Domingues, M., Santana, H., Ruzene, D., & Silva, D. (2022). Metadata analysis of systematic literature reviews on academic spin-offs. International Journal for Innovation Education and Research. https://doi.org/10.31686/ijier.vol10.iss7.3815.

Festel, G. (2012). Academic spin-offs, corporate spin-outs and company internal start-ups as technology transfer approach. The Journal of Technology Transfer, 38, 454 - 470. https://doi.org/10.1007/s10961-012-9256-9.

Fini, R., Fu, K., Mathisen, M. T., Rasmussen, E., & Wright, M. (2017). Institutional determinants of university spin-off quantity and quality: a longitudinal, multilevel, cross-country study. SMALL BUSINESS ECONOMICS, 48(2, SI), 361–391. https://doi.org/10.1007/s11187-016-9779-9

Fischer, B., Schaeffer, P., Vonortas, N., & Queiroz, S. (2018). Quality comes first: university-industry collaboration as a source of academic entrepreneurship in a developing country. The Journal of Technology Transfer, 43, 263-284. https://doi.org/10.1007/S10961-017-9568-X.

Flórez, D. H. & Cardenas, L. J. (2022). Análisis de tendencias: Spin-Offs alternativas para la transferencia de conocimiento en AGROSAVIA. Recuperado de: http://hdl.handle.net/20.500.12324/39002.

Fuster, E., Padilla-Melendez, A., Lockett, N., & Rosa del-Aguila-Obra, A. (2019). The emerging role of university spin-off companies in developing regional entrepreneurial university ecosystems: The case of Andalusia. TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE, 141, 219–231. https://doi.org/10.1016/j.techfore.2018.10.020

Graff, G., Heiman, A., & Zilberman, D. (2002). University Research and Offices of Technology Transfer. California Management Review, 45, 115 - 88. https://doi.org/10.2307/41166155.

Haddaway NR, Page MJ, Pritchard CC, McGuinness LA. PRISMA2020 : An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and Open Synthesis. Campbell Systematic Reviews 2022;18. https://doi.org/10.1002/cl2.1230.

Han, J., & Heshmati, A. (2016). Determinants of Financial Rewards from Industry-University Collaboration in South Korea. International Journal of Innovation Management. https://doi.org/10.1142/S1363919616500754.

Hayter, C. (2015). Social Networks and the Success of University Spin-offs. Economic Development Quarterly, 29, 13 - 3. https://doi.org/10.1177/0891242414566451.

Hess, S., Suhrbeer, S., & Siegwart, R. (2013). The Impact of Collaborative Innovation between Established Industry and Academic Technology Spin-offs. Business and Management Research, 2, 1. https://doi.org/10.5430/BMR.V2N3P1.

Hossinger, S., Chen, X., & Werner, A. (2020). Drivers, barriers and success factors of academic spin-offs: a systematic literature review. Management Review Quarterly, 70, 97-134. https://doi.org/10.1007/S11301-019-00161-W.

Iacobucci, D., Micozzi, A., & Piccaluga, A. (2020). An empirical analysis of the relationship between university investments in Technology Transfer Offices and academic spin-offs. R&D Management. https://doi.org/10.1111/RADM.12434.

Jiménez-Zapata, Y.A. y Calderón-Hernández, G. (2018). Factores culturales que inciden en la creación de spin-off universitarias. Un estudio en una universidad pública colombiana. Estudios Gerenciales, 34(148), 320-335.

Kautonen, T., Gelderen, M., & Fink, M. (2015). Robustness of the Theory of Planned Behavior in Predicting Entrepreneurial Intentions and Actions. Entrepreneurship Theory and Practice, 39, 655 - 674. https://doi.org/10.1111/etap.12056.

Kautonen, T., Gelderen, M., & Tornikoski, E. (2011). Predicting entrepreneurial behaviour: a test of the theory of planned behaviour. Applied Economics, 45, 697 - 707. https://doi.org/10.1080/00036846.2011.610750.

Krueger, N., Reilly, M., & Carsrud, A. (2000). Competing models of entrepreneurial intentions. Journal of Business Venturing, 15, 411-432. https://doi.org/10.1016/S0883-9026(98)00033-0.

Llano Franco, J. V., & Aponte García, M. S. (2024). Estado del Arte: Estudios de antropología y sociología jurídica en el Norte del Cauca. Estudios Socio-Jurídicos, 26(2). https://doi.org/10.12804/revistas.urosario.edu.co/sociojuridicos/a.14453

Lenzer, J., & Kulczakowicz, P. (2021). Fueling Spin-offs: Case Studies of University-based Technology Start-up Funding. Technology & Innovation. https://doi.org/10.21300/21.4.2021.4.

Li, H., Yang, X., & Cai, X. (2022). Academic spin-off activities and research performance: the mediating role of research collaboration. JOURNAL OF TECHNOLOGY TRANSFER, 47(4), 1037–1069. https://doi.org/10.1007/s10961-021-09869-y

Lockett, A., & Wright, M. (2005). Resources, capabilities, risk capital and the creation of university spin-out companies. Research Policy, 34, 1043-1057. https://doi.org/10.1016/J.RESPOL.2005.05.006.

López Obando, P. (2017). Surgimiento de empresas catalogadas como spin-off universitarias en Colombia, análisis desde la gerencia de proyectos (fase I). Revista EAN, 82, pp. 61-72. https://doi.org/10.21158/01208160.n82.2017.1649

Markman, G., Gianiodis, P., Phan, P., & Balkin, D. (2004). Entrepreneurship from the Ivory Tower: Do Incentive Systems Matter?. The Journal of Technology Transfer, 29, 353-364. https://doi.org/10.1023/B:JOTT.0000034127.01889.86.

Markman, G., Phan, P., Balkin, D., & Gianiodis, P. (2005). Entrepreneurship and university-based technology transfer. Journal of Business Venturing, 20, 241-263. https://doi.org/10.1016/J.JBUSVENT.2003.12.003.

Morales Gualdrón, Silvia Teresa. (2020). Una mirada a la evolución de la creación de spin-offs académicas en países iberoamericanos: los casos de España y Colombia. Tec Empresarial, 14(2), 32-46. https://dx.doi.org/10.18845/te.v14i2.5093

Mosquera, G., & Barbosa, J. (2021). El emprendimiento resultado de investigación: una tarea pendiente en Colombia. , 19. https://doi.org/10.15665/ENCUEN.V19I01.1685.

Munari, F., & Toschi, L. (2011). Do venture capitalists have a bias against investment in academic spin-offs? Evidence from the micro- and nanotechnology sector in the UK. Industrial and Corporate Change, 20, 397-432. https://doi.org/10.1093/ICC/DTQ053.

Naranjo Africano, G., (2011). Spin-off académica en Colombia: estrategias para su desarrollo. Multiciencias, 11(1), 35-43.

Ndonzuau, F., Pirnay, F., & Surlemont, B. (2002). A stage model of academic spin-off creation. Technovation, 22, 281-289. https://doi.org/10.1016/S0166-4972(01)00019-0.

Norman, G., & Eisenkot, R. (2017). Technology Transfer: From the Research Bench to Commercialization. JACC: Basic to Translational Science, 2, 197 - 208. https://doi.org/10.1016/j.jacbts.2017.03.004.

O'Shea, R., Allen, T. J., Chevalier, A., & Roche, F. (2005). Entrepreneurial orientation, technology transfer and spinoff performance of U.S. universities. Research Policy, 34(7), 994-1009.

Page, M., McKenzie, J., Bossuyt, P., Boutron, I., Hoffmann, T., Mulrow, C., Shamseer, L., Tetzlaff, J., Akl, E., Brennan, S., Chou, R., Glanville, J., Grimshaw, J., Hrõbjartsson, A., Lalu, M., Li, T., Loder, E., Mayo-Wilson, E., McDonald, S., McGuinness, L., Stewart, L., Thomas, J., Tricco, A., Welch, V., Whiting, P., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews.. Journal of clinical epidemiology. https://doi.org/10.1016/j.jclinepi.2021.03.001.

Paola, N. (2013). Spin Off Firms from College Students: The Determinants of Entrepreneurial Intentions. Social Sciences Education eJournal.

Patzelt, H., & Shepherd, D. (2009). Strategic Entrepreneurship at Universities: Academic Entrepreneurs' Assessment of Policy Programs. Entrepreneurship Theory and Practice, 33, 319 - 340. https://doi.org/10.1111/j.1540-6520.2008.00291.x.

Rasmussen, E., & Wright, M. (2015). How can universities facilitate academic spin-offs? An entrepreneurial competency perspective. JOURNAL OF TECHNOLOGY TRANSFER, 40(5), 782–799. https://doi.org/10.1007/s10961-014-9386-3

Rasmussen, E., Mosey, S., & Wright, M. (2014). The influence of university departments on the evolution of entrepreneurial competencies in spin-off ventures. RESEARCH POLICY, 43(1), 92–106. https://doi.org/10.1016/j.respol.2013.06.007

Rasmussen, E., Mosey, S., & Wright, M. (2015). The transformation of network ties to develop entrepreneurial competencies for university spin-offs. ENTREPRENEURSHIP AND REGIONAL DEVELOPMENT, 27(7–8, SI), 430–457. https://doi.org/10.1080/08985626.2015.1070536

Reina, D., Rapini, M., & Corradi, A. (2023). Motivations for University-Industry Interaction: A Typology of Academic Scientists at the National University of Colombia. Innovar. https://doi.org/10.15446/innovar.v34n92.99300.

Restrepo Pimienta, J. L., Heras Montes, F. A., Aponte García, M. S., & Romero Sánchez, A. (2024). Nulidad e inexistencia del acto administrativo en Colombia. Editorial UCEVA. http://hdl.handle.net/20.500.12993/4676

Romero Rueda, F., Rueda Forero, P., Estevez, F. A., & Barrientos Monsalve, E. J. (2022). LA IMPORTANCIA DE LA CREACION DE LAS SPIN-OFF ACADEMICAS. REVISTA COLOMBIANA DE TECNOLOGIAS DE AVANZADA (RCTA), 2(40), 62-70. https://doi.org/10.24054/rcta.v2i40.2353

Romero Sánchez, A., Aponte García, M. S., López Trujillo, M., y Salcedo Mosquera, J. D. (2023). Spin-offs universitarias en Colombia: análisis desde la investigación, innovación y emprendimiento. Revista Venezolana De Gerencia, 28(No. Especial 9), 832-849. https://doi.org/10.52080/rvgluz.28.e9.51

Romero, A., Perdomo-Charry, G. and Burbano-Vallejo, E.L. (2024a) 'Exploring the entrepreneurial landscape of university-industry collaboration on public university spin-off creation: A systematic literature review', Heliyon. https://doi.org/10.1016/j.heliyon.2024.e27258

Romero, A., Perdomo-Charry, G. and Burbano-Vallejo. (2024b). Academic Spin-offs through the Lens of Pragmatism and Mixed Methods . EVOLUTIONARY STUDIES IN IMAGINATIVE CULTURE, 30–67. https://doi.org/10.70082/esiculture.vi.951

Romero-Sánchez, A., Perdomo-Charry, G., & Burbano-Vallejo, E. L. (2024c). From academic entrepreneurship to the performance of academic spin-offs: A systematic review of the international gap and the Colombian context. Review of Contemporary Philosophy, 23(1), 667-700. https://doi.org/10.52783/rcp.107

Rybnicek, R., Königsgruber, R. (2019). What makes industry–university collaboration succeed? A systematic review of the literature. J Bus Econ 89, 221–250. https://doi.org/10.1007/s11573-018-0916-6

Sciarelli, M., Landi, G. C., Turriziani, L., & Tani, M. (2021). Academic entrepreneurship: founding and governance determinants in university spin-off ventures. JOURNAL OF TECHNOLOGY TRANSFER, 46(4, SI), 1083–1107. https://doi.org/10.1007/s10961-020-09798-2

Sciarelli, M., Landi, G., Turriziani, L., & Tani, M. (2020). Academic entrepreneurship: founding and governance determinants in university spin-off ventures. The Journal of Technology Transfer, 46, 1083 - 1107. https://doi.org/10.1007/s10961-020-09798-2.

Shook, C., & Bratianu, C. (2010). Entrepreneurial intent in a transitional economy: an application of the theory of planned behavior to Romanian students. International Entrepreneurship and Management Journal, 6, 231-247. https://doi.org/10.1007/S11365-008-0091-2.

Siegel, D., Veugelers, R., & Wright, M. (2007). Technology transfer offices and commercialization of university intellectual property: performance and policy implications. Oxford Review of Economic Policy, 23, 640-660. https://doi.org/10.1093/OXREP/GRM036.

Soetanto, D. P., & van Geenhuizen, M. (2011). Social networks, university spin-off growth and promises of `living labs'. REGIONAL SCIENCE POLICY AND PRACTICE, 3(3, SI), 305–321. https://doi.org/10.1111/j.1757-7802.2011.01044.x

Soetanto, D., & Geenhuizen, M. (2015). Getting the right balance: University networks' influence on spin-offs' attraction of funding for innovation. Technovation, 36, 26-38. https://doi.org/10.1016/J.TECHNOVATION.2014.10.008.

Sternberg, R. (2014). Success factors of university-spin-offs: Regional government support programs versus regional environment. TECHNOVATION, 34(3), 137–148. https://doi.org/10.1016/j.technovation.2013.11.003

Tagliazucchi, G., Marchi, G., & Balboni, B. (2021). A nonlinear relationship between the team composition and performance in university spin-offs. TECHNOLOGICAL FORECASTING AND SOCIAL CHANGE, 172. https://doi.org/10.1016/j.techfore.2021.121061

Urriago Fontal, J. C., Salcedo Mosquera, J. D., Romero Sánchez, A., & Aponte García, M. S. (2023). Consolidación de procesos investigativos integrando criterios de acreditación en alta calidad educativa y tecnologías en Cauca-Colombia . Revista De Ciencias Sociales, 29(3), 112-123. https://doi.org/10.31876/rcs.v29i3.40701

Victoria, D., Aponte García, C.., García Valdés, M. P., Aponte García, M. S., & Romero Sánchez, A. (2022). La posición de la incumbencia especial – Formulación de un concepto. Editorial UCEVA. http://hdl.handle.net/20 500.12993/2295

Visintin, F., & Pittino, D. (2014). Founding team composition and early performance of university Based spin-off companies. TECHNOVATION, 34(1), 31–43. https://doi.org/10.1016/j.technovation.2013.09.004

Walter, T., Ihl, C., Mauer, R., & Brettel, M. (2018). Grace, gold, or glory? Exploring incentives for invention disclosure in the university context. The Journal of Technology Transfer, 43, 1725-1759. https://doi.org/10.1007/S10961-013-9303-1.

Wright, M., Mosey, S., & Noke, H. (2012). Academic entrepreneurship and economic competitiveness: rethinking the role of the entrepreneur. Economics of Innovation and New Technology, 21, 429 - 444. https://doi.org/10.1080/10438599.2012.656528.