

# Creation of University or Academic Spin-Offs: A Study of Failure and Success Factors

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## Abstract

Sharing knowledge produced by university research is still a complex activity, especially when it comes to commercial exploitation. One way to share this knowledge is through the creation of these university or academic spin-offs. In this context, this article aims to identify the main factors of failure and success related to the creation of these spin-offs, through a systematic review of the literature. The results of the research made it possible to understand what motivates the failure or success of university or academic spin-offs based on the concepts found in the literature that guides this article. In addition, the factors identified in this research provide valuable insights for the development of strategies that allow structuring initiatives for the creation of better targeted and successful spin-offs. Therefore, it is possible to conclude that, regardless of the number of success or failure factors found in each category, all have their due importance, to a greater or lesser degree, as they directly impact the creation and maintenance of university or academic spin-offs.

## Keywords

Academic Spin-Off, University Spin-Off, Failure Factors, Success Factors

## 1. Introduction

One of the main responsibilities of universities is the development of scientific and technological knowledge, with broad expertise and impact linked to the progress of society (Calderón-Hernández, Jiménez-Zapata, & Serna-Gomez, 2020).

In Brazil, the article 207 of the 1988 Federal Constitution (Brazil, 1988) states that the Brazilian public university can be defined by three main factors: teaching, research and extension. Through policies and regulations specific to and external

to the institution, the community develops projects whose main objective is the generation of new knowledge or the evolution of existing knowledge (Czarnitzki & Lopes-Bento, 2014).

As a result, these projects can develop services or products with the potential to be shared with society, especially projects designed and implemented in public universities. However, Brazilian higher education does not envision the large-scale manufacturing and production of technologies developed by the academic community as part of its mission (Brazil, 1996).

The solution to this dilemma presents itself in the possibility of transferring technology created in the institution to organizations that are capable of finalizing development and producing on a large scale. Therefore, universities need to strengthen the university-industry-government partnership and foster university entrepreneurship.

It is worth noting that data from 2020 published by the Ministry of Science, Technology and Innovation—MCTI, through a report that presents data provided by Scientific, Technological and Innovation Institutions, indicate that of the research organizations, 199 are public and 135 institutions had requests for intellectual property protection or requests granted. Of these, 83 are Public Higher Education organizations and were responsible for 1571 requests for intellectual property protection of their creations (FORMICT, 2024). The report also points out that, although the Innovation Law allows Scientific, Technological and Innovation Institutions, including universities, to enter into technology transfer and licensing contracts for the right to use or exploit developed creations, of the 135 public institutions, only 58 had technology contracts signed in 2020, with Higher Education Institutions representing the majority.

This information highlights the difficulties that universities, especially public universities, face in ensuring that their technological creations, the result of their projects, reach the target audience. Thus, the creation of university or academic spin-offs (spin-offs can be called by both nomenclatures referring to the same type of spin-off) emerges as an alternative for the results of research developed within universities to reach production and market bias. University or academic spin-offs consist of companies created with the objective of exploiting intellectual property held in academia (THE, 2022). Spin-offs combine a product or service to be marketed and the know-how of university members so that it is possible to explore new opportunities (Carayannis et al., 1998).

There is relevance in creating this type of company, as it is a requirement evaluated in the rankings of entrepreneurial universities, including by the Ministry of Science, Technology and Innovation (MCTI, 2023). The Ministry of Science, Technology and Innovation produces an annual report in which it requests the number of spin-offs developed by these institutions. In the 2020 document, the information is that of the 199 Scientific, Technological and Innovation Institutions surveyed, only 31 developed Spin-offs.

Furthermore, it is worth highlighting the relevance of the regional context in

which a university or academic spin-off is created, since regional capacity has a significant influence and impact on the maintenance of the company that is being activated (Nesello et al., 2019). For academics, the study of the topic allows the acquisition of knowledge about the creation and adequate maintenance of university or academic spin-offs and, as a researcher, envisions a possibility of undertaking through this type of company.

The creation and maintenance of a spin-off requires dedication, effort and resilience from those who will be its founders. In this sense, this article aims to answer the following question: what factors influence the failure and success of universities or academic spin-offs?

## 2. Spin-Off

A spin-off is an organization created with new economic activities emerged from an existing company and that, through its support, becomes independent with their own viable structure (León, Salazar, & Sánchez, 2022). The initial definition of spin-off pointed out by Rubio (2009), focuses on partners or employees of the new company obtaining basic conditions for its creation in the development of a new economic activity associated with novelties produced in the original organization.

The recognition of an organization of this type can be carried out when three premises are highlighted: it has linked to its emergence an organization that already exists and which the literature calls the mother organization; involve individuals who work and have varied functions within the parent organization; and whoever creates an organization (spin-off) leaves the parent organization to found a new company—Spin-off (Pirnay, Surlemont, & Nlemvo, 2003).

There are three spin-off models: reactive, proactive and non-offensive. The first of these refers to developing solutions in advance or when the objective is to maintain a certain competence that could be better developed outside the original organization. In the case of the proactive model, the spin-off is created to make the activities and/or products of the original company grow in the external market. It is suggested that a new company be developed so that it can have an innovative focus in order to work with new products and/or new markets (Rubio, 2009).

Spin-offs arise from any type of organization, whether private or public, for-profit or not-for-profit, of products or services (Carayannis et al., 1998). The involvement of companies and universities in product and service development activities allows us to glimpse ways of exploring the assets and skills explored (Clarysse, Wright, & Van de Velde, 2011).

In the context of universities, transferring developed technology has been a challenge. One way to carry out this activity is through licensing, which presents some difficulty considering the imminent risk due to the level of maturity of the invention, that is, it is still in the very early stages of the product, process or service. In this context, university or academic spin-offs are suggested as a viable alternative capable of reducing tensions arising from this problem, as they are cre-

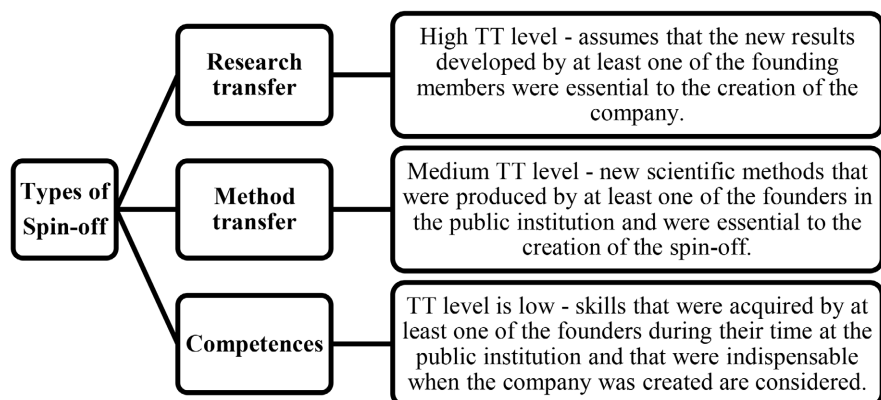
ated with the specific purpose of transferring knowledge and technologies generated in universities, aiming at commercial exploitation (Pirnay, Surlemont, & Nlemvo, 2003; Clarysse, Wright, & Van de Velde, 2011).

University or academic spin-offs arise so that technology-based processes, products or services produced by universities can be commercially exploited (Rubio, 2009). These are companies created by researchers from public institutions, employees, professors and students; those that intend to license technological creations from public institutions; and those that arise from public investment (OECD, 2001).

Furthermore, this type of company, which emerges from academia, allows the university to fulfill its mission of providing society with solutions in the most diverse areas, such as social, economic, political and cultural areas; as well as favoring regional development and the country's competitiveness (Calderón-Hernández, Jiménez-Zapata, & Serna-Gomez, 2020; Carayannis et al., 1998). Universities are favorable environments for the creation of technology and are concerned that the inventions developed reach society and that society can benefit from academic production.

Thus, knowledge launched on the market via spin-off can be offered in the following ways, **considering** the function of this type of company: providing knowledge; offering a product or service; and providing solutions to demands from the market, in order to mediate technology transfer (Fontes, 2005).

Müller (2010) demonstrated that knowledge, the focus of technology transfer in academia, is highly heterogeneous. The study identifies three types of spin-offs based on the level of research outcomes—whether a product or service—and their connection to this type of organization, as shown in Figure 1.



Source: Müller (2010).

**Figure 1.** Types of spin-offs according to the result to be transferred.

Another classification relating to the types of university or academic spin-offs highlights their members and the specificity of the activities that their members carry out, as idealized by Pirnay, Surlemont and Nlemvo (2003) and demonstrated in Figure 2.

Nature of transferred knowledge		Individual Status	
		Researcher	Student
		Academic spin-	Student spin-off
		TYPE I	TYPE III
Codified	Service-oriented spin-off	TYPE II	TYPE IV
Tacit	Service-oriented spin-off		

Source: Pirnay, Surlemont, & Nlemvo (2003).

**Figure 2.** Typology of universities or academic spin-offs.

Analyzing **Figure 2**, “Type I” spin-offs involve academic researchers as members, with a focus on transferring technology in the form of a product. “Type II,” by contrast, also includes academic researchers but emphasizes tacit knowledge—know-how—aimed at providing services through the spin-off. “Type III” comprises students as members and centers on knowledge that results in a product as the business focus. Finally, “Type IV” also includes students but relies on tacit knowledge, leading to the provision of services as the spin-off’s core activity (Pirnay, Surlemont, & Nlemvo, 2003).

Regardless of the type of academic spin-off created, the founders’ skills are critical in determining the company’s pace of development and market impact, as well as its contribution to the university. Therefore, it is essential for universities to implement policies that incentivize spin-off creation as a means of technology transfer, fostering a secure environment for these companies to grow (Müller, 2010). The process of technology transfer in a university, since it arises from research and consequently generates new knowledge, will be strongly influenced by the type of knowledge generated and capable of being transferred. Aspects such as bureaucracy, especially in public universities, and intellectual protection of the technologies created may also affect the time it takes to create spin-offs with the aim of transferring technologies (Müller, 2010).

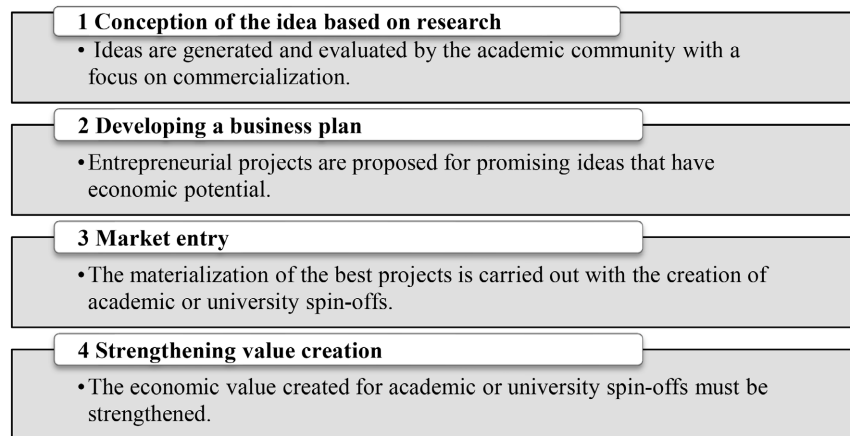
It is important to highlight the way in which university or academic spin-offs act in the transformation process, enabling the knowledge produced by higher education institutions to be the focus of commercial exploitation: bringing the results of university research to the market in the form of technology, making knowledge accessible to the market and enabling the diversification of possible application areas, and being an active player in the transfer of technology from universities, identifying knowledge that can be taken to the market and commer-

cially exploited, including adapting creations to specific contexts (Fontes, 2005).

From the development of research which results in technology linked to innovative knowledge, be it a product, process or service, the process of creating a university or academic spin-off will begin. In order to add value to the technology generating the new company, it is suggested that the following requirements be met: (Rubio, 2009):

- Confirm the market potential.
- Have a level of maturity appropriate for the Market.
- Have intellectual protection that guarantees the rights related to the technology.

Based on applied research with public and academic authorities, Ndonzuau, Pirnay, and Surlemont (2022) developed a four-stage model for the creation of university or academic spin-offs, as illustrated in Figure 3.



Source: Ndonzuau, Pirnay, & Surlemont (2002).

**Figure 3.** Stages of the process of creating universities or academic spin-offs.

The research conducted with universities indicated that two main difficulties were encountered in phase 1 of the proposed model: academic culture and internal identification. Regarding culture, the university policy that encourages and promotes publications as a way of advancing research professors is cited. These aspects do not motivate university researchers to undertake projects, and publishing research can destroy the originality of a result that could be exploited commercially. Another issue is the ambiguous relationship between professors and financial returns from the results of their research: professors understand that funding is a means for research to be carried out, and when it comes to companies, financial returns are also part of the process. Finally, the authors highlighted the need to show academia that developing research that results in applicable technologies is a way of reaching society and taking the knowledge developed to it. Internal identification is related to the university's ability to structure itself so that it is possible to train and advise those interested in undertaking projects and identify ideas that may be capable of being exploited commercially (Ndonzuau, Pirnay,

& Surlemont, 2002).

In the second step of the model, ideas are developed into structured entrepreneurial projects. This transformation focuses on protecting and developing the new idea. The protection of the creation that will be the object of the project is concerned with identifying its creators and the possibility of protection, which will require technical knowledge and financial resources. When it comes to development, the creation of a prototype is proposed so that commercial exploitation can be identified; in addition, a business plan is also drawn up that demonstrates how commercial exploitation will be carried out (Ndonzuau, Pirnay, & Surlemont, 2002). Furthermore, the financing required for this phase becomes a barrier for most university entrepreneurs (Ndonzuau, Pirnay, & Surlemont, 2002).

In phase three, the focus is on launching the university or academic spin-off on the market. Resources are a concern at this stage of the model and refer to both labor, i.e., personnel resources and their capabilities, as well as financial and material resources for implementation. Another issue at this stage is the relationship between the university and the spin-off. In the relationship between the spin-off and the mother university, the study is conducted on how the latter can assist the new company, whether through financial resources, assets for commercialization, or work structure. Furthermore, the relationship between researchers who are related to or in the spin-off and the mother university can generate a conflict of interest, in the case of favoritism towards the new company that is being created due to such relationship (Ndonzuau, Pirnay, & Surlemont, 2002).

Phase 4 of the Ndonzuau, Pirnay and Surlemont (2002) model is related to the risk of changing the location of the spin-off, since the technologies developed by this type of company are highly innovative, and changing the location may generate a lack of personnel and structure for the spin-off to operate if the location in which it is established does not favor its growth. Furthermore, the authors point out that due to financial issues, product-oriented spin-offs tend, at the beginning, to provide consulting services to finance their technologies and place them on the Market. If spin-offs maintain their initial strategy of providing consulting services, meeting local demand for technologies that the spin-off could produce would be compromised and the spin-off would lose the opportunity to be successful.

The phases presented in **Figure 3** are not entirely independent, each influencing the other and all are relevant for the model to work (Ndonzuau, Pirnay, & Surlemont, 2002). The model is not linear and each stage depends on the quality of what was achieved in the previous phase. And not every idea or opportunity considered interesting will be converted into the creation of academic or university spin-offs.

Carrying out the suggested process presents obstacles, difficulties, impediments, and other resistances, and is not a simple activity to carry out, but it can be a way to be adopted in the process of creating academic or university spin-offs (Ndonzuau, Pirnay, & Surlemont, 2002).

Considering the aspects related to the process of creating universities or aca-

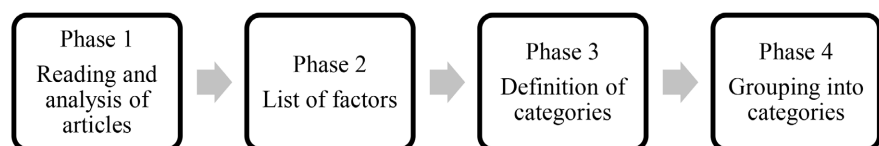
demographic spin-offs, a variety of aspects that should be considered in their creation can be seen. Theory suggests that there are many factors that can contribute to the creation and maintenance of universities or academic spin-offs, therefore, this article aims to raise aspects related to the success and failure of this type of organization.

### 3. Methodology

The article aims to investigate the factors that may motivate or hinder the success of creating and maintaining university spin-offs. The difference between motivating or hindering factors was determined based on concepts obtained in the articles studied and globally accepted trends in the literature through a systematic literature review (Macedo, 2022). To achieve this, a search was conducted in three databases—Scopus, Web of Science, and Emerald—using the constructs “university or academic spin-offs” and “framework.”

There were few articles involving frameworks and most of the files found were from the academic spin-off or university spin-off constructs. The choice of the articles and its relevance to the research was made based on the analysis of the title, abstract and keywords. In total, 96 articles were found covering these constructs. Among these 96 articles, 78 articles were selected to identify success and failure factors. The main challenge was to extract the articles that cited negative and limiting aspects and aspects considered motivating and facilitating the development of spinoffs, based on the interpretation of the concepts found in these articles, and then group these factors into categories.

To identify the success and failure factors, the steps necessary to carry out this research were presented in **Figure 4**.



Source: Authors.

**Figure 4.** Research phases.

Phase 1, reading and analyzing the articles, allowed us to identify which articles contained relevant information to achieve the objective of this research. Thus, the reading of the articles aimed to select the articles that contained in their content factors of failure and factors of success in the creation and maintenance of university spin-offs. At the same time, the articles were separated into a list of articles that presented factors of failure in the creation and maintenance of university spin-offs and another list with articles that reported aspects of the factors of success in the creation and maintenance of university spin-offs. In the end, of these 96 articles, 77 articles contained success and failure factors.

In phase two, we identified what we call a list of factors, that is, by rereading the

selected articles, we identified what we call success and failure factors. This list therefore contains success and failure factors identified in the creation and maintenance of university spin-offs. In addition to the success and failure factors included in the list, we also selected the articles from which each success and failure factor was extracted, as well as the author of each article. It is worth noting that the list of failure factors included 127 factors and the list of success factors presented 130 success factors. All these factors were extracted from the 77 articles analyzed.

In phase three, through the analysis of each of the lists of failure factors and success factors, categories were created so that these factors could be grouped into each of them based on the relationship that exists between the categories and factors. Ten categories were listed for each type of success and failure factor. This grouping of categories and factors was carried out based on positive and negative concepts for the development of spinoffs extracted from the literature. All of these categories have their due influence and importance in this process; however, this study was limited to identifying them only, and did not determine which categories should be prioritized in the creation of spinoffs.

In phase four, the identified factors were grouped into categories in which they had some relationship. In total, there were 127 failure factors and 130 success factors divided into each of these 10 categories according to the relationship between each of them.

## 4. Results and Discussion

This chapter presents the results of the research following the methodology described in chapter 3 of methodology. The research was applied following the steps presented in phases 1 to 4, as shown in **Figure 4**. In addition, this topic presents a discussion on the topic through a comparison between the failure factors and success factors for the creation and maintenance of university spin-offs, as well as identifies the categories created to group the failure and success factors related to the creation and maintenance of university spin-offs, in order to point out aspects that hinder and encourage the creation and maintenance of university or academic spin-offs.

### 4.1. Presentation of Research Results

#### Failure Factors

##### Phase 1: Reading and Analysis of Articles

From the selected articles, factors that limit the development and growth of university or academic spin-offs were identified and classified as failure factors. Out of the 78 articles reviewed, 45 contained characteristics related to the failure of university or academic spin-offs. These factors were extracted from concepts considered negative and limiting to the development of spinoffs according to the authors' concepts listed in **Table 1**.

##### Phase 2: List of Failure Factors

After analyzing the 45 articles, all identified failure factors were compiled into a table, resulting in 127 distinct factors. It is important to note that individual articles often mentioned multiple failure factors, meaning the total number of factors exceeds the number of articles analyzed. **Table 1** provides a detailed list of the failure factors associated with the creation of university spin-offs as identified in the reviewed articles.

**Table 1.** Failure factors table.

Failure factors	Authors	Failure factors	Authors
External features such as regional infrastructure	O'Shea, Chugh and Allen (2008)	Lack of market-oriented research institutions	Zhou et al. (2011)
Country and region specific differences	Hossinger, Chen and Werner (2020)	Lack of best practices for entrepreneurship	Montiel-Campos (2018)
Being in an environment conducive to entrepreneurship	Lockett et al. (2005)	Lack of qualified professionals at the university for guidance	Botelho and Almeida (2011)
Evolution of the ecosystem in the spin-off region	Bagchi-Sen, Baines and Lawton Smith (2020)	Lack of a legal arrangement conducive to innovation	Hayter, Lubynsky and Maroulis (2017)
Lack of external support (where it is located)	Harrison and Leitch (2010)	Lack of an "entrepreneurial culture"	Hayter, Lubynsky and Maroulis (2017)
Infrastructure (environments conducive to innovation)	Gómez Gras et al. (2008)	Academic system	Hossinger, Chen and Werner (2020)
Entrepreneurial competence	Bolzani, Rasmussen and Fini (2020)	Human capital	Gómez Gras et al. (2008)
Weak entrepreneurial culture and infrastructure	Botelho and Almeida (2011)	Homogeneous team composition	Santos and Teixeira (2012)
University culture not conducive to technology transfer, culture clash between industry and academia	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Recruitment of personnel with connection to the market	Wennberg, Wiklund and Wright (2011)
Conceptual divergences,	Czakov, Jedynak and Konopka-Cupiał (2022)	Employee engagement	Hayter, Lubynsky and Maroulis (2017)
Involvement in entrepreneurial activity (studies of individual characteristics)	O'Shea, Chugh and Allen (2008)	Diverse team	Lockett et al. (2005)
Institutional and cultural studies	O'Shea, Chugh and Allen (2008)	Very young team	Fiorentino et al. (2022)
Existence of myths and misconceptions about academic entrepreneurship	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Delayed Human Resource Management	Zhou et al. (2011)
Lack of a model to stimulate entrepreneurial culture	Oliveira (2015)	Human capital limitations	Hayter, Lubynsky and Maroulis (2017)
Lack of entrepreneurial skills, knowledge and	Hossinger, Chen and Werner (2020)	Internal capabilities	Freitas et al. (2012)
Lack of training in entrepreneurship	Neves and Franco (2016)	Organizational characteristics Bureaucracy	Hossinger, Chen and Werner (2020)

## Continued

Internal governance conflicts	Hossinger, Chen and Werner (2020); Ndonzuau, Pirnay and Surlemont (2002)	Conflict of interest	Hossinger, Chen and Werner (2020); Ndonzuau, Pirnay and Surlemont (2002)
Difficulty in the project of enterprise	Ndonzuau, Pirnay and Surlemont (2002)	Insufficient political support	Zhou et al. (2011)
Delayed management style	Zhou et al. (2011)	Lack of public support	Kulkov et al. (2019)
Irrational management structure	Zhou et al. (2011)	Lack of public policy	Lockett et al. (2005)
Lack of professional management	Lockett et al. (2005)	Vague beneficial interests	Zhou et al. (2011)
Lack of growth	Yagüe-Perales and March-Chordà (2012)	Adaptation to the market	Santos and Teixeira (2012)
Lack of economies of scale	Zhou et al. (2011)	Market-seeking alliances reduce the probability of failure, while technology-seeking alliances increase the probability of failure.	Bruneel et al. (2020)
Lack of legitimacy with companies and universities	François and Philippart (2019)	Trade barriers	Kulkov et al. (2019)
Delayed Operation Philosophy	Zhou et al. (2011)	Market demand	van Geenhuizen and Soetanto (2009)
Project management	Santos and Teixeira (2012)	Being away from the market	Modina et al. (2024)
Ambiguous corporate governance	Zhou et al. (2011)	Lack of applicability of knowledge	Hossinger, Chen and Werner (2020)
Individualism of entrepreneurs/researcher	Neves and Franco (2016)	Lack of application of knowledge	Neves and Franco (2016)
Business mismanagement	Ndonzuau, Pirnay and Surlemont (2002)	Lack of trust from future customers	Santos and Teixeira (2012)
Unable to separate spin-off and parent university	Ndonzuau, Pirnay and Surlemont (2002)	Government support	Zhang (2009)
Business-oriented management concerns	Zhou et al. (2011)	Negative link between the inventor's ongoing interaction with the university and with the spin-off	Laage-Hellman et al. (2020)
Internal governance issues	Hossinger, Chen and Werner (2020)	Suitable business model	Martínez-Martínez et al. (2021)
Management overload	van Geenhuizen and Soetanto (2009)	Little experience of entrepreneurs	Santos and Teixeira (2012)
Lack of external relationships	Laage-Hellman et al. (2020); Harrison and Leitch (2010)	Contact networks	Freitas et al. (2012)
lack of market selectivity - Business model analysis	Botelho and Almeida (2011)	Spin-off policies that offer little support.	Botelho and Almeida (2011)
Weak collaboration between universities and industry.	Montiel-Campos (2018)	Few incentives	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)

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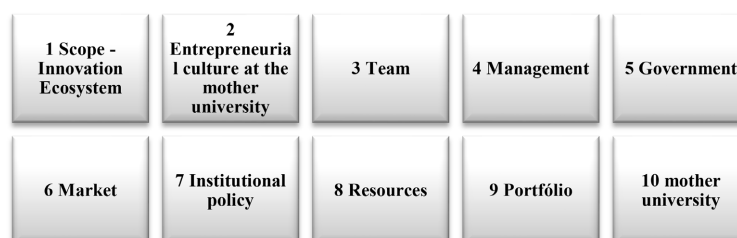
Degree of technology maturity	Zhang (2009)	Support programs	van Geenhuizen and Soetanto (2009)
Negative impact-trying to over-anticipate customer expectations: proactive customer intelligence generation (PCIG)	Buratti, Profumo and Persico (2021)	Legal restrictions on spin-off creation	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Technological ties maintained by academic entrepreneurs committed to serving the technological development of parent universities have a negative impact on the market performance of spin-offs	Bolzani, Rasmussen and Fini (2020)	Diversity of product and service categories offered by spin-offs.	Baines and Smith (2019).
Support in the development of business plans offered by public institutions	Czakoń, Jedynak and Konopka-Cupiał (2022);	Insufficient financial support	Zhou et al. (2011)
Lack of monetary incentives for researchers	Muscio, Quaglione and Ramaciotti (2016)	Venture capital	Yagüe-Perales and March-Chordà (2012)
Lack of institutional policy	Muscio, Quaglione and Ramaciotti (2016)	High cost to generate spin-off	Odei and Stejskal (2018)
Lack of policy	Lockett et al. (2005); Fini et al. (2017)	Difficulty in obtaining financial support due to bureaucracy	Hossinger, Chen and Werner (2020)
Internal regulations for the creation of spin-offs	Muscio, Quaglione and Ramaciotti (2016)	Lack of venture capital	Zhou et al. (2011)
Lack of policy that motivates the creation of spin-offs	Montiel-Campos (2018)	Lack of resources	Hayter, Lubynsky and Maroulis (2017)
Technology stock - capacity to generate new technological innovations	Gómez Gras et al. (2008)	Lack of resources	Neves and Franco (2016)
Patenting	Yagüe-Perales and March-Chordà (2012)	Lack of financial resources	Vega-Gómez et al. (2020)
Lack of financial resources	Kulkov et al. (2019)	Resources and capabilities of the ttos ability to seek external financing	Gómez Gras et al. (2008)
Infrastructure	Hayter, Lubynsky and Maroulis (2017)	Support from the parent university	van Geenhuizen and Soetanto (2009)
Infrastructure	van Geenhuizen and Soetanto (2009)	Links with parent universities can also introduce liabilities that limit their market performance.	Bolzani, Rasmussen and Fini (2020)
Risk of investing in SPIN-offs	Munari and Toschi (2011)	Lack of intervention by the university management team	François and Philippart (2019)
Inadequate type of financing	Martínez-Martínez et al. (2021)	Lack of infrastructural support.	Zhou et al. (2011)

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Difficulty accessing tangible resources such as structure and machinery	Ndonzuau, Pirnay and Surlemont (2002)	Lack of internal support (university)	Harrison and Leitch (2010)
Difficulty in raising funds	Fini et al. (2017)	Lack of internal relationship with the parent university	Laage-Hellman et al. (2020)
Shortage of resources for investment	Santos and Teixeira (2012)	Lack of support from the home institution	Santos and Teixeira (2012)
Structure of resources and capabilities that the parent organization provides	Yagüe-Perales and March-Chordà (2012)	The fact that the parent university was not properly asked to rescue a process that was failing.	François and Philippart (2019)
Lack of access to tangible resources	Lockett et al. (2005)	Minimum university-business-state integration	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Lack of facilities	Zhou et al. (2011)	Support measures provided by universities	Gómez Gras et al. (2008)
Lack of intangibles	Lockett et al. (2005)	The attributes of universities such as human capital, commercial resources and institutional activities	O'Shea, Chugh and Allen (2008)
Lack of resources	Ndonzuau, Pirnay and Surlemont (2002)	Researchers ignore the institution's formal process	Fini et al. (2017)
Insufficient investment	Montiel-Campos (2018)	Accommodation problems	van Geenhuizen and Soetanto (2009)
Non-Availability of Resources	Ndonzuau, Pirnay and Surlemont (2002)	Relationships that must be established between the spin-off company and its parent university	Ndonzuau, Pirnay and Surlemont (2002)
Bias on the part of venture capital firms against investing in asos	Munari and Toschi (2011)	Financial issues to transform the invention into a developed technological product	Ndonzuau, Pirnay and Surlemont (2002)
Cash flow problems	van Geenhuizen and Soetanto (2009)		

**Phase 3: Definition of Categories**

In the articles researched, 127 factors were found that can lead a spin-off to failure. These factors were grouped into categories. Each of these categories grouped a set of failure factors. A total of ten categories were classified as shown in **Figure 5**.



Source: prepared by the authors.

**Figure 5.** Failure categories.

When analyzing the list of failure factors found in the researched articles, it was noted that some of these factors referred to the region where the spin-off is located or to the region's link with innovation. Thus, the first category, "Scope – innovation ecosystem", was defined, as can be seen in **Figure 5**.

The description of characteristics related to how the parent university drives motivation for entrepreneurship was also presented among the failure factors found in the articles analyzed, with this category being called "entrepreneurial culture of the parent university".

In several articles researched, factors related to the number of employees and the method of choosing these professionals were found as reasons for the failure of spin-offs. These factors were grouped into a category called "Team". Failure factors related to spin-off management were also found. These factors highlighted in the researched articles were grouped into another category called "Management".

Government support, also present in the list of failure factors identified in the articles researched, was grouped into a category called "Government". There were many failure factors also related to the market environment in which the spin-off is or should be inserted, indicating a negative influence on the creation and maintenance of this type of organization. These factors were grouped into the category called "Market".

Some articles also pointed out failure factors related to the lack of a consistent "Institutional Policy" on the part of the mother university, with clear and specific rules that provide motivation for its researchers. Another category, called "Portfolio", was created based on failure factors that linked the failure of spin-offs to the lack of development of diverse technologies by these companies.

The lack of adequate infrastructure, as well as lack of investment, were also presented in several researched articles and considered as factors of failure. These factors were grouped into a category called "Resources".

Finally, the "Parent University" category was created to encompass the various failure factors that dealt with aspects directly related to the parent university and that affect the creation and maintenance of university spin-offs. Highlights include the lack of support from the parent university in providing adequate infrastructure and the lack of a relationship with the university spin-off.

#### **Phase 4: Category Group**

**Table 2** shows the number of factors related to each category. The same article may have cited several failure factors that were classified as belonging to a given category, as shown in **Table 2**.

**Table 2.** Number of factors cited in their categories.

<b>Category</b>	<b>Number of factors</b>
Resources	27
Management	20
Market	19

**Continued**

Entrepreneurial culture	16
Mother university	14
Institutional policy	9
Team	8
Scope - Innovation Ecosystem	6
Government	5
Portfolio	3
Total	127

Source: Authors.

Considering the failure factors cited in the articles, the category “resources” stood out, which includes infrastructure and financial resources. Next came the categories management, market, entrepreneurial culture and parent university with the most significant results.

**Table 3** presents the classification of failure factors in each category, as well as the authors who cited each failure factor. Each category (Cat.) is represented by an equivalent numbering as shown in **Figure 5**: 1 Scope - Innovation Ecosystem, 2 Entrepreneurial culture at the mother university, 3 Team, 4 Management, 5 Government, 6 Market, 7 Institutional policy, 8 Resources, 9 Portfolio, 10 Mother university.

**Table 3.** Factors classified by category.

Cat.	Failure factors	Authors	Cat.	Failure factors	Authors
1	External features such as regional infrastructure	O’Shea, Chugh and Allen (2008)	2	Lack of market-oriented research institutions	Zhou et al. (2011)
1	Country and region specific differences	Hossinger, Chen and Werner (2020)	2	Lack of best practices for entrepreneurship	Montiel-Campos (2018)
1	Being in an environment conducive to entrepreneurship	Lockett et al. (2005)	2	Lack of qualified professionals at the university for guidance	Botelho and Almeida (2011)
1	Evolution of the ecosystem in the spin-off region	Bagchi-Sen, Baines and Lawton Smith (2020)	2	Lack of a legal arrangement conducive to innovation	Hayter, Lubynsky and Maroulis (2017)
1	Lack of external support (where it is located)	Harrison and Leitch (2010)	2	Lack of an “entrepreneurial culture”	Hayter, Lubynsky and Maroulis (2017)
1	Infrastructure (environments conducive to innovation)	Gómez Gras et al. (2008)	2	Academic system	Hossinger, Chen and Werner (2020)
2	Entrepreneurial competence	Bolzani, Rasmussen and Fini (2020)	3	Human capital	Gómez Gras et al. (2008)
2	Weak entrepreneurial culture and infrastructure	Botelho and Almeida (2011)	3	Homogeneous team composition	Santos and Teixeira (2012)
2	University culture not conducive to technology transfer, culture clash between industry and academia	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	3	Recruitment of personnel with connection to the market	Wennberg, Wiklund and Wright (2011)

## Continued

2	Conceptual divergences,	Czakov, Jedynek and Konopka-Cupiał (2022)	3	Employee engagement	Hayter, Lubynsky and Maroulis (2017)
2	Involvement in entrepreneurial activity (studies of individual characteristics)	O'Shea, Chugh and Allen (2008)	3	Diverse team	Lockett et al. (2005)
2	Institutional and cultural studies	O'Shea, Chugh and Allen (2008)	3	Very young team	Fiorentino et al. (2022)
2	Existence of myths and misconceptions about academic entrepreneurship	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	3	Delayed Human Resource Management	Zhou et al. (2011)
2	Lack of a model to stimulate entrepreneurial culture	Oliveira (2015)	3	Human capital limitations	Hayter, Lubynsky and Maroulis (2017)
2	Lack of entrepreneurial skills, knowledge and	Hossinger, Chen and Werner (2020)	4	Internal capabilities	Freitas et al. (2012)
2	Lack of training in entrepreneurship	Neves and Franco (2016)	4	Organizational characteristics Bureaucracy	Hossinger, Chen and Werner (2020)
4	Internal governance conflicts	Hossinger, Chen and Werner (2020); Ndonzuau, Pirnay and Surlemont (2002)	4	Conflict of interest	Hossinger, Chen and Werner (2020); Ndonzuau, Pirnay and Surlemont (2002)
4	Difficulty in the project of enterprise	Ndonzuau, Pirnay and Surlemont (2002)	5	Insufficient political support	Zhou et al. (2011)
4	Delayed management style	Zhou et al. (2011)	5	Lack of public support	Kulkov et al. (2019)
4	Irrational management structure	Zhou et al. (2011)	5	Lack of public policy	Lockett et al. (2005)
4	Lack of professional management	Lockett et al. (2005)	5	Vague beneficial interests	Zhou et al. (2011)
4	Lack of growth	Yagüe-Perales and March-Chordà (2012)	5	Government support	Zhang (2009)
4	Delayed Operation Philosophy	Zhou et al. (2011)	6	Market-seeking alliances reduce the probability of failure, while technology-seeking alliances increase the probability of failure.	Bruneel et al. (2020)
4	Lack of economies of scale	Zhou et al. (2011)	6	Trade barriers	Kulkov et al. (2019)
4	Lack of legitimacy with companies and universities	François and Philippart (2019)	6	Market demand	van Geenhuizen and Soetanto (2009)
4	Project management	Santos and Teixeira (2012)	6	Being away from the market	Modina et al. (2024)
4	Ambiguous corporate governance	Zhou et al. (2011)	6	Lack of applicability of knowledge	Hossinger, Chen and Werner (2020)
4	Individualism of entrepreneurs/researchers	Neves and Franco (2016)	6	Lack of application of knowledge	Neves and Franco (2016)

## Continued

4	Business mismanagement	Ndonzuau, Pirnay and Surlemont (2002)	6	Lack of trust from future customers	Santos and Teixeira (2012)
4	Unable to separate spin-off and parent university	Ndonzuau, Pirnay and Surlemont (2002)	6	Adaptation to the market	Santos and Teixeira (2012)
4	Business-oriented management concerns	Zhou et al. (2011)	6	Negative link between the inventor's ongoing interaction with the university and with the spin-off	Laage-Hellman et al. (2020)
4	Internal governance issues	Hossinger, Chen and Werner (2020)	6	Suitable business model	Martínez-Martínez et al. (2021)
4	Management overload	van Geenhuizen and Soetanto (2009)	6	Little experience of entrepreneurs	Santos and Teixeira (2012)
6	Lack of external relationships	Laage-Hellman et al. (2020); Harrison and Leitch (2010)	7	Legal restrictions on spin-off creation	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
6	lack of market selectivity - Business model analysis	Botelho and Almeida (2011)	7	Support programs	van Geenhuizen and Soetanto (2009)
6	Weak collaboration between universities and industry.	Montiel-Campos (2018)	8	Insufficient financial support	Zhou et al. (2011)
6	Degree of technology maturity	Zhang (2009)	8	Venture capital	Yagüe-Perales and March-Chordà (2012)
6	Negative impact - trying to over-anticipate customer expectations: proactive customer intelligence generation (PCIG)	Buratti, Profumo and Persico (2021)	8	High cost to generate spin-off	Odei and Stejskal (2018)
6	Technological ties maintained by academic entrepreneurs committed to serving the technological development of parent universities have a negative impact on the market performance of spin-offs	Bolzani, Rasmussen and Fini (2020)	8	Difficulty in obtaining financial support due to bureaucracy	Hossinger, Chen and Werner (2020)
6	Support in the development of business plans offered by public institutions	Czakon, Jedynek and Konopka-Cupiał (2022)	8	Lack of venture capital	Zhou et al. (2011)
6	Contact networks	Freitas et al. (2012)	8	Lack of resources	Hayter, Lubynsky and Maroulis (2017)
7	Lack of monetary incentives for researchers	Muscio, Quaglione and Ramaciotti (2016)	8	Lack of resources	Neves and Franco (2016)
7	Lack of institutional policy	Muscio, Quaglione and Ramaciotti (2016)	8	Lack of financial resources	Vega-Gómez, González and Pérez-Mayo (2020)
7	Lack of policy	Lockett et al. (2005); Fini et al. (2017)	8	Lack of financial resources	Kulkov et al. (2019)

## Continued

7	Internal regulations for the creation of SPIN-OFFS	Muscio, Quaglione and Ramaciotti (2016)	8	Infrastructure	Hayter, Lubynsky and Maroulis (2017)
7	Lack of policy that motivates the creation of spin-offs	Montiel-Campos (2018)	8	Infrastructure	van Geenhuizen and Soetanto (2009)
7	Spin-off policies that offer little support.	Botelho and Almeida (2011)	8	Risk of investing in SPIN-offs	Munari and Toschi (2011)
7	Few incentives	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	8	Inadequate type of financing	Martínez-Martínez et al. (2021)
8	Difficulty accessing tangible resources such as structure and machinery	Ndonzuau, Pirnay and Surlemont (2002)	9	Diversity of product and service categories offered by spin-offs.	Baines and Smith (2019)
8	Difficulty in raising funds	Fini et al. (2017)	10	Support from the parent university	van Geenhuizen and Soetanto (2009)
8	Shortage of resources for investment	Santos and Teixeira (2012)	10	Links with parent universities can also introduce liabilities that limit their market performance.	Bolzani, Rasmussen and Fini (2020)
8	Structure of resources and capabilities that the parent organization provides	Yagüe-Perales and March-Chordà (2012)	10	Lack of intervention by the university management team	François and Philippart (2019)
8	Lack of access to tangible resources	Lockett et al. (2005)	10	Lack of infrastructural support.	Zhou et al. (2011)
8	Lack of facilities	Zhou et al. (2011)	10	Lack of internal support (university)	Harrison and Leitch (2010)
8	Lack of intangibles	Lockett et al. (2005)	10	Lack of internal relationship with the parent university	Laage-Hellman et al. (2020)
8	Lack of resources	Ndonzuau, Pirnay and Surlemont (2002)	10	Lack of support from the home institution	Santos and Teixeira (2012)
8	Insufficient investment	Montiel-Campos (2018)	10	The parent university was not properly asked to rescue a process that was failing.	François and Philippart (2019)
8	Non-Availability of Resources	Ndonzuau, Pirnay and Surlemont (2002)	10	Minimum university-business-state integration	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
8	Prejudice on the part of venture capital firms against investing in spin-offs.	Munari and Toschi (2011)	10	Support measures provided by universities	Gómez Gras et al. (2008)
8	Cash flow problems	van Geenhuizen and Soetanto (2009)	10	The attributes of universities such as human capital, commercial resources and institutional activities	O'Shea, Chugh and Allen (2008)
8	Resources and capabilities of the ttos ability to seek external financing	Gómez Gras et al. (2008)	10	Researchers ignore the institution's formal process	Fini et al. (2017)

## Continued

8	Financial issues to transform the invention into a developed technological product	Ndonzuau, Pirnay and Surlemont (2002)	10	Accommodation problems	van Geenhuizen and Soetanto (2009)
9	Technology stock - capacity to generate new technological innovations	Gómez Gras et al. (2008)	10	Relationships that must be established between the spin-off company and its parent university	Ndonzuau, Pirnay and Surlemont (2002)
9	Patenting	Yagüe-Perales and March-Chordà (2012)			

Source: authors.

Within the scope of this article, understanding how success factors were classified into categories, as well as the number of de factors in times each category was cited, allows us to move on to the next phases and identify the tendency for categories to influence the failure of university spin-offs.

## 4.2. Success Factors

To present the success factors found in the analyzed articles, the methodology in **Figure 4** will be used.

### Phase 1 - Reading and analysis of articles

In this first phase, 33 selected articles were read and analyzed. In these articles, the aspects that motivate and facilitate the creation and maintenance of university or academic spin-offs were selected. These aspects were considered success factors for this type of organization. These aspects were extracted from concepts considered motivating and facilitating the development of spinoffs according to the authors' concepts listed in **Table 4**.

### Phase 2 - List of success factors

For this phase, all the aspects researched in the articles and considered success factors were gathered in a table. In this case, 130 success factors were found, which, according to the articles analyzed, favor the creation and maintenance of university or academic spin-offs. **Table 4** lists the 130 success factors found, as well as the authors of the articles in which the factors were cited.

**Table 4.** List of success factors.

Success factors	Authors	Success factors	Authors
Venture capital support	Bruneel et al. (2020)	Human capital	Oliveira (2015)
Venture capital	Martínez-Martínez et al. (2021)	Team formation with students of different ages, young and senior	Fiorentino et al. (2022)
Venture capital investors	Bruneel et al. (2020)	Management teams	Hossinger, Chen and Werner (2020)
Financial support	Santos and Teixeira (2012)	Qualified staff	Baines and Smith (2019)

**Continued**

Financial support from the public, universities and other sources	Odei and Stejskal (2018)	Recruit high quality staff	Mustar et al. (2006)
Public support/funding	Kulkov et al. (2019)	Member selection	Bruneel et al. (2020)
Financing of new ventures	Mathisen and Rasmussen (2019)	Economic environment	Torres and Invernizzi (2022)
Financing and investment	Baines and Smith (2019)	Favorable market conditions	Montiel-Campos (2018)
Financing for the creation of the Spin-off	Martínez-Martínez et al. (2021)	Regional and national contexts	Hossinger, Chen and Werner (2020)
Financial resources	Oliveira (2015)	Economic factors	Fiorentino et al. (2022)
Financial resources	Mustar et al. (2006)	Innovation ecosystem	Kulkov et al. (2019)
Research funding	Odei and Stejskal (2018)	Innovation ecosystem	Montiel-Campos (2018)
Public funding for research	Martínez-Martínez et al. (2021)	Existence of an innovation ecosystem in the region	Mustar et al. (2006)
Have working capital	Santos and Teixeira (2012)	Support infrastructures, such as science parks, incubators, incentive support	Odei and Stejskal (2018)
Development of an organizational culture	Czakov, Jedynak and Konopka-Cupiał (2022)	Policy	Oliveira (2015)
Culture	Oliveira (2015)	Entrepreneurial skills	Thomas et al. (2020)
Organizational culture	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Favorable climate for the development of entrepreneurship	Czakov, Jedynak and Konopka-Cupiał (2022)
Sociocultural dimension	Torres and Invernizzi (2022)	Entrepreneurial behavior	Teppo (2020)
Full-time dedicated academic	Bagchi-Sen, Baines and Lawton Smith (2020)	Management Skills Needed by Academic Entrepreneurs	Baines and Smith (2019)
Diverse team	Prencipe et al. (2023)	Create a business environment where all activities aimed at creating value for the customer are coordinated and collaboration between the different areas is developed	Buratti, Profumo and Persico (2021)
Develop a viable business model	Baines and Smith (2019)	Market adaptation	Santos and Teixeira (2012)
Existence of business model and growth model	Martínez-Martínez et al. (2021)	Technology-market matching capability	Thomas et al. (2020)
Models as drivers	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Ability to interpret the Business environment	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Competitiveness	Korpysa (2018)	Market understanding	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Dynamic sensing and modeling capabilities	Thomas et al. (2020)	Focus on market characteristics	Mustar et al. (2006)

**Continued**

Dissemination, integration and interfunctional coordination	Buratti, Profumo and Persico (2020)	Market orientation	Buratti, Profumo and Persico (2021)
Goal setting	Baines and Smith (2019)	Know the competition	Korpysa (2018)
Company strategies and objectives and structures	Hossinger, Chen and Werner (2020)	Technological surveillance	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Internal factors of a company	Hossinger, Chen and Werner (2020)	Business environment	Torres and Invernizzi (2022)
Focus on integration between different functions	Buratti, Profumo and Persico (2021)	Management capacity and market orientation of its managers	Vega-Gómez, González and Pérez-Mayo (2020)
Organizational characteristics	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Anticipating customer needs - developing new value propositions - capable of satisfying the needs of potential customers	Buratti, Profumo and Persico (2021)
Hierarchy	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Understanding customer needs	Baines and Smith (2019)
Composition and characteristics of the foundation	Hossinger, Chen and Werner (2020)	Knowing the needs of customers	Korpysa (2018)
Initial competence	Hossinger, Chen and Werner (2020)	Responsive customer intelligence generation	Buratti, Profumo and Persico (2021)
Organization reputation	Mustar et al. (2006)	Alliance in the Market	Bruneel et al. (2020)
Internal interrelationships (new inventions) to enhance the creation of spin-offs	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Proximity to the commercial world	Modina et al. (2024)
Assessment of technology maturity before launch	Thomas et al. (2020)	Relationship with the market	Oliveira (2015)
Nature of bonds or ties	Torres and Invernizzi (2022)	External interrelations (relationship with the market) to enhance the creation of spin-offs	Laage-Hellman et al. (2020)
Technology Transfer Recipient Participation	Pimenta (2017)	Relationship with industry	Torres and Invernizzi (2022)
Collaborations with external partners and gaining access to external technological knowledge and expertise	Baines and Smith (2019)	Number of registered patents and investment	Pimenta (2017)
Building connections outside the university	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Patenting	Martínez-Martínez et al. (2021)
Creation of formal cooperation procedures	Czakov, Jedynak and Konopka-Cupiał (2022)	Patents	Vega-Gómez, González and Pérez-Mayo (2020)
Development of cooperation networks	Czakov, Jedynak and Konopka-Cupiał (2022)	Protect the invention	Thomas et al. (2020)
Partners	Santos and Teixeira (2012)	Unconventional solutions to solve problems	Vutsova and Arabadzhieva (2021)

**Continued**

Prominent partners	Bruneel et al. (2020)	Innovation policies	Modina et al. (2024)
Potential Business Partners	Laage-Hellman et al. (2020)	Legal framework and regulatory structure	Torres and Invernizzi (2022)
Relationship with other partners - creating collaborative relationships	Laage-Hellman et al. (2020)	University policy	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Relations with the innovation ecosystem	Modina et al. (2024)	Property rights for spin-off	Kulkov et al. (2019)
Type of interaction in the ecosystem and relationship with the industry	Torres and Invernizzi (2022)	Understanding the concept of spin-off	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Autonomy and predisposition for innovation and trust	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	Mechanisms in universities to avoid conflicts of interest	Czakov, Jedynak & Gabriela Konopka-Cupiał (2022)
Ability to innovate	Mathisen and Rasmussen (2019)	Models for building strategies, processes and institutional mechanisms facilitating the generation of spin-offs.	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Entrepreneurial capacity	Thomas et al. (2020)	University technology transfer support systems need to be effective	Baines and Smith (2019)
Founding of the spin-off by the entrepreneurial scientist	Thomas et al. (2020)	Internal mechanisms to support academics to commercialize research results	Odei and Stejskal (2018)
Ability to take advantage of opportunities.	Thomas et al. (2020)	Incentives for business creators	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
New inventions	Laage-Hellman et al. (2020)	Type of support received	Torres and Invernizzi (2022)
Adequate support, training and infrastructure at universities	Fernández-Lopez et al. (2018)	Improving studies by Technology Transfer offices	Montiel-Campos (2018)
Availability of universities to provide support mechanisms on or around campus	Odei and Stejskal (2018)	Improve the skills of professionals at university who are experts in moving from university to industry	Kulkov et al. (2019)
Receive bureaucratic support from the university	Vega-Gómez, González and Pérez-Mayo (2020)	Parent institution can also be a source of network connections	Mustare et al. (2006)
Receive training support from the university	Vega-Gómez, González and Pérez-Mayo (2020)	Role of research excellence	Bagchi-Sen, Baines and Lawton Smith (2020)
University to have resources	Montiel-Campos (2018)	Focus on disseminating knowledge	Buratti, Profumo and Persico (2021)
Attract and mentor the founding team	Thomas et al. (2020)	Proposal and significance for university	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)

**Continued**

Support from the board of directors-highest level of decision-making body	Veltri, Puntillo and Pierrri (2022)	Third mission recognition	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
Strategic support from the university	Mustar et al. (2006)	Encouragement from the university to undertake	Montiel-Campos (2018)
Supporting institution	Oliveira (2015)	Relationship and trust in the parent university	Laage-Hellman et al. (2020)
Provision of support by the parent university	Czakov, Jedynak and Konopka-Cupiał (2022)	Academic culture	Bolzani, Rasmussen and Fini (2020)

Source: the authors.

**Phase 3 - Definition of categories**

In the articles researched, 130 factors were found that can lead a spin-off to success. These factors were grouped into categories. Each of these categories grouped a set of success factors. Ten categories were classified as shown in **Figure 6**.



Source: authors.

**Figure 6.** Success factor categories.

One of the factors identified among the articles analyzed is related to issues related to the finances of spin-offs. According to the studies read, the financial issue was identified as essential for the success in the creation and maintenance of university or academic spin-offs. Thus, this factor gave rise to a category called “Financial Support”.

Another fact indicated as being important for the success of spin-offs is related to the way the university deals with issues related to entrepreneurship internally and in its surroundings. These factors were grouped in the category called “Organizational Culture”.

The studies analyzed also pointed out some issues related to the components of the university spin-off. These success factors were grouped into the category called “Team”. Another success factor found is related to the environment in which the university spin-off is inserted, involving ecosystem and regionalization. Thus, the category “Environmental factors” was created.

The category called “Management” was created because many of the articles analyzed brought together relevant success factors in the way the university spin-off is managed by its leaders. The category “Market” was created because many articles cited aspects of success that the university spin-off must consider in its

insertion and maintenance in the market of which it will be a part.

Success factors that refer to the existence of relationship networks and contacts that were identified in the studies were associated with the category called “Partnerships”. The characteristics of success of the university spin-off found in the research and related to entrepreneurship were grouped into a category called “Entrepreneurial profile”.

A set of factors found in the studies analyzed described the “Institutional policy” at the parent university as a relevant aspect for the creation of the university spin-off to be successful. Furthermore, several other success factors related to the institution that originated the university spin-off were cited. These factors were grouped in the category “Mother University”.

#### Phase 4 - Category group

The information in **Table 5** shows the number of times each success factor was cited in the articles analyzed and its corresponding category. The same article may have cited several success factors that were classified as belonging to a given category.

**Table 5.** Number of factors cited in the articles por categories.

Category	Number of factors
Management	24
Parent university	21
Market	19
Financial support	14
Entrepreneurial profile	11
Partnerships	10
Institutional policy	10
Environmental factors	9
Team	8
Organizational Culture	4
Total	130

Looking at **Table 5**, we can see that the category with the highest number of success factors is “Management” with 24 mentions, followed by the parent university, which appears 21 times, and then by the market, mentioned 19 times.

**Table 6** presents the categories, their respective success factors and the authors of the articles that cite each factor.

**Table 6.** Factors classified by category.

Cat.	Success Factors	Authors	Cat.	Success Factors	Authors
1	Venture capital support	Bruneel et al. (2020)	3	Team formation with students of different ages, young and sênior	Fiorentino et al. (2022)
1	Venture capital	Martínez-Martínez et al. (2021)	3	Human capital	Oliveira (2015)

## Continued

1	Venture capital investors	Bruneel et al. (2020)	3	Qualified staff	Baines and Smith (2019)
1	Financial support	Santos and Teixeira (2012)	3	Recruit high quality staff	Mustar et al. (2006)
1	Financial support from the public, universities and other sources	Odei and Stejskal (2018)	3	Member selection	Bruneel et al. (2020)
1	Public support/funding	Kulkov et al. (2019)	4	Economic environment	Torres and Invernizzi (2022)
1	Financing of new ventures	Mathisen and Rasmussen (2019)	4	Favorable market conditions	Montiel-Campos (2018)
1	Financing and investment	Baines and Smith (2019)	4	Regional and national contexts	Hossinger, Chen and Werner (2020)
1	Financing for the creation of the Spin-off	Martínez-Martínez et al. (2021)	4	Economic factors	Fiorentino et al. (2022)
1	Financial resources	Oliveira (2015)	4	Innovation ecosystem	Kulkov et al. (2019)
1	Financial resources	Mustar et al. (2006)	4	Innovation ecosystem	Montiel-Campos (2018)
1	Research funding	Odei and Stejskal (2018)	4	Existence of an innovation ecosystem in the region	Mustar et al. (2006)
1	Public funding for research	Martínez-Martínez et al. (2021)	4	Support infrastructures, such as science parks, incubators, incentive support	Odei and Stejskal (2018)
1	Have working capital	Santos and Teixeira (2012)	4	Policy	Oliveira (2015)
2	Development of an organizational culture	Czakov, Jedynak and Konopka-Cupiał (2022)	5	Develop a viable business model	Baines and Smith (2019)
2	Culture	Oliveira (2015)	5	Entrepreneurial skills	Thomas et al. (2020)
2	Organizational culture	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	5	Favorable climate for the development of entrepreneurship	Czakov, Jedynak and Konopka-Cupiał (2022)
2	Sociocultural dimension	Torres and Invernizzi (2022)	5	Business behavior	Teppo (2020)
3	Full-time dedicated academic	Bagchi-Sen, Baines and Lawton Smith (2020)	5	Management Skills Needed by Academic Entrepreneurs	Baines and Smith (2019)
3	Diverse team	Prencipe et al. (2023)	5	Existence of business model and growth model	Martínez-Martínez et al. (2021)
3	Management teams	Hossinger, Chen and Werner (2020)	5	Hierarchy	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
5	Organizational characteristics	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	6	Ability to interpret the Business environment	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)

## Continued

5	Models as drivers	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	6	Market understanding	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
5	Competitiveness	Korpysa (2018)	6	Focus on market characteristics	Mustar et al. (2006)
5	Dynamic sensing and modeling capabilities	Thomas et al. (2020)	6	Know the competition	Korpysa (2018)
5	Dissemination, integration and interfunctional coordination	Buratti, Profumo and Persico (2021)	6	Technological surveillance	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
5	Goal setting	Baines and Smith (2019)	6	Market orientation	Buratti, Profumo and Persico (2021)
5	Company strategies and objectives and structures	Hossinger, Chen and Werner (2020)	6	Understanding customer needs	Baines and Smith (2019)
5	Internal factors of a company	Hossinger, Chen and Werner (2020)	6	Management capacity and market orientation of its managers	Vega-Gómez, González and Pérez-Mayo (2020)
5	Internal interrelationships (new inventions) to enhance the creation of spin-offs	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	6	Anticipating customer needs - developing new value propositions capable of satisfying the needs of potential customers	Buratti, Profumo and Persico (2021)
5	Create a business environment where all activities aimed at creating value for the customer are coordinated and collaboration between the different areas is developed	Buratti, Profumo and Persico (2021)	6	Knowing the needs of customers	Korpysa (2018)
5	Composition and characteristics of the foundation	Hossinger, Chen and Werner (2020)	6	Business environment	Torres and Invernizzi (2022)
5	Initial competence	Hossinger, Chen and Werner (2020)	6	Responsive customer intelligence generation	Buratti, Profumo and Persico (2021)
5	Organization reputation	Mustar et al. (2006)	6	Alliance in the market	Bruneel et al. (2020)
5	Assessment of technology maturity before launch	Thomas et al. (2020)	6	External interrelations (relationship with the market) to enhance the creation of spin-offs	Laage-Hellman et al. (2020)
5	Nature of bonds or ties	Torres and Invernizzi (2022)	6	Proximity to the commercial world	Modina et al. (2024)
5	Technology Transfer Recipient Participation	Pimenta (2017)	6	Relationship with the Market	Oliveira (2015)
5	Focus on integration between different functions	Buratti, Profumo and Persico (2021)	6	Relationship with industry	Torres and Invernizzi (2022)
6	Market adaptation	Santos and Teixeira (2012)	8	Entrepreneurial capacity	Thomas et al. (2020)

## Continued

6	Technology-market matching capability	Thomas et al. (2020)	8	New inventions	Laage-Hellman et al. (2020)
7	Partners	Santos and Teixeira (2012)	8	Number of registered patents and investment	Pimenta (2017)
7	Building connections outside the university	Baines and Smith (2019)	8	Patenting	Martínez-Martínez et al. (2021)
7	Creation of formal cooperation procedures	Czakov, Jedynak and Konopka-Cupiał (2022)	8	Patents	Vega-Gómez, González and Pérez-Mayo (2020)
7	Development of cooperation networks	Czakov, Jedynak and Konopka-Cupiał (2022)	8	Protect the invention	Thomas et al. (2020)
7	Relations with the innovation ecosystem	Modina et al. (2024)	8	Unconventional solutions to solve problems	Vutsova and Arabadzhieva (2021)
7	Prominent partners	Bruneel et al. (2020)	9	Innovation policies	Modina et al. (2024)
7	Potential Business Partners	Laage-Hellman et al. (2020)	9	Legal framework and regulatory structure	Torres and Invernizzi (2022)
7	Relationship with other partners-creating collaborative relationships	Laage-Hellman et al. (2020)	9	University policy	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
7	Collaborations with external partners and gaining access to external technological knowledge and expertise	Baines and Smith (2019)	9	Property rights for spin-off	Kulkov et al. (2019)
7	Type of interaction in the ecosystem and relationship with the industry	Torres and Invernizzi (2022)	9	Understanding the concept of spin-off	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
8	Autonomy and predisposition for innovation and trust	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	9	Mechanisms in universities to avoid conflicts of interest	Czakov, Jedynak & Gabriela Konopka-Cupiał (2022)
8	Ability to innovate	Mathisen and Rasmussen (2019)	9	Models for building strategies, processes and institutional mechanisms facilitating the generation of spin-offs.	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
8	Founding of the spin-off by the entrepreneurial scientist	Thomas et al. (2020)	9	University technology transfer support systems need to be effective	Baines and Smith (2019)
8	Ability to take advantage of opportunities.	Thomas et al. (2020)	9	Internal mechanisms to support academics to commercialize research results	Odei and Stejskal (2018)
9	Incentives for business creators	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)	10	Type of support received	Torres and Invernizzi (2022)
10	Adequate support, training and infrastructure at universities	Fernández-Lopez et al. (2018)	10	Improving studies by Technology Transfer offices	Montiel-Campos (2018)

**Continued**

10	Availability of universities to provide support mechanisms on or around campus	Odei and Stejskal (2018)	10	Improve the skills of professionals at university who are experts in moving from university to industry	Kulkov et al. (2019)
10	Receive bureaucratic support from the university	Vega-Gómez, González and Pérez-Mayo (2020)	10	Parent institution can also be a source of network connections	Mustare et al. (2006)
10	Receive training support from the university	Vega-Gómez, González and Pérez-Mayo (2020)	10	Role of research excellence	Bagchi-Sen, Baines and Lawton Smith (2020)
10	University to have resources	Montiel-Campos (2018)	10	Focus on disseminating knowledge	Buratti, Profumo and Persico (2021)
10	Attract and mentor the founding team	Thomas et al. (2020)	10	Proposal and significance for university	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
10	Support from the board of directors - highest level of decision-making body	Veltri, Puntillo and Pierri (2022)	10	Third mission recognition	Calderón-Hernández, Jiménez-Zapata and Serna-Gomez (2020)
10	Strategic support from the university	Mustar et al. (2006)	10	Encouragement from the university to undertake	Montiel-Campos (2018)
10	Supporting institution	Oliveira (2015)	10	Relationship and trust in the parent university	Laage-Hellman et al. (2020)
10	Provision of support by the parent university	Czakov, Jedynak and Konopka-Cupiał (2022)	10	Academic culture	Bolzani, Rasmussen and Fini (2020)

Source: the authors.

Within the scope of this article, understanding how success factors were classified into categories, as well as the number of factors in each category, allows us to move on to the next phases and identify the tendency for categories to influence the success of university spin-offs.

### 4.3. Results and Discussion

The categories were created by grouping similar characteristics found in the articles researched, which we call factors. This was done in relation to both failure factors and success factors.

The number of failure factors and success factors identified in the articles and categorized are presented in **Table 7**. The table is organized in descending order, starting with the category containing the most factors and ending with the one with the fewest factors.

**Table 7.** Relationship between categories of failure factors and success factors considering positioning.

Category Failure factors	No. of factors	Position	Category Success factors	No. of factors
Resource	27	1°	Management	24
Management	20	2°	Mother university	21
Market	19	3°	Market	19

**Continued**

Entrepreneurial culture	16	4°	Financial support	14
Mother university	14	5°	Entrepreneurial profile	11
Institutional policy	9	6°	Partnerships	10
Team	8	7°	Institutional policy	10
Scope -Innovation Ecosystem	6	8°	Environmental factors	9
Government	5	9°	Team	8
Portfolio	3	10°	Organizational culture	4

Source: authors.

The analysis of the categories associated with failure factors and those linked to success factors revealed similarities between the two sets of categories. **Table 7** identifies categories with identical names and others with different names but equivalent meanings. Despite these similarities, the perspectives described by the authors differ. When referring to failure, the focus is on negative aspects of the process of creating and maintaining university spin-offs. Conversely, success is viewed from a positive perspective, emphasizing factors associated with each category that contribute to the creation and sustainability of university spin-offs.

Categories with identical names across both failure and success factors include Management, Market, Mother University, Institutional Policy, and Team. Other categories, while differing in name, are equivalent due to shared characteristics among the factors they encompass.

**Table 7** indicates that when addressing failure in the creation and maintenance of university spin-offs, articles highlight resource availability as the primary issue. For success, management-related aspects are identified as essential for the creation and sustainability of university spin-offs.

Failure factors grouped under the Resources category are primarily related to the lack of infrastructure and financial resources. A comparison of the identified categories shows that Resources (failure factors) and Financial Support (success factors) are equivalent, as both highlight inadequate financial resources as a critical factor influencing the creation and maintenance of university spin-offs.

**Table 7** also reveals that success factors categorized under “Financial Support” rank fourth in terms of citations regarding the creation and maintenance of university spin-offs. This indicates that the relevance of financial support for spin-off success is less significant compared to its equivalent failure category, “Resources,” which ranks at the top as the primary challenge in the creation and maintenance of university spin-offs. While lack of funding and infrastructure is a critical challenge for universities, they can overcome these barriers by adopting a strategic approach focused on internal innovation, local partnerships, efficient utilization of existing resources, and human capital development. These approaches can create an environment conducive to innovation and collaboration even without significant external support, helping universities address financial constraints and poor infrastructure.

However, there are some strategic and practical approaches that can be adopted to effectively address these barriers, even in limited contexts. These include: maximizing the use of existing resources, optimizing existing infrastructure, using digital platforms, fostering innovation within the university, encouraging collaborative research and development projects within the institution itself, leveraging local and regional partnerships, collaborations with other universities, supporting smaller public and private funds, leveraging internal human capital, fostering a culture of sustainability and efficiency, fostering an entrepreneurial culture by encouraging the creation of spin-offs.

These data also show that aspects related to “Management” were among the most cited failure factors in the context of creating and maintaining university spin-offs. The consolidation presented in **Table 7** highlights that, in both perspectives analyzed in this study, management plays a critical role in the creation and sustainability of university spin-offs.

Regarding the “Market” category, which has the same name in both failure and success factors, it ranks third with an equal number of citations (19) in the literature. This suggests that market demand can either negatively or positively affect spin-offs, depending on the level of investment and attention given by the spin-off to market engagement.

“Market demand” is an ambivalent factor, that is, it can be both a factor of success and a factor of failure, depending on how the business responds to this demand, whether there is a good understanding of the market, and whether management is able to adapt to its changes. The key to the transition between these two scenarios lies in the ability to adapt, strategic planning and differentiation in the market. The ability to anticipate market trends and adapt supply to changing customer needs can make demand a success factor; A lack of adequate market research or an inability to understand market nuances can turn market demand into a failure factor. Businesses that have flexible, agile management and a team capable of reacting to changes in demand (such as new technologies or regulations) can turn favorable demand into success; If management is slow or unable to change the direction of the business in response to changing market conditions, demand can quickly become a failure factor. Companies that can create strong market differentiation, through innovation or a unique business model, can better take advantage of demand and stand out, ensuring success. If the business fails to distinguish itself from competitors or loses its competitive advantage, demand may be insufficient to ensure success.

The relationship and support from the “Mother University” stood out as a significant factor for the success of university spin-offs but had a more modest role among failure factors. Support from the originating university can have a considerable impact when the institution proactively provides resources, such as infrastructure and training in areas where the spin-off lacks expertise.

For the category “Institutional Policy” of the mother university, it was cited as both a failure and success factor for the creation and maintenance of university

spin-offs, with similar citation frequencies. The absence of institutional policy was linked to failure factors, while its existence was associated with success.

In terms of the mother university's culture, failure factors highlighted a lack of entrepreneurial focus, such as insufficient training in entrepreneurship and the absence of qualified professionals within the university to provide guidance. Conversely, the "Organizational Culture" category in success factors emphasized entrepreneurial culture alongside other organizational aspects contributing to the success of university spin-offs.

Regarding the culture of the mother university, failure factors highlight the lack of entrepreneurial orientation, including insufficient entrepreneurship training and a shortage of qualified professionals within the university to provide guidance. In contrast, success factors within the "Organizational Culture" category emphasize the presence of an entrepreneurial culture alongside other organizational aspects.

It is worth noting that the "Entrepreneurial Culture" category ranks fourth among failure factors in terms of frequency of citation in the articles. Conversely, the equivalent "Organizational Culture" category, when considering success factors, is ranked as having the least influence on the creation and maintenance of university spin-offs. Different cultural contexts play an essential role in the creation and development of university spin-offs, especially in regions with less developed entrepreneurial ecosystems. The impact of local culture can be observed in both the success and failure factors indicated in the tables above.

The equivalence between the "Portfolio" and "Entrepreneurial Profile" categories lies in their shared focus on intellectual property protection and the development of new products by spin-offs. Among the failure factors, the "Portfolio" category was cited the least, occupying the last position in the defined categories. This indicates a lower influence of the failure factors in this category on the creation and maintenance of university spin-offs. On the success factors list, the "Entrepreneurial Profile" of the university spin-off is considered to have a moderate impact on achieving business objectives.

In regions where entrepreneurship is not yet consolidated, there are structural and cultural challenges that affect the viability of spin-offs, such as: Low culture of innovation, lack of infrastructure which are essential for the development of spin-offs and resistance to innovative business models, as traditional companies may not recognize the value of new technologies developed at universities.

The categories "Scope-Innovation Ecosystem" (failure factors) and "Environmental Factors" (success factors) are equivalent in terms of factors related to the innovation ecosystem. While failure factors highlight the lack of external support from the environment where spin-offs operate, success factors extend beyond the innovation ecosystem (which accounts for most of the factors cited) to include aspects of the regional economy.

Furthermore, the category "Scope - Innovation Ecosystem" (failure factors) aligns with the position of the related category "Environmental Factors" (success

factors), differing only in the number of citations. Compared to the other categories, both present a relatively small number of factors, suggesting a smaller impact on the creation and maintenance of academic or university spin-offs. For spin-offs to be successful in challenging cultural contexts, especially in regions with less developed ecosystems, some strategies can be adopted: creation of collaborative networks to establish connections between universities, the private sector and the government to strengthen support for entrepreneurship; change in academic culture to encourage entrepreneurial training programs and bring researchers closer to the market; and public policies to encourage the creation of financing mechanisms and legal support for spin-offs; and internationalization to explore partnerships with more developed ecosystems to overcome local barriers.

The “Partnership” category, related to success factors, emphasizes collaboration among actors within the spin-off’s ecosystem. Key success factors include establishing external connections beyond the university and building collaborative relationships with other partners.

The “Government” category listed among failure factors did not have a corresponding category for success factors in the creation and maintenance of academic or university spin-offs. The cited failure factors highlight the lack of governmental support.

The analysis and comparison of the categories encompassing failure and success factors demonstrate similarities between them. However, the influence of these categories, whether as drivers of success or failure, directly impacts the development of university spin-offs—companies derived from technologies created within universities.

In this context, the data from this research were compared with the four stages of university spin-off creation proposed by Ndonzau, Pirnay, and Surlemont (2002), as illustrated in **Figure 1**. The comparison revealed that some factors identified in this study align with those emphasized in the authors’ model, impacting the creation and maintenance of university spin-offs.

In Stage 1 of the model, the authors highlight the importance of university culture, noting that the existence of an entrepreneurial culture and university policies focused on entrepreneurship are essential for the success of spin-offs. This study corroborates these findings, identifying the absence or deficiency of an entrepreneurial culture and university policies as key failure factors. Conversely, the presence of these elements, especially when accompanied by institutional support for spin-offs, is highlighted as a success factor in their creation and maintenance.

Stage 1 also emphasizes the need for support from the mother university, such as providing advisory services to entrepreneurs, a factor also reflected in this study under the “Mother University” category. Additionally, the model underscores the role of the mother institution in identifying commercially viable innovations. This study aligns with these findings, identifying failure factors related to this issue under the “Portfolio” category, while success factors are grouped under the “Entrepreneurial Profile” category.

The “Portfolio” (failure factors) and “Entrepreneurial Profile” (success factors) categories identified in this study also correspond to Stage 2 of the model, which stresses the need for intellectual property protection to enable commercial exploitation.

Stage 2 further highlights barriers such as inadequate spin-off management and insufficient funding, which align with the findings of this study. According to **Table 7**, “Resources,” the most cited failure factor, and “Management,” the second most cited, reflect these challenges. Supporting this, the “Management” and “Financial Support” categories in this study encompass success factors critical to the creation and maintenance of university spin-offs.

Stage 3 addresses market integration, relationships with the mother university, and access to financial, material, and human resources. These aspects are mirrored in this study (see **Table 7**), where corresponding categories are cited as both failure factors (Market, Mother University, Resources, and Team) and success factors (Market, Mother University, Financial Support, and Team). However, their impacts differ, as reflected in the rankings of these categories in **Table 7**.

Entrepreneurial competence is a dynamic factor that can be a factor of success or failure depending on how the entrepreneur applies it. It is directly related to management skills, strategic vision, adaptation to market changes and leadership capacity. Success occurs when these competencies are well developed, while failure occurs when there are gaps in these areas, such as lack of vision, resistance to change or failures in strategic execution. Thus, entrepreneurial competence can transition between these two states depending on the situation, context and actions taken by the entrepreneur.

Finally, Stage 4 of the model points to concerns such as insufficient personnel and infrastructure, financial issues, inefficient management, and relocation of the spin-off. These challenges are consistent with the failure factors identified in this study, specifically the categories “Team,” “Mother University,” “Resources,” “Management,” and “Scope.”

The authors of the model (Ndonzuau, Pirnay, & Surlemont, 2002) primarily highlight barriers to the creation of university spin-offs while also proposing strategies to mitigate these challenges. All the aspects identified by the authors align with the categories found in this study. However, the model presents fewer specific success or failure factors compared to this research, which identifies multiple factors—both positive and negative—within each category that influence the creation and maintenance of university spin-offs.

The role of the mother university is particularly significant in this context. As the institution from which the spin-off originates, numerous success and failure factors are linked to it. These include institutional policies that encourage and support the creation of spin-offs through investments, infrastructure, and career incentives for researchers. Additionally, the university’s role extends to providing training for spin-off managers, particularly through specialized technology transfer departments; offering networks and connections to newly established spin-

offs; supplying new technologies to spin-offs; fostering an entrepreneurial environment, including supporting and maintaining innovation habitats like incubators; and recognizing its mission to deliver research outcomes to society.

In this context, addressing the factors of failure and success outlined in this study, and categorized systematically, is essential for the effective creation and maintenance of university spin-offs. These factors provide valuable insights for developing structures and strategies that enable more targeted and successful spin-off initiatives.

## 5. Conclusion

The defined categories, to varying degrees, significantly influence the creation and maintenance of academic or university spin-offs. These categories, along with their associated success and failure factors, must be carefully considered when developing this type of enterprise.

The most influential failure factors are linked to the following categories: Resources, which involve financial, infrastructure, and personnel challenges; Management, which includes inadequate administration, conflicts of interest, lack of business guidance, and strained relationships with the parent university; and Market, which refers to limited knowledge and difficulties in market insertion for the spin-off. Additionally, the study highlights failure factors related to the parent university's entrepreneurial culture, its relationship with the spin-off, institutional policies, the spin-off team, the innovation ecosystem where the spin-off is located, government support for innovation, and the spin-off's portfolio.

Regarding success factors critical to the creation and maintenance of spin-offs, the following categories stand out: Management, which emphasizes effective leadership, entrepreneurial skills, and the adopted business model; Parent University, focusing on its supportive relationship with the spin-off; and Market, identifying its characteristics to facilitate the spin-off's integration.

The research also identified other positive aspects that contribute to the success of spin-offs, including adequate financial support, an entrepreneurial profile, partnerships, suitable institutional policies from the parent university, favorable environmental factors in both the market and the innovation ecosystem, an adequate spin-off team with the right size, experience, and diversity, and an entrepreneurial organizational culture within the parent university.

Based on the conclusions about the success and failure factors in the creation and maintenance of academic spin-offs, some suggestions for future studies can be made, with the aim of deepening the understanding of this topic and contributing to the improvement of practices and policies in this field. Here are some suggestions: study of the impact of institutional policies on the success of spin-offs; analysis of the entrepreneurial culture in universities and its influence on spin-offs; assessment of the university-spin-off relationship and its effects on success; the influence of the local innovation ecosystem on the performance of spin-offs; the relationship between public and private funding and the growth of spin-

offs; analysis of market barriers to academic spin-offs; comparison between spin-offs from different areas of knowledge; longitudinal study on the evolution of spin-offs.

These suggestions for future studies can not only deepen the knowledge about the process of creating and maintaining academic spin-offs, but also provide valuable insights for universities, policymakers, entrepreneurs and investors interested in supporting and maximizing the success of these companies.

## Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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