VNIVERSITAT DE VALÈNCIA

Facultat d' Economia

TESIS DOCTORAL

A QUANTITATIVE INSIGHT INTO THE IMPACT AND PERFORMANCE OF SEED ACCELERATORS AND THEIR ACCELERATED START-UPS

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A mi marido y a mi hijo, Paul y Oliver

A mi madre y a mi padre, Maricarmen y Miguel

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Index

Index of tables

Index of figures

CHAPTER 1: INTRODUCTION

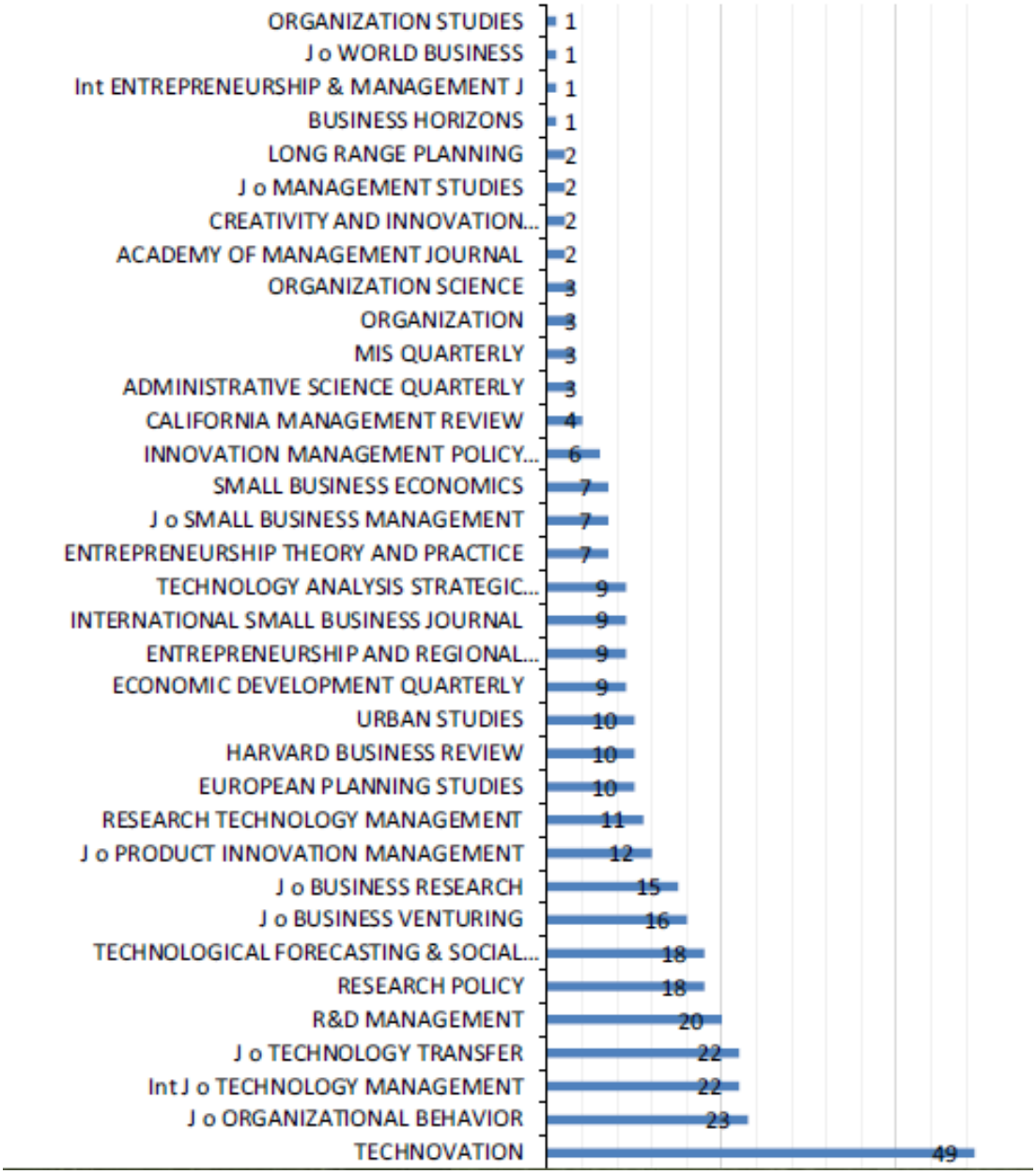
1.1. INTRODUCTION AND MOTIVATION OF THE RESEARCH TOPIC

This dissertation has been accomplished following the stipulations and the requirements for official doctorate programs stablished by the Doctoral School of Valencia University according to the "R.D. 99/2011". The modality chosen to present this dissertation corresponds to a blend between the traditional format and the compendium of papers. Hence, the current dissertation displays three papers (Chapter 3, 4 and 5) published, accepted or in process of publication in different research journals. The papers presented in Chapter 3 and Chapter 4 have already been published, and the paper presented in Chapter 5 is currently in review process.

The topic of this dissertation is the study of a specific type of entrepreneurship support organization, known as the Seed Accelerator (SA). The start-up acceleration field is gaining importance due to the global evolution that these organizations have experienced in recent years. The number of SAs has increased from the first known Accelerator in 2005 (United States) to an estimated of 3,000 SAs world-wide (Hochberg, 2016). This fact has attracted the attention of an increasing number of researchers who are exploring the distinctive aspects of accelerators to answer questions regarding their nature, characteristics, and socioeconomic impact.

The popularity of this topic is reflected in the evolution of "Call for papers" and "Special issues" published from high impact research journals specialized on entrepreneurship, innovation, and business management, among other subjects. Some top-ranked journals with a significant amount of publications in this topic are: Technovation, Journal of Organizational Behavior, International Journal of Technology Management, Journal of Technology Transfer, R&D Management, and Research policy (Figure 1.1).

Figure 1.1. Number of relevant papers on business incubation and acceleration by Research Journal (January, 2018)



Source: Hausberg and Korreck (2020)

In addition, in 2012 I had the privilege of gaining professional experience in this field after joining a business Accelerator and launching an investment fund in the city of Valencia (Spain), where I provided consulting and financing services to investors and new entrepreneurs.

This participation helped me gain practical knowledge and increased my passion and curiosity to learn more about these organizations.

While the business acceleration topic it is a quite recent research subject, I managed to build complete, comprehensive and fully up-to-date databases that will allow us to explore the first results of SAs and their accelerated start-ups.

The purpose of this dissertation is to describe and characterize accelerators, and above all to analyze their performance and impact by providing three empirical models with validated indicators. The proposed indicators constitute the fundamental empirical contribution of this dissertation, since they have been applied to a large number of SAs and accelerated new companies contained in my databases.

1.2. THE RESEARCH TOPIC

The research topic of this dissertation is the study of SAs, considered as a new generation of business incubators (Bøllingtoft, 2012). These recent organizations are specifically set up to develop sounder projects and enhance their chances to overcome initial market barriers and financial difficulties.

SAs are especially designed to assist new ventures (start-ups) early in their lifecycle (Birdsall, et al., 2013). To achieve this goal, SAs work around a scheduled training program accepting a limited number of participating business projects. The Seed Accelerator Program (SAP) is a fixed-term, cohort-based scheduled plan with mentorship, educational and networking components that culminates in a funding event known as "Demo Day" (Cohen and Hochberg, 2014).

SAs are organizations originated and located inside business ecosystems. These ecosystems are made up of several actors that stimulate the creation of new companies, including governments, universities, investors, businesses, and start-up incubators and accelerators. The business ecosystem presents different dimensions depending on how these actors interact with each other. One of these dimensions is shaped with the name of "entrepreneurial ecosystem", defined as a context designed to foster entrepreneurship

within a given territory, forming a horizontal network (customers and suppliers) and a vertical network (competitors and allies) (Theodoraki and Messeghem, 2017).

In this context, SAs are active participants of the entrepreneurial ecosystem as they promote the creation of a great number of new innovative businesses. Likewise, start-up companies play a crucial and active role inside the entrepreneurial ecosystem.

A start-up is a newly created innovative company that seeks a scalable, repeatable and profitable business model. Start-ups normally have a highly innovative business model and are specialized in digital and technological products and services.

But start-up companies also face a number of challenges that can affect their chances of survival, such as access to financial resources (Smilor, 1997), lack of experience in the initial team (Gruber et al., 2008), the need to attract highly qualified and specialized professionals (Zott and Huy, 2007), or limited knowledge on how to take advantage of certain opportunities (Ambos and Birkinshaw, 2010).

Business incubators (BIs) and SAs are part of the organizations that support these new start-ups. The entrepreneurs seeking to be helped by BIs and SAs are those who want to launch a business as profitable as possible in a limited period of time, and this is the promise that this typology of organizations extend to the entrepreneurial ecosystem.

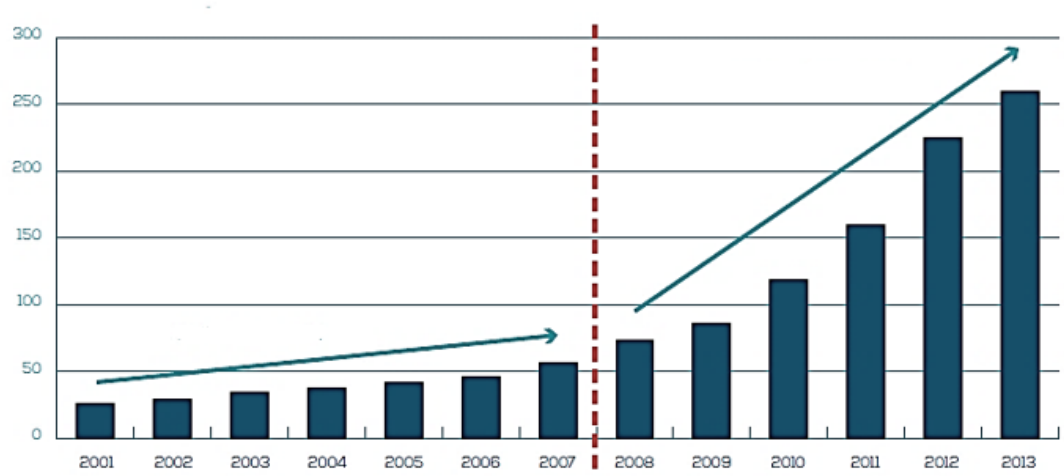
Both BIs and SAs allow young companies to start through a learning, consulting and investment process, with the aim of increasing their chances of survival and growth in the market during their first months of life (Cohen and Hochberg, 2014).

The number of SAs has increased from the first known Accelerator in 2005 (Y-Combinator) to an estimated 3,000 worldwide (Hochberg, 2016). Particularly Europe experienced a boom in the number of SAs since the beginning of the financial crisis (Figure 1.2) at the end of 2007 (Salido et al., 2013).

Hoffman and Radojevich-Kelley (2012) suggest that SAs increased in numbers since 2008 because the recession decreased the amount of funds previously available for start-ups, especially from private investors and bank loans. This decrease in alternative financing

made SAs more attractive to start-up entrepreneurs. Hathaway (2016) estimated that SAs growth rate was 50% per year in the period between 2008 and 2014.

Figure 1.2. Incubators and accelerators evolution since 2001



Source: Salido et al.(2013)

Furthermore, SAs maintain a key role in the innovation and development capacity of a region, since they stimulate the economy through job creation and the attraction of talent, providing opportunities for national and international growth and the expansion of local companies.

In developed countries, particularly in the United States, BIs and SAs are leading the promotion and creation of new companies, generating qualified employment and facilitating technology transfer between innovative companies.

Despite the growth that SAs have experienced in recent years, there is limited research on this phenomenon, mainly due to their novelty and limited data availability. The general absence of large-scale representative public databases makes it difficult for researchers to assess the impact of such programs (Hochberg, 2016).

As Cohen and Hochberg (2014) point out, the lack of studies on the performance of SAs makes their efficacy unclear. In fact, little research has explored, even at a descriptive level, the effectiveness of these programs or the reasons behind achieving better or worse results.

Since the performance measures to define the effectiveness and success of these initiatives are not yet clearly established, further research based on the impact of SAs will require

complete and updated information regarding the survival and growth prospects of the hosted start-ups (Stayton and Mangematin, 2019). Moreover, while SAs programs have proliferated, a consensual analysis on how measuring their performance remains poorly understood, as well as their effects on employment creation, source of investment, start-up survival rates, and economic growth. This information is critical for an entrepreneur considering to participate in a SAP (Cohen and Hochberg, 2014).

Much of the limited research to date on the acceleration field falls into one of these four categories: (1) conceptual descriptions of the accelerator model (Cohen and Hochberg, 2014; Dempwolf et al., 2014; Hochberg, 2016); (2) qualitative analyses on how SAs can serve to accelerate new companies (Kim and Wagman, 2012; Hoffman and Radojevich-Kelley, 2012; Cohen, 2013; Pauwels et al., 2016; Cohen et al., 2019); (3) quantitative studies that attempt to assess whether SAs have a positive effect on the results of companies participating in their programs (Smith and Hannigan, 2015; Cohen et al., 2019; Fehder and Hochberg, 2019; Hallen et al., 2020); and (4) empirical attempts to assess whether SAs have a negative or inconclusive effect on the results of accelerated start-ups (Smith et al., 2015; Gonzalez-Uribe and Leatherbee, 2017; Yu, 2020).

Therefore, the purpose of this dissertation is to address this gap by providing a conceptual framework regarding the performance of SAs along multiple dimensions that may be of importance for entrepreneurs, investors, policy makers, and shareholders.

This research aims to contribute to this field through three pioneering empirical analyses on the performance of SAs (Chapter 3, 4 and 5), and the use of three broad and representative samples of the world population. For this purpose, we selected a set of variables and measures used in the literature of BIs, and more recently in the literature of SAs. To this extent, we provide a list of essential indicators for the performance of SAs based on a broad literature review. These indicators will allow us to better asses SAs impact on their accelerated start-ups, and therefore, the effects on the entrepreneurial ecosystem where they are located.

1.3. OBJECTIVES OF THE DOCTORAL DISSERTATION

The main purpose of this dissertation is to cast new light into the Accelerator field by stablishing three different models to measure the performance of SAs and the companies supported by them.

The general objectives of this dissertation are:

1) To introduce and analyze the theoretical background and evolution of the phenomenon of SAs since their inception till today.
2) To identify a number of variables based on an in-depth review of the literature that can be used to explain and evaluate the performance and growth prospects of SAs and their accelerated start-ups.

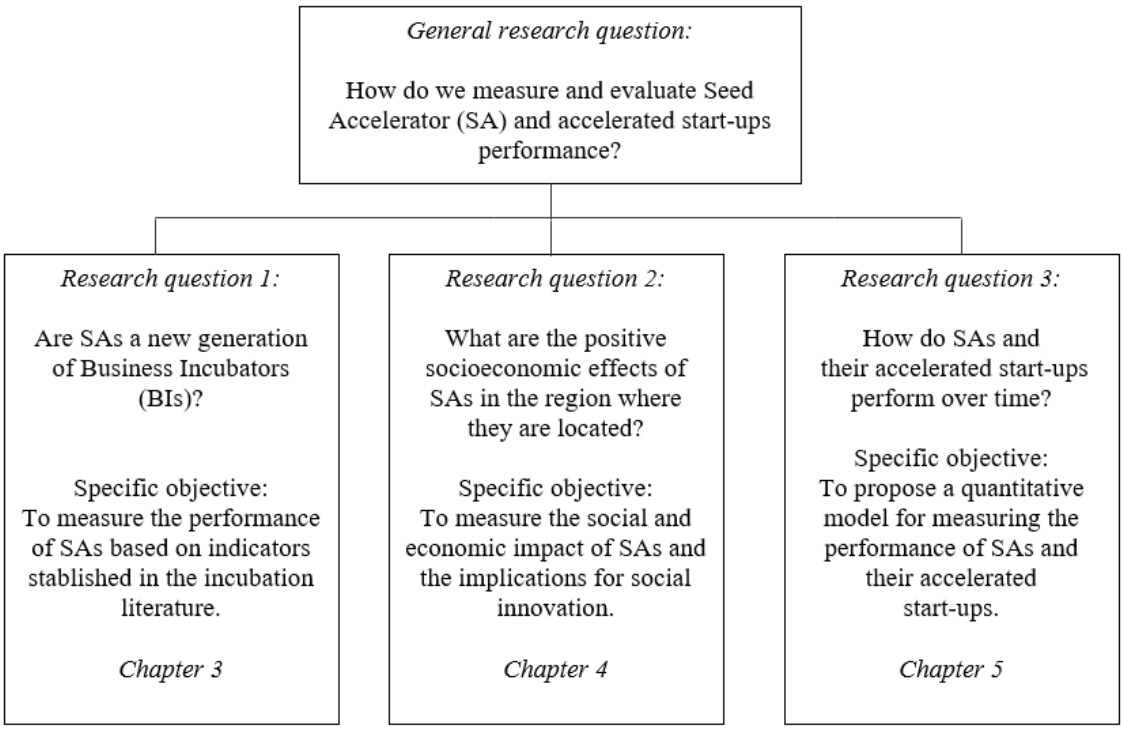
In order to achieve these goals, a broad empirical study has been conducted through Chapter 3, 4 and 5, using three different samples of SAs and their accelerated companies. In this way, we expect to open new avenues of knowledge in the SA field by exploring their efficiency and performance in general.

The specific goals of the main empirical models presented in Chapter 3, 4 and 5 are:

1) The purpose of Chapter 3 is to throw new light on the SA field by empirically assessing for the first time the performance and prospects of these organizations through a survey of 116 accelerators. A model based on the BI literature is built under three categories covering size, location, age and profitability variables, leading to five hypotheses to be tested.
2) The study of Chapter 4 investigates in an exploratory way the performance of SAs, identifying the variables that most intensely affect the establishment of new companies and their employment levels, leading to four hypotheses to be tested.
3) The main goal of Chapter 5 is to empirically assess the performance and prospects of SAs and their accelerated start-ups using two pioneer surveys. A model based on the variables used in the most recent literature of SAs is built under two perspectives to assess the better prospects of accelerated firms. This model leads to two hypotheses to be tested.

The following Figure 1.3 offers a summary of the general research question and the three key research questions this dissertation attempts to solve, in connection with each chapter.

Figure 1.3. Summary of general and specific objectives of the dissertation



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1.4. METHODOLOGY

The methodology used throughout this dissertation is specified as follows:

Chapter 2 presents a general theoretical review of theories covering the origin, effects, and performance of BIs and SAs, with the aim of providing a general theoretical basis.

Chapters 3, 4, and 5 provide a thorough and comprehensive review of the literature to measure the performance of BIs and SAs, leading to the definition of three analysis models. The models have been built based on the main findings and conclusions of the literature review, especially from empirical studies published in high impact journals that contributed with the necessary quantitative approaches for the research topic.

The empirical methodology is based on three samples collected and built on purpose for this dissertation. The first two samples cover a representative number of SAs from around the world, while the third sample includes more than 10,000 start-ups accelerated by accelerators gathered in the second sample.

Next, we present more information about the characteristics of the samples, followed by the statistical procedures that we have carried out throughout this dissertation.

1.4.1. Sample

The first sample was collected in 2014 using data from a secondary source. Seed-DB, the first online public source available at the time was used to build a sample of 116 accelerators created between 1995 and 2014, and to conduct the empirical work of Chapter 3 and 4.

Four years later, in 2018, a second sample was collected using the latest SA data available from Seed-DB and other public online sources such as Crunchbase, AngelList, and LinkedIn. Then, a third sample was built to include information on accelerated start-ups. This third sample was compiled in 2019 and includes information on those companies that participated in SAs selected from the second sample.

Both the second and third samples were used for the empirical analysis of Chapter 5. Sample 2 includes accelerators created between 1997 and 2019 and consists of 131 SAs. Sample 3 includes 10,116 accelerated start-ups funded between 1997 and 2019.

Finally, a subsample was created with information of Sample 2 and 3. Using the data available in Sample 3, all accelerated start-ups were filtered by Accelerator, and calculated the average and the median values for each indicator. The results were added to Sample 2 next to each Accelerator. This subsample was made to gather in one place all necessary indicators to empirically analyze the performance of SAs using the information of their accelerated new companies. This subsample was used to run the empirical analysis of Chapter 5.

Data for the second and third samples were collected manually from the aforementioned secondary sources, plus some real-time, retrospective online sources, including information obtained by email for clarification and updates, visits to each Accelerator's websites, and archived data obtained through blogs and LinkedIn profiles (Table 1.1). Collecting data

from multiple sources improves the reliability and credibility of the results, while visits to the Accelerator website and other channels help improve internal validity by offering insights into the behaviors of those who are associated with acceleration programs (Eisenhardt and Graebner, 2007).

Table 1.1. Secondary sources used to build Sample 1, 2 and 3

Name	***Source***	***Type of information***
Seed-DB	www.seed-db.com	• Accelerators list. • Accelerated companies list. • Total funding raised. • Total exit amount achieved.
Crunchbase	www.crunchbase.com	• Accelerators list. • Accelerated companies list per Accelerator. • Performance indicators. • Contact information.
AngelList	www.angel.co	• Accelerators list. • Start-ups list. • Accelerator Program profile and characteristics.
LinkedIn	www.linkedin.com	• Professional profile of Accelerators and start-ups' founders.
Accelerator's websites and blogs	Each Accelerator website (131 SAs)	• Accelerator Program duration. • Number of participating projects. • Number of successful start-ups. • Average funding amount. • Characteristics of the SAP. • Selected industries.

Source: own compilation

A general descriptive of the samples taking part in this dissertation is shown in Table 1.2 and Table 1.3.

Table 1.2. Sample 1 and 2 descriptive

	Chapter 3 and Chapter 4	***Chapter 5***
Sample summary	Sample 1	Sample 2
Number of accelerators	116	131
U.S. accelerators	72	79
Accelerators from other countries	44	52
Accelerators foundation date	1995-2014	1997-2019

Source: own compilation

Table 1.3. Sample 3 and Subsample descriptive

	Chapter 5	***Chapter 5***
Sample summary	Sample 3	Subsample
Number of accelerators	-	131
Number of accelerated companies	10,116	10,116
U.S. accelerators	-	79
U.S. accelerated companies	5,197	5,197
Accelerators from other countries	-	52
Accelerated companies from other countries	4,919	4,919
Accelerators foundation date	-	1997-2019
Accelerated companies foundation date	1997-2019	1997-2019

Source: own compilation

1.4.2. Models

The models presented in Chapter 3, 4 and 5 propose different variables to measure the performance of SAs, but also of their accelerated start-ups.

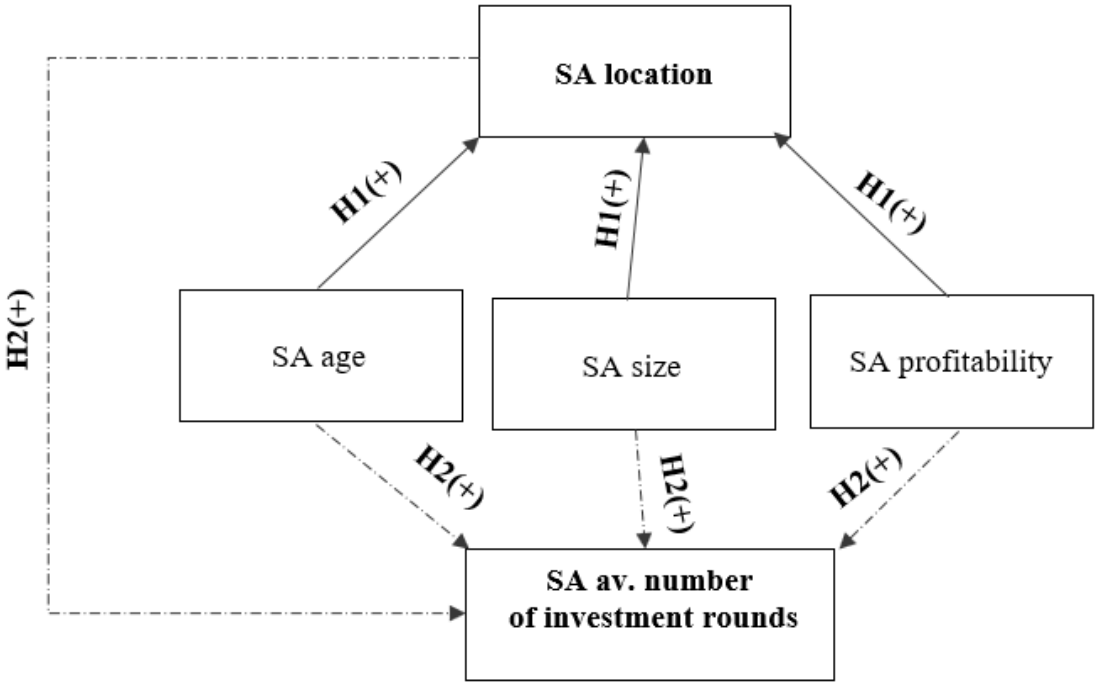
The purpose of Chapter 3 is to shed new light on the SA field by empirically evaluating for the first time the performance and prospects of these organizations through a survey of 116 SAs. A model based on the BI literature was built under three categories covering size, location, age, and profitability variables, leading to testing two hypotheses.

The first hypothesis predicts that SAs located in the United States tend to be larger and outperform their foreign counterparts in terms of SA key performance ratios.

The second hypothesis expects that SAs with a higher average number of investment rounds per accelerated company to outperform others in the main performance ratios.

Figure 1.4 specifies the model of analysis with the two hypotheses.

Figure 1.4. Analysis model of Chapter 3



Source: own compilation

In Chapter 4, we exploratively investigated the performance of SAs, identifying the variables that most intensely affect the establishment of new companies and their employment levels, which leads to testing four hypotheses.

The first hypothesis expects that SAs located in the United States create more start-ups and, in general, achieve a higher performance than those located in other countries.

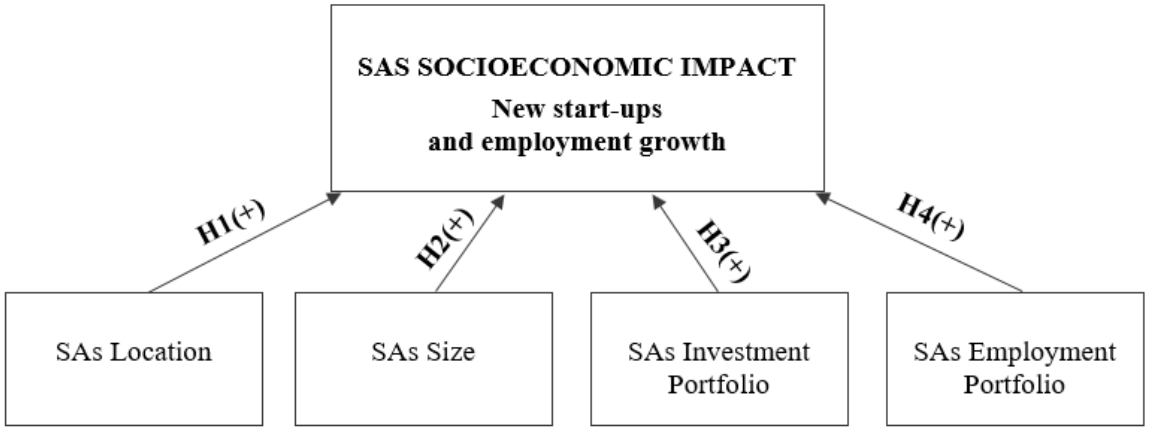
The second hypothesis predicts that SAs investing in new start-ups at a more advanced stage of development and with a greater number of employees per company, outperform other SAs in the main performance indicators.

The third hypothesis expects that SAs with an accelerated start-up portfolio with at least more than one million dollars of investment to generate more employment and outperform other SAs in the main performance indicators.

The fourth hypothesis predicts that, of all Accelerator's performance variables, those that are directly related to a greater number of employees per company determine the impact expectations of SAs in terms of employment generated and social impact.

Figure 1.5 specifies the model of analysis with the four hypotheses.

Figure 1.5. Analysis model of Chapter 4



Source: own compilation

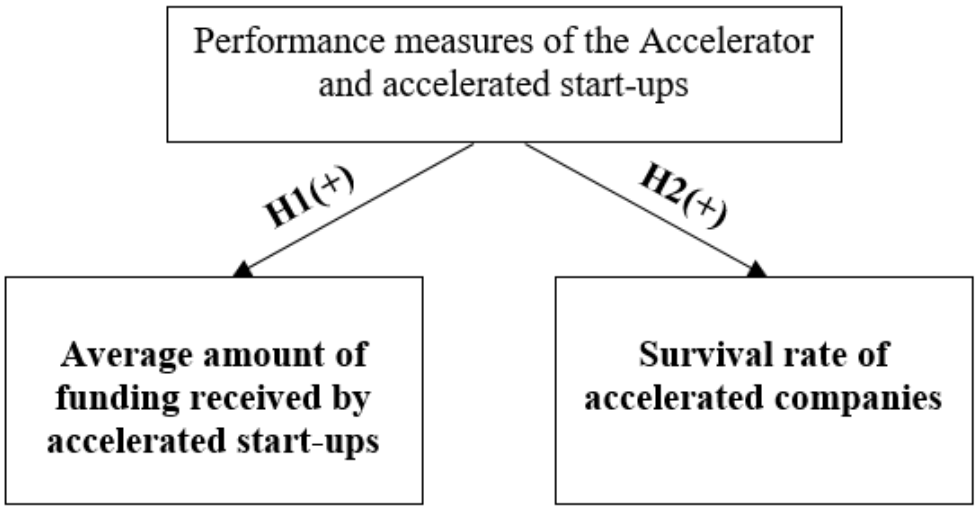
The purpose of Chapter 5 is to empirically evaluate the performance and prospects of SAs and their accelerated start-ups using two pioneering surveys. A model was built based on the variables used in the most recent SA literature, under two perspectives, to assess the best prospects of accelerated companies. This model leads to two hypotheses to be tested.

The first hypothesis expects that the average amount of financing received by the new accelerated companies, coming from the capital resources of the SA, will be influenced by a set of variables associated with both the Accelerator and the new company. This hypothesis is divided into two (1a, 1b) complementary sub-hypotheses.

The second hypothesis predicts that the survival rates of new companies will depend on certain characteristics associated with both the Accelerator and accelerated companies.

Figure 1.6 specifies the model of analysis with the two hypotheses.

Figure 1.6. Analysis model of Chapter 4



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1.4.3. Statistical techniques

The statistical results and findings of this dissertation are offered through three interrelated studies and in the format of a research journal's paper. Therefore, the methodology used and the statistical techniques are explained in detail in Chapters 3, 4, and 5.

Next, we make a brief introduction to the techniques adopted in the three empirical analyzes.

In general, a descriptive analysis was performed, followed by a bivariate analysis and a multivariate analysis to give the best possible answer to the research questions and to meet the research objectives.

First, the process begins by analyzing whether the main variables used in Chapters 3, 4 and 5 of this dissertation are independent with respect to certain variables that will be used as factors. That is, the means of the distributions of the quantitative variables are compared in the different groups established by the categorical variable. Next, different methods are used depending on whether the main quantitative variable is normally distributed or not, and whether the categorical variable has two or more than two categories.

Within the parametric tests, when the categorical variable has two categories, the Student T test is used. However, when the categorical variable has three or more categories, the comparison of means is made by analyzing the ANOVA variance.

Then, the Mann-Whitney U test is used in nonparametric tests when the categorical variable has two categories, and the Kruskal Wallis test is used when there are three or more groups of variables. Furthermore, the Kruskal Wallis test is the most appropriate method to compare populations that do not follow a Normal distribution, as is the case of some variables in the models presented in Chapters 3, 4 and 5. The level of significance with which comparisons are made is always 95%.

To apply multiple regression analysis to the proposed models in Chapters 3, 4, and 5, it was mandatory to study whether there was a high correlation coefficient and a high determination coefficient. In this way, it was possible to establish if the chosen variables included in the adjusted models were good predictors for the dependent variable. An ANOVA independence test was also performed on each model, the importance of which

ensures that the independent variables function as good predictors of the dependent variable.

Table 1.4 summarizes the statistical techniques applied in each chapter.

Table 1.4. Summary of methodologies

Chapter	***Methodology***
Chapter 3: A pioneer and comparative insight into the performance of seed accelerators	(1) Descriptive analysis (2) Bivariate analysis (3) Multivariate analysis
Chapter 4: The socioeconomic impact of accelerators. An analysis of conditioning factors and implications for social innovation	(1) Bivariate analysis (2) Multivariate analysis
Chapter 5: A quantitative-based model to assess accelerated start-ups performance	(1) Descriptive analysis (2) Bivariate analysis (3) Multiple regression

Source: own compilation

1.5. STRUCTURE OF THE DISSERTATION

This dissertation is structured in 6 chapters. In general terms, the thesis is divided into 2 main areas: Chapter 2, and chapters 3, 4, 5.

The first area (Chapter 2) constitutes the theoretical framework of the dissertation. This chapter reviews the general literature on the origin, performance, and impact of business accelerators. This theoretical framework begins with an introduction to the entrepreneurship ecosystem, since it is the context where BIs and SAs are created, defining critical concepts such as: entrepreneurship, entrepreneur, and entrepreneurial ecosystems, followed by innovation and innovative ecosystems.

The following is an introduction to the BI literature to address the origin of SAs as a new version of incubators. More specifically, the theories and approaches that can explain the origin and performance of BIs and SAs are presented, as well as the socioeconomic effects that this type of organization can induce into the region where they are located due to the encouragement of entrepreneurship and innovation.

Finally, the general review of the literature ends introducing the role of two key theoretical approaches: the renowned resource-based view theory and the incubation theory. Both provide a basic theoretical framework for measuring the impact and performance of BIs and SAs.

The second main area (Chapter 3, 4 and 5) corresponds to the empirical research. In these chapters, the performance of business accelerators and accelerated start-ups is analyzed from different perspectives, including their location, job creation, financing resources, and investment capabilities. Likewise, the way in which SAs influence the process of creating new technological companies, and their impact on social innovation are also explored.

Chapter 3, "New evidence on Accelerator performance based on funding and location", corresponds to a paper published on January 2020 in the European Journal of Management and Business Economics with DOI 10.1108/EJMBE-10-2017-0029 (Scopus CiteScore 2019-2020: 1.620; Q1; SJR 2019: 0.64). This chapter includes an in-depth review of the literature integrating the main theoretical and empirical research on incubator performance. Next, an empirical model is built using a sample of accelerators worldwide, based on the business incubation theory and the resources-based view theory. This model includes three categories of variables: (1) size, (2) location and age, and (3) performance ratios. The results confirm at statistically significant levels a greater size and performance in the accelerators located in the United States. This chapter contributes by classifying the main indicators of accelerator performance, determining a new conceptual model for empirical analysis, and identifying ways for future research.

Chapter 4, "Social and economic impact of Seed Accelerators: significant factors and implications for the social innovation", corresponds to a paper published on August 2018 in CIRIEC-España, Revista de Economía Pública, Social y Cooperativa n° 93, pp. 211-240 with DOI:10.7203/CIRIEC-E.93.9855 (Scopus CiteScore 2019-2020: 0.71; Q2; SJR 2019: 0.33). This chapter explores in a pioneering and exploratory way accelerators' performance

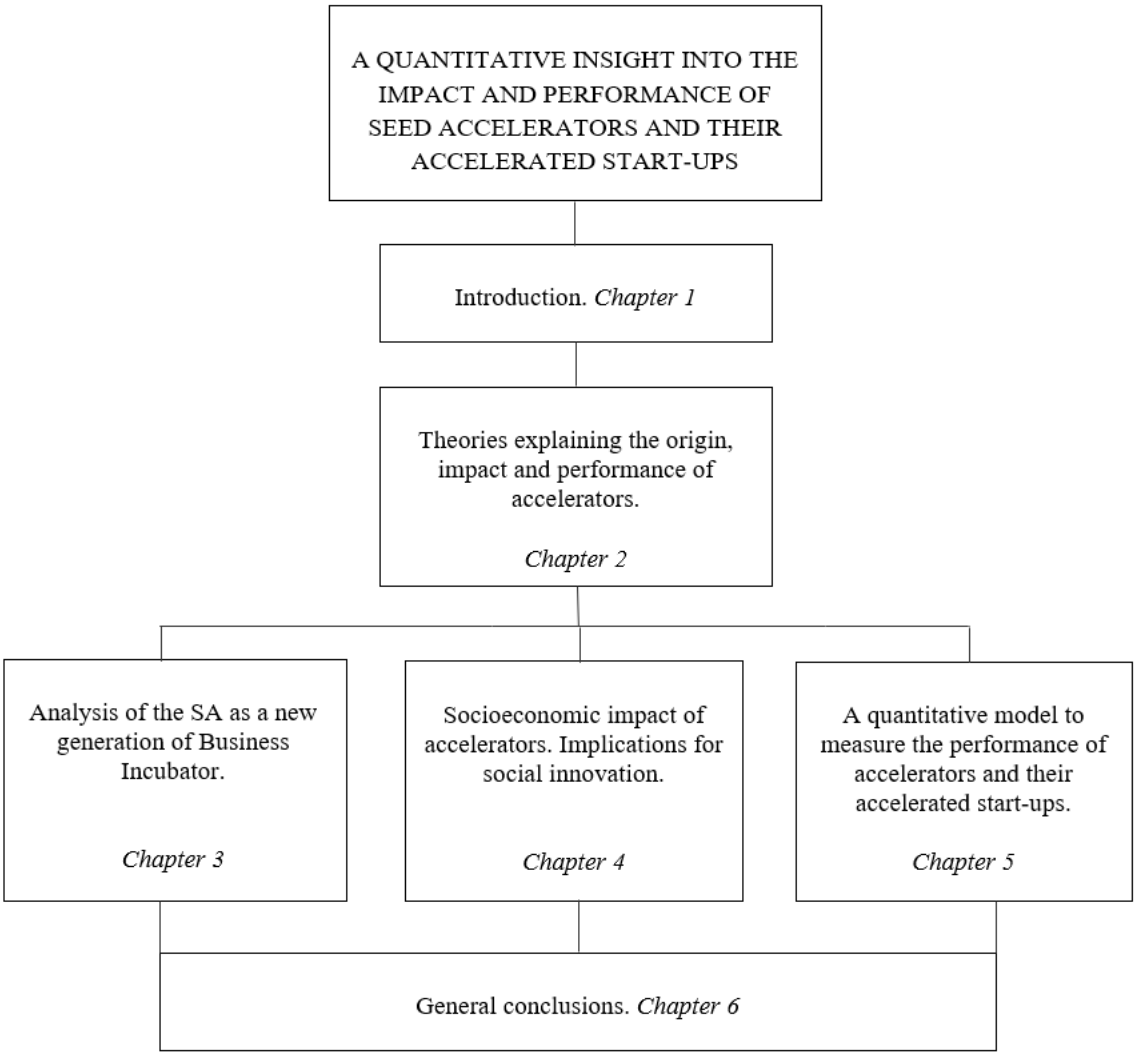
in terms of the employment generated by their accelerated new companies. The results reveal that SAs located in the United States stimulate the creation of a greater number of start-ups and new jobs, compared to SAs located in other countries. In addition, the study identifies the variables that most intensely affect the creation of new companies and their employment levels.

Chapter 5, "A quantitative-based model to assess accelerated start-ups performance", corresponds to a paper that is currently under review process by the Entrepreneurship and Regional Development Journal (Scopus CiteScore 2019-2020: 3.620; Q1; SJR 2019: 1.37). This chapter evaluates the performance of accelerated start-ups to determine the most critical and influential characteristics of SAs that impact their survival and growth. A quantitative analysis is performed based on the variables used in the most recent SA literature. The results confirm at statistically significant levels that the size of the Accelerator portfolio, the survival rates of new companies, and the proportion of employees in the accelerated firms, have a positive effect on the median value of the funding received by accelerated start-ups from the SAs funds. Furthermore, SAs located in the United States, and those that are active for a longer period of time, show a greater impact on the survival rates of new companies. These results contribute to the still sparse quantitative literature on accelerator performance, and provide important management implications using a two-perspective approach: the Accelerator and accelerated start-ups.

In addition to the results and specific findings of each chapter, the dissertation ends in Chapter 6 with general conclusions, which summarize the main findings and contributions of Chapters 3, 4 and 5. The academic and managerial implications are discussed afterwards, followed by the proposed lines for future research.

Figure 1.7 shows a summary of the general research question of this dissertation and its structure throughout the chapters.

Figure 1.7. Summary of the dissertation to answer the general research question



Source: own elaboration

1.6. REFERENCES

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CHAPTER 2: BUSINESS INCUBATION AND ACCELERATION. A GENERAL THEORETICAL FRAMEWORK.

2.1. INTRODUCTION

The first known incubator was established in Batavia (New York) in 1959. Back then, this was a virtually unknown phenomenon and its diffusion during the 1960s and 1970s experienced a slow but continuous process. The popularity of this type of organization increased significantly in the 1980s and 1990s, sparking the interest of entrepreneurs, investors, politicians, and researchers, who began to question the effects of incubators on the regional economy (Hackett and Dilts, 2004).

The establishment of business incubation associations in the United States and the United Kingdom, such as the NBIA in 1984 and the UKBI in 1998, generated increased interest in how to measure the performance of incubators. Academic contributions soon increased and have continually evolved to this day (Hackett and Dilts, 2004; Phan et al., 2005).

But to gain a deeper understanding of BI organizations, it is important to start by explaining how they work. A business incubator selects a group of entrepreneurs to support the launch and development of their business projects or start-ups for a limited period of time, in a safe and low-cost environment, providing shared office space, targeted business training and commercial assistance. This system works through the appropriation, control and distribution of resources that the incubator has and facilitates to the projects that participate in the incubation program. The main objective of a BI is to successfully accelerate the development of new companies, while containing the cost of a possible failure (Hackett and Dilts, 2004).

Although much of the literature focuses on incubator facilities and the services they provide to incubated companies (better known as *incubatees*), it is also important to recognize the key role that the entire network of incubators (internal and external) plays in the incubation process for new companies.

In the absence of an integrated theory to understand how and why the incubation process contributes to incubation results, different authors have adopted existing theories and approaches to analyze the business incubation process. Authors such as Hackett and Dilts (2004), attempted to mitigate this gap by establishing "the business incubation theory", defining a model that integrates the factors involved in the incubation process in a way that allows researchers to predict and explain the performance of this type of organization.

To better understand the origin, performance, and impact of incubators and accelerators, it is important to consider the most common theories used in the BI literature. These theories are often combined to evaluate the multiple dimensions of this phenomenon. For example, several authors consider that these organizations facilitate the union of entrepreneurship, innovation (Acs et al., 2014; Levie et al., 2014), and technological change (Link et al., 2007) through the entrepreneurial ecosystem.

According to Romer (1994), the entrepreneurial ecosystem offers business incubators the possibility of promoting human capital, innovation and the transfer of knowledge, which are the necessary factors to obtain good performance. BIs and SAs play an important role in innovation (Ayers and Harman, 2009), allowing the formation and design of business ecosystems over time (Fernández et al., 2015).

These organizations are innovative and entrepreneurial structures that also participate in innovative and entrepreneurial ecosystems, providing knowledge-intensive services and generating good practices during the dissemination process.

The following sections provide a summary of the main concepts, theories and approaches, used in the literature to explain the phenomenon of business incubation and acceleration.

2.2. THE ENTREPRENEURSHIP ECOSYSTEM

2.2.1. Entrepreneurship and entrepreneur

In the existing literature, the word "entrepreneurship" and "entrepreneur" lack of an unified and consistent definition which reveals diverging views towards this phenomenon and its related actors.

Bygrave and Hofer (1992), suggested a concept based on the "characteristics of the entrepreneurial process", by defining entrepreneur as a person who perceives an opportunity and creates an organization to pursue it. Only a year later, Van de Ven (1993), observed the tendency in academic studies to focus mainly on the personal characteristics and individual behavior of entrepreneurs.

Shane and Venkataraman (2001) argued that, although the phenomenon of entrepreneurship provides research questions for many different academic fields, the existing literature covers primarily the following topics:

1) Why, when, and how opportunities for the creation of goods and services begin to exist;
2) Why, when, and how some people and not others discover and exploit these opportunities;
3) Why, when, and how different actions are carried out to exploit business opportunities.

According to Ahmad and Seymour (2008), entrepreneurs are those who seek to generate value by creating and expanding the economic activity, identifying and exploiting new products, processes, and markets.

In the absence of a consensus definition, researchers have proposed different word combinations, creating new concepts applicable to a particular context, such as "corporate entrepreneurship," "social entrepreneurship," or "entrepreneurial ecosystem." (Gedeon, 2010; Malecki and Spigel, 2017).

2.2.1.1. The entrepreneurial ecosystem and its environment

The notion of an entrepreneurial ecosystem (or ecosystem for entrepreneurship) is quite new and comes from diverse backgrounds. As Stam (2015, p. 1761) points out, "a widely shared definition does not exist yet." In part, this is because these ecosystems are defined in very different ways, at different scales and with different research designs and data. In addition, there are several types of ecosystems, of which the ecosystem that includes the entrepreneur is only one (Acs et al., 2017; De Vasconcelos Gomes et al., 2018).

Most definitions of entrepreneurial ecosystems highlight the existence of a combination or interaction of elements, often through networks, producing shared cultural values that support the business activity. This is the example of Silicon Valley, the most famous and successful entrepreneurial ecosystem in the world, is a reference to follow for economic policy developers and researchers, who keep a special focus on the replication of this model (Neck et al., 2004).

Gnyawali and Fogel (1994) define a "business environment" as a combination of factors that facilitate the development of the entrepreneur and his abilities to turn an opportunity

into a business. The authors classified this combination of factors under two different perspectives. The first perspective refers to the economic, sociocultural and political factors that influence people's willingness and ability to participate in business activities. The second perspective refers to the availability of assistance and support services for entrepreneurs that helps facilitate the start-up process. The conditions of the business environment are gathered in five dimensions: (1) government policies and procedures, (2) socioeconomic conditions, (3) entrepreneurial and management skills, (4) financial support, and (5) non-financial support. Table 2.1 includes the elements that are part of these dimensions.

Table 2.1. Theoretical framework of the business environment

Government policies and procedures	• Restrictions on imports and exports • Provision of bankruptcy laws • Entry barriers • Procedural requirements for registration and licensing • Number of organizations reported by employers • Rules and regulations that regulate business activities • Laws to protect property rights
Socioeconomic conditions	• Public attitude towards entrepreneurship • Presence of experienced entrepreneurs • Successful role models • Existence of people with entrepreneurial skills • Recognition of exemplary business performance • Proportion of small businesses in the business population • Diversity of economic activities • Scope of economic growth

Entrepreneurship and management skills	• Technical and professional education • Business education • Business training programs • Technical and professional training programs • Availability of information
Financial support	• Venture capital • Alternative sources of financing • Low cost loans • Will of financial institutions to finance small entrepreneurs • Credit guarantee program for start-up companies • Competition between financial institutions
No financial support	• Advisory and support services • Business networks • Incubator facilities • Public procurement programs for small businesses • Government support for research and development • Tax incentives and exemptions • Local and international information networks

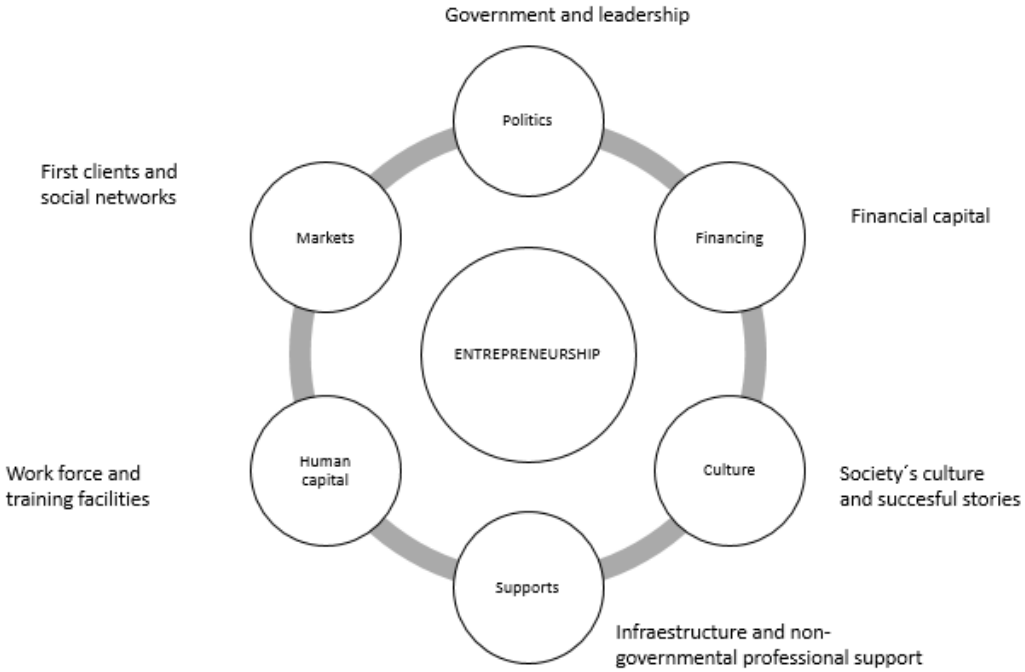
Source: adapted from Gnyawali and Fogel (1994)

According to Isenberg (2010, p.43), one of the most prestigious authors in entrepreneurship, the entrepreneurship ecosystem consists of a set of individual elements, such as leadership, culture, capital markets, and customers, which are all combined in a complex way. Isenberg broadens this definition in 2011 adding a new approach: "the entrepreneurial ecosystem strategy for economic development". This approach, according to the author, is a novel and profitable strategy to stimulate economic achievement, with the potential to replace or become a precondition for clustering strategies, innovation systems, knowledge economics or national competitiveness policies.

Isenberg argued that the need for an ecosystem strategy comes from observing societies where entrepreneurship occurs regularly or is self-sufficient, as a unique and complex environment that is continually evolving.

Isenberg (2011) identifies in his study six dimensions (Figure 2.1) within the entrepreneurial ecosystem: (1) a favorable culture, (2) favorable policies, (3) availability of financing, (4) human capital, (5) markets for products, and (6) a wide variety of institutional supports.

Figure 2.1. Dimensions of the entrepreneurial ecosystem



Source: adapted from Isenberg (2011)

Cukier et al. (2016, p.1) were pioneers in introducing the concept of the start-up ecosystem, as a "limited region within a range of 48 kilometers (or 1 hour trip), consisting of people, their new companies and various types of supportive organizations, interacting as a complex system to create start-up companies and boost existing organizations."

Theodoraki and Messeghem in 2017 (p.50, 56-57) delimited the dimensions of the entrepreneurial ecosystem established by Isenberg (2011) and grouped them as follows: (1) the actors who are part of it and their social interactions (formal and informal network), (2) the physical infrastructure, and (3) the culture. They also expanded the definition by adding that the entrepreneurial ecosystem can be described as "a generic context designed to foster entrepreneurship within a given territory, forming a horizontal network (customers and suppliers) and a vertical network (competitors and allies)."

2.2.1.2. The actors of the entrepreneurial ecosystem

The latest research tends to replace, or at least complement, the concept of an entrepreneurial ecosystem with that of an innovation ecosystem (Fang et al., 2015), which is especially conducive to driving development and accelerating the region's economy. The main actors that form an innovation ecosystem are: (1) start-ups and business support organizations, such as (2) publicly funded agencies (government institutions), (3) private companies (banks, private investors, venture capital), (4) support entities (business incubators and accelerators, consultants), (5) research institutions (universities, research centers, laboratories), and (6) business consorts (active companies, associations, and unions) (Fang et al., 2015; Theodoraki and Messeghem, 2017).

These actors interact with each other and their needs change over time. For example, incubators and accelerators may require public or private funding, and collaborate with commercial consorts and research centers in the region. New companies participating in an incubation or acceleration program can obtain investments through private investors, collaborate with companies that are part of a consortium or with research centers for the development of new products. Meantime, business consorts may have access to innovations carried out in research centers, or they may develop innovative products in-house to obtain financing through public or private investors. Private investors obtain an economic return as a result of these relationships, and public investors gain socioeconomic benefits in the region where these actors are located. To build and become a proper start-up ecosystem, all of these economic actors are required and expected to support each other equitably. Healthy and strong ecosystems require each of them to work as a team, since their needs are interdependent and success is created together (Fang et al., 2015).

2.2.2. Innovation and innovative ecosystems

Innovation is defined differently in academic literature according to context and author. According to Van de Ven (1986), innovation (in its most basic modality) refers to a new form or a new perspective of doing things.

The latest (third) edition of the Oslo Manual (OECD, 2005) defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organizations, or external relations.

There is a large number of studies on innovation from a product or process perspective (Bundy, 2002). King et al. (1994), characterize innovation in the context of information technologies, through three phases: (1) invention, (2) innovation, and (3) dissemination. Invention is the idea or the product, which does not necessarily have an economic value. Innovation is the phase focused on the transformation of the invention into a product, technique, or process. Diffusion is the use of innovation or the ability to produce it.

Rogers et al. (2005), describe the generation of innovations as a complex development process that consists of: (1) recognizing a problem or need; (2) basic and applied research; (3) development; (4) commercialization; (5) diffusion and adoption; and (6) consequences. Consequently, the term innovation includes both the process and the product simultaneously. From the perspective of the product, or the result of the innovation, there are several types of innovation discussed in the literature. In this sense, disruptive innovation is the most used in the field of technology companies, since it disrupts a market or displaces an existing technology. The concept of innovation through creative destruction became popular through the economist Joseph Schumpeter in the 1940s and has been discussed over the years by authors like Christensen (2013).

Innovation is an important mechanism to trigger the economy. The innovation literature places special emphasis on the remarkable impact that innovative products may have on the economy through the companies that market them. The role of start-ups in fostering innovation is also worth highlighting, as start-ups tend to focus on creating new solutions that have a transformative impact on the market through the use of disruptive innovation.

Norman and Verganti (2012) added two trends within disruptive innovation that are relevant to consider: (1) radical innovation and (2) incremental innovation. Radical innovation refers to doing something new, while incremental innovation refers to improving something that has already been done. The authors consider that radical innovation is rare and requires great technological change, adding that most of the innovation produced by new companies is incremental innovation. Following this line, Cuevas and Román (2008), note three types of disruptive innovation: (1) according to the object of the innovation, (2) according to the degree of innovation novelty, and (3) according to the strategic purpose of the innovation.

Table 2.2. Classification of innovation by type and degree of novelty

	Radical innovations	Incremental innovations
Innovation in product	New goods or services in the market.	• Goods or services with substantial changes in the market. • Goods or services with slight modifications in the market. • Goods or services similar to those of the market.
Innovation in processes	New processes in the market created by the company.	• Introduction of machinery and equipment with new technology. • Introduction of new information and communication systems (ICT). • Small modifications in processes resulting from experience.

Source: adapted from Cuevas and Román (2008)

Innovative ecosystems emerge and grow in entrepreneurial ecosystems endowed with the right conditions for the implementation of disruptive innovations.

Innovative ecosystems are characterized by an abundance of technological start-ups. The most relevant examples of innovative ecosystems are located in Silicon Valley, New York City, London, Beijing, and Boston. These areas represent the five most important innovative ecosystems in the world, according to the Start-up Genome Project (2019). Some of the key factors that characterize these ecosystems are: talent, density, culture, capital, a regulatory environment, infrastructure, and existing institutions. Consequently, business incubators and accelerators are part of these areas as entrepreneurship and innovation supportive organizations.

According to Ranga and Etzkowitz (2013), these areas also assemble an innovation system whose interactions emerge from close ties between universities, industry and the government. Popularly, these areas have been recognized in the literature as "clusters" (Porter, 1998) for benefiting from a "cluster effect" (De Fontenay and Carmel, 2001).

That is, companies located in these places obtain comparative advantages by benefiting from access to abundant human capital, a culture of work, the existence of tacit knowledge, proximity to the workplace, and the existence of governmental supportive organizations, such as business incubators. Therefore, entrepreneurs and their new companies can reap many benefits and incentives by being located in these types of areas.

Authors such as Adner and Kapoor (2010) discovered that the success of innovative start-ups was strongly related to the performance of other companies located in the same geographical area. According to Fal (2013), these benefits originate from (1) the amount of resources that entrepreneurs can access to (financing, skills, knowledge, talent and infrastructure), and (2) the existing business assistance organizations (business incubators and accelerators).

2.3. SEED ACCELERATORS

2.3.1. Business incubation literature

The growth in the number of business incubators operating in the United States since the 1980s has been continuous and exponential, extending first in European countries and then to the rest of the world.

As Table 2.3 shows, academic contributions soon grew and have continued to evolve to this day, with the emergence of a new institutional form in the entrepreneurial ecosystem: accelerators, a new generation of business incubators (Hackett and Dilts, 2004; Phan et al., 2005; Hochberg, 2016).

The first phase of studies on incubators, between 1985 and 1990, focused on the search for a definition and a general theoretical framework, as well as the analysis of specific aspects of the incubation process. Main questions posed in this period by the authors were: what is an incubator?, how does an incubator develop?, what incubation model do they have?, what are the critical factors of their success?, or, how do they work?

In the second phase, between 1991 and 1999, studies began to focus on performance analysis and the impact produced on the *incubatees* with questions such as: do incubators achieve what their stakeholders affirm?, how can their results be evaluated?, what is the impact on the new incubated company?, what are the rates of survival, employment, industry creation, and innovation?, or, what are the social and economic impacts of an incubator? However, because rapid failure is a common occurrence that especially affects companies of the start-up type (Watson et al., 1998; Zacharakis et al., 1999), performance measures contributed by the incubation literature in this period, focused mainly in the survival of new companies in their early stages of development, after completing the incubation process.

In the third phase, between 2000 and 2005, the theory of business incubation began to be drawn along with other theories (access to resources, social networks, the characteristics of the founder, etc.), with the intention to explain the origin and behavior of the incubation process. Researchers at this stage tried to answer questions such as: what is the meaning of

social relationships in the incubation context, and how do they influence entrepreneurship?, or, what are the critical factors for the success of incubators and their *incubatees*?

Additionally, at this stage a consensus definition of BI was finally reached: "A business incubator is defined as an organization that offers a shared office space with facilities to accommodate its entrepreneurs, including a series of services that involve added value, such as advice and commercial assistance… Incubators use a system in which they control and link the resources available to them and that are difficult for the entrepreneur to assume, with the aim of facilitating the successful development of new companies and minimizing the risk of failure" (Hackett and Dilts, 2004).

The fourth phase (2006-2012) offers a wide range of empirical studies with valuable information on the business incubation process, based on a theory widely accepted by the literature: the incubation theory of Hackett and Dilts, (2004). Empirical studies on incubators at this period particularly analyzed the incubation process based on the incubation theory, through a wide range of qualitative methods that include case studies (Clarysee et al., 2005; Grimaldi and Grandi, 2005; Bergek and Norman, 2008; Schwartz and Hornych, 2008; Ratinho and Henriques, 2010), categorization by questionnaires, interviews and reports (CSES, 2002; Knopp, 2007; UKBI, 2009; Soetanto and Jack, 2013), and comparisons of incubated companies with others not incubated (Lindelöf and Löfsten, 2002; Amezcua, 2011). These studies focused primarily on connections to the local business environment, in order to establish several recommendations for best practices and gain a deeper understanding of the key factors leading to incubator success.

The fifth phase (2013-2020) is the most recent and focuses mainly on the study of accelerators as a new generation of business incubators. This last stage is characterized by conceptual, descriptive, and empirical research that analyzes the Accelerator as a more advanced incubation model, based on the incubation theory and other complementary theories (resources and capabilities, social capital, agency theory, and others). Researchers strive in this phase to provide a theoretical starting point for this new business phenomenon (Cacciolatti, et al., 2020; Hallen et al., 2020; Yu, 2020).

Table 2.3. Phases of business incubation literature over time

Phase	Objectives	Methodology	Authors
(1) 1985-1990	Development and configuration studies of incubators	Conceptual definitions. Political implications. Impact on the development and foundation of new companies.	Allen, 1985; Allen and Levine, 1986; Fry, 1987; Kuratko and LaFollette, 1987; Merrifield, 1987; Smilor, 1987; Campbell et al., 1988; Hisrich and Smilor, 1988; Allen and McCluskey, 1990; Udell, 1990.
(2) 1991-1999	Studies on the impact of incubators	Analysis of the impact and results. First performance measures.	Lichtenstein, 1992; Rice, 1993; Mian, 1996; Mian, 1997; Westhead, 1997; Autio and Klofsten, 1998; Shermann and Chappell, 1998; Watson et al., 1998; Zacharakis et al., 1999.
(3) 2000-2005	Theories on the incubation process	Traditional theories to explain the incubation process: agency theory, resources and capabilities, social capital, network theory, and others.	Hansen et al., 2000; Nowak and Grantham, 2000; CSES, 2002; Colombo and Delmastro, 2002; CSES, 2002; Lindelöf and Löfsten, 2002; Philips, 2002; Rice, 2002; Siegel et al., 2003; Hacket and Dilts, 2004.
(4) 2006-2012	Empirical studies with mixed theories to explain the performance of incubators	First qualitative and quantitative studies on the performance of incubators and *incubatees*.	Dettwiler et al., 2006; Knopp, 2007; Bergek and Norrman, 2008; Schwartz and Hornych, 2008; Chen, 2009; UKBI, 2009; Amezcua, 2010; Ratinho and Henriques, 2010; Amezcua, 2011.
(5) 2013-2020	Studies on the new generation of incubators: accelerators	First definitions. First empirical studies on the performance of accelerators. Analysis of their socio-economic impact.	Hochberg et. al.,2015; Gonzalez-Uribe and Leatherbee, 2017; Cavallo et al., 2019; Cohen, et al., 2019; Fehder and Hochberg, 2019; Cacciolatti, et al., 2020; Hallen et al., 2020; Yu, 2020.

Source: own compilation

2.3.2. Accelerators definition

Accelerators are considered the third generation of business incubators after Science Parks and traditional business incubator models (Bøllingtoft, 2012).

The Accelerator or Seed Accelerator (both terms are used interchangeably (Cohen and Hochberg, 2014), is a concept of an organization conceived in Silicon Valley, and it is a relatively new phenomenon that has grown and expand continuously around the world since 2005.

The interest of academics in the SA field has grown over time. Different authors have attempted to provide an universal concept that defines this type of organization, explaining how they generally operate, and trying to find the key characteristics that makes them different from business incubators. Miller and Bound (2011) are amongst the first authors providing a definition of an Accelerator, by describing the five key characteristics that this organization should gather:

- An open and highly competitive application process.
- Pre-seed investment usually in exchange for equity.
- Relatively short period of programed events and intensive mentoring.
- A focus on small teams (as opposed to individual founders).
- Training in "cohorts" rather than individual companies.

Radjoevich and Hoffman (2012, p.58) added to this definition two key characteristics "early stage funding and intensive mentorship".

Cohen (2013) defines accelerators as "organizations that provide entrepreneurship education for a limited period of time to cohorts of selected ventures who begin and graduate together". In the following year, Cohen's original definition from 2013 was further extended by Cohen and Hochberg (2014, p.4), describing Accelerator as "a fixed-term, cohort-based program, including mentorship and with an educational component, that culminates in a public pitch event named Demo-Day". But accelerators are not only programs, they are also "business entities that make seed-stage investments in promising companies in exchange for equity" (Dempwolf et al., 2014, p. 26). Accelerators are mostly private, for-profit organizations, and display a clear business model (Tasic, et al., 2015).

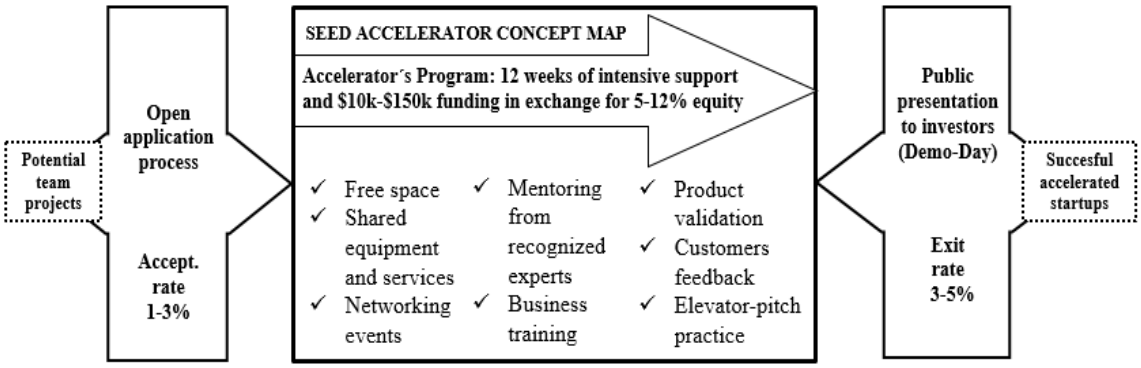
Lastly, Hathaway (2016) describes the Accelerator experience as a process of comprehensive, learning-by-doing education within a short period in order to fasten the life-cycle of young and innovative firms. In addition, accelerators are mostly funded privately, backed by governments, corporations, or universities (Hallen et al., 2020).

Nevertheless, Accelerator´s definition has been linked in several occasions to the business incubator concept. Both concepts try to leverage entrepreneurial talent and speed up the company's development, as well as the technological development by creating synergies between know-how, experience, capital, and network.

Considering the lack of a general consensus on a formal definition, we will adopt throughout this dissertation the definition introduced by Miller and Bound (2011) and Cohen and Hochberg (2014), adding that accelerators´ main goal is to promote and accelerate the creation of new ventures, especially those working with low structural costs and based on Internet and electronic commerce (Teo and Ranganathan, 2004).

Most accelerators launch an open application process where anyone with a business idea can apply. Next, the best projects are chosen and admitted into the Seed Accelerator Program (SAP), which last an average of 12 weeks. The SAP typically offers to its hosted companies free working space, shared equipment and office services. Also significant is the networking with other entrepreneurs on place, and a range of training and mentoring services offered to each project´s team, in exchange for equity at pre-seed or seed stage of each future company. The program finally culminates with the presentation of the most successful projects to investors in a public pitch event known as “demo day” (Figure 2.2).

Figure 2.2. Seed Accelerator model concept map



Source: adapted from Hackett and Dilts (2004), and Dee et al.(2011).

The above named key features, defined by Cohen and Hochberg (2014), are common in each SAP. The SAP is an intense working period during which the Accelerator offers a selected number of services to the start-up in order to accelerate the start-ups' growth and therefore making them more attractive for outside investors such as business angels and venture capitalists.

2.3.3. Differences between business incubators and seed accelerators

Incubators and accelerators share a common historical background which is the reason behind they are sometimes used interchangeably (Lewis et al, 2011). Hence, it is even more important to demonstrate the actual differences between these two programs.

Miller and Bound (2011) were pioneers in recognizing a number of distinctive features that set Accelerator programs apart from existing incubators and other supportive start-up programs. The main difference between SAs and BIs probably lies in the requirements to be met when applying to either an accelerator or incubator program. While BIs accept any project regardless of the promoter, SAs prefer entrepreneurial teams. Accelerators are far more stringent in their selection process and contribute with investment, consequently, the percentage of project application acceptance onto an accelerator program is frequently very low (Christiansen, 2009; Cohen, 2013).

SAs are also typically financed with private funds while BIs are often government funded organizations, focused both on individual entrepreneurs and small teams. The incubator program lasts between six months and three years, and they usually charge fees for their mentoring services or use of the shared office space. In some cases applications are restricted to students enrolled in partner universities (Hackett and Dilts, 2004; Ali-Mubaraki and Busler, 2010; Dee et al., 2011; Jørgensen, 2011; Özdemir and Sehitôglu, 2013).

Other differences between SAs and BIs lay in terms of investment, the equity taken by SAs (15 % on average) is greater than that of BIs (2% on average), while the initial average funding by SAs (10k-150k) is less than that of BIs (250k on average) (Christiansen, 2009; Miller and Bound, 2011; Cohen, 2013; Salido et al., 2014; Hathaway, 2016).

The reason behind these differences could be explained due to SAs been typically a for-profit and private organizations, while BIs are often non-profit, government funded organizations or sponsored by big multinationals.

In summary, we highlight the six characteristics that defines accelerators and differs them from business incubators, according to Clarysse et al. (2015):

1) Accelerators offer upfront investment ($10k – $150k) in exchange for equity (5–12%).
2) Accelerator programs have a limited time of start-up support (average of 12 weeks) comprising programed networking events and intensive mentoring.
3) Accelerator programs attract new start-up projects by an open application process which is very competitive (just 1-3% of the projects that apply are accepted).
4) Every Accelerator program accepts several start-up projects.
5) Most accelerators focus on multidisciplinary teams instead of individual founders.
6) The Accelerator program culminates in a Demo Day, where start-ups present their business plans to investors (known as elevator pitch).

Despite BIs and SAs certainly follow the same business structure and philosophy, and most authors tend to describe “accelerators” as a “part of the incubation process” (Carayannis and Zedtwitz, 2005; Aaboen, 2009; UKBI, 2009), there are some distinctions in practice worth noting. These main differences between SAs and BIs are summarized in Table 2.4.

Table 2.4. Differences between incubators and accelerators

	Company profile	Application process	Who can apply	Accepted founders	Program period
BI	Private or public funded.	Online open process or contract.	Students, individuals.	Individual entrepreneurs or small teams.	Between 6 months and 3 years.
SA	Private funded.	Online open process or competition.	Teams, companies.	Multidisciplinary teams.	3 months.
	Industries accepted	**Service payments**	**Equity taken**	**Funding intervals**	**Exit method**
BI	General.	Space rented or membership.	0-5% average.	$50,000 to $200,000.	Investor, VC, leader company, or founders.
SA	Saas, marketplace, and ecommerce.	Generally none.	5-15% average.	$10,000 to $50,000.	Investor, VC, leader company, or founders.

Source: adopted from Christiansen (2009), Petersson et al. (2012), and Cohen (2013).

2.3.4. The key agents of the Accelerator ecosystem

After reviewing what is an Accelerator and its characteristics, we will proceed explaining the key agents that are part of an Accelerator ecosystem. There are three key agents observed in the Accelerator ecosystem that working together facilitate access to investment in start-ups: entrepreneurs, investors, and mentors (Barrehag et al., 2012). When operating

together, these three agents contribute to creating the acceleration program and also benefit directly from it, professionally and financially.

2.3.4.1. Entrepreneurs

Entrepreneurs are the agents who are expected to benefit the most from the SAP (Miller and Bound, 2011; Wu, 2011). Christiansen (2009) highlights the value of entrepreneurs and the connection they create with potential investors to access future capital, through the Accelerator network. On the other hand, Barrehag et al. (2012) point out the relationship between entrepreneurs and professional mentors as the most valuable outcome of the SAP under a financial scope.

In any event, accelerators give to entrepreneurs access to an important network of potential partners, customers, and professional mentors, increasing both human capital and chances to success.

2.3.4.2. Investors

Accelerators are expected to help entrepreneurs to build a strong connection and trust with local investors, professionals, and the community. Accelerators are expected to provide an attractive range of projects, filtering and aligning them within the personal interests of each investor. Investors can find in the SAP attractive opportunities to invest in companies keeping costs to the minimum, developing the products faster, and launching them to the market more easily (Miller and Bound, 2011; Ries, 2011; Blank, 2020). In the investors group there are two different subgroups or investment mechanisms depending on the amount of investment: (1) business angels (or private investors) and (2) venture capitalists (or investment funds).

Angel investment is a more unformal type of funding, which has expanded very rapidly in recent years to improve the survival rates of start-ups. Kerr et al. (2010) note that "start-ups funded by angel investors are 14 percent to 23 percent more likely to survive for the first three years, and increase their employment by 40 percent, compared to non-angel funded start-ups". Angel investors are wealthy individuals who invest their own money into early stage start-ups, usually having previous experience in seed investing. It is also common to find angel investors who are or had been serial entrepreneurs (Wiltbank et al., 2009).

On the other hand, the corporate funding type is the venture capital investment, provided by venture capital funds investing in companies with high growth, but also high risk, and are often within technology intensive industries (Black and Gilson, 1998).

Venture capital is defined as a multiple stage equity investment in privately held ventures, which acts as a financial intermediary in order to take advantage of profitable opportunities (Li, 2008).

2.3.4.3. Mentors

Another key agent in the Accelerator Program is the mentor.

Mentors are defined by Techstars Accelerator (2020) as "individuals with deep industry, investment, or entrepreneurship experience, working with companies pro bono, without expectation of reward or compensation, willing to share their knowledge and guidance freely, opening their networks when appropriate."

Mentors, according to Wu (2011), increase the human capital of companies participating in the SAP and add value in the form of business ideas, potential contacts and business advice to avoid entrepreneurs committing typical mistakes in their first months. Previous experience as entrepreneurs or investors is common amongst mentors.

An Accelerator aims to engage several top mentors for a fruitful marketing strategy, since that will facilitate the attraction of entrepreneurs, investors, and potential networks into future SAPs.

Mentors generally do not charge any fees for their mentoring services. However, they will if they are invited to continue working for a particular start-up after the end of the acceleration program (Barrehag et al., 2012).

2.4. THEORIES EXPLAINING THE PERFORMANCE OF ACCELERATORS

Accelerators help new entrepreneurs in the launch of start-ups, and while some SAs support the entire acceleration process others do not. This heterogeneity leads to inconsistent definitions, criteria for evaluating effectiveness, determination of how much value SAs add, and problems establishing the key factors for success (Albort-Morant and Ribeiro-Soriano, 2016). These differences in organizational structure and objectives hamper the development of a unified conceptual framework for SAs research (Mian et al., 2016).

Researchers have relied on various theoretical approaches to study the business acceleration process spanning various disciplines of the incubation literature (Mian et al., 2016). Phan et al. (2005) point out that generalizable theory may not be possible due to the idiosyncrasies of this type of organization in relation to geographic, political, social and economic systems.

In order to establish a conceptual basis and theoretical framework on accelerators for this dissertation, the most representative theories implemented in past and current BI and SA research studies have been compiled and briefly explained in the following sections, along with their limitations to analyze this phenomenon.

2.4.1. The resource-based view

The resource-based view has its origin in the works of Penrose (1959) and Selznick (1997), and its theoretical evolution has continued to develop remarkably (Barney, 1991; Grant, 1991; Peteraf, 1993).

According to this approach, the creation of a long-term competitive advantage depends on the company's position in the industry, shifting the focus from the competitive environment to the internal factors of the company. This is how the resources that make up the company, when they meet certain conditions, allow building a sustainable competitive advantage and generate a long-term income, which is the final goal of the business strategy (Schoemaker, 1990).

Penrose (1959) was one of the first authors to consider the company as an entity with a set of resources of different types: physical, tangible, and human. Wernerfelt years later (1984), introduced the idea of heterogeneity in the company's resource endowment.

With this approach, Foss added in 1997 that (1) each company is heterogeneous since it is made up of a unique set of resources that allow building a competitive advantage (as a result of its history, past decisions, and fortuitous situations); and (2) this heterogeneity can be maintained over time, so that the competitive advantage can be sustainable and generate income in the long term. Peteraf (1993) expanded this definition by adding that the resources to generate a higher long-term income than those of competitors must meet the following conditions: (1) heterogeneity, (2) ex-ante limits to competition, (3) ex post limits to competition, and (4) imperfect mobility.

Table 2.5. Necessary conditions for resources to generate a sustainable competitive advantage over time

(1) Heterogeneity	Possession of superior and limited (natural) resources and capacities implies lower commercial costs and, consequently, greater benefits.
(2) Ex-ante limits to competition	They enable an organization to achieve a superior position by owning a strategic resource before competitors.
(3) Ex-post limits to competition	They delay, make it more expensive, or make it difficult for competitors to imitate or exceed a competitive position. Only then is it possible to maintain a competitive advantage over time.
(4) Imperfect mobility	It implies that the resources that generate the competitive advantage cannot be bought or sold.

Source: adapted from Peteraf (1993) and Sánchez et al. (2012).

In summary, from this perspective, the company is understood as a set of resources that, when combined and deployed in a unique way, allow it to generate higher income than the competition. This privileged position can be maintained over time when resources are scarce and of imperfect and limited transfer, substitution and / or appropriation (Barney, 1991; Grant, 1991; Peteraf, 1993).

According to Acedo et al. (2006), and to Ordonez, Peteraf, and Ventura (2007), the RBV has evolved in recent years towards two approaches: the knowledge-based approach and the dynamic capabilities approach.

The resource-based view together with the knowledge-based and the dynamic capabilities approach, could broadly explain how technological companies, such as start-ups, can generate a competitive advantage thanks to the resources they have access to in the entrepreneurial and innovative ecosystem, but also due to the capabilities and knowledge acquired by participating in an incubator or accelerator program.

First, the resource-based view (RBV) suggests that a company's ability to achieve continuous income (or profit) comes from its internal resources, land, labor, and capital.

And second, the resources that incubators or accelerators provide to start-ups are valuable, rare, inimitable, and non-substitutable, which helps companies achieve a sustainable competitive advantage (Mian, 1996).

However, within BIs and SAs, these resources are provided only temporarily, until the new company develops company-specific capabilities and competencies to develop its own competitive advantage (Todorovic and Moenter, 2010).

Alvarez and Busenitz (2001) argue that entrepreneurship is an integral part of RBV and defined entrepreneurship as “the recognition and exploitation of opportunities that result in the creation of a firm that seeks to obtain entrepreneurial rents” (p. 757). Entrepreneurship, however, is not seen as the activity of starting a new venture, but rather “entrepreneurship is a mechanism by which society converts technical information into products and services” (Shane and Venkataraman, 2000, p. 219). Stevenson and Jarillo (1990) consider entrepreneurship as a management approach, defining it as a “process by which individuals seek opportunities without taking into account the resources they currently control” (p. 23).

It is through this process that entrepreneurship provides alternative uses of resources that lead to competitive advantages; therefore, entrepreneurship is an intricate part of RBV (Alvarez and Busenitz, 2001; Barney, 2001; Bruton and Rubanik, 2002).

As entrepreneurs dedicate themselves to exploiting new opportunities, they have many obstacles to overcome, especially in the early stages of company development. To this end, the incubator and accelerator are considered to provide the temporary support resources that lead to the development of a company-specific competitive advantage (Von Zedtwitz and Grimaldi, 2006; McAdam and Marlow, 2007). BIs and SAs often serve to provide entrepreneurs with basic resources such as physical space, business support, and network access, making an enriching environment available to start-ups (Mian, 1996).

The resource-based view is a compelling theory, and can provide insight into the way in which the incubator values and selects *incubatees*. However, the resource-based view can be faulted for ignoring issues of process (Foss, 1998).

2.4.1.1. The knowledge-based approach

The knowledge-based approach is based on the argument that knowledge is the main strategic resource of the company to develop and maintain a competitive advantage and, consequently, to achieve superior performance (Grant, 1996; Spender, 1996).

According to Grant (1996), knowledge is a fundamental resource in the creation of market value, which explains the difference between companies' results through heterogeneity in their knowledge bases, and the difference in the capacity for their development and subsequent application or exploitation. The knowledge that results from value is the one that fulfills certain conditions related to: transferability, aggregation capacity, appropriation, specialization and application to production (Grant, 1996).

The knowledge-based view of the firm, could be used to explain the incubation and acceleration process as the accumulation and application of new venture development know-how to the mentoring of start-up entrepreneurs. However, while the knowledge-based view could provide an interesting foundation for business incubation research, it does not accommodate the selection process component of the incubation and acceleration

program, and should be implemented with other complementary theories (Hackett and Dilts, 2004).

2.4.1.2. The dynamic capabilities approach

The dynamic capabilities approach tries to explain the origin of sustainable competitive advantage, considering that companies operate in a dynamic environment (Teece et al., 1997; Teece, 2007)

This approach distinguishes between resources and capabilities, emphasizing the importance of the latter in terms of the need for their dynamic nature to generate a sustainable competitive advantage (Weerawardena et al., 2007; Fletcher, et al., 2011).

A capacity is the ability of an organization to carry out the basic activities or tasks of the company in a more efficient and effective way than its competitors (Grant, 1991; Collis, 1994).

The dynamic adjective emphasizes the organization's potential to renew competencies that are consistent with a changing environment (Teece et al., 1997). Therefore, dynamic capabilities are the company's abilities to integrate, build, and reconfigure internal and external skills that allow it to adapt to a rapidly changing environment (Teece et al., 1997).

Dynamic capabilities are crucial to maintaining a competitive advantage over time. To this end, the organization and its members will modify their knowledge as a result of the learning cycles, with several levels of analysis that can be temporarily differentiated (Zollo and Winter, 2002; Argote et al., 2003). Organizations change using their basic capacities to transform their resources and capacities (Garud and Nayyar, 2004). Dynamic ability also implies the ability to learn from changes made, as a result of adaptations to changes in customer needs and tastes, and the need to anticipate the movements of competitors (Sánchez et al., 2012).

The dynamic capabilities approach facilitates consultation on how incubators and accelerators build new resources and capabilities, and how they allocate these resources to the transformation of entrepreneurs into producers of value. The dynamic capabilities approach serves as a solid theoretical basis for studies focused on development strategies for start-up companies. However, when the incubator is the unit of analysis, the focus on

building and maintaining a strategic competitive advantage, that is intrinsic to the dynamic capabilities perspective, is not so important because the typical incubator/ accelerator does not have many local competitors (Hackett and Dilts, 2004).

2.4.2. Other theories and approaches

There are several theories and approaches that could be used to explain the phenomenon of business incubators from different perspectives of analysis.

The first group of theories serves to describe the context in which incubators are created, while the second group gives an explanation of the factors that constitute the incubation process.

Below, we give a brief explanation of the different theories corresponding to the first group, that have been used to describe the context in which the incubator infrastructures and the services they offer are created.

1) Theory of market failures. Market failures occur when the competition in the transactional space for the production and sale of goods and ideas does not produce a desired product. The sources of market failures include externalities, imperfect information, monopoly power, and public goods. The researchers who have used the theory of market failures justify that the intrinsic structure and conditions of the market prevent the successful development of new entrepreneurial organizations, and incubators manage to solve this problem.

2) The theory of structural contingency. This theory suggests that the incubator configuration must be adjusted to the needs of the environment in order to achieve a successful incubation (Ketchen et al., 1993).

3) The theory of the value of co-production. This theory suggests that the context in which an incubator is created is co-produced by the incubator manager and that of the incubated company. This fact implies that the intensity of time spent by incubators on business assistance interventions must be strategically designated by the incubator manager. In this way, incubators will be adequately prepared to use the advice and knowledge they have obtained as a result of this intervention (Parks et al., 1981; Rice, 2002).

4) The theory of networks. This theory proposes that the characteristic that adds more value to the context of the creation of an incubator is the set of institutional processes and standards that are carefully structured and disseminate knowledge through its network of contacts. These relationships manage to create the conditions that facilitate the development of incubation projects and the commercialization of their future innovations (Nohria and Eccles, 1992).

In the following table we show the limitations that, in our opinion, these theories present to study the business incubation context.

Table 2.6. Theories related to the context of business incubation and their limitations

THEORY	LIMITATIONS
Theory of market failures	Incubators do not always achieve the success of their incubated companies.
Structural contingency theory	Incubators do not have to adapt to the needs of the environment, but their incubated companies that develop innovative products or services.
Theory of the value of co-production	The context in which an incubator is created does not involve the incubator manager and the company incubated before the incubation process, but other agents in the entrepreneurial ecosystem.
Network theory	This theory explains the context in which an incubator is created, but only the part concerning the relationships between the actors that make it possible.

Source: adapted from Hackett and Dilts (2004)

In the second group, we find theories aimed at explaining the factors that constitute the incubation / acceleration process, the mechanisms that these factors involve, how, why and where they are implanted, the contexts of these factors and the relationships between them.

1) Behavioral theory. This theory examines the influence of the environment on the unit of analysis. This theory could be used to study the influence of the external environment on the incubator, and the influence of the internal environment on the incubated companies (Skinner, 1976).

2) Classic economic theories. Classic economic theories focus on the balance between supply and demand. These theories linked to business incubation could predict the incubation of new companies based on perceived innovations (transaction perspective and rational economic cost), to satisfy demand and maximize potential benefits when it is commercialized (Coase, 1937).

3) The theory of social capital. This theory helps explain the success of the people involved in the incubation process by using their contacts, connections, and the resources they provide for their personal gain. Burt (2009) characterized social capital as a resource that provides a higher rate of return on investment. The theory of social capital helps to explain the relational factors that exist inside and outside the incubator that lead to the success of incubated companies, and as a consequence, to the success of the incubator (Burt, 1992; Leana and Van Buren, 1999; Adler and Kwon, 2002).

4) The agency theory. This theory has a relationship-based approach between managers who delegate tasks to their agents. Problems with these relationships appear because it is inefficient for the manager to continuously monitor the agent, and also because of the differences between their goals and perspectives. This theory can provide an adequate basis for research that focuses on the relationships between the incubator manager and the incubator (Eisenhardt, 1989).

5) Institutional theory. This theory postulates that organizations monitor competitors and tend to isomorphism. The literature answers questions focused on the institutionalization process and the impact of institutions on organizations, especially on the organizational structure and its internal processes. From this perspective, the incubator can be analyzed as a mediator between incubated companies and institutions. If the incubator is perceived

as an institution by its stakeholders, this theory can be used to examine how the incubator impacts the organizational structure and processes that occur within incubated companies. This theory can also be used to analyze the local, regional, national and international effect of institutions on the incubator and its incubated companies (Dimaggio and Powell, 1983; Zucker, 1987; Kuhns, 1999).

In the following table we summarize the limitations that, in our opinion, these theories present to analyze the business incubation process.

Table 2.7. Theories related to the business incubation process and their limitations

THEORY	LIMITATIONS
Behavioral theories	The existence of three discrete environments (external, incubator, and incubation) significantly complicates an empirical study based on behavioral theory to encompass the incubation process.
Classic economic theories	Theories of classical economics are based on industrial economics and accept the assumptions of (1) that the market operates rationally and (2) there are no barriers to entry for new business. However, this does not happen with many of the incubated companies, which often depend on the personal contacts created to be able to enter the market and spread their innovations.
The theory of social capital	The theory of social capital is incomplete to explain the incubation process, since it contemplates only a part of the incubator's intangible resources and ignores tangible resources. This theory can be used in conjunction with the RBV and capabilities theory, among others.

The agency theory	This theory does not consider the effects of the network of contacts that are part of the incubation process, it does not take into account that the relationships established through the network of contacts of the incubator, according to the existing literature, are associated with success, (Lichtenstein, 1992; Hansen et al., 2000). Furthermore, incubator start-up's managers do not work for the incubator manager, nor for the incubator's success (in the traditional sense), but rather work to achieve the success of their own companies.
Institutional theory	This theory does not serve to explain the incubation process, only the effect of institutions in this process, so it must be used together with other complementary theories.

Source: adapted from Hackett and Dilts (2004)

2.5. MEASURING THE IMPACT OF BUSINESS INCUBATORS AND ACCELERATORS: THE BUSINESS INCUBATION THEORY

The business incubation theory described by Hackett and Dilts in 2004 is the theoretical framework used by many researchers (Ensley and Hmieleski, 2005; Schwartz and Hornych, 2008; Schwartz and Hornych, 2010; Sá and Lee, 2012; Vanderstraeten and Matthyssens, 2012; Isabelle, 2013; Özdemir and Şehitoğlu, 2013; Schwartz, 2013; Clarysse and Yusubova, 2014; Albort-Morant and Ribeiro-Soriano, 2016; Hausberg and Korreck, 2020) to carry out empirical studies in this field, and to measure the impact and performance of this type of organizations.

This theory is based on the RBV and dynamic capabilities approach, since it is measured according to the capacity of the incubator, developed over time, to achieve the accumulation of resources and new capacities necessary for the creation of new companies.

These resources and capabilities help the incubator create business options through the selection of promising business projects. Once entrepreneurs are admitted to the program, the incubator seeks to achieve its goal by monitoring, advising, and infusing resources to business teams, while bearing the cost of some of these projects ending in failure.

The theory of business incubation of Hackett and Dilts (2004) is expressed as follows: BIP= f (SP + M&BAI + RM)

where,

- BIP = business incubator performance;
- SP = performance of the selected companies (*incubatees*);
- M&BAI = intensity of monitoring and commercial assistance;
- RM = abundance of resources.

First, the performance of the BI (BIP) is measured based on the growth of the incubated companies and the financial performance at the time of the exit of the investment by the incubator. In the latter lies the financial profitability of the incubator.

The value of a start-up company that has already completed the incubation program is particularly uncertain during its early stages, when it is struggling to overcome the lack of resources and simultaneously developing its organization and its first products (McGrath, 1999).

There are five different results that can be obtained as a result of the incubation process:

1) The incubated company is surviving and growing profitably.
2) The incubated company is surviving and growing and is moving towards a profitable model.
3) The incubated company is surviving but it is not growing and it is not profitable, or it is only in a few periods.

4) The incubation process is over but the incubated company is still in the incubator, and the losses were minimized.
5) The incubation process is over but the incubated company is still in the incubator, and the losses were high.

The literature has suggested that the first three states are indicative of a successful incubation program and the last two end states are indicative of incubator failure (Hackett and Dilts, 2004).

However, it can be argued that the fourth result (along with the first and the second) is a partial success for the incubator, since it managed to limit the cost of failure of the incubated company and could still show a business model with benefits in the future. On the other hand, the authors recommend that the third income statement be considered a failure because the incubation of "zombie" companies is not within the mission declared by this type of organization.

The performance of the selected companies (SP) refers to the results expected by the incubator on the emerging organizations selected to participate in the incubation process. This behavior includes a propensity to select projects based on the management characteristics of the entrepreneurial team (previous employment, experience and technical knowledge), as well as the characteristics of the market, the product, financial needs and expectations (Riquelme and Watson, 2002).

The intensity of monitoring and commercial assistance (M&BAI) refers to the degree to which the incubator observes and assists its *incubatees* in the development of their companies. This intensity is characterized by the time and quality of the assistance provided (Chrisman, 1989; McGrath, 1999; Rice, 2002). The incubator adds value to the incubation program by providing high quality services, especially those related to business consulting (Temali and Campbell, 1984; Allen and Rahman, 1985; Brooks, 1986; Smilor, 1987; Udell, 1990; Mian, 1997; Sherman and Chappell, 1998; Hansen et al., 2000). Rice (2002) in a case-based exploratory investigation, suggests that the intensity of time devoted to the advice of incubated companies may be a good predictor of the results of business incubation.

Resource abundance (RM) refers to the quantity of resources to which the incubator has access and is characterized by the availability of these resources, their quality and use. Daft (1983) defines the incubator's resources as ‘‘all the assets, capacities, organizational processes, attributes, information, knowledge, etc., controlled by the incubator that allows it to conceive and implement strategies that improve its efficiency and effectiveness”.

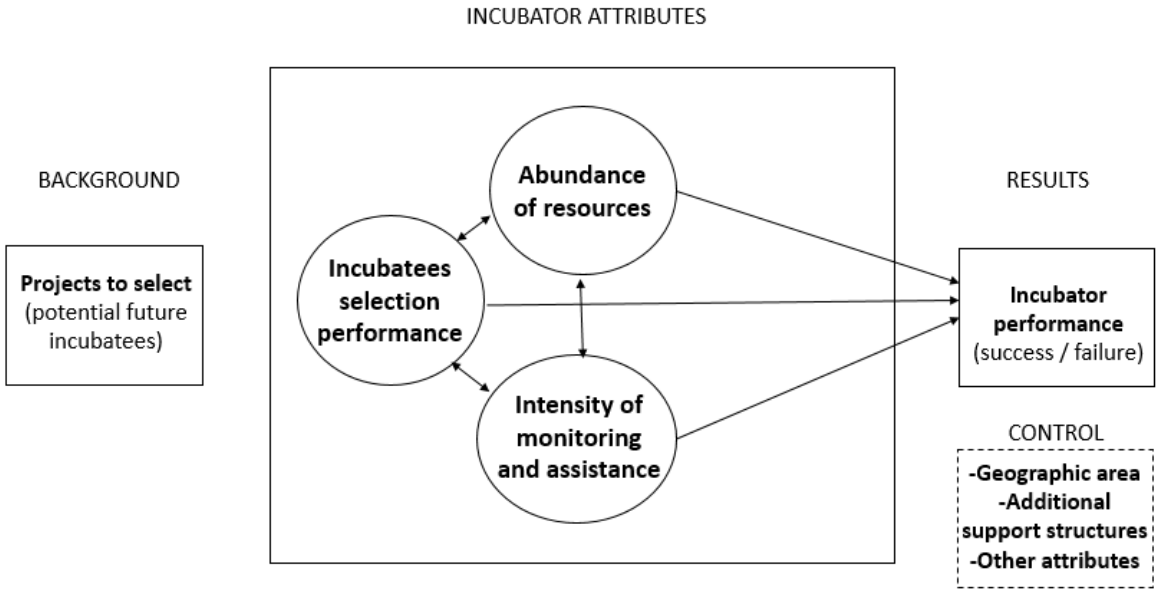
Incubator resources can be divided into two subcategories depending on whether they are internal or external. Internal resources are those within the incubator that are related to its financial system, networks, personnel, and business operations. External resources are those that are outside the incubator and are the combination of local innovation communities, including the incubator and the incubator-related industrial innovation network groups. That is why it seems likely that an incubator with high availability of resources (for example, high financing, good management, with extensive networks of contacts, access to innovations, experienced entrepreneurs and management teams), can infuse its incubated companies with everything necessary for incubation to be successful and obtain better results, compared to those incubators that cannot provide all these resources.

Incubators that help their incubated companies to fail quickly and economically are successful incubators because rapid failures cost less and provide opportunities for business learning, company recovery and repositioning. In addition, it implies an optimal allocation of resources for the incubator to the *incubatee*, and an injection of new start-ups to the population that will be incorporated into the local economy (Hackett and Dilts, 2004).

2.5.1. The business incubation model

In the mid-1980s, the business incubation literature introduced the concept of added value, analyzing the effect that such organizations cause on incubated start-ups (Campbell et al., 1988). Business incubation and venture capital investment activities share functional similarities. However, there are important elements in the incubation process that immediately distinguish them from other investment groups, such as the process of selecting the business projects, monitoring, assistance and infusion of resources. This process is shown in Figure 2.3.

Figure 2.3. The business incubation model



Source: adapted from Hackett and Dilts (2004) and M'Chirgui et al. (2018).

The Hackett and Dilts (2004) model, known as "the black box of business incubation", indicates that those incubated are selected from a group of candidates. Once in the process, they are assisted by training and specific consulting services (commercial, technical, management, etc.), monitored and infused with resources while undergoing an accelerated development. The results of the incubator can be measured based on whether the incubated company survives after the incubation process (success), or closes after a few months (failure). Control variables include regional differences according to economic dynamism, the level of development of the incubator and the size of the incubator.

The model is timeless and the arrows indicate the relationships between the variables. Arrows in both directions indicate feedback loops that can occur over time and through experience, suggesting organizational learning effects.

2.6. CONCLUSIONS

This section has presented the most relevant concepts and theories to explain the context in which business incubators and accelerators are created, the characteristics and factors that are part of the incubation and acceleration process, and the process of measuring their performance.

These organizations are part of the actors that participate in the entrepreneurial ecosystem, who can drive development and accelerate the economy of the region. In this way, the concepts of entrepreneurship and entrepreneurial ecosystem were covered to build the necessary context for the creation of innovative organizations that accelerate the development of companies, as is the case of BIs and SAs. These organizations appear as a consequence of the existence of six favorable dimensions within the entrepreneurial ecosystem: (1) culture, (2) policies, (3) availability of financing, (4) human capital, (5) markets for products, and (6) institutional support (Isenberg, 2011).

Innovative ecosystems are created within entrepreneurial ecosystems that present the right conditions for the implementation of disruptive innovations. These ecosystems are characterized by the abundance of new technology companies in places endowed with key factors: (1) talent, (2) density, (3) culture, (4) capital, (5) a regulatory environment, (6) infrastructure, and (7) supporting institutions. Consequently, business incubators and accelerators are part of these ecosystems that support entrepreneurship and innovation through their commercial activity.

The incubation and acceleration literature was introduced to describe BIs and SAs as key actors participating in the entrepreneurial ecosystem. This section introduced the main definitions, as well as the evolution of the literature and the differentiating characteristics of these organizations.

Within the different theories that researchers use to study BIs and SAs, we analyzed the resource-based view, followed by a summary of other existing theories that have been previously used in the literature, as well as their limitations to explain this phenomenon.

The RBV theory together with the knowledge-based and dynamic capabilities approach could broadly explain how technological companies, such as start-ups, can generate a

competitive advantage thanks to the resources they have access to in the entrepreneurial and innovative ecosystem, but also due to the capabilities and knowledge acquired by participating in an incubator or accelerator program (Hackett and Dilts, 2004). However, these resources are provided only temporarily (Todorovic and Moenter, 2010).

The theoretical review ends by presenting the widely accepted incubator theory of Hackett and Dilts (2004), based on the RBV theory. The incubation theory is measured based on the capacity of the incubator to accumulate the resources and capacities necessary for the creation of new start-ups. The incubation model of Hackett and Dilts (2004) and M'Chirgui et al. (2018), shows the process that a BI follows: from the acceptance of the entrepreneurs who will be part of the incubation process, to the launch of new operating companies on the market that benefited from the incubation services provided and the financing obtained. In this sense, the performance (success or failure) of a BI is measured based on (1) the selection of the project, (2) the abundance (or not) of resources, and (3) the intensity of monitoring and assistance to incubated companies. But there are other factors to consider, such as the demographic area or the existing institutional support in the region where the BI is located.

From this perspective, the incubation theory of Hackett and Dilts (2004) is used to better understand the incubation and acceleration model, the factors that are part of the process and its operation. The incubation theory is used as a starting point in the BI literature to explain how to measure the impact of this type of organization, as well as their performance model.

In summary, this exhaustive review of the literature has aimed to provide a general theoretical framework to establish the necessary theoretical bases to support the empirical studies presented throughout Chapters 3, 4, and 5.

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CHAPTER 3: NEW EVIDENCE ON ACCELERATOR PERFORMANCE BASED ON FUNDING AND LOCATION

ABSTRACT

Seed accelerators (SAs) appear as a more advanced version of business incubators. These for-profit organizations in exchange of equity, help setting new start-ups by providing mentoring and funding during their first months. Due to their emergent nature, the impact and expectations of SAs remains largely unknown. Therefore, the purpose of this study is to throw new light on this field by empirically assessing for the first time the performance and prospects of these organizations through a survey of 116 SAs. A model based on the Business Incubators literature is built with four categories covering size, location, age and profitability variables, leading to two hypotheses to be tested empirically over a survey of 116 SAs. Some remarkable findings arise after implementation of both bivariate and multivariate analysis. The results confirm a higher size and performance in the U.S. and in the oldest SAs at statistically significant levels. The study is not free from limitations but the findings make a contribution to the still scarce existing literature on SAs, and provide some managerial implications to their stockholders, to investors and to entrepreneurs. The findings concerning performance indicators are especially helpful for investors, primarily concerned with the percentage return on investment factor, the period and the investment rounds needed to achieve exit. Another key issue is the SA's role as an employment seedbed. At first glance, the amount of employment, both overall and per company, might seem small given the young age of these firms. The impact of SAs on the generation of new employment is difficult to measure as it usually takes place in further stages of development of the tenant companies, the so-called scale-up process. Nonetheless, at present, the number of new companies being born is remarkable and, in terms of employment, the results are indeed promising. Our findings also offer important implications for entrepreneurs, venture investors and policy-makers. To entrepreneurs, our findings offer insight on the expectations to hold in the accelerator programs. For policy-makers and would-be accelerator founders, our results support the idea shared in the literature that accelerators can be an effective entrepreneurial intervention, even in small entrepreneurial ecosystems, compared to the strongest entrepreneurial hubs (Hallen et al., 2020). SAs are considered a key agent in the prospects of any entrepreneurial ecosystem. However, no studies have so far analyzed the impact and performance of this emerging instrument. This is precisely the main purpose of this paper, to offer for the first time an approximate and exploratory assessment on the impact and prospects of SAs, based on a database.

3.1. INTRODUCTION

Since emerging in Silicon Valley in the late 1990s, seed accelerators (SAs) have evolved into a new model for incubating technology start-ups, specializing in the software and Internet industry. Today, more than 200 seed accelerator programs (SAPs) operate in the United States and over 300 operate in Europe. SAPs are also spreading rapidly elsewhere around the world.

Most SAPs were launched after the financial crisis in late 2007, and the number of new accelerators in Europe increased by nearly 400% from 2008 to 2013. This increase reflects an impressive counter-cyclical appearance of start-up initiatives across the continent (Salido et al., 2013).

An SA is usually described as a new type of early-stage development program for start-ups that combines elements of traditional business incubators (BIs) with equity-based funding and in-depth mentoring. Different versions have rapidly spread, with names such as micro-seed funds, business growth accelerators and boot camp programs.

An SA is typically an independent, private organization that aims at creating scalable and viable businesses in just a few months by connecting founding teams with a broad pool of experts and investors. Thus, SAs can be viewed as a more advanced version of BIs (Pauwels et al., 2016). The expectation is that SAs enhance the innovative capacity and development of a region by matching promising businesses with investors. In developed countries, particularly the United States, SAs and BIs take the lead in promoting the birth of new companies, generating skilled employment and encouraging technology transfer.

Born in the United States, SAs have become a key component of entrepreneurial ecosystems worldwide. Most start-up founders are eager to enroll in SAPs, which they view as useful channels to increase their chances of attracting external investment and boost their start-up's visibility and perceived viability.

Although SAs have rapidly become a global phenomenon, their performance and effectiveness are still insufficiently studied because of their newness and the lack of comparative analysis of their key aspects. This study bridges this gap by offering an initial appraisal of the key indicators of SA performance using a comparative approach.

More specifically, the main objectives of this study are: (1) to identify specific key performance indicators of SAs; (2) to determine the factors that are most closely linked to these key performance indicators; (3) to determine the extent to which SAs located in the U.S. are the leading SAs worldwide and identify their main advantages, if any, over non-U.S. SAs; and (4) to provide an overview of the performance of a group of representative SAs from the time of their emergence to mid-2018.

The extent and scope of these objectives can be better understood through the following research questions: (1) Which variables and attributes best explain the effectiveness and prospects of SAs? (2) What is the initial performance of SAs in terms of the indicators that are most highly valued by promoters and users? (3) What are the critical variables and attributes that SAs should prioritize to meet their goals more effectively? (4) What is the record of a global group of SAs in terms of their key performance indicators?

The few studies that have examined SAs have tended to target accelerated firms (Gonzalez-Uribe and Leatherbee, 2017; Stayton and Mangematin, 2019). Although new ventures are a key part of understanding the impact of SAPs, they are insufficient on their own to properly quantify the effectiveness of a SA in terms of its business and social impact. Therefore, an empirical study such as the present one, which focuses on the initial performance of SAs, makes a valuable contribution to the literature by exploring the impact and prospects of SAs. The results of the study have key implications for both SA managers and SA promoters.

This research identifies performance trends and initial outcomes of the SA phenomenon.

Although the study relies on some variables and measures that are covered in the BI literature, new variables that are especially valuable for SAs are introduced and assessed.

This empirical study is based on a data set of 116 SAs located in the United States and elsewhere between 1997 and 2014. Data were collected from retrospective and real-time sources including website visits, accelerators, start-up websites, blogs, LinkedIn profiles, trade publications and funding databases such as Crunchbase and Seed-DB. Collecting data from multiple sources improves the reliability and credibility of results (Yin, 2009).

The paper is structured as follows. The literature on BIs is first reviewed in search of an appropriate definition of SAs, followed by a review of empirical studies of BI and SA

performance. The hypotheses are also stated. Next, the model and method are described. The empirical results section then presents the results of bivariate and multivariate analyses of the data, and the following section discusses these results. The final section describes the findings and managerial and scholarly implications, concluding with the limitations of this study and highlighting important issues for further research.

3.2. LITERATURE REVIEW

3.2.1. From business incubators to seed accelerators

BIs first appeared in the 1980s and underwent rapid growth until the late 1990s. During this period in Europe, most BIs were integrated into the European BIC network. However, this growth slowed in the years following the burst of the internet bubble in 2000/2001.

Simultaneously, a new form of BI, the SA, emerged as an important springboard for local entrepreneurs. SAs support the generation and growth of innovative technology-based firms, specializing in software- and Internet-related businesses.

New BI models providing investment and assistance in pre-seed stages have emerged and blossomed in recent years, first in the United States. These models then spread to Europe before rapidly expanding to other parts of the world. This new generation of BIs aims to help and accelerate the creation of innovative companies, from the conception of the initial idea to market launch and scalability. To do so, these new BIs began providing important business assistance, resources, funding and networking opportunities, and they soon came to be known as SAs or SAPs. These SAPs are described as fast-track processes for new venture development, and they are offered in return for a percentage of equity in the newly established company. The return on investment and profits are made when the SA sells its shares to other investors through exit operations.

The definition of an SA amongst practitioners remains inconsistent. Some BIs refer to themselves as SAs, capitalizing on the current hype surrounding SAs. In contrast, others that meet the formal definition of an SA still refer to themselves as BIs (Hochberg, 2016).

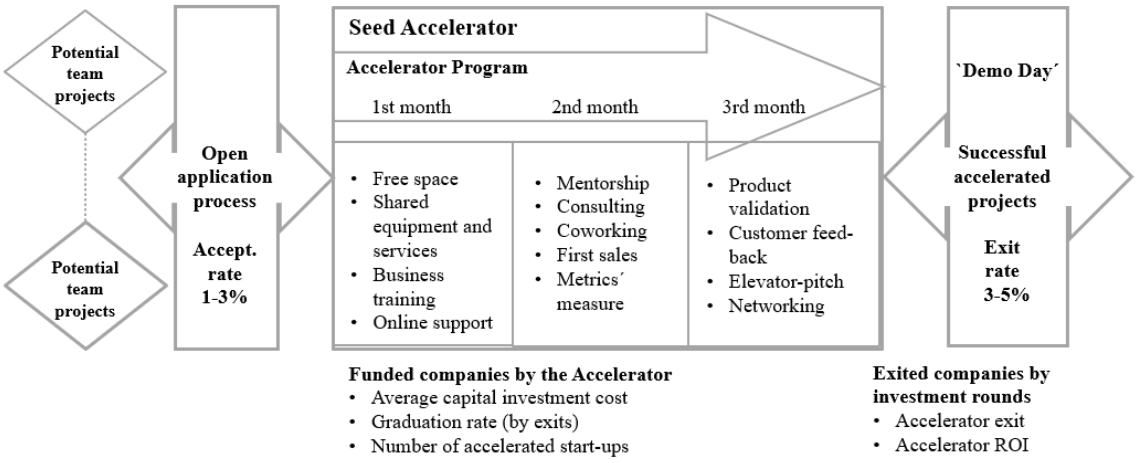
Although SAs were conceived with the same business structure and philosophy as BIs, some significant differences have emerged. Thus, an SA does indeed follow a specific organizational model in its own right.

The majority of SAs provide an initial seed investment in exchange for accommodation

and services (Bliemel et al., 2016; Pauwels et al., 2016). Dempwolf et al. (2014) describe four subtypes of accelerators: innovation, social, university and corporate. All of these accelerators are consistent with Cohen and Hochberg's (2014) definition. Innovation accelerators are the best-known form of SAs. Examples include Techstars and Y- Combinator. Innovation accelerators are still the most widespread kinds of accelerators. Social accelerators have been gaining increasing acceptance since the launch of social entrepreneurship programs such as the Global Social Venture Competition. Some universities back entrepreneurship programs linked to hosting entrepreneurs at their own accelerator facilities (Shah and Pahnke, 2014). Finally, corporate accelerators have emerged since 2014 to provide corporations with their own innovation ecosystems in pursuit of the goal of acquiring client start-ups (Page and Garbuio, 2016).

SAs can be described as a more advanced version of BIs (Pauwels et al., 2016). They usually launch an open application process where anyone with a business idea can apply. The best projects are then chosen and enrolled in an SAP. The program culminates with the presentation of the most successful projects to investors in a public pitch event known as "demo day" (Figure 3.1).

Figure 3.1. Seed Accelerator Program



Source: adapted from Pauwels et al. (2016)

3.2.2. Accelerator performance indicators

There has been limited research on accelerators, primarily because of the newness of the phenomenon and limited data availability (Stayton and Mangematin, 2019). Challenges in finding data are considerable and affect researchers' ability to conduct rigorous empirical analyses and performance evaluations. Accelerators have quickly proliferated, but there is a general absence of large-scale representative public databases covering accelerator programs. This lack of such databases prevents researchers from evaluating the impact of these programs (Hochberg, 2016).

As Cohen and Hochberg (2014) noted, the scarcity of studies on the performance of accelerators makes it unclear how effective they are. Indeed, little research has explored, even at a descriptive level, the effectiveness of SAPs or the reasons for better or worse results. The measures that should be used to quantify the effectiveness and success of these initiatives are not yet clear.

Much of the limited research on accelerators to date falls into one of the following four categories: (1) conceptual descriptions of the accelerator model (Cohen and Hochberg, 2014; Dempwolf et al., 2014; Hochberg, 2016); (2) qualitative assessment of how accelerators may serve to accelerate start-ups (Radojevich-Kelley and Hoffman, 2012; Cohen, 2013; Pauwels et al., 2016; Cohen et al., 2018); (3) empirical studies to assess whether accelerators positively affect the outcomes of the companies that participate in their programs (Smith and Hannigan, 2015; Cohen et al., 2019; Fehder and Hochberg, 2019; Hallen et al., 2020); and (4) empirical studies to assess whether accelerators have a negative or inconclusive effect on the outcomes of accelerated start-ups (Smith et al., 2013; Gonzalez-Uribe and Leatherbee, 2017; Yu, 2020). Table 3.1 summarizes accelerator studies in terms of the perspective, focus of the study and main findings.

Accelerators have attracted the attention of researchers because they provide a window into early-stage entrepreneurship, which has historically been difficult to observe (Aldrich and Yang, 2012). However, the existing research is highly fragmented and has yet to form into a robust corpus of knowledge built around a core framework with a shared understanding of questions, methodologies and knowledge gaps (Cohen et al., 2019).

Table 3.1. Accelerators studies

(1) Conceptual descriptions of the accelerator model				
Authors	**Dependent variable/ research focus**	**Method**	**Data**	**Summary and findings**
Cohen and Hochberg (2014)	Accelerator model definition	Conceptual		Differences between accelerators, incubators, angel investors and coworking environments. Success factors.
Dempwolf et al. (2014)	Accelerator performance assessment	Conceptual		Taxonomy of innovation accelerator: (1) incubators and venture development organizations, (2) proof-of-concept centers, and (3) accelerators.
Hochberg (2016)	Accelerator model definition	Conceptual		Evidence on the effects of the accelerator models on the regional entrepreneurial environment.
(1) Qualitative analyses assessing accelerator performance				
Kim and Wagman (2012)	(1) Accelerator portfolio size choice; (2) Profit-maximizing portfolio size; (3)Entrepreneurial effort effects; (4) Accelerator disclosures; (5)Accelerator portfolio quality; (6) Accelerator exit time.	Qualitative		Game theory model of the accelerator as certification of start-up quality. Accelerator may possess incentives to exit its portfolio firms early.
Radojevich-Kelley and Hoffman (2012)	Accelerator model and start-ups: (1) Motivations; (2) Success rates; (3) Selection criteria; (4) Challenges; (5) Added value.	Qualitative	5 U.S. accelerators	Exploratory case study examining how accelerator programs connect start-ups with potential investors.

Cohen (2013)	Accelerators organizational learning	Qualitative	70 interviews from 9 U.S. accelerators	Embedded multiple-case study to assess how the new venture process is accelerated.
Pauwels et al. (2016)	Design elements: (1) Program; Strategy; (2) Selection; (3) Funding; Alumni.	Qualitative	13 European accelerators	Accelerator model's key design parameters.
Cohen et al. (2019)	Accelerators 'choices: (1) Consultation intensity ; (2) Disclosure level; (3) Extent of customization.	Qualitative	8 U.S. accelerators and 37 accelerated start-ups	Inductive multiple-case study on how accelerator programs influence new ventures' ability to survive and grow.
Stayton and Mangematin (2019)	Venture characteristics: (1) Survival; (2) Resource network; (3) Accelerator´s resources.	Qualitative	4 Clean tech start-ups	Explores the mechanisms by which accelerator programs assist nascent technology ventures to minimize start-up time.
(3) Empirical studies of accelerators , establishing a new performance framework or studying the positive effect on the outcomes of accelerated start-ups				
Smith and Hannigan (2015)	(1) Time of exit; (2) Subsequent funding outcomes.	Quantitative	619 U.S. start-ups	Study based on 2 top accelerators (Y Combinator and Tech Stars) for the period 2005–2011. Participation in a top accelerator program increases the speed of exit by acquisition and by quitting.
Cohen et al. (2019)	(1) Founder background; (2) Sponsor type; (3) Accelerated start-up raised funding post-program > $500 K; (4) Total $ funding raised; (5) Maximum valuation attained.	Quantitative and qualitative	146 U.S. accelerators and 100 interviews	Descriptive correlations between design elements and performance of the start-ups that attend the Accelerator programs.

Fehder and Hochberg (2019)	(1) Accelerator year foundation; (2) MSA location.	Quantitative	59 U.S. accelerators	Impact of an accelerator's arrival on the volume of seed and early-stage VC deals completed in the region.
Hallen et al. (2020)	(1) Accelerated start-up outcomes; (2) Time to fundraising; (3) Start-up learning process; (4) Consultation in focal accelerators; (5) Inter-organizational learning mechanisms.	Quantitative and qualitative	8 U.S. accelerators and 70 interviews	Comparison of treated and untreated start-ups on a variety of outcomes.
This study	(1) Accelerator investment rounds in accelerated start-ups; (2) Location effect.	Quantitative	116 worldwide accelerators	Model exploring accelerator performance on three axes: (1) size, (2) location and age and (3)profitability variables. Higher size and performance in the United States and in the eldest accelerators.
(4) Empirical studies of accelerator´s negative or inconclusive effect on the outcomes of accelerated start-ups				
Smith et al. (2013)	(1) Accelerated stat-ups survival; (2) Funding; (3) Founder background.	Quantitative	740 accelerated start-ups	Analysis of differences in the founder backgrounds in two top accelerators (Y Combinator and TechStars) compared to other start-ups.
Gonzalez-Uribe and Leatherbee (2017)	(1) Effect of basic accelerator services on new venture performance; (2) Effect of schooling and basic services.	Quantitative	3,258 Accelerator applicants and 276 pitch-day competitors	Study based on an individual accelerator program (Start-up Chile).Start-ups selected for access to entrepreneurship schooling tend to achieve more intermediate milestones.

Yu (2020)	(1) External financing and venture growth; (2) Acquisitions; (3) Closures.	Quantitative and qualitative	13 accelerators and 70 interviews	Start-ups admitted to accelerators are less likely to achieve key milestones.

Source: own compilation

Few studies have used quantitative analyses to measure the impact of a global set of SAs on the performance of their accelerated start-ups. Gonzalez-Uribe and Leatherbee (2017) used a sample of 3,258 applicants to an individual accelerator program (Start-up Chile) and found that access to certain basic services, such as the coworking space provided by the program, had a limited impact on the future performance of Start-up Chile graduates. Cohen et al. (2019) used a sample of 146 U.S. accelerators and 100 interviews to confirm a connection between SAP design and the performance of the accelerated start-ups. Fehder and Hochberg (2019) examined a list of 59 accelerators founded between 2005 and 2013. They concluded that the arrival of an accelerator is associated with a significant increase in the volume of seed and early-stage deals, driven by outside investor groups and the emergence of new local early-stage investors. Hallen et al. (2020) used a matched sample from four cohorts of eight top U.S. Accelerator programs to compare treated and untreated start-ups. They found evidence that accelerators substantially aid and accelerate venture development. "Novel learning" was observed to be the key driver of the accelerator effects. Finally, Yu (2020) compared start-ups affiliated with 13 accelerator programs to (non-accelerated) start-ups backed by venture capitalists (VCs). The findings suggest that new ventures admitted to accelerators are less likely to reach key milestones. In contrast to these recent studies, our subject of analysis is the accelerator itself rather than the hosted companies.

3.2.3. The accelerator's location

Analysis at the country level has attracted ample attention in the BI literature. Many BI studies have focused on developed countries (Chen, 2009), principally the United States (Mian, 1997; Rothaermel and Thrusby, 2005) and European countries (CSES, 2002; Clarysee et al., 2005). Many BI studies provide comparisons between BI activity in these

two markets (Aerts et al., 2007). Other studies have focused on particular countries such as the United Kingdom (Soetanto and Jack, 2013), Finland (Abetti, 2004), Sweden (Lindelof and Lofsten, 2002), Germany (Schwartz and Hornych, 2008, 2010; Schwartz, 2013), Italy (Colombo and Delmastro, 2002), Israel (Rothschild and Darr, 2005), Spain (Peña, 2004) and Portugal (Ratinho and Henriques, 2010). Others have examined developing countries (Akçomak, 2009) such as Brazil (Etzkowitz et al., 2005), the Gulf Cooperation Council countries (Mubaraki and Busler, 2010), and Turkey (Ozdemir and Sehitoglu, 2013).

Whilst there is abundant coverage of BIs, broad studies based on worldwide surveys of incubators are practically non-existent.

Europe and the United States host a comparable number of start-up programs per capita. In Europe, the number of SAs has increased dramatically since the start of the financial crisis in 2007. Between 2007 and 2013 the number rose by almost 400% (Salido et al., 2013). SAs have emerged as a plausible way of creating job opportunities and technology-based businesses, revealing innovative ways to offer products that can conquer the international market and grow without the need for huge injections of capital (Christiansen, 2009; Cohen, 2013).

The accelerator phenomenon was born in the United States, and despite extensive globalization, it is still the undisputed leader in terms of the number of acceleration programs. Of the top 20 SAPs, 15 are located in the United States. Silicon Valley pioneers new forms of the original SA model. The United States also plays a leading role in the development of university-driven accelerators. Start-x (Stanford) and Skydeck (UC Berkeley) offer notable examples. The same is true of corporate accelerators, which are now flourishing around the world. The purpose of our first hypothesis is to test the extent to which the United States leads in SAs.

Hypothesis 1: Accelerators located in the United States tend to be larger and surpass their foreign counterparts in terms of key SA performance ratios.

3.2.4. Investment in SAs

A key indicator of the prospects and expectations of most high-tech companies, especially start- ups, is the presence of funding by external investors, primarily VCs. SAPs are expected to make

their hosted start-ups more appealing to VCs and business angels. Similarly, firms that succeed in attracting external investors are expected to have more chances of survival and growth.

These better chances are because there is generally a positive association between VC finance and growth, although this view is not unanimous (Bottazzi and Da Rin, 2002). As noted by Bertoni et al. (2011), most studies of VCs suffer from a bias because they consider only IPO firms.

This approach leaves privately held firms unstudied, the vast majority of which are start-ups. Accelerated start-ups have better chances of attracting VC investment and closing investment rounds if they adapt to the VCs' preferences for investing in firms whose founders have management, educational and professional experience (Puri and Zarutskie, 2008; Colombo and Grilli, 2010; Bertoni et al., 2011). These are precisely the areas where most entrepreneurs improve during SAPs.

Firms with VC investment tend to excel over others in most performance indicators (Gompers and Lerner, 2001; Dennis, 2004). In the context of start-ups, closing successive investment rounds is vital and offers the route to a marketable solution and the gateway to customers. Prestigious VC funds provide extra marketplace credibility to participating firms and greater attractiveness to new investors. In addition, these start-ups seem to have easier access to valuable skills and resources (Colombo et al., 2006; Hsu, 2006) and have more chance to grow in employment terms (Bertoni et al., 2011). Davila et al. (2003) performed a broad study of 494 Silicon Valley start-ups, concluding that the quality, reputation and credibility of new ventures is enhanced when an investment round is undertaken by a VC.

In accordance with these findings and conclusions from the literature, we assume that receiving sufficient investment from a VC by closing an investment round above US$ 1 million improves start-ups' expectations and growth prospects. Most entrepreneurs starting

ventures in Silicon Valley share the view that closing at least an A round of investment (US$1–5 million) and, ideally, a B round (over US$5 million) is the main success indicator. For practically all such start-ups, this amount is viewed as sufficient to keep pace and fuel their growth. The arguments in this section lead us to formulate our second hypothesis.

Hypothesis 2: Accelerators with higher levels of average total rounds per company outperform others in the main performance ratios.

3.3. EMPIRICAL ANALYSIS

3.3.1. Analysis Model

The previous literature review reveals that, despite the vast number of empirical studies assessing the impact of BIs, there is a lack of consensus on BI performance measurement. In addition, the absence of a single standard method makes any analysis of BI efficiency and performance even more difficult (Phan et al., 2005; Bergek and Norrman, 2008; Schwartz and Gothner, 2009; Ratinho and Henriques, 2010). Further, few studies have used a robust quantitative approach to assess the economic effects of incubator organizations. In addition, most results and findings are inconclusive and somewhat contradictory. Table 3.2 summarizes some of the most significant variables that have previously been used in the BI literature.

Table 3.2. Variables to measure performance used in previous BI studies

Average capital investment cost
Number of incubator tenants
Funding received
New firms created
Exit policy
Local development of the economy
Employment generated
Profitability

Source: own compilation

Given the lack of specific variables for measuring SAPs and in light of the BI literature review in the previous section, we propose a model for measuring SA performance, with variables grouped into three categories.

(1) Size. Variables in this category provide quantitative information regarding the actual size of the accelerators: (1.1) Total funding: total amount of capital invested in the participating companies; (1.2) Total employees: total number of employees in the participating companies; (1.3) Total rounds: total number of investment rounds; (1.4) Total companies: total number of accelerated companies in each accelerator.

(2) Location and age. This category comprises two typical control variables: (2.1) Country: location of the accelerator (United States or elsewhere); (2.2) Founding year: period in which the accelerator started to operate (1995–2000, 2001–2005, 2006–2010 or 2011–2014).

(3) Performance ratios. Indicators and ratios suggested by Crunchbase (2018): (3.1) Total exits: amount of capital obtained by the accelerator through the exit of participating companies. This variable is only available for accelerators that have exited companies; (3.2) Average total exits per company (total exits/total companies); (3.3) ROI (return on investment) factor (total exits/total funding) x 100, which reflects the return on investment by the accelerator through company exits; (3.4) Average total funding per company (total funding/total companies); (3.5) Average total investment rounds per company (total rounds/total companies); (3.6) Average employees per company (total employees/total companies).

3.3.2. Data

One of the main limitations to increasing knowledge about SAs lies in the absence of large-scale representative databases that include data on program features and the companies that enter and graduate from the programs (Cohen and Hochberg, 2014). In accordance with the accelerator definition used in this study and to ensure a certain degree of homogeneity, we limited the type of SAs to those that meet the following selection criteria:

(1) located in the United States and elsewhere, (2) at least four years old, (3) take equity in exchange for investment, and (4) are not mostly funded by private investors. An initial set of 191 SAs worldwide met these selection criteria. Of these, 100 were included in Seed-DB, an online accelerator database that probably represents the largest public repository of accelerators and graduate data (Hochberg, 2016).

The other 91 were hand-collected from Crunchbase, which is an open source database with partnerships with more than 400 venture capital firms, accelerators, incubators and angel groups to ensure the accuracy of the data (Yu, 2020). Crunchbase tends to have more early-stage transactions than similar databases, which makes it ideal for hand-collecting data on the companies in our sample. Then, we used AngelList and LinkedIn profiles for verification purposes.

The presence of missing data for some variables forced us to delete some SAs initially exported from the Seed-DB database. The final sample consisted of 116 SAs, of which 72 were located in the United States and the remaining 44 in other countries.

3.4. RESULTS

3.4.1. Descriptive analysis

Total funding ranged from a minimum of US$ 9,000 to a maximum of US$ 2.2 billion. In addition, 62.93% of accelerators invested more than US$ 1 million in their accelerated companies.

SAs have not yet excelled as employment seedbeds. Only one had generated more than 1,000 jobs in participating companies, and over 80% of SAs had not yet created 100 new jobs. Only 25 accelerators participated in 10 or more rounds. In terms of the number of participating companies, 46 accelerators hosted 20 or more start-ups and 10 hosted more than 50. The largest accelerator supported 585 new ventures.

As expected, younger SAs hosted fewer companies, created fewer jobs, generated less total investment and completed fewer total rounds. When the accelerator had been operating for four years, the differences in terms of size indicators tended to grow exponentially, as shown in Table 3.3.

Table 3.3. Descriptive analysis of rates per period

Min-Max rates per period and total SA survey	**1995-2000**	**2001-2005**	**2006-2010**	**2011-2014**
Total funding	80,397,018	11,697,500	15,000	9,000
(US$)	2,202,878,093	164,000,676	103,305,094	8,455,000
Total exits value	17,000,000	500,000	0	0
(US$)	1,276,008,100	390,750,000	22,500,000	25,000,000
Total employees in participating companies	326—3667	121—763	11—270	3—34
Rounds of investment	56—492	8—142	0—98	0—5
Nº participating companies	110—585	63—77	11—49	3—10

Source: Own compilation

The location and age of the accelerators are of interest. The accelerators were grouped into four age intervals based on their founding year: 1995–2000, 2001–2005, 2006–2010 or 2011– 2014. Our data confirm the young status of the SA phenomenon, with 91.38% of SAs founded from 2006 onwards (Table 3.4).

Table 3.4. Descriptive analysis of accelerators evolution

Accelerators' evolution	Total SA Global survey	The U.S. (%)	Other countries (%)
1995-2000	3	1.72%	0.86%
2001-2005	7	5.17%	0.86%
2006-2010	63	32.76%	21.55%
2011-2014	43	22.41%	14.65%
Total	N= 116		

Source: Own compilation

In terms of performance and effectiveness indicators, the most significant profitability ratio (ROI) was only available for 19 SAs.

3.4.2. Results of bivariate and multivariate analyses

Bivariate and multivariate analyses were used to test the two hypotheses. The bivariate analysis provided statistically significant results regarding the differences between two groups based on a single variable.

The existence or absence of significant differences between groups of SAs in terms of the variables in the model was verified using the non-parametric Kruskal–Wallis* or Mann–Whitney U** test. The required level of significance in the comparisons was 95%.

For testing Hypothesis 1, a bivariate analysis was conducted using country of location of the SAs as the grouping variable. U.S. accelerators (72 in total) were thus distinguished from non-U.S. accelerators (44 in total). Table 3.5 summarizes the results of this bivariate analysis. We observed statistically significant differences based on country of origin for the following variables: total rounds (category 1), average total funding per company (category 3), average employees per company (category 3) and average total rounds per company (category 3).

All four variables had higher values for the SAs located in the United States. Three of the variables corresponded to category 3 (performance ratios), which indicates that levels of profitability and efficiency are higher in US accelerators.

Table 3.5. Differences analysis based on country of origin: U.S. vs Non-U.S. Survey 1 (N=116)

Variable	Differences on average	T Student	p-value
Total companies	-14.183	-1.299	0.115
Total exits	-23986086	-1.299	0.197
Total funding	-46780226	-1.526	0.131
Total employees	-89.752	-1.706	0.092
Total rounds	-17.626	-2.368	0.020**
% ROI factor	56.433	0.746	0.459
Average total funding per company	-495598	-4.942	0.000***
Average total exits per company	-64603.18	-0.606	0.545
Average employees per company	-0.843	-3.201	0.001**
Average total rounds per company	-0.294	-4.496	0.000***

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: Own compilation

Next, to test Hypothesis 1 with greater precision, we ran a binomial model with country as the dependent variable. This variable took a value of 1 if the accelerator was located in the United States and 0 if the accelerator was located elsewhere. The intrinsic features and nature of the data made binomial logistic regression models suitable.

From the initial set of six variables, those used in the regression model were selected using the stepwise regression method. After each variable was added, all candidate variables in the model were checked to observe whether their significance had been reduced below the specified tolerance level. The Akaike information criterion (AIC) was employed to compare the different models. The model with the lowest AIC comprised only two independent variables:

$$Country = \alpha + \beta 1 \cdot Foundation + \beta 2 \cdot Average\ Total\ Funding + \mu i$$

The results are displayed in Table 3.6, with the estimated coefficient and the standard error. In this model, the only significant variable was average total funding per company. The model fit was satisfactory, with an AIC value of 136.12.

Table 3.6. Logistic regression results

Independent Variables	Estimated coef.	Standard Error	p-value
Constant	0.045	0.308	0.884
Year of Foundation(1)	--	--	--
Total Funding +1M,-1M	-0.902	0.538	0.094
% Multiplicator factor	--	--	--
Average Total Funding	$3.15 \cdot 10^{-6}$	0.000	0.002**
Average Total Exits	--	--	--
Average employees	--	--	--
Average Total Rounds	--	--	--
AIC	**136.12**		

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: Own compilation

Average total funding was the only variable identified by both the bivariate and multivariate analyses. It is therefore considered the key component characterizing SAs located in the United States.

To test Hypothesis 2, we applied a Tweedie distribution for generalized linear models (GLMs; tweedie), with the logarithm of the average total rounds per company as the dependent variable. To check the normality of the continuous variables, a Shapiro–Wilk test was run. All the p-values were greater than the significance level of 0.05, which implied that the variables did not follow a normal distribution.

When running GLMs, several models are typically feasible and valid. Three GLMs models were run with the average total rounds per company as the dependent variable and with the following independent variables:

(1) Model 1: founding year, country, average total funding, average employees and total funding.

(2) Model 2: total companies, total exits, total funding, total employees and country.

(3) Model 3: total companies, % multiplicator factor, average total funding, average total exits, average employees and country.

After running all the models, the best model – and the one that was selected – was based on Model 1. It comprised three significant independent variables: average funding, average employees and total funding. Consequently, one key finding is that the SAs that close most rounds of investment per company are those that have a higher amount of funding per company, a higher average number of employees per company and a larger amount of funding being raised from investors.

Accordingly, as stated in Table 3.7, these are the three key factors that SAs should prioritize to outperform others in terms of ability to close more investment rounds for start-ups participating in their programs

Table 3.7. GLM model: Results

Independent variables	**Estimated Coef**	**Standard Error**	**p-value**
Constant	-4.279	0.437	0.000
Average Funding	$4.5 \cdot 10^{-7}$	0.000	0.020**
Average Employees	0.227	0.075	0.003**
Total Funding	2.230	0.478	0.000***
AIC	**102.193**		

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: Own compilation

3.5. DISCUSSION

A summary of our findings, connected to our two hypotheses, is presented below.

1) U.S. accelerators: SAs located in the United States tend to attract more funding for their tenant start-ups. This capacity to raise more funding is the primary advantage of U.S. accelerators over those located elsewhere.
2) Investment: Our findings suggest that SAs with a greater ability to close funding rounds are more likely to generate more accelerated companies, employment and local economic development.
3) Accelerator networks: Entrepreneurs are more attracted to SAs that offer greater networking opportunities. Therefore, being located in an established entrepreneurial ecosystem enhances an accelerator's chances of attracting capital and consequently first-class, talented entrepreneurs.
4) Local influence: The more successful the SA is, the higher its business influence and reputation in the area will be, helping new companies attract attention from local agents.

The last research question addressed by this study refers to the performance record of a group of representative SAs in a set of key performance indicators. Table 3.8 displays data for the top SAs based on a series of performance indicators, including those identified by our study. As of June 2018, the Seed-DB Crunchbase database covered 190 SAPs worldwide, with 7,450 accelerated companies, 1,024 exits worth US$ 7 billion and US$ 40 billion of total funding raised. Table 3.8 displays the evolution of the top 13 SAs from June 2014 to June 2018. The data show a dramatic growth in almost all indicators, with the figures for some SAs increasing by a scale of 1–10 or even more. Total funding increased by a factor of more than 10 over these four years, whilst average funding in 2018 grew to US$ 5 to 7 million from less than US$ 1 million in 2014. The growth achieved in terms of number of exits, which is a key success indicator for start-ups and SAs, was also remarkable.

Table 3.8. Top Seed Accelerators in the world

ACCELERATOR	Country	Age	Total Fund. 2014 ($M)	Total Fund. 2018 ($M)	Av. Fund. 2014 ($M)	Av. Fund. 2018 ($M)	Nº exits 2014	Nº exits 2018
Y Combinator	U.S.	2005	2200	23000	3,7	15	57	188
Techstars	U.S.	2006	500	5100	2	5	29	129
500 Start-ups	U.S.	2010	97	1800	0,46	2,6	10	158
AngelPad	U.S.	2010	148	1000	2	7,4	10	22
DreamIT Ventures	U.S.	2007	97	750	1,1	3,8	3	17
SeedCamp	U.K.	2007	80	620	0,73	5,3	6	26
Amplify.LA	U.S.	2011	9,5	350	0,41	9,7	1	11
RockHealth	U.S.	2010	37,5	340	0,77	7	1	13
Imagine K12	U.S.	2011	33	300	0,92	4	0	5
UpWest Labs	U.S.	2012	4,5	290	0,27	6,9	0	10
Launchpad LA	U.S.	2009	39,2	230	1,5	7	0	6
Portland Incubator	U.S.	2009	52,4	150	2,4	5,1	0	5
StartMate	AUS	2010	6,9	100	0,33	2,2	1	2

Source: Crunchbase (2018)

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CHAPTER 4: THE SOCIOECONOMIC IMPACT OF ACCELERATORS. AN ANALYSIS OF CONDITIONING FACTORS AND IMPLICATIONS FOR SOCIAL INNOVATION.

ABSTRACT

This study investigates in a pioneering and exploratory way the performance of accelerators and start-ups housed in them in terms of employment.

Entrepreneurs participating in an Accelerator have an experience that is crucial for the survival, development and expansion of their start-ups.

Accelerators are generating great expectations in the United States with Silicon Valley at the helm, but since this is a very recent phenomenon, the existing empirical evidence is inconclusive or does not exist.

Hence the pioneering nature of this study, which offers an approximation of the scope of employment generated by start-ups located within a gathered sample of 116 accelerators.

The findings provide valuable practical implications to consider when generating realistic expectations about these business strengthening instruments. Exploratory results show that accelerators located in the United States stimulate the creation of more new companies and jobs than in other countries.

The study identifies the variables that most intensely affect the establishment of new companies and their employment levels.

4.1. INTRODUCTION

This study aims to analyze and evaluate the role and expectations of Seed Accelerators, which is still emerging and little known to the general public, but of growing acceptance and rapid popularity among the segment of young entrepreneurs and founders of new companies.

Some private and institutional agents doubt the social relevance of SAs and the impact they can have in terms of employment and wealth generation, through the formation of new companies capable of surviving and growing. The debate is well served and the suitability of public support for these instruments begins to be questioned. Having information about their expectations and first results is expected to be essential to determine the "social benefit" of these spaces, and decide if they are interested in involving public institutions in their promotion. That is the purpose of this study, which investigates evidence derived from the most veteran accelerators, located primarily in the United States.

The SAs phenomenon in Spain is very recent, with the first ones created in 2008 and 2009, being 2012 the year of their definitive impulse. There are already more than 30 SAs in operation in Spain, and Valencia stands out as one of the main entrepreneurial centers, even ahead of Madrid and Barcelona.

It is still too early to carry out a rigorous and complete diagnosis of the impact and expectations of these SAs and determine to what extent the passage through these spaces increases the chances of survival and growth of new companies. However, we can observe the performance that this entrepreneurial instrument is achieving in other countries, information of great value to generate realistic expectations about the benefits and social impact, mainly in terms of investment and employment.

Most of the accelerated companies are still in their initial phase and have not had time to close considerable investment rounds, grow enough to generate a significant impact in terms of jobs, or demonstrate the usefulness of these spaces.

But we are not resigned to waiting years before we can predict the social impact and expectations of these initiatives, so this study takes a broad perspective and aims to explore the performance of SAs internationally, especially in the United States, where they have a more extensive history that allows examining their behavior against various indicators.

Although each country has its own particularities, we have the advantage that SAs are an instrument with a fairly homogeneous format and operating behavior in all developed countries. Therefore, we are convinced that our results will at least serve as a guide and basis to measure the expectations and potential impacts of SAs in Spain.

While some studies have carried out approaches from a theoretical perspective in order to measure the effectiveness of this entrepreneurial instruments (Rothaermel and Thursday, 2005; Bergek and Norman, 2008), there are still large gaps of information when defining their socioeconomical contribution in the economy, and a notable shortage of quantitative studies.

The first opinions of the analysts, mostly coming from studies of a qualitative and subjective nature, tend to diminish the optimism and the high expectations that the SAs initially generated as generators of wealth and employment.

In this context of expectation and doubts, we consider that an empirical study on job creation in new companies that have been part of a Business Acceleration Program would be a valuable theoretical and practical contribution, and would be of great help to the institutions in charge of designing economic policies, Accelerator managers, entrepreneurs and investors in Spain and other countries.

The interest of SAs in the field of social economy is undeniable. On the one hand, the progress and growing roots of new approaches closely linked to the social sphere, such as the circular economy, the collaborative economy or the economy of the common good, are encouraging an increasing number of entrepreneurs to lead business projects with high social content. On the other hand, we are witnessing the appearance of several SAs created for social purposes.

Ashoka is, without a doubt, the pioneer and most recognized worldwide in the promotion of business projects for social innovation. Founded in United States in 1981 and established in Spain in 2005, it has a community of more than 3,400 social entrepreneurs and 300 Changemaker schools worldwide.

Other more recent SAs with notable thrust are Echoing Green, Civic Accelerators, and Masschallenge. In Spain, and specifically in Valencia, SocialNest stands out as a benchmark Accelerator with great success in promoting sustainable business projects with social impact.

The study begins with an analysis of business accelerators and start-ups, as well as the reference to social innovation and social content start-ups. Next, the analysis model and the methodology leading to a series of hypotheses are presented. The empirical results are displayed in the following section, through an analysis of the data. The last sections provide the conclusions and a series of academic, political, and business implications, the possible limitations of the study and lines for future research.

4.2. LITERATURE REVIW

4.2.1. Business accelerators as drivers of employment.

Business Accelerators (AE) are generally understood as a more advanced version of the widely known Business Incubators (IE), which have been studied extensively in the literature since the 1980s.

Seed accelerators (SAs) are generally understood as a more advanced version of the widely known Business Incubators (BIs), which have been extensively studied in the literature since the 1980s.

Since appearing in Silicon Valley in the 1990s, SAs have evolved into a new technology start-up incubation model, specializing in the Internet industry, primarily software. Since the dot.com crisis in 2000, the environment encompassing the generation of new tech companies has changed dramatically. In 2016, at least 250 Acceleration Programs operated in the United States, and more than 300 in Europe, rapidly expanding worldwide.

Some European countries have experienced a boom in accelerators since the start of the financial crisis in late 2008 (Salido et al., 2013).

The SA is a new organization model, conceived as such in Silicon Valley and whose expansion has accelerated and internationalized since 2005. Its main objective is to promote the creation of new companies, especially those that work with low structural costs, based on technological and digital business models (Teo and Ranganathan, 2004). The popularity of Seed Acceleration Programs (SAPs) has grown steadily in the United States since 2005 after the launch of Y-Combinator, an organization that received great attention from the business community, leading to many similar initiatives.

Europe and the United States host a comparable number of SAPs. In Europe, the number of accelerators has grown exponentially since the beginning of the financial crisis, between 2007 and 2013, where their number increased almost 400% (Salido et al., 2013).

Regarding their operational dynamics, SAs can be described as organizations that provide business advice, open to any entrepreneur with a business idea who aspires to join a SAP. Subsequently, the best projects are chosen and admitted to a three-month acceleration program. The SA typically provides free access and workspace, work equipment, and office services to participating companies. The atmosphere of mutual support that is generated among the entrepreneurs and the training offered and access to the SA's network of contacts is also remarkable. All this is offered to the teams of each project in exchange for a percentage of the shares of their future or newly formed companies. SAPs are generally managed by private accelerators, and their purpose is to act as a shuttle to success for start-ups. The program finally culminates with the presentation of the most successful projects to investors at a public event known as "Demo Day" (Cohen, 2013).

The National Association of Business Incubators (NBIA, 2012), estimates that in North America alone, existing BIs/SAs assist more than 27,000 start-ups, which in turn provide more than 100,000 workers with full-time skilled employment, generating income of more than 17 billion dollars. These initial shuttles create 40,000 new net jobs each year in the United States and around 13,000 in the United Kingdom (Knopp, 2007).

These reports certify the progressive growth of BI and SA organizations, as well as their effects on the real economy. The average portfolio size of this type of organization is

between 25 and 40 new companies every year, which generates on average between 44 and 91 qualified jobs per year (Dee et al., 2011). Most studies show that the employment generated indirectly through these types of organizations is much higher when new companies have participated in a SAP, as well as their skills, training and chances of survival during the first five years of existence (Löfsten and Lindelöf, 2002; Rothaermel and Thrusby, 2005; Scillitoe and Chakrabarti, 2010). However, some studies have not found significant differences in the volume of employment generated by new companies that participated in a SAP compared to those that did not (Siegel et al., 2003; Chen, 2009).

Next, we will address the capacity of SAs to generate employment through the new companies supported by them.

4.2.2. Performance of accelerators and start-ups in terms of employment

SAs are organizations that promote entrepreneurship and stimulate the ecosystem of new companies, boosting the development of the economy in the region where they are located. There are numerous differences between countries in terms of the nature and structure of their business system, however, the importance of new companies for economic and social development is widely recognized worldwide (Mazzarol and Reboud, 2006; Stangler and Litan , 2009). Entrepreneurs start new companies and, in turn, create new job opportunities, intensifying competition, increasing productivity and efficiency through the use of innovative systems and processes that improve technological change. The business boom translates into higher levels of innovation, employment and development (Baumol, 2002; Zoltan and Amorós, 2008). Government policies must consider the impact that this type of company produces on the economy and society, and determine whether it results in a greater transfer of innovation, technology, and in the intensification of: (1) outsourcing services to others companies, (2) talent acquisition, (3) tax collection, and (4) foreign direct investment (Salido et al., 2013).

The Kauffman Foundation in the United States illustrates the impact of new businesses on employment, showing that virtually all net job creation is generated by young companies under the age of five (Stangler and Litan, 2009). The American Census of Business Dynamics Statistics (BDS) confirm that without new companies there would be no net job growth in the U.S. economy.

Despite the volatility experienced by this type of business (less than half of the new companies created survive during their first five years), the destruction of work caused by the cessation of the group of newly created companies is offset by the creation of employment of those who manage to survive (Horrell et al., 2010; Stangler, 2010). This volatility, according to Schwartz and Göthner (2009), is smaller for those companies that have participated in a SAP, since they are more likely to be successful after three years of operation compared to those that have not participated in such programs.

Regarding the Spanish context, the absence of official data makes it difficult to estimate the employment generated by the category of newly created companies and, even more so, by those born in Accelerator-type environments. The few data available come from reports promoted by private consultants. According to the South Summit Entrepreneurship Map (2017), with data referring to 2016, 50% of Spanish new companies invoiced less than 150,000 euros per year and had a workforce of between 2 and 5 employees; only 6% of them invoiced more than 1 million euros or had more than 20 employees, highlighting the fact that 40% of them did not have any hired employees.

The current number of start-ups registered in Spain are only approximations, in the absence of clear criteria to determine whether if a new company is a start-up, to decide when it is no longer a start-up.

Startupexplore (2018) estimates that there were 3,300 total start-ups in Spain at the end of 2017, a figure that falls short compared to the report of the South Summit (2017) according to which only in 2016 there were 2,500 new start-ups created. In the field of employment, nobody ventures to offer an official figure of the total employment generated by this type of companies. We estimate that if the average is between 3 and 4 new employees per start-up, it would mean that between 10,000 and 15,000 direct jobs are created.

These figures confirm, as expected, the small size of the start-ups and minimize their real impact in terms of employment. Furthermore, they place Spain below the European averages. The positive data lies in the speed with which new companies are created, far exceeding mortality rates, which are also high. The market share of social entrepreneurship driven by business acceleration spaces is still limited, but it is increasing.

4.2.3. Social innovation and social accelerators

Social innovation is the axis that guides business initiatives of a social nature.

The Regulation for the Europe Union Employment and Social Innovation Program (EaSI) published in 2013, in line with the objectives of the 2020 Horizon Program, defines social innovation as "the development and launch of new products, services or models that meet social needs, therefore benefiting society and strengthening its capacity for action."

Although the acceptance of social innovation is evident and growing, research in this field is still scarce and basically reduces to the study of practical cases (Salom et al., 2017).

The link between social innovation, progress and change is evident in the definition provided by Antadze and Westley (2012), who defined social innovation as a "complex process of introducing new products, processes or programs that profoundly change routines, resources and the flows of authority in the social system where innovation occurs."

Nest, we briefly analyze social entrepreneurs, the agents largely responsible for generating and implementing innovations of a social nature.

These entrepreneurs highlight their ability to imagine and implement innovative and sustainable models of drivers of social change through the constitution of social-type companies (Leadbeater, 1997).

The range of business-type or non-business projects that fit the mission of social innovation is vast. The study of Salom et al. (2017) analyzed a total of 79 initiatives with which he worked a priori and for social innovation in the city of Valencia, Spain. These include those linked to social dynamics and inclusion (19 initiatives), and networks of exchange and collaborative economy (15 initiatives).

Unlike new start-ups, corporate initiatives of a social nature do not take place mainly in accelerator spaces.

The SA model emerged in the United States spreading rapidly in Europe and the rest of the world. Its distinctive features were its private, profit-oriented nature, with the aim of launching programs aimed at creating fast-growing new companies and obtaining greater

investment in just a few months. However, soon social innovation and entrepreneurship began to have a place and to establish itself in the field of accelerators.

A good proof of the interest that social entrepreneurship has in Europe is the BENISI project, the European network of incubators for social innovation, which was born in 2013 with the aim of identifying at least 300 social innovations with great potential for growth and scalability. The program, with an initial duration of three years, has had an excellent reception (Gramescu, 2016).

In Spain, we witness the appearance of accelerator entities, coworking spaces, committed to promoting and supporting social entrepreneurship. Socialnest, which emerged in 2011 in Valencia, is considered the pioneering social accelerator in Spain. Also in Valencia it is worth mentioning Las Naves Foundation of the Valencia City Council.

Below, we mention the most active organizations, recently established in Spain, aimed at promoting innovative projects with a positive impact on society and the environment. This is the case of UnLtd Spain, UpSocial, Tandem Social, MovimientoIdun or Capazia, aimed at people with disabilities. In them, unlike conventional accelerators, the social component prevails over the technological content. In addition to incubators and accelerators exclusively for social projects, companies with a social component in conventional accelerators are beginning to establish themselves in the United States and it is expected that this social sensitivity will soon be transferred to Spanish accelerators as well.

For all the above, it is clear that innovation and technological advance have a place in the social field, a space that begins to cover an increasing number of new social technology companies, defined as emerging companies that develop and implement technological solutions for social needs in a financially sustainable way (Arena et al., 2018).

The new social technology companies arouse growing interest, but they do not yet have the sufficient entity to consider them a new modality within the environment of start-ups. The most relevant difference with respect to new conventional companies lies in their hybrid character or double value mission that combines commercial objectives with a positive social impact (Arena et al, 2018). The progressive implementation of this new business modality is mainly due to the emergence of social market opportunities linked to technological advances (Bria, 2015). It also responds to explicit incentives deployed by

social and economic policy programs such as Horizon 2020 (European Commission, 2012), in recognition of the relevance of the phenomenon of social innovation and its ability to influence basic aspects such as job creation, raising education levels, reducing poverty and social exclusion, and the control of environmental pollution.

4.3. MODEL AND HYPOTHESES

4.3.1. Analysis model

Several studies have considered as a measure of the performance of BIs and SAs "the creation and growth of employment in invested companies" (Colombo and Delmastro, 2002; Löfsten and Lindelöf, 2002, Amezcua, 2011). Other analyzes have incorporated variables such as "the average invested capital per start-up", and "number of new accelerated companies" (Knopp, 2007).

After reviewing the existing BI literature, we propose a model whose objective is to measure the performance of SAs through the employment generated in the newly created hosted companies. The following table summarizes the variables chosen for our study.

- Year of foundation. Period in which the SA begins its activity. Four options: 1995-2000, 2001-2005, 2006-2010, 2011-2014.
- Country. Accelerator's location. Two options: United States (U.S.), and other countries.
- Total start-ups. Total number of companies that have been accelerated in a SAP for each Accelerator.
- Total investment outflows. Capital obtained through the sale of shares that the Accelerator has over accelerated start-ups. This variable is available only in those SAs that have managed to achieve "exits" on one or more occasions.
- Total capital invested. Total amount of capital invested in accelerated start-ups, this being the capital obtained by the contributions of the Accelerator, the entrepreneurs themselves, and private investors.
- Return of the Investment (ROI). Calculated as follows: (total investment outflows / total invested capital) x100. This indicator reports on the return on investment obtained by

the Accelerator through the accelerated investment outflows of new companies compared to the total capital invested.

- Total employees. Total number of employees hired by accelerated start-ups.
- Total investment rounds. Total number of investment rounds reached.
- Average investment outputs per start-up. Calculated as follows: (total investment outputs / total start-ups).
- Average capital invested per start-up. Calculated as follows: (total capital invested / total start-ups).
- Average investment rounds per start-up. Calculated as follows: (total investment rounds / total start-ups).
- Average employees per start-up. Calculated as follows: (total employees / total start-ups).

The analysis model groups these variables into three categories (Table 4.1):

Table 4.1. Proposal for performance measurement in business accelerators

Classification	BIs literature	Proposal of performance measures for SAs
First category	• Investment received.	Size: • Total capital invested; • Total employees; • Total investment rounds; • Total start-ups.
Second category	• Local development of the economy.	Location; Year of foundation.
Third category	• Average capital invested; • Number of incubated start-ups; • Number of projects in incubation; • Policy of exit of the investment; • Employment generated; • Cost effectiveness.	Performance (profitability and efficiency): • Total investment outflows; • Average investment outflows per start-up; • Return of investment; • Average capital invested per start-up; • Average rounds of investment per start-up; • Average employees per start-up.

Source: Own elaboration based on the BI literature (Colombo and Delmastro, 2002; Löfsten and Lindelöf, 2002; Amezcua, 2011).

4.3.2. Hypotheses

Despite the growing interest in the literature on BIs and SAs, very few studies have conducted robust quantitative analyzes to assess their economic impact.

The few available studies refer to the incubation format but not to the acceleration, and yield inconclusive or even contradictory results. Therefore, Aerts et al. (2007) analyzed the degree of failure among new companies hosted in a set of 107 European incubators in 2003, while Chen (2009) examined the influence of incubators on the performance of new companies along with other factors.

None of them presented good results in favor of the BIs. On the other hand, Schwartz and Hornych (2010) considered 150 companies located in German incubators, highlighting advisory and consulting services as great advantages, in contrast to a lower level of synergies among the new companies. Shortly thereafter, Schwartz (2013) analyzed the survival rate of a sample of 371 companies incubated in five German BIs, compared to another 371 without incubation, and obtained no conclusive results.

Empirical studies on SAs are very recent and of a qualitative nature. Among them, the work of Pauwels et al. (2016) based on an analysis of accelerators from the United Kingdom, France and Germany. After a descriptive review, the study classifies the 13 SAs into three groups. The first is formed by "ecosystem creators", SAs sponsored or promoted by a large corporation, therefore, following the "corporate" model. The second group are the "investment transmitters" and is made up of SAs that seek to generate investment opportunities for certain venture capital funds. The third group is called "wealth generators" and includes the SAs promoted by public entities committed to promoting economic growth in a territory thanks to the emergence of new start-ups. This last modality is the one that can arouse the greatest interest among public agents as an instrument that generates wealth and generates new jobs.

Next, the study hypotheses are specified, which are aligned with the few results observed in previous studies on BIs. However, the novelty of the topic to be analyzed and the practical absence of empirical studies on the performance of SAs justify that some of these hypotheses are more exploratory than confirmatory.

Hypothesis 1: SAs located in the United States help create more start-ups and generally perform better than those found in other countries.

Hypothesis 2: SAs with a more advanced portfolio of start-ups in terms of development, and with a higher number of employees per company, outperform the rest in the main performance indicators of accelerators.

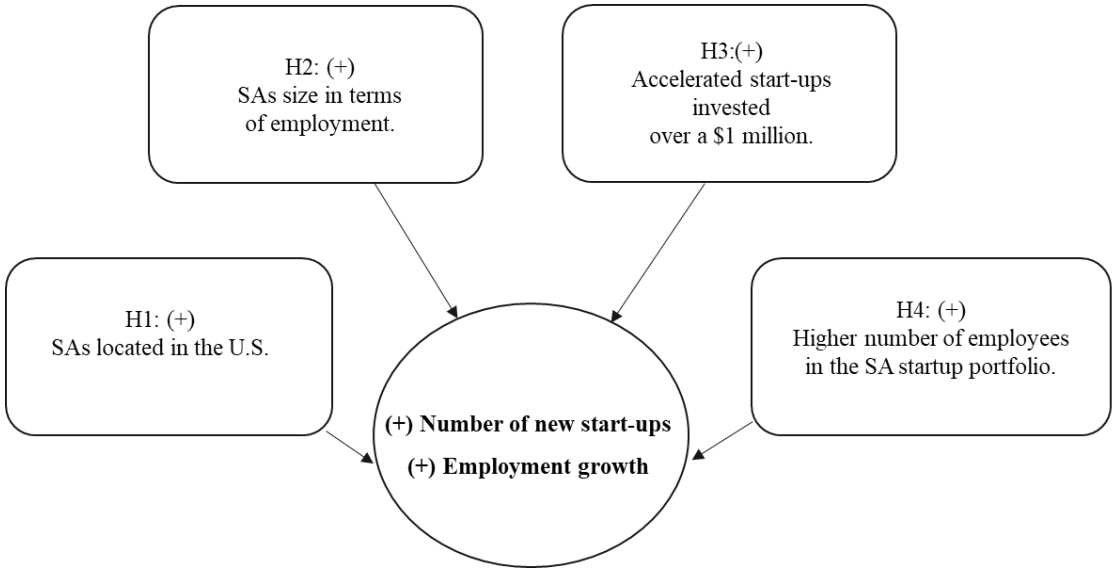
Hypothesis 3: SAs that have at least one accelerated start-up portfolio with more than one million dollars of investment, generate more jobs and outperform the rest in the main performance indicators of accelerators.

Hypothesis 4: Of all the SA performance variables, those that are directly related to a greater number of employees per company, determine the expectations of the accelerators in terms of employment generated and social impact.

Hypotheses 1 to 3 are confirmatory and will be contrasted through bivariate analyses while hypothesis 4 seeks to discover the significant variables and their contrast will require the application of a multivariate model.

The relationships between the hypotheses and the variables of our model are specified in Figure 4.1:

Figure 4.1. Relationships between hypotheses and model variables



Source: own elaboration

4.3.3. Methodology

We have created a database of SAs around the world to verify compliance with the proposed assumptions. At this point, we emphasize that the analysis is carried out with a database exclusively of accelerators, and not of incubators, for the following reasons: (1) SAs are the figure of the acceleration of new companies that presents a greater implementation and better reception by entrepreneurs since 2005; (2) Many incubators are being transformed or adapted to a model closer to that of accelerators; (3) It is an important methodological contribution due to the lack of quantitative analyzes that have worked with databases exclusively with SAs; (4) SAs and BIs promote the creation of new companies and help generate new jobs through their respective programs. However, the SAP process has a shorter duration in relation to the incubation program, so the opportunities to achieve these entrepreneurship and employment objectives in SAs are doubled.

Considering the above points, our initial database collected a total of 187 SAs. This database comes from a secondary source available online, owned by Christiansen (2009) and adapted for our study. This is the Seed Accelerator Database (Seed-DB), which contains extensive information on a good number of SAs worldwide, although more than half of them are based in the United States.

The results obtained have been complemented with information from CrunchBase and AngelList online platforms, which are updated every day by entrepreneurs, accelerators and investors registered under their personal profiles. Some SAs that are part of this database began their activity in the 1990s under the figure of an incubator, currently adapting to the structure and objectives of an accelerator. Some missing data forced us to reduce the initial database from 187 to 116 SAs.

Regarding the characteristics or requirements that the registered SAs in the Seed-DB database must meet, the organization is only required to regularly organize acceleration programs of a few months' duration. Although the access mode of projects and start-ups is competitive and restricted to a few, access by invitation of the accelerator itself is increasingly frequent.

The final database that forms part of this study is made up of three different samples whose objective is to analyze the accelerator figure as a whole: (1) complete sample consisting of 116 SAs (Sample I); (2) 63 SAs with investments of more than one million dollars per accelerated start-up (Sample II); (3) 33 SAs with investment outlets (Sample III). The first sample collects information from the 116 SAs, 77 accelerators based in the United States, and the rest are located in other countries. The second sample collects information only from those SAs that have invested a million dollars in at least one accelerated start-up. The third, integrates only those SAs that have managed to sell their shares in one of their accelerated start-ups and, therefore, have achieved an investment outflow (or exit), to obtain benefits and continue with new SAPs. In these last two samples, American accelerators also number more than half.

4.4. EMPIRICAL ANALYSIS AND RESULTS

4.4.1. Bivariate Results

The study applies bivariate statistical methods to generate statistically solid results that allow testing the hypotheses. A bivariate analysis offers significant statistical information on the differences between two groups in a single variable.

The existence or not of significant differences between the groups of SAs in the model variables has been verified using the *Kruskal-Wallis* and *Mann-Whitney U* non-parametric test.

The *Kruskal-Wallis* test is the most appropriate method to compare populations that do not follow a Normal distribution, as is the case of the variables in our model. This is the non-parametric alternative to the ANOVA test. The level of significance with which we make the comparisons is 95%.

We will apply the bivariate analysis to the three samples to verify compliance with hypotheses 1, 2 and 3.

The first bivariate analysis is performed by choosing the accelerator "country of origin" as a grouped variable, distinguishing between SAs located in the United States (72) and those located in other countries (44).

The following table (Table 4.2) summarizes the results obtained with the first analysis corresponding to the total sample.

Table 4.2. Analysis of differences according to the country of origin:

U.S. SAs versus non-U.S. SAs. Sample I (N = 116)

Variables	Differences on average	*T Student*	*p-value*
Total start-ups	-14.183	-1.299	0.115
Total investment outflows	-23,986,086.00	-1.299	0.197
Total capital invested	-46,780,226.00	-1.526	0.131
Total employees	-89.752	-1.706	0.092
Total investment rounds	-17.626	-2.368	0.020**
ROI (%)	56.433	0.746	0.459
Average capital invested per start-up	-495,598.00	-4.942	0.000***
Average investment outputs per start-up	-64,603.18	-0.606	0.545
Average employees per start-up	-0.843	-3.201	0.001**
Average investment rounds per start-up	-0.294	-4.496	0.000***

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own elaboration

We found significant differences in the country of origin for the following variables: "Total investment rounds (first category)", "Average capital invested per start", "Average employees per start-up", and "Average investment rounds per start-up (third category)".

These four variables obtain a higher value for SAs located in the United States. Three of them correspond to the third category (performance indicators), which reveals higher levels of profitability and efficiency in the accelerators located in the United States.

The following bivariate analysis refers to the variable "Average employees per start-up", a critical measure of the performance and the economic impact of the SAs. It takes two values:

0: Accelerators with “Average employees per start-up” below the median (58)

1: Accelerators with “Average employees per start-up” above the median (58).

Table 4.3 provides the results for the full sample of 116 SAs.

Table 4.3. Analysis of differences in the variable “Average employees per start-up”

Variables	**Differences on average**	***T Student***	***p-value***
Total start-ups	-28.517	-2.715	0.008**
Total investment outflows	-31,912,217.00	-1.396	0.168
Total capital invested	-64,355,405.00	-1.701	0.094
Total employees	-149.724	-2.343	0.022**
Total investment rounds	-26.931	-3.007	0.004**
ROI (%)	-83.672	-1.443	0.154
Average capital invested per start-up	-766,148.30	-7.212	0.000***
Average investment outputs per start-up	-240,090.10	-2.176	0.034**
Average investment rounds per start-up	-0.534	-8.132	0.000***

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own elaboration

We observed statistically significant differences in the variables: "Total start-ups”, “Total employees”, “Total investment rounds”, ‘Average capital invested per start-up”, “Average investment outputs per start-up” , and " Average investment rounds per start-up”. In all cases, the values for group 0 are lower than for group 1.

Consequently, accelerators that stand out in terms of job creation by new companies tend to be higher in terms of the number of participating start-ups and total employment, but more importantly, achieve better performance ratios.

Next, we applied the bivariate analysis to sample II to determine if there are differences in the means according to the groups formed by the dichotomized variable "Companies founded + $1M", taking the following values:

0: if the variable “Companies founded + $1M” is below the median

1: if the variable “Companies founded + $1M” it is above the median

Table 4.4. Numerical results of the differences in means according to the variable “Companies founded + $1M” dichotomized (N = 63)

Variable	Kendall's W statistic	p-value
Total investment outflows	364	0.005**
Total capital invested	28	0.000***
Total employees	47.5	0.000***
Total investment rounds	5	0.000***
ROI %	367	0.006**
Average capital invested per start-up	287	0.007**
Average investment outputs per start-up	367	0.006**
Average employees per start-up	235.5	0.073
Average investment rounds per start-up	270.5	0.003**

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own elaboration

We observe differences in all variables except in “Average employees per start-up”. In all cases, the median values are higher at level (of the grouping variable) 1 than at level 0.

4.4.2. Multivariate Results

In the study, we explored the possibility of applying various multivariate analysis techniques to confirm the results indicated by the bivariate analysis and, more importantly, to determine the variables that have a significant relationship with our variable of interest at the global level: the average number of employees per start-up, the main indicator of accelerators' social performance.

Of all the possible techniques applicable, we have finally chosen the GLM Gamma models. The generated models will help us verify compliance with hypothesis 4.

We begin with the model and the results related to the full sample of 116 SAs.

Table 4.5. Model 1: GLM Gamma, after eliminating non-significant variables. Response variable: "Average employees per start-up". Sample 116 SAs.

Independent variables	Estimated coef.	Standard Error	p-value
Constant	1.031	0.073	0.000
Year of foundation (1)	0.511	0.359	0.157
Country (1)	-0.094	0.095	0.328
Average capital invested per start-up	7.1·10-7	0.000	0.012**
Average investment rounds per start-up	2.301,00	0.482	0.000***
AIC	**167.29**		
R^2	**0.84**		

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own elaboration

Table 4.5 shows statistically significant values in the independent variables "Average capital invested per start-up" and "Average investment rounds per start-up", both of which are positive coefficients, indicating an ascending relationship between independent and dependent variables. Therefore, SAs with the highest average number of employees per hosted company achieve higher investment volumes per accelerated start-up, and also more easily access investment rounds for their start-ups.

Both indicators are relevant and confirm a higher performance in aspects related to investment in SAs that prioritize, or manage to host, start-ups with greater capacity to generate new jobs.

The model presents a good fit since it explains 84% of the variability of the model. The variable "Year of foundation" is not significant, but if it is removed from the model, the AIC increases, so we keep it.

Then we apply the same analysis to the sample of 63 SAs that have managed to close at least an investment of more than $ 1 million.

Table 4.6. Model 2: GLM Gamma, after eliminating non-significant variables. Response variable: "Average employees per start-up". Sample 63 SAs.

Independent variables	Estimated coef.	Standard Error	p-value
Constant	1.375	2.756	0.619
Year of foundation (1)	2.802	4.517	0.537
Country (1)	-5.137	2.286	0.028**
Average capital invested per start-up	8.1·10-7	0.000	0.179
Average investment rounds per start-up	4.211	1.495	0.006**
AIC	404.36		
R^2	0.39		

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own elaboration

As for the goodness of the fit, represented by the Pseudo- R^2, it explains 38% of the total variation, a moderate but acceptable percentage.

Table 4.6 reveals the independent variables with statistically significant p-values: "Country" and "Average investment rounds per start-up." The negative sign of the coefficient associated with the "Country" variable shows a lower average number of employees per company in the U.S. accelerators. Meanwhile, the "Average investment

rounds per start-up" maintains a direct and positive relationship with the dependent variable "Average employees per start-up".

Finally, we replicate this analysis with the sample of 33 SAs with at least an "exit" of more than $ 1 million among their accelerated new companies.

After testing several models, we finally settled on Model 3, the results of which are shown in Table 4.7. The significant variables are "Average capital invested per start-up" and "Average investment rounds per start-up". The coefficients of both variables are positive, confirming an increasing association with the mean of the response variable, although the relationship is greater with the variable "Average capital invested per start-up". Regarding the goodness of fit measured with the Pseudo-R^2, the total variability explained is 40%, a moderate and acceptable value.

Table 4.7. Model 3: GLM Gamma, after eliminating non-significant variables. Response variable: "Average employees per start-up". Sample 33 SAs.

Independent variables	Estimated coef.	Standard Error	p-value
Constant	2.219	0.881	0.017
Year of foundation (1)	—	—	—
Country (1)	-2.033	1.026	0.057
Average capital invested per start-up	1.3·10-6	0.000	0.027**
Average investment rounds per start-up	1.697	0.746	0.031**
AIC	157.46		
R^2	0.40		

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own elaboration

GLM multivariate analyzes have allowed us to identify two variables directly related to the variable under study: the size of the accelerators in terms of the average number of employees per start-up.

The most intense relationship is maintained with the "Average investment rounds per start-up ", in the sense that SAs with the highest level of employment in their accelerated

companies manage to close the investment rounds for a volume significantly higher than the rest. It is the only significant independent variable in the three samples.

The other variable is "Average capital invested per start-up", significant in two of the three samples, although its relationship with the dependent variable is weaker. Therefore, our analysis confirms that in SAs with the highest employment per company, investors inject more capital on average in the accelerated start-ups.

Therefore, these two are the variables that determine the performance and expectations of the accelerators' social impact in terms of employment generated.

On the other hand, the variable "Country", which we initially thought would be significant and in favor of the U.S. accelerators, is only significant in Sample II and in the opposite direction to that expected in relation to the dependent variable.

4.4.3. Hypotheses contrast

The first hypothesis states that U.S. accelerators help create more new companies than those located in other countries and outperform them in terms of performance. The first assumption about the creation of a greater number of start-ups is only verified in Sample II, made up of 63 SAs with at least an investment of more than one million dollars in a new company. On the other hand, our study confirms that accelerators located in the United States effectively obtain higher levels of performance (profitability and efficiency), and generate more employment than those located in other countries.

The second hypothesis is also widely fulfilled, since SAs that stand out in terms of job creation per start-up tend to be higher in terms of the number of new companies that participated and total employment, but more importantly, they achieve better performance ratios.

Hypothesis 3 expects SAs with at least one accelerated start-ups with more than a million dollars of investment to generate more employment. Although it could be predicted that more new companies will create more jobs, this hypothesis is not accepted since there are no statistically significant results in terms of employment.

Hypothesis 4 seeks to reveal the variables directly related to a greater number of employees per company. Our study confirms two variables. First and as the most determining variable is the "Average investment rounds per start-up", which means that the greater the number of investment rounds, the greater the number of employees per accelerated company. We have also discovered a direct but less intense relationship with the "Average capital invested per start-up", meaning that SAs with a higher magnitude in this investment parameter tend to host new companies with a higher number of average employees.

Therefore, there are two variables of an investment nature that determine SAs' performance expectations in terms of employment generated and social impact.

4.5. DISCUSSION

After testing the hypotheses of our study through the application of bivariate analysis and multivariate analysis, we have contributed to a better understanding of the performance of this recent type of business acceleration organization, which is important given the speed with which these new SAPs are taking hold around the world.

The main results emanating from our analysis are presented and discussed below:

SAs with at least one investment in a start-up of more than a million dollars and located in the United States generate a greater number of new companies than SAs located in other countries. This result was to be expected given that it was in the United States where the Accelerator phenomenon arose and, therefore, these type of organizations have been in operation for more years.

The highest performance recorded in the U.S. accelerators can be explained, among other reasons, from the greater support and financial strength that they have since their inception.

Furthermore, the United States has a long tradition and culture of investing in companies with a start-up profile, a factor that is still little present in Spain and whose progress inevitably involves sensitizing and convincing agents with investment capacity, such as venture capitalists, family offices, banks, large companies, and successful entrepreneurs.

In terms of age, SAs functioning more than ten years stand out in terms of new business creation and number of jobs, compared to the most recent accelerators. However, they do not stand out in the rest of the performance indicators. In fact, our analysis has not found a clear relationship between SAs performance and the number of years in operation. This result is of great informative value for the future operational decisions of the managers of SAs, since it warns that the expectations and growth of these initiatives do not depend exclusively on the number of working years but on the strategy and approach they apply in the start-up selection strategy, and, most importantly, the ability to attract capital to their accelerated companies.

The social impact of SAs is directly related to their size in terms of employment and ROI. Therefore, we confirm that SAs with a larger size and a positive ROI generate a greater contribution to the local economy, since they produce more job opportunities through a greater number of new hosted companies, than those SAs that have not yet been able to obtain this return on investment.

The main contribution of our study in the social field lies in discovering the underlying factors of job creation in accelerators. Through a multivariate analysis, we have detected that the volume of investment that the SA manages to attract for its new companies is the main trigger for greater job creation in the accelerated start-ups. Therefore, the creation of new SAs must be accompanied and promoted by one or more venture capital investment funds. In this way, companies housed in the accelerator space would have greater facilities to close investment rounds and job creation would multiply. In addition to the ease of attracting investors, our study also highlights the importance of closing rounds for volumes greater than half a million dollars and ideally greater than a million dollars. The SAs with start-ups that manage to close this type of rounds of considerable size are the ones that generate more employment per company.

Once the central role of the variable "investment" has been confirmed, the factors that investors prioritize when making their investments in start-ups could be analyzed. That would be the object of a different study, but we can anticipate that the innovative potential, the quality and scalability of the product in the market, and the leadership of the entrepreneurial team, are certainly among the most relevant factors.

Our study shows the leadership that the United States has taken with a good number of SAs with several "exits" of companies for amounts greater than a million dollars. In Spain, the accelerator phenomenon is very recent, and all of them were founded as of 2010. Therefore, most are less than 8 years old and have not yet achieved a positive return on their investment. There are still very few that have managed to close an investment "exit" of more than a million dollars, a volume that is understood as an indicator of success for initial investors, the founding entrepreneurs, and the accelerator itself.

The SA phenomenon, despite being so recent, is moving in a changing context. Therefore, there is already an incipient change towards specialization in different formats, among which the "corporate" approach stands out, in which the accelerator places itself at the service of a large corporation, and accepts only new companies with projects destined to respond to challenges and needs of the sponsoring corporation. This "corporate" mode broke into Silicon Valley in 2012, and is rapidly spreading to the European environment. In Spain, some of the best-known SAs are opening lines towards this format (Lanzadera) or have completely become corporate accelerators (Plug & Play; Insomnia). No less relevant is the appearance of SAs with a strong social orientation, as is the case of the well-known Akhoka.

The results of the study may lead to some public policy proposals aimed at promoting the creation of accelerators for the creation of new companies and, above all, employment.

The generation of employment will undoubtedly be greater as long as the accelerated new companies are viable, sustainable and capable of growth. There are no magic recipes that guarantee success, but the quality of the project and the promoting team are essential, as well as the innovative content, economic viability and rapid scalability towards new markets. Therefore, an effective system for selecting projects and entrepreneurs is an essential starting point.

On the other hand, the link with the dominant productive sectors of its territory is a pending issue in the environment of SAs. On the basis of public policies, the creation of "Sector Accelerators" should be encouraged to promote business projects linked to the main productive sectors of the territory where they are located. This would facilitate the participation of leading and consolidated organizations, in terms of launching challenges, sponsoring projects or investing in the most promising new companies. The result would

be a greater overlap of new companies in the territory and, undoubtedly, a higher rate of job creation, since these new companies would have the support of consolidated organizations within the industry, investors and potential clients.

New companies in general, and those located in SAs in particular, show difficulties in covering technical and highly specialized jobs. For example, the demand for specialists in software development, big data or artificial intelligence, far exceeds the existing offer in many Spanish territories. This shortage of highly rated, high-demand profiles is hampering the growth of new companies at the forefront of technology that aim to clearly expand market segments. Therefore, it would be advisable to better plan and update the training offering to meet the changing needs of high-tech sectors, mostly represented by start-ups.

Finally, start-ups are flexible business organizations ready to change locations in search of market and investment opportunities. Therefore, geographic areas with precarious market conditions and low investor availability often have difficulties in retaining the new generated companies. Therefore, attracting a sufficient volume of investors, such as Business Angels and Venture Capital funds primarily from the sectors most likely to invest in start-ups, is vital to avoid the escape of new expanding companies and attract the interest of new SAs and entrepreneurs from other areas. As a consequence, the greater number of new companies would translate into a greater volume of employment generated.

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CHAPTER 5: A QUANTITATIVE-BASED MODEL TO ASSESS ACCELERATED START-UPS PERFORMANCE

ABSTRACT

Seed Accelerators appear as a new generation of business incubators. While accelerators have exponentially grown around the world, a consensual analysis on measuring their performance remains poorly understood, as well as the role of this type of organizations in employment creation, source of investment, start-up survival rates, and economic growth. Therefore, the purpose of this study is to cast new light into this field by empirically assessing the performance and prospects of accelerators using two pioneer surveys. The first survey includes 131 accelerators and the second survey 10,116 accelerated start-ups. A model, based on the variables used in the literature of accelerators was built on two perspectives used to assess the better prospects of the accelerated firms: (1) the Accelerator´s perspective and (2) the accelerated start-ups' perspective. This model leads to two hypotheses to be tested. Some remarkable findings arise after the implementation of a binomial and ANOVA regression analysis. The results confirm at statistically significant levels that the portfolio size of the Accelerator, the start-ups´ survival rates, and the proportion of employees in the accelerated firms, has a positive effect on the median value of the funding received by the accelerated start-ups from the Accelerator´s funds. Furthermore, accelerators located in the United States, and those running for a longer period of time, show a higher impact for start-ups´ survival rates. The number of exits and investments of accelerators have a negative impact on the funding they invest in their start-ups due to strategical and financial reasons. The study is not free of limitations, but the findings make a contribution to the still scarce existing quantitative literature on the performance of accelerators, and provide important managerial implications to their managers, investors, and entrepreneurs.

5.1. INTRODUCTION

The growing stream of knowledge about Entrepreneurial Ecosystems (EEs) delves into the role that some key actors and networks can play in effectively promoting the emergence and growth of new companies in a given geographical area.

The main stakeholders in EEs change over time, and in recent years, technological advancements and the rise of the digital economy (Clarysse et al, 2015), have led to the emergence of a key new player: the Accelerator, a new generation of business incubator (Pauwels et al., 2016) that is receiving increasing attention and interest from entrepreneurs, investors, and policy makers (Del Sarto et al., 2020).

The Accelerator, also known as the Seed Accelerator (SA) or start-up Accelerator (Cohen and Hochberg, 2014), has rapidly spread as a tool to speed up the business creation process, launching products, and increasing start-up survival rates, helping to attract investments in the early stages (Bliemel and Flores, 2015; Bliemel et al., 2016: Cohen et al., 2019). These start-ups face a number of challenges that can affect their chances of survival: access to limited financial resources (Smilor, 1997), lack of initial team experience (Gruber et al., 2008), problems accessing skilled workers (Zott and Huy, 2007), or limited knowledge on how to seize certain opportunities (Ambos and Birkinshaw, 2010).

SAs are organizations created specifically to develop sounder projects and enhance their chances of overcoming these barriers and difficulties at the beginning of their lifecycle (Birdsall et al., 2013). This is made possible by the provision of specific services during an intensive, time-limited program, which generally lasts a few months (Cohen and Hochberg, 2014). Although considered by some to be an evolutionary descendant of incubators (Pauwels et al., 2016), accelerators have distinctive characteristics compared to previous generations of business incubators.

Since SAs are a relatively recent phenomenon, most academic studies have either been descriptive (Cohen and Hochberg, 2014; Dempwolf et al., 2014) or have assessed effectiveness based on their initial results (Hoffman and Radojevich-Kelley, 2012; Hallen et al., 2020). Although Accelerator programs have proliferated, a consensual analysis on how to measure Accelerator performance remains poorly understood, as well as the role of

SAs in job creation, investment, start-up survival, and economic growth. This information is critical to an entrepreneur who is considering participating in an Accelerator program. However, finding empirical evidence regarding the performance of these types of programs is a difficult task, and there is much confusion and debate about how performance should be measured for an Accelerator (Cohen and Hochberg, 2014), so the entrepreneur is left with uncertainty.

Since research on this new form of organization is still emerging, empirical studies on this topic provide mixed results. Several studies report on the positive impact of acceleration on start-ups (Fehder and Hochberg, 2019; Hallen et al., 2020), while others find neutral or even negative impacts (Gonzalez-Uribe and Leatherbee, 2016; Dvouletý et al., 2018; Lukeš et al., 2019; Yu, 2020).

Most of the existing studies are qualitative in nature and represent a breakthrough in the Accelerator literature, nonetheless they are based on databases that include few accelerators from a single country. In this paper, we seek to provide valuable information to the existing Accelerator literature in various ways. First, we offer a conceptual framework on the performance of SAs programs across multiple dimensions that may be important to entrepreneurs, investors, and managers. Second, and similarly to Cohen et al. (2019), we provide preliminary cross-sectional relationships between different Accelerator design elements and the performance of the Accelerator portfolio. Thanks to its international coverage, our study is methodologically pioneering in conducting an extensive quantitative analysis with SAs and start-ups around the world, compared to previous single-country based studies (Gonzalez-Uribe and Leatherbee, 2017; Cohen et al., 2019; Del Sarto et al., 2020; Yu, 2020).

The aim of this paper is to provide a broader and deeper understanding of the SA phenomenon by determining the variables associated with its performance, those that are most critical and influential in the financing and survival of new companies

To meet this goal, an empirical study was conducted using two pioneering samples. The first sample includes 131 SAs from around the world, and the second sample includes 10,116 companies accelerated by the selected SAs. The data was collected and combined using information from secondary online sources such as Crunchbase, AngelList, LinkedIn, Seed-DB, and the accelerators websites.

Our study aims to contribute to the existing literature, first, by carrying out a brief analysis of the Entrepreneurial Ecosystems and their current derivations, such as innovative ecosystems, and the ecosystems of start-ups. Hence, we broaden the scope of the EEs by introducing the key role that SAs and start-ups play as participating actors. Second, while early studies provide descriptions of SAs activities, and an initial assessment of their impact, this study breaks new ground in the field of start-up accelerators by exploring the overall performance of a wide range of SAs and the new companies supported by them. Accordingly, our results will add new evidence to the recent stream of studies aimed at assessing the impact of business incubators and SAs on the survival and growth of participating new companies. Third, our study will open new paths in the financing strategy of SAs towards participating companies, revealing the factors related to more intensive Accelerator financing, and the effectiveness of this investment on its accelerated start-ups.

Overall, our study will provide critical information for key stakeholders in Entrepreneurial Ecosystems.

The reminder of the paper includes a review of the previous literature on accelerators, the start-up ecosystem, and its impact on accelerated companies, followed by a review of a set of empirical studies dealing with their performance. Next, we present our model, methodology and hypotheses. The empirical results section shows the outcomes of the analysis on the data. The last sections discuss the results and findings, and include some managerial and academic implications. Finally, we highlight the limitations of this study and the avenues for future research.

5.2. THEORETICAL FRAMEWORK

5.2.1. Entrepreneurial and innovation ecosystems

The EE literature initially gave priority to the presence of actors not directly related to start-ups, such as large companies, universities, public sector organizations, health care systems, banks and stock markets (Isenberg, 2010; Mason and Brown, 2014).

However, the scope of EEs has recently been expanded with the entry of agents dedicated mainly to promoting the birth and development of new start-up companies, as is the case of SAs. Consequently, the EE literature provides an improved theoretical framework to analyze the underlying dynamics of new business formation in certain geographic locations compared to others (Brown and Mason, 2017).

A recent stream of literature tends to connect EEs more explicitly with innovation, leading to the concept of innovation ecosystem, defined as an evolving set of actors, activities and artifacts, institutions and relationships (including complementary and substitute relations), that are important for the innovative performance of an actor or a population of actors (Granstrand and Holgersson, 2020).

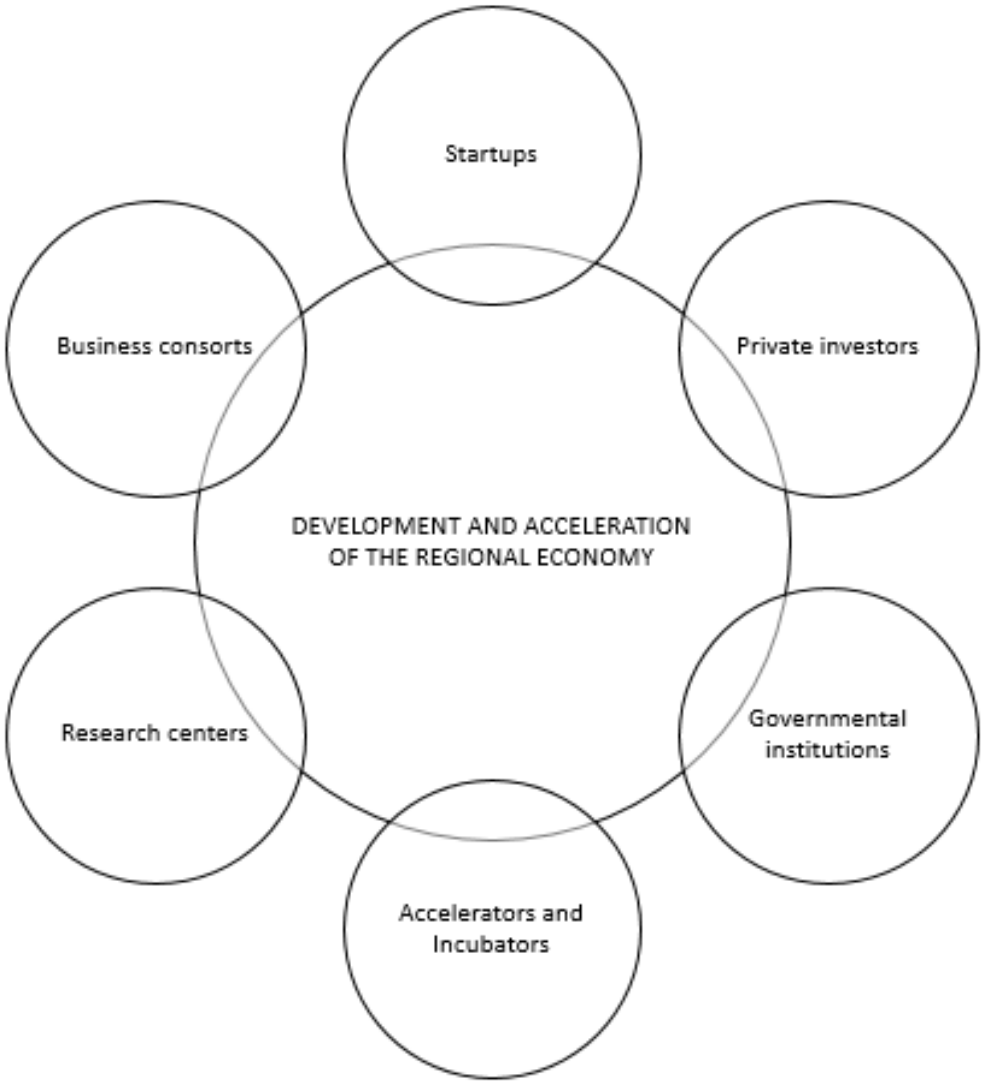
Innovation ecosystems are characterized by a larger proportion of companies that focus on the development of new products (Scaringella and Radziwom, 2018), and tend to grow in areas provided with the right conditions for the implementation of disruptive innovations.

The innovation ecosystem literature emphasizes the collaborative networks between organizations and innovation actors (for example, companies, governments, science parks, universities), forming a community in which they cooperate and compete (Xu et al., 2018; Arenal et al., 2020). However, little attention has been paid to business incubators and seed accelerators as agents that promote innovation by enhancing the emergence and growth of new companies.

The study of Oh et al. (2016), is amongst the few studies that explicitly mentions accelerators as key actors in a specific type of innovation ecosystem. SAs role is particularly significant in creating a hyperlocal innovation ecosystem, offering essential services and facilities for the emergence of innovative new companies.

Fang et al. (2015) affirm that an entrepreneurial ecosystem is typically characterized as an innovation ecosystem, aimed primarily at driving development and accelerating the region's economy. Start-up firms become an essential actor in these ecosystems (Figure 5.1).

Figure 5.1. Actors that drive development and accelerate the regional economy



Source: adapted from Fang et al. (2015); Theodoraki and Messeghem (2017).

The actors mentioned in Figure 5.1 maintain an interdependent relationship. New companies that have gone through an Accelerator are expected to subsequently obtain investment through private investors, or to enter into collaboration agreements with other companies or research centers for the development of new products. Healthy and strong ecosystems require all their actors to work as a team, since their needs are interdependent and success is created together (Fang et al., 2015).

The connection between EEs and innovation is made more explicit with the regional innovation system (RIS) approach, which emphasizes that innovation and economic growth is stimulated by interactive processes between industry actors and knowledge-intensive organizations, such as universities and R&D-organizations, that are geographically close to each other (Asheim and Isaksen, 2002).

The relationship between RIS and entrepreneurship seems unquestionable. Rypestol and Aarstad (2018) highlight the advantages for entrepreneurs to locate in thick RISs, those characterized by a strong presence of R&D institutions together with an industrial sector of a highly educated workforce (Isaksen and Trippl, 2016).

Entrepreneurship academics and policy makers are turning more attention to the role of high growth companies (Brown et al., 2019) and young and innovative companies (Shneider and Veugelers, 2010), as central agents in the so-called 'start-up ecosystems', characterized by a large number of new technology companies, driven by various agents to develop and grow rapidly. It is in the largely start-up oriented EE context that SAs appear and become essential agents to accelerate innovative business creation and growth (Stayton and Mangematin, 2019). The main stakeholders involved in a start-up ecosystem are entrepreneurs, investors, and supportive organizations, including incubators and accelerators (Tripathi et al., 2019).

Neither the EEs nor the innovation ecosystems adequately cover the start-up ecosystem, a new concept with growing support. To date, only a few studies recognize start-ups as major players in most EEs (Stam, 2015), where they seek out for other actors that can provide resources and connections to financial support networks and agents (Van Rijnsoever, 2020). Actors in these networks include private venture capitalists, banks, public funders, and business angels, as sources of financial capital.

Our empirical analysis is intended to close this gap by deepening the role of SAs as business negotiators and their degree of success in forming funds to invest in their new hosted companies.

5.2.2. Impact of the Accelerator in accelerated companies

The SA is a relatively new phenomenon that has grown and expanded continuously worldwide since 2005 (Cohen and Hochberg, 2014).

Accelerators are considered the new generation of business incubators (Bøllingtoft, 2012), but differ from typical incubators, first, because they are not primarily designed to provide resources or office support, and second, because they are less focused on venture capitalists as the next financing step, being more closely related to informal and individual small-scale investors (Clarysse et al., 2015).

SAs are for-profit organizations, generally backed by governments, corporations, or universities (Hallen et al., 2020). A widely accepted concept of SA is that of Cohen and Hochberg (2014, 4), who define Accelerator as 'a fixed-term, cohort-based program that includes mentoring and an educational component, culminating in a public presentation event called Demo Day'. However, rather than programs, SAs are 'business entities that make seed-stage investments in promising companies in exchange for equity' (Dempwolf et al., 2014, 26).

The way these organizations work is through an open application process where anyone with a business idea can apply. The best projects are chosen and supported by the Seed Accelerator Program (SAP), which is a structured limited period plan during which the Accelerator offers a selected number of specific services to accelerate the growth of new companies, and therefore, make them more attractive to external investors.

In principle, the appearance of SAs promotes the birth and growth of companies driven by innovation, generating employment in the region where they are established (Barrehag et al., 2012). Furthermore, SAs attract to the region potential partners, investors, entrepreneurs, qualified workforce, and representatives of public administration.

Accelerators have proliferated rapidly, but the general absence of large-scale, representative public data sets covering accelerator programs, and the lack of complete and up-to-date data on the survival and growth of new hosted companies (Stayton and Mangematin, 2019), make it difficult for researchers to assess the impact on accelerated companies that participate in this type of program (Hochberg, 2016).

Similarly, few studies have covered the success and survival of start-ups participating in SAPs, mainly due to the novelty of the phenomenon and the limited availability of data. This study is expected to contribute to closing that gap by building an appropriate framework to reveal the SAP components most conducive to supporting the emergence of high growth, sustainable technology companies in a rapidly changing economic environment.

Research on accelerators to date can be grouped into these four categories: (1) conceptual descriptions of the Accelerator model (Cohen and Hochberg, 2014; Dempwolf et al., 2014; Hochberg, 2016), (2) qualitative evaluation of how accelerators are useful to accelerate new companies (Radojevich-Kelley and Hoffman, 2012; Cohen, 2013; Kim and Wagman, 2014; Pauwels et al., 2016; Cohen et al., 2019); (3) empirical analyses evaluating the positive effects of accelerators on the results of companies participating in their programs (Smith and Hannigan, 2015; Cohen et al., 2019; Fehder and Hochberg, 2019; Hallen et al., 2020), and (4) empirical analyses that reveal that accelerators have a negative or inconclusive effect on the results of accelerated new companies (Smith et al., 2015; Gonzalez-Uribe and Leatherbee, 2017; Yu, 2020).

Existing empirical research has not yet been built around a central framework theory, with a shared understanding of questions and methodologies (Cohen et al., 2019). In addition, the literature on SAs has not yet provided a widely accepted set of performance indicators, largely due to the unavailability of extensive empirical quantitative studies.

In this context, one of the most prominent and widespread techniques for analyzing SAs performance indicators is provided by the Seed Accelerator Ranking Project (Hochberg, et al., 2015), which establishes a way to measure the positive effect of SAs in accelerated start-ups by calculating a set of indicators linked to accelerated companies: ´Valuation´, when a firm has a priced round; ´Qualified Exit´, occurs when a portfolio firm either issues an Initial Public Offering (IPO) or is acquired for an amount greater than 5 million dollars

above the amount of capital raised by the company; ´Qualified Fundraising´ occurs when a portfolio firm raises an aggregate of at least 250,000 dollars in the year following the Accelerator program; ´Survival´, measured through the percentage of start-ups still in business; ´Founder Satisfaction´, determined by a survey of the entrepreneurs who have graduated from the programs.

Recent studies attribute a positive impact of SAPs on the performance and expectations of new hosted companies. Hallen et al., (2020) found evidence that accelerators support business development by corroborating the experience of the founders of accelerated start-ups. Cohen et al. (2019), found a connection between the design elements of the Accelerator and the performance of the accelerated start-ups attending their programs. Furthermore, Fehder and Hochberg (2019) found links between the arrival of an Accelerator with a significant increase in the volume of external seed investment and regional agreements.

However, some studies come to less optimistic conclusions. Yu (2020), states that new companies admitted to SAs are less likely to reach key development and financing milestones. Dvouletý et al. (2018), conducted a study based on Czech incubators that shows worse financial performance of companies that had been incubated, compared to a similar sample of their non-incubated counterparts.

Therefore, results on accelerator performance and expectations of accelerated new companies based on the SA literature generally show limited and inconclusive results.

5.2.3. Accelerators as investment instruments

Incubators and SAs are expected to facilitate the link between new companies and private investors. A well-developed Funding Service Network (FSN) consisting of start-ups and private venture capitalists is critical to the success of start-ups in entrepreneurial ecosystems (Van Rijnsoever, 2020).

Accelerators use distinctive investment models for capital deployment to participating start-ups (Cohen et al., 2019). For many, the amount allocated to each start-up is quite small, not enough to allow significant development once the program ends. Despite the fact that most SAs work hard to serve as a bridge to the private investor community, only a few

have managed to raise enough funds to invest large amounts of capital. The source of these additional funds may come directly from the Accelerator or from an adjacent fund provided by investors. For-profit accelerators under strong pressure to provide favorable returns to their investors are named investor-led accelerators (Cohen et al., 2019).

Overall, the review of the literature on recent empirical studies does not provide sufficient evidence on the positive impact of SAs on the ability to finance new tenants. Furthermore, the existing literature leaves two key questions unanswered: to what extent do SAs manage to mediate and facilitate high-quality start-ups for investors seeking early access? and, how successful are SAs in meeting start-up expectations in raising funds from trusted investors on good terms?

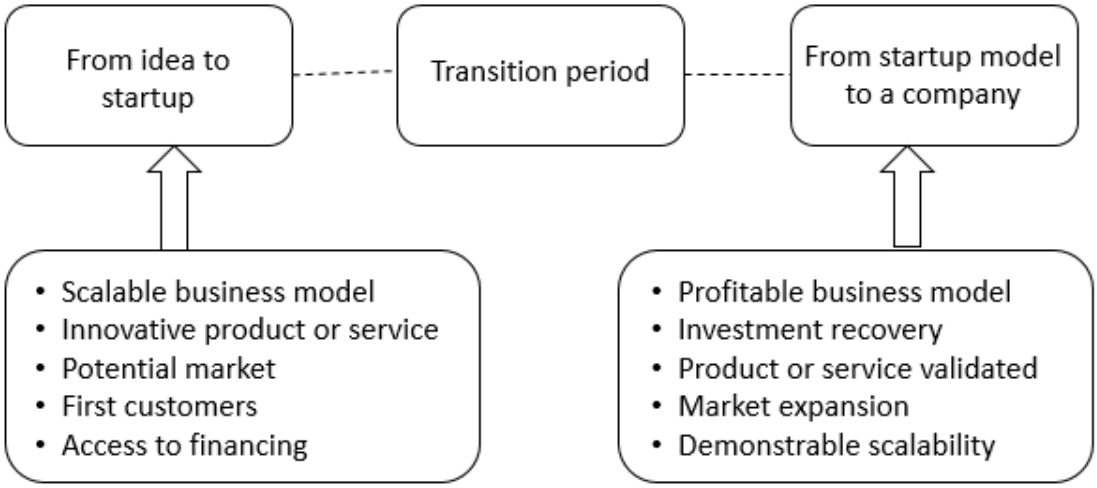
Based on the literature and with the intention of giving an answer to both questions, we propose our first hypothesis.

Hypothesis 1 expects that the average amount of funds received by the accelerated start-ups from the SAs' own capital resources, will be positively influenced by a set of variables associated with both the Accelerator and the start-up. This hypothesis will be divided into two (1a, 1b) complementary sub-hypotheses and will be explained further.

5.2.4. Start-up survival

A start-up is a temporary organization that seeks a scalable, repeatable, and profitable business model (Blank and Dorf, 2012), and often seeks outside investment to drive rapid growth (Figure 5.2).

Figure 5.2. The evolution of a start-up business model

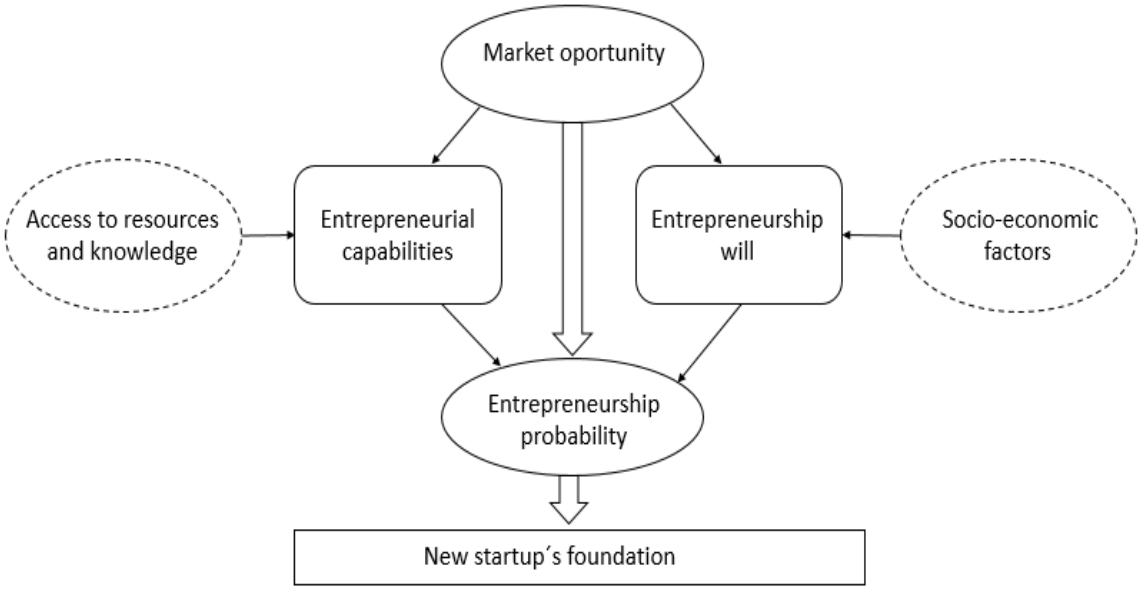


Source: adapted from Blank and Dorf (2012)

The more conducive the ecosystem and the business environment are, the more likely it is that new start-ups will emerge and grow. Entrepreneurs feel more prepared to start a new company when the social environment that surrounds them provides values that promote business activities and opens up a wide variety of opportunities.

According to Gnyawali and Fogel (1994), the possibilities of creating a successful new business increase substantially when potential entrepreneurs do not face significant difficulties to enter a market, and have the necessary knowledge to start a business (Figure 5.3).

Figure 5.3. Relationship between the entrepreneurial environment and the key elements for the start-up creation process



Source: adapted from Tripathi et al. (2019)

Although there is a lack of consensus in the literature on the existing level of mortality rates among younger companies, it is commonly accepted that the start-up is a high-risk company that carries a high probability of failure. In this sense, the literature covering the early mortality of new companies, and in particular of start-ups, tends to point out three key elements that participate in the analysis of success: (1) the profile of the entrepreneur (Sandberg and Hofer, 1986; Stuart and Abetti, 1987; Blenker, 1991); (2) the company strategy carried out by the entrepreneur and the characteristics of the company (McDougall and Robinson, 1990; Carter et al., 1994; McDougall et al., 1994); and (3) the socioeconomic environment (Stearns et al., 1991; Tsai et al., 1991).

One criterion for understanding how well SAs are doing is to measure whether start-ups are surviving longer as a result of participating in a SAP (Regmi et al., 2015). But, very few studies have so far covered with empirical data and a quantitative approach the impact of SAs on the survival of their accelerated start-ups.

For example, Mas-Verdú et al., (2015), based on the study of a single business incubator, conclude that participating in an incubation program does not guarantee the survival of the

company. For an incubator to influence survival, it is necessary to combine other factors related to the company, such as size or sector. Similarly, in the recent study by Del Sarto et al. (2020) four company-specific structural factors (company size, manufacturing / service sector, technology-based versus non-technology-based start-up, and export activity) were analyzed, to also conclude that participation in an Accelerator program by itself does not affect the survival of the company. And ultimately, additional factors must be met in order to have an effect on survival.

In order to more accurately and reliably assess the effect of SA on the survival and growth of its participating companies, and according to the limited results found in the literature, it is necessary to carry out joint studies on larger and more representative samples.

It is within this framework that our second hypothesis emerges, in order to identify characteristics linked to a higher survival rate, and associated with both the Accelerator and the accelerated companies.

Hypothesis 2 expects that the better the performance indicators are, both in the Accelerator and in its accelerated start-ups, the higher the survival rate of start-ups per Accelerator.

5.3. EMPIRICAL ANALYSIS

5.3.1. Variables

Based on the literature review, we provide a summary of the variables used by the most recent studies evaluating the performance of start-ups in the SA context since 2017. The variables in our study have been obtained from the recent literature (Table 5.1), and to meet our analysis purposes, some have been calculated differently than in previous studies. For example, the key variable ‘Survival’ in our study is a ratio of accelerated start-ups still active in each Accelerator portfolio, while most authors use this variable as a dummy variable 0-1 (0: did not survive / 1: survived).

Table 5.1. Variables used in recent studies to assess the performance of accelerators and accelerated start-ups

Variables selected for this study	Other studies on SAs
TOTFUNDACCEL	Cohen et al. (2019)
NEXIT	Hochberg et al. (2015)
NINVEST	Hochberg et al. (2015)
REGION	Del Sarto et al. (2020)
AGE	Cavallo et al. (2019); Lukeš et al. (2019); Del Sarto et al. (2020)
DURATION	Cacciolattia et al. (2020)
FOUNDBACK	Smith and Hannigan (2015); Hallen et al. (2020)
PORTFOLIO	Mas-Verdú et al. (2015); Del Sarto et al. (2020)
SURVIVAL	Gonzalez-Uribe and Leatherbee (2017); Hallen et al. (2020); Yu (2020); Del Sarto et al. (2020)
TOPEMPL PROPORTIONTOPEMPL	Gonzalez-Uribe and Leatherbee (2017); Hallen et al. (2020); Lukeš et al. (2019); Cacciolattia et al. (2020)
VALUFUND VALUFUNDPERFIRM	Gonzalez-Uribe and Leatherbee (2017); Cavallo et al (2019) ; Cacciolattia et al. (2020); Hallen et al. (2020); Yu (2020);
MEDIANFUND MEDIANFUNDPERCOMPANY	Smith and Hannigan (2015); Cavallo et al. (2019); Cohen et al. (2019); Yu (2020)
WEBVISITS	Hallen et al. (2020); Yu (2020)

Source: own compilation

Likewise, the variables used for this study are classified into two categories:

1) Variables with information about the Accelerator:
    - TOTFUNDACCEL: Total amount of financing received by the Accelerator through investors. This absolute value is expressed in dollars.
    - NEXIT: Number of exits achieved by the Accelerator.
    - NINVEST: Number of investments made by the Accelerator in start-ups.
    - In addition, several control variables have been included, referred to the Accelerator:
    - REGION: Location of the Accelerator. Three options, 1: United States; 2: Europe; 3: Other.
    - AGE: Accelerator founding date. Two periods, 1: 1997-2011; 2: 2012-2019.
    - DURATION: duration of the SAP in weeks. Two options, 0: 12 weeks or less; 1: more than 12 weeks.
    - FOUNDBACK: Background of the founders of the Accelerator. Three options, 1: Most founders with bachelor's or higher studies; 2: Most founders with higher education and serial entrepreneurs; 3: Other.
    - PORTFOLIO: Total number of accelerated start-ups.

2) Variables with information on accelerated start-ups:

    - SURVIVAL. Percentage of start-ups that are still operational with respect to the total portfolio of each Accelerator: (Number of active companies in 2019 / total accelerated companies from 2007 to 2019) x 100, in each Accelerator
    - TOPEMPL: Number of employees in accelerated start-ups. Two options, 0: between 1 and 10 employees; 1: more than 10 employees.
    - PROPORTIONTOPEMPL: Percentage of accelerated companies with more than 11 employees.
    - VALUFUND: Total amount of financing received by accelerated start-ups, both from the Accelerator and from investors. This absolute value is expressed in dollars.
    - VALUFUNDPERFIRM. Average funding per accelerated company, calculated as: (VALUFUND / number of new companies in the accelerators portfolio). This absolute value is expressed in dollars.

- MEDIANFUND: Median value of the financing received by the accelerated companies from the Accelerator funds. Two options 0: more than $ 500,000; 1: less than $ 500,000.
- MEDIANFUNDPERFIRM: Median value of the funding received individually by the accelerated company from the Accelerator funds. This absolute value is expressed in dollars.
- WEBVISITS: Total monthly average website visits received by accelerated start-ups.

5.3.2. Data

One of the main limitations to increasing knowledge of SAs lies in the absence of representative large-scale data sets, with information on companies entering and graduating from acceleration programs (Cohen and Hochberg, 2014). Given the large number of new SAs that have been created in recent years, our dataset is limited to the more established SAs that meet our selection criteria: (1) SAs located in United States, and in other places, (2) at least four years old, (3) take equity in exchange for support, and (4) mainly financed with private investment.

After imposing this selection criteria, two samples were built with data compiled in late 2019. First, a set of 131 global SAs founded between 1997 and 2019 included in Crunchbase, an online database containing profiles of companies, people, and investors. Crunchbase has partnerships with over 400 venture capital firms, accelerators, incubators, and angel investor groups to ensure data accuracy (Yu, 2020). In addition, we used the Seed-DB Accelerator database, which is an online database representing the world's largest public Accelerator repository (Hochberg, 2016). Other secondary online information sources, such as AngelList, LinkedIn, and the websites of each Accelerator, were used for data verification purposes.

Second, we selected a set of 10,116 accelerated start-ups that participated in the acceleration programs of these 131 SAs. The information was also collected from Crunchbase. These data collection efforts have been carried out to provide accurate information on a proportion of the world's SA population and accelerated start-ups, so that we can efficiently analyze their performance.

Finally, it was necessary to combine and cross both samples to carry out our analyses. For this purpose, we built a subsample including the data of the 131 SAs and the 10,116 accelerated start-ups, with information for all the variables used in the SA literature. A multilevel process was applied to collect accurate information about each Accelerator's actual portfolio.

5.3.3. Hypotheses

The first hypothesis expects that the average amount of financing received by the accelerated new companies, coming from the capital resources of SAs, is influenced by a set of variables associated with both, the Accelerator itself and the new company. This hypothesis is divided into two (1a, 1b) complementary sub-hypotheses.

Hypothesis 1a: We expect that at least half of accelerated start-ups will receive more than $ 500,000 in funding from the Accelerator fund (MEDIANFUND), when most performance measures, tied to accelerators and start-ups, are higher. More specifically, MEDIANFUND is expected to exceed $ 500,000 when performance metrics tied to accelerators and start-ups are highest. The performance measures are based on:

- The total amount of financing received by the Accelerator through investors (TOTFUNDACCEL).
- The number of investments made by the Accelerator in start-ups (NINVEST).
- The number of exits achieved by the Accelerator (NEXIT).
- The survival rate of start-ups in the Accelerator (SURVIVAL).
- The number of start-ups in the Accelerator with more than 10 employees (TOPEMPL).
- The average monthly number of visits to the website of the accelerated start-ups (WEBVISITS).
- Accelerator founders' backgrounds include one or more highly educated and experienced founders as serial entrepreneurs (FOUNDBACK).
- The Accelerator is located in the U.S. (REGION).
- The Accelerator has been operating for a longer time (AGE).
- The duration of the Accelerator Program is longer (DURATION).
- The total number of new accelerated companies is greater (PORTFOLIO).

Sub-hypothesis 1b refers to the median value of the financing received by the accelerated companies (MEDIANFUNDPERFIRM), coming exclusively from the Accelerator funds.
Hypothesis 1b: We expect the average amount of funding received by each accelerated start-up (MEDIANFUNDPERFIRM) using the Accelerator fund, to be greater than $ 500,000 when most performance measures tied to accelerators and start-ups are higher (referred to in the previous sub-hypothesis):
The second hypothesis expects the survival rate of new companies to depend on certain characteristics associated with both, the Accelerator and the accelerated companies.
Hypothesis 2: The survival rate of accelerated start-ups (SURVIVAL) will tend to be higher when most performance measures related to accelerators and start-ups are higher.

5.4. RESULTS

5.4.1. Descriptive analysis

This section begins with a brief description of the data and variables related to the Accelerator perspective (Table 5.2) and Sample I (131 SAs).

The minimum total funding received for an Accelerator was $ 50,000 with a total average of $ 18,898,731.50, to some extent biased by large SAs like Y Combinator or 500 Start-ups. Of this set, 58 obtained more than $ 5 million from investor financing. Older and U.S accelerators prevail, with 60.31% located in the United States, and 55% founded more than 8 years ago.

Of the total sample, only 30 SAs achieved more than 5 exits.

Most SAs (74.81%) directly employed between 1 and 10 workers, mainly engaged in coordination, marketing, administration, and financial tasks.

Looking at the background of their founders, most of them (61.72%) had a bachelor's degree or higher, and previous experience as serial entrepreneurs.

Most SAs in our sample (112 out of 131) accelerated less than 100 companies in all their years of active support. Most SAs only organized 4 or fewer events (Demo Day) per year (77.10%), due to the preference of concentrating the best accelerated projects in few annual public events, to increase the possibilities of receiving external investments and exits.

Table 5.2. Descriptive analysis of the Accelerator perspective

N1= 131 SAs

TOTFUNDACCEL	NINVEST	NEXIT	PORTFOLIO
Min. $50,000	Min. 1	Min. 0	Min. 1
Max. $700,000,000	Max. 1910	Max. 196 Av. 7	Max. 1,633
Av. $18,898,731.50	Av. 103	30 SAs >	19 SAs> 100 accelerated start-ups
58 SAs>	57 SAs >	5 exits (22.90%)	
$5,000,000 (44.27%)	50 investments (43.51%)	Av.	4 SAs> 500 accelerated start-ups
		$ 60,194,531	
		Median	
		$ 5,000,000	

REGION	AGE	FOUNDBACK	DURATION
60.31% SAs located in the U.S.	51.91% SAs founded between 1997-2011	61.72% SAs´ founders with superior studies and serial entrepreneurs	51.14% SAs with SAP 12 weeks or less

Source: own compilation

The variables associated with the new companies come from an extensive database with 10,116 (Sample II) accelerated start-ups (Table 5.3).

The average valuation obtained by accelerated start-ups was $ 511,984,637.34, again due to accelerators such as Y Combinator and 500 Start-ups. Most SAs (70.23%) had at least one start-up in portfolio that received $ 5 million or more. The average financing per accelerated company was $ 3,761,509.

Regarding employment, 34.27% of the accelerated new companies hired more than 10 employees, and only 2.92% had more than 100 employees, confirming the small size of this type of organization.

SAs primarily invest in their accelerated start-ups up to $ 500,000 (57.25%), with an average Accelerator fund investment of only $ 2,018,227.

Looking at survival rates since 2007 (a total of 9,395 out of 10,116), we found that 91.52% of companies were still active in 2019. The highest mortality rates occurred after 5 and 8 years of operation.

Table 5.3. Descriptive analysis of the accelerated start-ups perspective

N2= 10,116 accelerated start-ups

VALUFUND	VALUFUND PERFIRM	TOTEMPL	PROPORTION TOPEMPL
Min. $ 0 Max. $25,148,727,324 Av. $511,984,637.34 92 SAs > $5,000,000 (70.23%)	Min. $ 0 Max. $ 85,898,595 Av. $ 3,761,509	2.92% Accelerated start-ups with more than 100 employees	Av. 34.27%

MEDIANFUND	MEDIANFUND PERCOMPANY	SURVIVAL	WEBVISITS
57.25% Median start-up funding $0-$500,000	Min. $0 Max. $ 64,000,000 Av. $ 2,018,227	91.52% Accelerated start-ups were active between 2007-2019	Min. 0 Max. 3,934,467.64 Av. 145,335.39 (4,844 per day)

Source: own compilation

5.4.2. Regression analysis and hypothesis contrast

A binomial regression was performed to test the hypotheses, and the backward stepwise regression was the method selected to analyze each model.

In each step, a model variable is considered for the subtraction of the set of explanatory variables, based on the t-test as a pre-specified criterion.

In the end, the last step shows the finally chosen model, which includes only statistically significant independent variables.

The model for testing Hypothesis 1a is as follows:

$$P(MEDIANFUND = 1) = 1/1+exp\ (-\alpha - \beta 1\ TOTFUNDACCEL - \beta 2\ NINVEST - \beta 3\ NEXIT - \beta 4\ SURVIVAL - \beta 5\ FOUNDBACK - \beta 6\ TOPEMPL - \beta 7\ WEBVISITS - \beta 8\ REGION - \beta 9\ AGE - \beta 10\ DURATION - \beta 11\ PORTFOLIO)$$

The finally chosen model was obtained after 10 iterations and revealed the independent variables that are statistically significant at 95% confidence. The model fit is acceptable with a Nagelkerke R Square of 0.399.

As indicated in Table 5.4, the only two statistically significant independent variables are NINVEST and SURVIVAL.

Table 5.4. Statistically significant results for the dependent variable MEDIANFUND.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 12[ab]							
	NINVEST	-0,015	0,006	5,585	1	0,018**	0,985
	SURVIVAL	6,313	2,778	5,164	1	0,023**	551,451
	Constant	-6,537	2,653	6,073	1	0,014	0,001

a. Variable(s) entered on step 1: TOTFUNDACCEL, NEXIT, PROPORTIONTOPEMPL, MEDIANFUNDPERCOMPANY, PORTFOLIO, VALUFUND, VALUFUNDPERFIRM, NINVEST, SURVIVAL, WEBVISITS, REGION, AGE, DURATION, FOUNDBACK.

b. Dependent Variable: MEDIANFUND

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own compilation

From this result, Hypothesis 1a is only partially fulfilled and the main findings are:
SAs that invest more than $ 500,000 in more than half of their accelerated start-ups are those that benefit from a higher survival rate.

The number of new companies that receive more than $ 500,000 from the Accelerator funds will tend to decrease in those SAs that have more investments. Therefore, the number of investments behaves in the opposite way than expected, and seems to act as a deterrent to the amount of financing that any new company will receive from the Accelerator. In any case, the magnitude of the effect measured by the B value, is small and the negative impact of this variable is testimonial. Hypothesis 1 is also tested through a second sub-hypothesis. Sub-hypothesis 1b refers to the median value of the funding received by the accelerated companies in dollars (MEDIANFUNDPERFIRM), coming exclusively from the Accelerator funds. This sub-hypothesis complements the previous one.

To test this Sub-hypothesis 1b, an ANOVA regression analysis was run on the following model:

$$P(MEDIANFUNDPERFIRM=1) = 1/1+exp\ (-\alpha-\beta1\ TOTFUNDACCEL-\beta2\ NINVEST-\beta3\ NEXIT-\beta4\ SURVIVAL-\beta5\ FOUNDBACK-\beta6\ PROPORTIONTOPEMPL-\beta7\ WEBVISITS-\beta8\ REGION-\beta9\ AGE-\beta10\ DURATION-\beta11\ PORTFOLIO)$$

We apply the step-by-step method and after several iterations, the finally chosen model is obtained in the 10th step and reveals the independent variables that are statistically significant at 95% confidence. The model fit is acceptable with an adjusted R-square of 0.131.

As indicated in Table 5.5, three independent variables are statistically significant:

Table 5.5. Statistically significant results for the dependent variable MEDIANFUNDPERFIRM.

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	**Std. Error**	**Beta**	**t**	**Sig.**
10[a]	(Constant)	-2352811,153	1116861,035		-2,107	0,037
	NINVEST	-32109,431	17016,477	-1,288	-1,887	0,062
	NEXIT	-207702,857	105370,053	-0,773	-1,971	0,050**
	PROPORTIONTOPEMPL	11384398,921	2652111,806	0,357	4,293	0,000***
	PORTFOLIO	62091,106	27200,994	2,064	2,283	0,024**

a. Dependent Variable: MEDIANFUNDPERCOMPANY

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own compilation

According to these results, the amount of funding received on average by each accelerated new company will tend to be greater when:

The number of exits achieved by the Accelerator is lower. SAs with less or no exits tend to invest larger amounts in each of their accelerated new companies. This is an unexpected result and implies that successful SAs in terms of exits invest less in the new companies they host.

The total number of companies accelerated by the Accelerator is greater. Consequently, the broader the portfolio of companies, the greater the average amount invested by the Accelerator in each of them.

The proportion of accelerated companies with more than 11 employees is higher. This means that SAs with a higher record of successful start-ups, in terms of job creation, tend to invest higher amounts in each of their hosted companies.

The portfolio variable is the one that has the greatest impact on the financing received by the accelerated companies.

The second hypothesis expected that the survival rate of new companies would depend on certain characteristics associated with both, the Accelerator and the accelerated companies. To test Hypothesis 2, we have performed an ANOVA regression analysis on the following model:

$$P(SURVIVAL=1) = 1/1+exp\ (-\alpha - \beta 1\ TOTFUNDACCEL - \beta 2\ NINVEST - \beta 3\ NEXIT - \beta 4\ VALUFUND - \beta 5\ VALUFUNDPERFIRM - \beta 6\ PROPORTIONTOPEMPL - \beta 7\ FOUNDBACK - \beta 8\ MEDIANFUND - \beta 9\ WEBVISITS - \beta 10\ REGION - \beta 11\ AGE - \beta 12\ DURATION - \beta 13\ PORTFOLIO)$$

We apply the step-by-step method and after several iterations, the finally chosen model is obtained in the 12th step and reveals the independent variables that are statistically significant at 95% confidence. The model fit is fairly low with an adjusted R-square of 0.094.

As indicated in Table 5.6, there are three statistically significant independent variables:

Table 5.6. Statistically significant results for the dependent variable SURVIVAL

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
12[a]	(Constant)	0,728	0,049		14,882	0,000
	MEDIANFUND	0,071	0,025	0,250	2,864	0,005**
	REGION	0,039	0,016	0,219	2,502	0,014**
	AGE	0,054	0,024	0,192	2,264	0,025**

a. Dependent Variable: SURVIVAL

** p < 0.1. ** p < 0.05. *** p < 0.0.*

Source: own compilation

From this result we conclude that Hypothesis 2 is only partially fulfilled. The results confirm that the survival rate of new companies tends to be higher:

1) In those SAs that invest at least $ 500,000 in more than half of their accelerated new companies. The greater the number of start-ups that receive substantial funding from the Accelerator, the higher their eventual survival rate.
2) In older SAs. The experience accumulated through the years of operation of the Accelerator has a positive impact on the chances of survival of new companies.
3) In SAs located in the United States.

5.5. DISCUSSION

In this paper, we aimed to gain insight into the profile of accelerators and discern the extent of their impact on accelerated start-ups.

Studies conducted on the impact of previous generations of incubators (Mas-Verdú et al., 2015; Del Sarto et al., 2020) do not necessarily apply to current accelerators and therefore it is important to analyze more recent data (Lukeš et al., 2019). To fill this gap, we studied how the key variables that define the profile of the Accelerator, along with other variables typically considered in the study of start-ups, are related to their survival. As far as we know, the role of SAs in the survival of the company is still in an incipient stage, since there are few studies available based on qualitative data (Lukas et al. 2019) or in a single country (Hochberg et al., 2015; Del Sarto et al., 2020).

Our results, supported by quantitative statistical methods, provide guidelines for researchers, policymakers, and practitioners alike, as they seek to explore and act on the impact of accelerators.

Starting with our first hypothesis, we found some statistically significant relationships between the Accelerator performance variables and the financing received by accelerated companies. Participating start-ups that want to receive more funds from the Accelerator should pay particular attention to the size of its portfolio, since the bigger the Accelerator is in terms of the companies it host, the greater the amount of funds it tends to invest on average in each of the new enrolled companies.

The negative relationship found between the number of exits and the funding received by accelerated start-ups means that successful SAs, in terms of exits, tend to invest less with their own funds in new companies. This negative relationship on the probability of raising significant funds could be due to different financial and strategic reasons, among which are:

- The Accelerator has had difficulty achieving an exit over time, the profits from an exit are used to pay for the Accelerator's financial structure.
- The Accelerator has made little profit from exiting a company and decides to increase and diversify the cohort to accelerate more start-ups, thereby reducing the total funding invested in each company.
- The Accelerator has not made a profit when exiting a company, the best financial decision is to decrease funding for future participating start-ups.
- The Accelerator combines internal and external funds to continue investing in new companies and grow sustainably.

Continuing with the variables that show a significant and negative impact, the number of investments seems to act as a deterrent to the amount of funding that new companies will receive from the Accelerator funds. Accelerators have limited financial resources and need to generate returns on investment and interest for their stakeholders. When the Accelerator has invested excessively of its own funds in different companies, and has not yet achieved an exit or an investment round, the funds invested in future start-ups will be affected.

Some important implications of the results obtained by our empirical study are summarized below.

Under the Accelerator perspective:

1) The number of investments made by the Accelerator over time in new companies has an inverse effect on the average value of the financing received by the accelerated companies from the Accelerator funds.
2) The number of exits achieved by the Accelerator has an inverse effect on the median value of the funds received individually by the accelerated company from the Accelerator funds.
3) The size of the Accelerator portfolio has a positive effect on the median value of the funding received individually by the accelerated company from the Accelerator funds.

Under the perspective of accelerated start-ups:

4) The survival rate of accelerated companies has a positive effect on the average value of the financing received from the Accelerator funds.

5) The larger the Accelerator in terms of employment, the higher the median value of the financing received individually by the accelerated company from the Accelerator funds.

Finally, we were unable to confirm an existing relationship between the financing received by the accelerated new companies from the Accelerator fund, with some of the performance measures, such as the total amount of funding received by the Accelerator, the duration of the Accelerator Program, and the average number of monthly visits to the websites of accelerated start-ups.

Regarding our second hypothesis and according to previous research on incubators (Mas-Verdú et al., 2015; Lukeš et al., 2019; Del Sarto et al., 2020), we found that participation in an Accelerator program by itself does not influence in the survival of the company. Furthermore, there is a direct and positive relationship between the company's survival and some Accelerator performance indicators. More specifically, the survival rate of new companies will be higher in those SAs with a greater number of start-ups that received substantial funding from the Accelerator. This also occurs in older SAs and those located in the United States.

Our findings highlight the widespread belief that the acceleration program period is too short for most start-ups to validate their business models and gain a good market position. During, and especially after, abandoning these acceleration programs, these companies face increased risk and uncertainty because they require time and substantial funding to develop technologies before they enter and expand on the market (Lukeš et al., 2019).

Through all of these findings, our study contributes to the SA literature by revealing certain characteristics of SAs that act as a promoter, or deterrent, to attract funds to their participating companies. In addition, we reveal the factors related to higher survival rates of accelerated companies, as well as those without a clear impact. Advancing this knowledge is valuable for policymakers willing to promote regional development through entrepreneurship.

At the theoretical level and in relation to EEs and innovation systems, this study sheds light on the role that SAs can play as entrepreneurial dealmakers by raising funds to invest in the projects they select to accelerate.

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CHAPTER 6: GENERAL CONCLUSIONS

6.1. INTRODUCTION

This dissertation aimed to gain a better understanding on the performance of SAs and their accelerated companies.

While SAs programs have proliferated, a consensual analysis on how measuring their performance has not been reached yet. In addition, the role and impact of SAs in employment creation, enhancing investment, rising start-up survival rates, and in the overall economic growth, remains poorly understood in a context where this information is critical for entrepreneurs, especially for those considering to apply to a SAP.

The literature review has shown how difficult is finding reliable data regarding the performance of this type of organizations, and the ongoing debate on how SA performance should be measured (Cohen and Hochberg, 2014), leaving the entrepreneur with uncertainly and misinformation.

Based on these facts, the first main objective of this dissertation was to try to assemble and classify the broadly dispersed views towards the SA phenomenon and next, to provide a model to explore the performance of SAs using two different approaches currently confronted in the literature: (1) accelerators as an advanced version of BIs (Chapter 3 and 4), and (2) accelerators as unique entities, differentiated from BIs (Chapter 5)

In this dissertation both perspectives have been tested by building models of analysis including a set of performance variables of undoubted value for managers, investors, entrepreneurs, and public institutions.

The following table summarizes the main conclusions of this dissertation. The table includes the research questions covered in each chapter, the data and method used, the main results of the empirical analyses, and their implications.

Table 6.1. A summary of the main conclusions of this dissertation

Chapter	*Research question*	*Data & Method*	*Results & Implications*
#3	Are SAs a new generation of BIs?	A descriptive, bivariate analysis and multivariate analysis of 116 Accelerators	(1) Accelerators located in the U.S. attract more funding for their participating start-ups. (2) SAs with a better success closing investment rounds for their tenant start-up are those receiving broader amounts of total funding, and those hosting new ventures with more employees per company.
#4	What are the positive socioeconomic effects of SAs in the region where they are located?	A bivariate and multivariate analysis of 116 Accelerators	(1) The incorporation of social content into SAs reinforces their impact and contributes to social progress. (2) Private investments in social start-ups are a key element to fulfil the social mission of accelerators.
#5	How do SAs and their accelerated start-ups perform over time?	A descriptive analysis, bivariate analysis and multiple regression of 131 Accelerators and 10,116 accelerated companies	(1) Accelerator's performance depends on: • Its number of investments. • Its number of exits. • The size of its portfolio. • Its location. • Its age. (2) Accelerated start-ups' performance depends on: • Their survival rates. • Their size in terms of employment. • Median funding received.

Source: own compilation

To review the contributions made with this dissertation, we summarize the main points that emerge from each empirical chapter. We also set out relevant implications for academics and professionals, and limitations and directions for future research.

6.1.1. Conclusions on chapter 3

As the SA phenomenon is still very recent, there is a widespread uncertainty about the prospects and conditions required for a SA to be successful (Pauwells et al., 2016). This study breaks new ground in the acceleration field by exploring the efficiency and overall performance of a wide range of initiatives labeled as SA.

This document offers a new proposal for the quantitative evaluation of SA performance, using three categories of variables: size, location and age, and profitability ratios. Our findings provide valuable insight into the acceleration process for start-ups, where we have identified a SA profile from the results of our empirical study:

(1) Accelerators located in the United States only outperform accelerators located elsewhere in their ability to attract funds for participating start-ups.

(2) SAs with the greatest possibilities of closing investment rounds for their accelerated new companies are those with portfolio companies with greater amounts of financing and more employees. This information indicates to us that investors seem to prefer investing in companies at a more advanced stage of development.

A review at the end of 2018 of the top 13 SAs in terms of total funding (Crunchbase, 2018) reveals that the percentage of hosted start-ups with over 100 employees ranged from 3% to 6%. The comparative data reveal a remarkable increase in two key performance indicators: average funding and number of exits per accelerator. This jump in both indicators confirms the growing credibility and popularity of SAPs amongst investors and start-up founders, regardless of their location. The significant proportion of tenant start-ups having received funding of more than US$ 1 million is also noteworthy. However, performance in terms of number of exits of more than US$ 1 million is not so positive. In the top 13 SAs in terms of funding, this milestone was reached by only eight SAs in 2018. This finding confirms that a substantial exit, the ultimate goal of most start-up founders, requires longer periods in business than the few months offered by SAPs.

In connection with most previous studies, our findings suggest that SAs play a substantial and supportive role to enhance the prospects and expectations of most tenant companies.

However, the literature does not yet definitively show a higher survival rate amongst firms hosted in SAs.

6.1.2. Conclusions on chapter 4

This study provides results from which valuable recommendations can be derived about the acceleration process and how it drives entrepreneurship through the creation of new start-ups and job opportunities.

The study proposes a model that tries to approximate the performance of the SA by placing the emphasis on the generation of employment that these platforms indirectly promote through the creation of new start-ups. Faced with the scarce existing literature on SAs and even less on their performance, the conclusions of this pioneering analysis represent an advance and a valuable indicator on the behavior of this type of company.

The results obtained serve as a basis for proposing a series of practical recommendations to current accelerator managers, as well as to accelerated start-up entrepreneurs, but also to those agents interested in promoting new accelerators.

It seems evident that, for a sustainable growth of employment in the regions, public and private support for start-ups, especially during their first years of life, is undeniable. But supporting accelerators as a nursery for these new companies is only one element of the environment in favor of innovative and technological entrepreneurship, which must be completed by a wide variety of actions in fields such as training, mentoring and investment.

The incorporation of social content into the accelerator format is a plausible alternative that would reinforce the impact and notoriety of these initiatives, making clear their contribution to social progress. The excellent welcome and encouraging results obtained by incubators and accelerators of a social nature such as Akhoka or Socialnest, demonstrate the viability and benefits linked to promoting companies that are focused on the environment and oriented to solving problems through social innovation.

The promotion of SAs oriented totally or partially to social entrepreneurship is of interest and makes full sense in the current context. The number and quality of social innovation projects grows rapidly, in view of the excellent reception of programs and competitions that have social projects as their fundamental axis. Its final takeoff will depend on the ability to arbitrate public support measures and obtain private sponsorships.

The European Union shows its sensitivity towards social and especially environmental entrepreneurship through its well-known Climate-KIC program, formed by a network of accelerators aimed at promoting clean technologies and renewable energy projects, with an increasing impact in terms of companies created and employment generated. For this reason, and due to the excellent acceptance of this program and the first accelerators of social entrepreneurship, it makes sense to prioritize specific programs within existing accelerators designed to host business projects with a high content of social innovation.

In any case, private support is mandatory, especially in the section on investment in accelerated companies.

6.1.3. Conclusions on chapter 5

This study provides valuable information on the Accelerator profile to assess the best prospects for accelerated companies and their performance, using a dual approach: accelerators and accelerated start-ups.

New companies are critical to the evolution of society and the growth of the economy, as they can create new jobs, increase market diversity, and attract capital to the region. Entrepreneurs need help to develop their ideas and turn them into reality, and although there are different entities such as governments, universities and investors that promote the development of new companies, they lack a complete support system to nurture companies in their early stages. This gap is largely filled with business incubators and accelerators. In this study, we chose to focus on SAs due to their increasing presence worldwide and the existing shortage of quantitative research regarding such programs, specifically from the point of view of performance (Alina and Zhu 2017).

Existing literature suggests that SAs, as a new generation of business incubators, should be re-evaluated because existing models cannot be applied directly without compromising the

Accelerator model. This led us to question which components depending on the Accelerator affect the performance of its new hosted companies.

Therefore, in this paper we seek to obtain a broader and deeper understanding of the internal and external factors associated with the performance of SAs, which are more critical and influential in the financing and survival of new companies hosted and supported by them.

6.2. CONTRIBUTIONS AND IMPLICATIONS

In this section, we expose some significant contributions, both to the theoretical and empirical literature for researchers, as well as for managers, entrepreneurs, investors, and policymakers. Finally, we explain the limitations of the dissertation and some interesting future research directions.

6.2.1. Contributions to the literature of business accelerators

This thesis contributes in several ways to the current debate on the impact of business accelerators.

First, we contribute to the topic of technological entrepreneurship, social innovation and performance measures, by adding new insight on the purpose and effectiveness of SAs in entrepreneurship ecosystems, explaining their mission and impact on the economy. These contributions come from the results of three empirical and quantitative studies, adopting a dynamic vision on the investigation of incubators and accelerators by explaining the heterogeneity of their performance measures. This dissertation contributes to delineate three sounder models to measure the performance of accelerators and establish their concept as a new and more advanced generation of business incubators. To this end, performance models have been developed using existing variables in the Incubator and Accelerator literature, with some pioneering alterations that we have considered appropriate to validate the research issues of our study. To achieve this task, we had to address the theoretical basis and existing approaches to incubation models and their evolution in a consistent manner, such as the business incubation theory of Hackett and Dilts (2004). During this process we considered the hybrid models. The variety of

incubation models is not only driven by the evolution of accelerated start-up requirements and their needs, but also by the objectives of investors.

Second, the extensive review of the literature gave us a more nuanced view of the relevance of accelerators, their role in the entrepreneurial ecosystem and their implications for social innovation. In addition, although SAs serve as intermediaries within their local ecosystems to offer support to entrepreneurs (Clayton et al., 2018), we also explore how SAs in turn benefit from institutional intermediaries. In general, our research has discovered that most SAs are entities that basically serve to broaden the financing and innovation landscape, attracting investment and creating self-employment in the places where they are implemented, instead of simply being a mechanism for rapid business creation.

Third, this dissertation responds to the "calls for papers" and "special issues" in high-impact journals that emerged since 2014, and which seek to deepen the knowledge on the incubation and acceleration process, with the aim of finding the practices and strategies that lead to better performance of SAs and their hosted start-ups (Hallen et al., 2014; Hochberg, 2016).

In summary, from a theoretical point of view, we expect to contribute to the expansion of knowledge about the general question of this research: "How do we measure and evaluate SA and accelerated start-ups performance?", and, more specifically, "to what extent the performance of SAs depends on the disposition of investors, the effects on financing, employment, and social innovation?"

6.2.2. Implications for entrepreneurs, investors, managers, and policymakers

Chapter 3, 4 and 5 offers three performance profiles of accelerators based in the incubation and the acceleration literature that has a number of practical implications for SA managers, entrepreneurs, investors, and policymakers.

SA stakeholders now have access to more accurate information on key expectations related to the size, age, location, investment of SAs as well as the survival, size, and funding of their accelerated start-ups.

Entrepreneurs have gained information in the process of choosing the best Accelerator to host their business projects. A better understanding of the differences between SAs according to criteria such as those proposed in our models will help entrepreneurs to choose the best option in order to develop their project, where to locate themselves, what growth possibilities they can achieve, and the advantages and disadvantages of this choice.

For investors, who are primarily concerned with the return on investment, the investment period and rounds required to achieve an exit, the performance ratios proposed in our models are especially helpful. Investors have gained a better understanding of what to expect when they invest in both an Accelerator and an accelerated company, as well as the Accelerator profile that can be more profitable for their invested capital.

For policymakers the key issue is the role of SAs as drivers of employment. The impact of SAs on job creation is difficult to measure because it generally occurs in later stages of company development (the so-called scalability process). Furthermore, job creation at significant levels is only achieved in the few start-ups that successfully pass the examination of the successive investment rounds and end up consolidating or, more often, being sold to other companies. Nonetheless, the number of start-up companies currently established is remarkable, and in terms of employment, the results are promising.

For managers of SAs, Chapter 3, 4, and 5, provide three models whose results confirm that investors are an essential part of the SA private support. Participation in start-ups through financial and investment operations is a key element to close the SAP circle, and for accelerators to fulfill a social mission.

6.2.3. Limitations of the dissertation

This study is not free of limitations, however, at the same time, we think they open opportunities for future research.

First, we acknowledge the limitations with respect to collecting data to create our samples, and as a result we had several difficulties which we summarize below:

1) Missing data and zero values forced us to reduce Sample 1 of 191 SAs to just 116 SAs in the final analysis. Due to this lack of data there are numerous newly created SAs that could not be taken into account.
2) Lack of willingness of some SAs and new companies to disclose information alleging legal or investment reasons and intellectual property concerns.
3) Mixed descriptions of the category of investor in Crunchbase (Accelerator, Incubator, VC, micro fund, angel, etc.) forced us to reduce Sample 2 of 324 SAs to just 131 SAs.
4) Some indicators of Accelerator performance adopted from Hochberg, Cohen, and Fehder (2015), were adapted due to this scarcity of data, especially those related with ´Valuation´, ´Qualified Exit´, ´Qualified Fundraising´ and ´Founder Satisfaction´.
5) Some variables, such as exits, request longer time to attain results and might be underrepresented. Consequently, the youngest SAs are in too early stage to achieve an exit.
6) These general difficulties made our samples mostly biased towards those located in the United States and consequently, SAs located in other places are not equally represented.

Second, the variables related to the financing of start-ups (Total Funding, VALUFUND, QFUND and MEDIANFUND) only capture the capital invested in the new companies, but do not consider the contributions of mentors or the support of the SA's network and infrastructure, and general expenses covered by the Accelerator.

Third, SAs take equity (or convertible notes) of the new companies in exchange for their support and financing, and expect to get profits through investment exits or the sale of shares, which have been measured using the % ROI Factor in Chapter 3 and 4. However, if the shares of a start-up are not sold or if new investors do not buy the percentage that the Accelerator is willing to release, this does not mean that the company is not generating a

return on investment, for example through the distribution of dividends at the end of the tax year. Data on these additional profitability indicators would allow a more accurate assessment of the performance of accelerated companies and SAs.

Finally, accelerators are not homogenous. Differences among SA types exist and future comparisons should be made between organizations with the same goals (Lukes et al., 2019). Consequently, the results of our empirical analyses could be hiding some important differences between various types of SAs.

6.2.4. Directions for future research

This dissertation provides a general and representative model to understand and measure the performance of SAs and accelerated start-ups at the present time.

Although the growth of SAs has spread rapidly around the world and the conclusions of most studies have usually been positive, SAs are not free from criticism. In a context of increasing globalization and international mobility, accelerator-backed start-ups do not necessarily remain in the region where they were born. In contrast, in regions lacking a strong business ecosystem, as soon as participation in a SAP ends, most promising companies tend to move to another region in search of better financing opportunities or larger markets.

Future research should try to focus more on how to achieve an acceptable level of Accelerator performance, in terms of attracting adequate investment and stablishing financial control mechanisms to avoid speculation.

Most policy makers are giving support to SAs with the intention to stimulate start-up activity and foster economic growth, either within a specific region or within a specific technological domain (Del Sarto et al., 2020). Further evidence needs to be gathered to determine whether SAs manage to accomplish firm survival in accelerated start-ups, since this relationship remains unclear.

The role and scope of contribution of SAs to the broader entrepreneurial ecosystem needs further research. We agree with Cohen et al. (2019) in the sense that accelerators are only

one of many types of intermediaries that are emerging and may exist in a region dealing with entrepreneurs and start-ups. More evidence is needed on the impact of different SA design elements and entrepreneurship programs in general.

We also suggest that future research should collect more data available on accelerators from all over the world and enlarge the existing databases. A more integrated image on the current landscape would allow researchers to run more accurately comparisons and predictions. Broader and more representative surveys would allow to undertake robust quantitative analyses on the behavior and evolution of SAs over time, as well as their accelerated companies. Entrepreneurs, investors, and public institutions, would also benefit from long term scales of data about the survival rates of the accelerated firms.

In addition, the application of mixed statistical methods, qualitative and quantitative analyses, would greatly improve the performance model analysis of an Accelerator.

Finally, we propose to expand the current databases and work with two different samples of start-ups, those that have participated in a SAP and those that have not, to more precisely test the effectiveness of these programs. We also wish to collect information about the generation of employment by start-ups, according to industry and functional areas: technical, management, commercial, and others. And in the near future, as soon as a sufficient number of social oriented SAs are consolidated, we wish to compare the performance of these programs with that of conventional ones, in terms of social impact, sustainable employment, and long term wealth generation.

In summary, accelerators are organizations that have evolve over the years exponentially in numbers but also in features. In this changing context we suggest that new criteria might be introduced to assess each Accelerator type in order to take into account a series of particular characteristics, like the Accelerator's connection with the entrepreneurship ecosystem, the training and consulting services given, and the nature of its investment support.

We hope that further studies will continue to explore and measure the impact of SAs on business ecosystems in a better, broader and more accurate way. This dissertation is expected to have contributed to that goal.

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RESUMEN

INTRODUCCIÓN

Motivación del tema de investigación

Esta tesis se ha realizado siguiendo las estipulaciones y los requisitos exigidos para los programas oficiales de doctorado establecidos por la Escuela de Doctorado de la Universidad de Valencia de acuerdo con el "Real Decreto 99/2011".

La modalidad elegida para presentar esta tesis doctoral corresponde a una combinación entre el formato tradicional y el compendio de artículos. Por lo tanto, esta tesis comprende tres artículos (capítulos 3, 4 y 5) publicados, aceptados o en proceso de publicación en diferentes revistas de investigación. El contenido presentado en el Capítulo 3 y Capítulo 4 ya han sido publicados, mientras que el documento presentado en el Capítulo 5 se encuentra actualmente en proceso de revisión.

El tema central de esta tesis consiste en el estudio de un tipo específico de organización para el apoyo al emprendimiento, conocido como Aceleradora de Empresas (AE).

Las motivaciones principales que me han llevado a elegir este tema de estudio para desarrollar mi tesis son las siguientes:

La primera motivación está relacionada con el gran aumento del interés académico a nivel general. El campo de la aceleración de empresas está ganando importancia debido a la evolución global que estas organizaciones han experimentado en los últimos años. El número de AE ha aumentado del primer acelerador conocido en 2005 (en Estados Unidos) a un estimado de 3.000 AE en todo el mundo (Hochberg, 2016). Este hecho ha atraído la atención de un número creciente de investigadores, interesados en explorar los aspectos distintivos de este tipo de organizaciones para responder a preguntas sobre su naturaleza, características distintivas e impacto socioeconómico, en la región donde se ubican.

La popularidad de este tema se refleja en la evolución de las “llamadas a presentación de artículos” y “convocatorias especiales” publicados en revistas de investigación de alto impacto, especializadas en emprendimiento, innovación, economía y gestión empresarial, entre otros temas. Algunas de las revistas mejor clasificadas con una cantidad significativa de publicaciones en esta área son: Technovation, Journal of Organizational Behavior,

International Journal of Technology Management, Journal of Technology Transfer, R&D Management y Research policy.

La segunda motivación proviene del campo profesional, ya que en 2012 tuve el privilegio de adquirir experiencia práctica en el mundo de las aceleradoras y las empresas de nueva creación (start-ups) en la ciudad de Valencia. A través del master en "Creación de Empresas Innovadoras y de Base Tecnológica (mEBT)" de la Universidad de Valencia, conocí a una Aceleradora de negocios a la que posteriormente me uní como colaboradora, y con la que creé un fondo de inversión para proporcionar servicios de consultoría estratégica y financiera a inversores y nuevos emprendedores. Esta participación me ayudó a adquirir conocimientos prácticos y aumentó mi pasión y curiosidad por aprender más sobre este tipo de organizaciones.

Si bien el tema de la aceleración empresarial es un tema de investigación bastante reciente, logré construir durante los últimos años una base de datos completa y totalmente actualizada que me permitirá explorar los primeros resultados de las AE y sus nuevas empresas aceleradas.

El propósito de esta tesis es describir y caracterizar las AE, y sobre todo analizar su comportamiento e impacto al proporcionar tres modelos empíricos con indicadores de desempeño. Los indicadores propuestos constituyen la contribución empírica fundamental de esta investigación, ya que se han aplicado a un gran número de AE y start-ups aceleradas contenidas en mis bases de datos.

Introducción al tema de investigación

El tema de investigación de esta tesis es el estudio de las AE, consideradas la nueva generación de incubadora de empresas (Bøllingtoft, 2012). Estas organizaciones recientes se crean específicamente para desarrollar proyectos más sólidos y mejorar sus posibilidades de superar las barreras iniciales del mercado y las dificultades financieras.

Las AE están especialmente diseñadas para ayudar a las nuevas empresas, conocidas con el nombre de start-ups, al comienzo de su ciclo de vida (Birdsall et al., 2013). Para lograr este objetivo, las AE trabajan en torno a un programa de capacitación que acepta un número limitado de proyectos empresariales participantes. Este plan de acción es conocido como

Programa de Aceleración Empresarial (PAE), y se trata de un plan programado basado en grupos de emprendedores a los que se les facilitan una serie de servicios de tutoría, educación empresarial y acceso a redes de contactos, culminando en un evento de búsqueda de financiación privada conocido como “Demo Day” (Cohen y Hochberg, 2014).

Las AE son organizaciones originadas y ubicadas dentro de ecosistemas empresariales. Estos ecosistemas empresariales están compuestos por varios actores que estimulan la creación de nuevas empresas, incluidos gobiernos, universidades, inversores, empresas, incubadoras y aceleradoras de start-ups. El ecosistema empresarial presenta diferentes dimensiones dependiendo de cómo interactúan estos actores entre sí. Una de estas dimensiones se configura con el nombre de "ecosistema emprendedor", definido como un contexto diseñado para fomentar el emprendimiento dentro de un territorio dado, formando una red horizontal (clientes y proveedores) y una red vertical (competidores y aliados) (Theodoraki y Messeghem, 2017).

En este contexto, las AE son participantes activos del ecosistema emprendedor ya que promueven la creación de una gran cantidad de nuevos negocios innovadores. Del mismo modo, las start-ups desempeñan un papel crucial y activo dentro del ecosistema emprendedor.

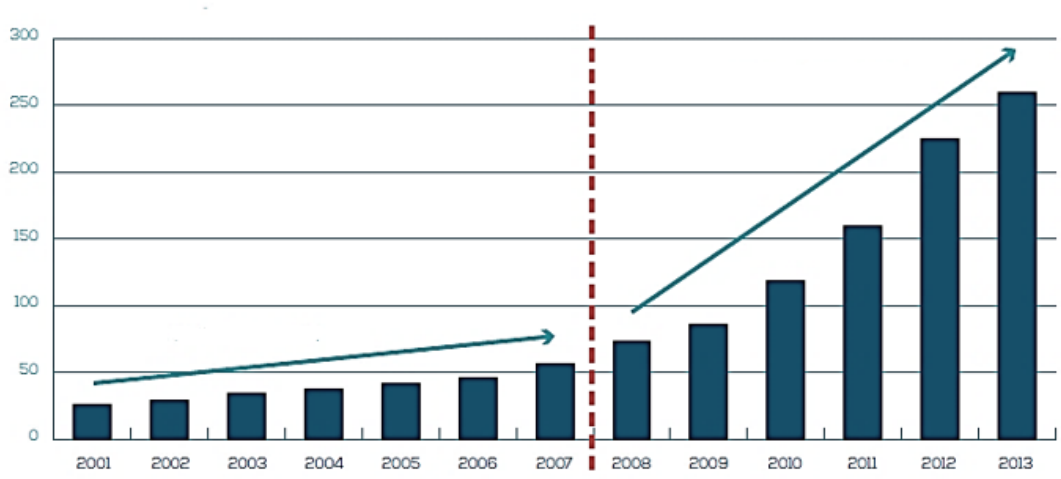
Una start-up es una empresa innovadora de nueva creación que busca un modelo de negocio escalable, repetible y rentable. Las start-ups suelen tener un modelo de negocio altamente innovador y están especializadas en productos y servicios digitales y tecnológicos. Estas empresas se enfrentan a una serie de desafíos que pueden afectar a sus posibilidades de supervivencia, como el acceso a recursos financieros (Smilor, 1997), la falta de experiencia del equipo inicial (Gruber et al., 2008), la necesidad de atraer a trabajadores altamente cualificados y especializados (Zott y Huy, 2007), o un conocimiento limitado sobre cómo aprovechar ciertas oportunidades (Ambos y Birkinshaw, 2010).

Las incubadoras de empresas (IE) y las AE forman parte de las organizaciones que respaldan a las start-ups. Los emprendedores que buscan ser ayudados por IE y AE son aquellos que desean lanzar un negocio lo más rentable posible en un período de tiempo limitado, y esta es la promesa que este tipo de organizaciones extienden al ecosistema emprendedor.

Tanto las IE como las AE permiten a las empresas jóvenes comenzar su actividad a través de un proceso de aprendizaje, consultoría e inversión, con el objetivo de aumentar sus posibilidades de supervivencia y crecimiento en el mercado durante sus primeros meses de vida (Cohen y Hochberg, 2014).

El número de AE ha aumentado drásticamente desde la primera Aceleradora conocida en 2005 (Y Combinator), hasta un estimado de más de 3.000 AE en todo el mundo (Hochberg, 2016). Europa en particular, experimentó un auge en el número de AE desde el comienzo de la crisis financiera (Figura 1) a finales de 2007 (Salido et al., 2013).

Figura 1. Evolución de las incubadoras y aceleradoras de empresas desde 2001



Fuente: Salido et al.(2013)

Hoffman y Radojevich -Kelley (2012) sugirieron que las AE aumentaron en número desde 2008 debido a la recesión, la cual disminuyó la cantidad de fondos previamente disponibles para nuevas empresas, especialmente por parte de inversores privados y entidades bancarias. Esta disminución en la financiación alternativa logró que las AE se convirtieran en un instrumento de financiación más atractivo para los nuevos emprendedores. Hathaway (2016) estimó que la tasa de crecimiento de las AE fue del 50% anual en el período comprendido entre 2008 y 2014.

Además, las AE mantienen un papel clave en la capacidad de innovación y desarrollo de una región ya que estimulan la economía a través de la creación de empleo y la atracción de talento, brindando oportunidades para el crecimiento nacional e internacional y la expansión de las empresas locales.

En los países desarrollados, particularmente en los Estados Unidos, las incubadoras y las aceleradoras están liderando la promoción y la creación de start-ups, generando empleo cualificado y facilitando la transferencia de tecnología entre empresas innovadoras.

A pesar del crecimiento que las AE han experimentado en los últimos años, existe investigación limitada sobre este fenómeno, principalmente debido a su novedad y a la disponibilidad limitada de datos. La ausencia general de bases de datos públicas, y representativas a gran escala, dificulta la tarea de los investigadores para evaluar el impacto de estos programas (Hochberg, 2016).

Como señalan Cohen y Hochberg (2014), la carencia de estudios sobre el desempeño de las AE hace que su eficacia no quede clara. De hecho, poca investigación ha explorado incluso a nivel descriptivo la efectividad de estos programas o las razones por las que obtienen mejores o peores resultados. Este hecho conlleva a que las medidas de desempeño para definir la efectividad y el éxito de estas iniciativas aún no estén claramente establecidas. La futura investigación basada en el impacto de las AE requerirá información completa y actualizada sobre las perspectivas de supervivencia y el crecimiento de sus start-ups (Stayton y Mangematin, 2019).

La existencia de análisis consensuados sobre cómo medir el desempeño de las AE, así como el papel que desempeñan en la creación de empleo, la estimulación de las operaciones de inversión, el incremento de las tasas de supervivencia inicial de sus empresas aceleradas y el crecimiento económico de una región, supone una información crítica para el emprendedor que esté considerando participar en un PAE, así como para todas las partes interesadas en el éxito de estas iniciativas (Cohen y Hochberg, 2014).

Gran parte de la investigación limitada existente hasta la fecha se encuentra en una de estas cuatro categorías: (1) descripciones conceptuales sobre el modelo de aceleración (Cohen y Hochberg, 2014; Dempwolf et al., 2014; Hochberg, 2016); (2) análisis cualitativos sobre cómo las AE pueden servir para acelerar nuevas empresas (Kim y Wagman, 2012; Hoffman

y Radojevich -Kelley, 2012; Cohen, 2013; Pauwels et al., 2016; Cohen et al. 2019); (3) estudios cuantitativos para evaluar si las AE tienen un efecto positivo en los resultados de las empresas que participan en sus programas (Smith y Hannigan, 2015; Cohen et al., 2019; Fehder y Hochberg, 2019; Hallen et al. 2020); y (4) intentos empíricos que evalúan si las AE tienen un efecto negativo o no concluyente en los resultados de sus nuevas empresas aceleradas (Smith et al., 2015; Gonzalez-Uribe y Leatherbee, 2017; Yu, 2020).

El propósito de esta tesis es abordar la disparidad existente en esta área de estudio, al proporcionar un marco conceptual con respecto al desempeño de las AE a lo largo de múltiples dimensiones que son importantes para los gerentes de estas organizaciones, así como para los emprendedores, inversores y formuladores de políticas.

La presente investigación tiene como objetivo contribuir en este campo a través de tres análisis pioneros sobre el desempeño de las AE (Capítulo 3, 4 y 5), mediante el uso de tres muestras amplias y representativas de la población mundial. Para este propósito, hemos seleccionado un conjunto de variables y medidas empleadas en la literatura de las IE y más recientemente en la literatura de las AE. En este sentido, proporcionaremos una lista de indicadores esenciales para el desempeño de las aceleradoras basados en una amplia revisión de la literatura. Esto nos permitirá evaluar mejor el impacto de las AE con respecto a sus nuevas empresas aceleradas y, por lo tanto, medir sus efectos en el ecosistema emprendedor donde se ubican.

En resumen, el Capítulo 2 incluye un marco teórico general sobre la incubación y aceleración de negocios donde realizamos una revisión de los conceptos y las teorías existentes que explican el origen, el desempeño y los efectos socioeconómicos de las IE y las AE.

Los capítulos 3, 4 y 5 constituyen el análisis empírico principal de esta tesis.

El Capítulo 3 corresponde a un artículo publicado en enero de 2020 por la European Journal of Management and Business Economics con DOI n° 10.1108/EJMBE-10-2017-0029 (Scopus CiteScore 2019-2020: 1.620; Q1; SJR 2019: 0.64), con el título *"New evidence on Accelerator performance based on funding and location"* ("Nueva evidencia sobre el rendimiento de la Aceleradora basada en la financiación y la ubicación").

El Capítulo 4 corresponde a un artículo publicado en agosto de 2018 en CIRIEC- España , Revista de Economía Pública , Social y Cooperativa n ° 93, pp. 211-240 con DOI n° 10.7203/CIRIEC-E.93.9855 (Scopus CiteScore 2019-2020: 0.71; Q2; SJR 2019: 0.33), con el título “Impacto social y económico de las aceleradoras de emprendimiento: análisis de factores condicionantes e implicaciones para la innovación social”.

El Capítulo 5 corresponde a un artículo actualmente en revisión por la Entrepreneurship and Regional Development Journal (Scopus CiteScore 2019-2020: 3.620; Q1; SJR 2019: 1.37), con el título *“A quantitative-based model to assess accelerated start-ups performance”* ("Un modelo cuantitativo para evaluar el rendimiento de las nuevas empresas aceleradas").

En las últimas secciones de esta tesis se presentan las conclusiones de los tres modelos, así como las contribuciones e implicaciones de esta investigación.

Finalmente, la tesis concluye con una serie de implicaciones académicas, socioeconómicas y empresariales, seguidas de sus limitaciones y una propuesta para futuras líneas de investigación.

OBJETIVOS DE LA TESIS DOCTORAL

El objetivo principal de esta tesis es el de ampliar el conocimiento en el área de las aceleradoras de start-ups, mediante la propuesta de tres modelos diferentes para medir el desempeño de estas organizaciones y el de sus empresas aceleradas.

Los objetivos generales de esta investigación son:

1) Introducir y analizar los antecedentes teóricos y la evolución del fenómeno de las AE desde su origen hasta el día de hoy.
2) Identificar una serie de variables basadas en una revisión profunda de la literatura para explicar y evaluar tanto el rendimiento como las perspectivas de crecimiento de las AE y de sus start-ups aceleradas.

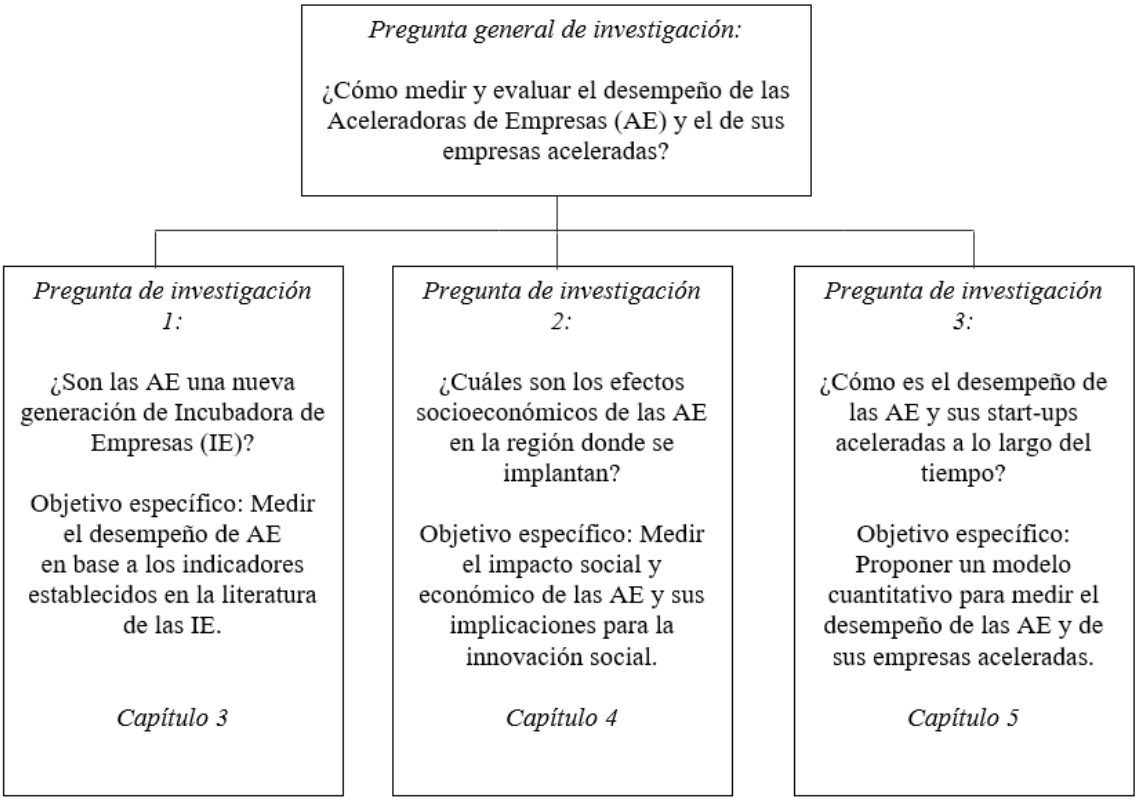
Para lograr estos objetivos, se ha llevado a cabo un amplio estudio empírico a través de los capítulos 3, 4 y 5, utilizando tres muestras diferentes para incluir una población representativa de AE y de compañías aceleradas. De esta manera, esperamos abrir nuevas vías de conocimiento en el campo de las AE al explorar su eficiencia y desempeño en general.

Los objetivos específicos de los principales modelos empíricos presentados en los capítulos 3, 4 y 5 son:

1) El propósito del Capítulo 3 es arrojar nueva luz sobre el fenómeno de las AE al evaluar empíricamente el desempeño y las perspectivas de estas organizaciones a través de una muestra de 116 AE. Para ello, se ha construido un modelo basado en la literatura de las IE bajo tres categorías que abarcan el tamaño, la ubicación, la edad y variables de rentabilidad, lo que nos lleva a contrastar cinco hipótesis.
2) El estudio del Capítulo 4 investiga de manera exploratoria el desempeño de las AE, identificando las variables que afectan más intensamente al establecimiento de nuevas start-ups y a sus niveles de empleo, lo que nos lleva a contrastar cuatro hipótesis.
3) El objetivo principal del Capítulo 5 es evaluar empíricamente el desempeño y las perspectivas de las AE, y el de sus nuevas empresas aceleradas, utilizando dos muestras pioneras. Para ello, se construye un modelo basado en las variables utilizadas en la literatura más reciente de las AE bajo dos perspectivas: la de la Aceleradora y la de la start-up acelerada, lo que lleva a contrastar dos hipótesis.

La siguiente Figura 2 ofrece un resumen de la pregunta de investigación general y las tres preguntas de investigación específicas que esta tesis se propone resolver.

Figura 2. Preguntas de investigación en la tesis doctoral



Fuente: elaboración propia

METODOLOGÍA

La metodología empleada a lo largo de esta tesis doctoral es la siguiente:

En el capítulo 2 presentamos una revisión teórica sobre las teorías que explican el origen, los efectos y el desempeño de las IE y AE, con el objetivo de proporcionar una base teórica general.

En los capítulos 3, 4 y 5, proporcionamos una revisión exhaustiva y rigurosa de la literatura sobre la medición del desempeño de las incubadoras y aceleradoras. Posteriormente, definimos nuestros modelos de análisis basados en los principales hallazgos y conclusiones de la revisión de la literatura, especialmente provenientes de estudios empíricos publicados en revistas de alto impacto que proporcionan enfoques cuantitativos a nuestro tema de investigación.

Nuestra metodología empírica se basa en tres muestras escogidas y desarrolladas a propósito para esta tesis. Las primeras dos muestras incluyen un número representativo de AE de todo el mundo, mientras que la tercera muestra está formada por más de 10.000 start-ups aceleradas por las AE presentes en la segunda muestra.

A continuación presentamos más información sobre las características de las muestras, seguido de los procedimientos estadísticos empleados.

La muestra

La primera muestra (Muestra I) se recolectó en 2014 utilizando datos de Seed-DB, la primera y única fuente pública disponible en ese momento. La Muestra I incluye 116 AE creadas entre 1995 y 2014, y se ha utilizado para realizar el trabajo empírico de los capítulos 3 y 4.

Cuatro años después, en 2018, recolectamos una segunda muestra (Muestra II) usando los últimos datos de AE disponibles en Seed-DB y Crunchbase, y otras fuentes públicas como AngelList y LinkedIn. La Muestra II incluye AE creadas entre 1997 y 2019, y consta de 131 aceleradoras.

Cuando se completó la segunda muestra, decidimos crear una tercera muestra (Muestra III) en 2019 para incluir información sobre las nuevas empresas aceleradas.

Tanto la segunda como la tercera muestra se han empleado para realizar el análisis empírico del Capítulo 5. La Muestra III está compuesta por 10.116 start-ups aceleradas y fundadas entre 1997 y 2019.

Finalmente, creamos una submuestra mediante un análisis multinivel para recolectar información de la Muestra II y III y así poder hacer los análisis estadísticos pertinentes. Utilizando los datos disponibles en la Muestra III, filtramos y calculamos las medias y medianas de cada indicador considerando todas las nuevas empresas aceleradas por Aceleradora. Los resultados se agregaron a la Muestra II al lado de cada Aceleradora. De esta forma, obtuvimos todos los indicadores necesarios para analizar empíricamente a las AE utilizando la información de rendimiento de sus nuevas empresas aceleradas. Esta submuestra se utilizó para realizar el análisis empírico del modelo propuesto en el Capítulo 5.

Los datos para la segunda y tercera muestra se recopilaron manualmente de las fuentes secundarias anteriormente mencionadas, además de algunas fuentes en línea, retrospectivas y en tiempo real, que incluyen información obtenida por correo electrónico sobre aclaraciones y actualizaciones, visitas a los sitios web de cada Aceleradora y datos archivados obtenidos a través de blogs y perfiles de LinkedIn (Tabla 1). La recopilación de datos de múltiples fuentes mejora la confiabilidad y credibilidad de los resultados, mientras que las visitas al sitio web de la Aceleradora y a otros canales, ayudan a mejorar la validez interna al ofrecer información sobre los comportamientos de aquellos que están asociados a los programas de aceleración (Eisenhardt y Graebner, 2007).

Tabla 1. Fuentes secundarias utilizadas para construir la Muestra I, II y III.

Nombre de la fuente	***Origen***	***Tipo de información obtenida***
Seed-DB	www.seed-db.com	• Lista de aceleradoras. • Lista de empresas invertidas. • Capital total invertido. • Capital total obtenido por salidas de inversión.
Crunchbase	www.crunchbase.com	• Lista de aceleradoras. • Lista de empresas invertidas por Aceleradora. • Indicadores del desempeño. • Información de contacto.
AngelList	www.angel.co	• Lista de aceleradoras. • Lista de start-ups. • Perfil de los programas de aceleración y sus características.
LinkedIn	www.linkedin.com	• Perfil profesional de los fundadores de aceleradoras y de start-ups.
Páginas web de las aceleradoras y sus blogs informativos	Página web de la Aceleradora (131 AE)	• Duración del Programa de Aceleración. • Número de proyectos participantes. • Numero de start-ups aceleradas con éxito en pasados programas. • Capital medio invertido por proyecto durante el PAE. • Características del Programa. • Sectores elegidos para participar en el PAE.

Fuente: elaboración propia

En la Tabla 2 y 3 se expone una descripción general sobre las muestras que han participado en el estudio empírico.

Tabla 2. Descripción general de la Muestra I y Muestra II

	Capítulo 3 and Capitulo 4	***Capítulo 5***
Resumen de la muestra	Muestra I	Muestra II
Numero de aceleradoras	116	131
Aceleradoras en EEUU	72	79
Aceleradoras en otros países	44	52
Fecha de creación de las aceleradoras	1995-2014	1997-2019

Fuente: elaboración propia

Tabla 3. Descripción general de la Muestra III

	Capítulo 5	***Capítulo 5***
Resumen de la muestra	Muestra III	Submuestra
Número de aceleradoras	-	131
Número de empresas aceleradas	10.116	10.116
Aceleradoras en EEUU	-	79
Empresas aceleradas en EEUU	5.197	5.197
Aceleradoras en otros países	-	52
Empresas aceleradas en otros países	4.919	4.919
Fecha de creación de las aceleradoras	-	1997-2019
Fecha de creación de las empresas aceleradas	1997-2019	1997-2019

Fuente: elaboración propia

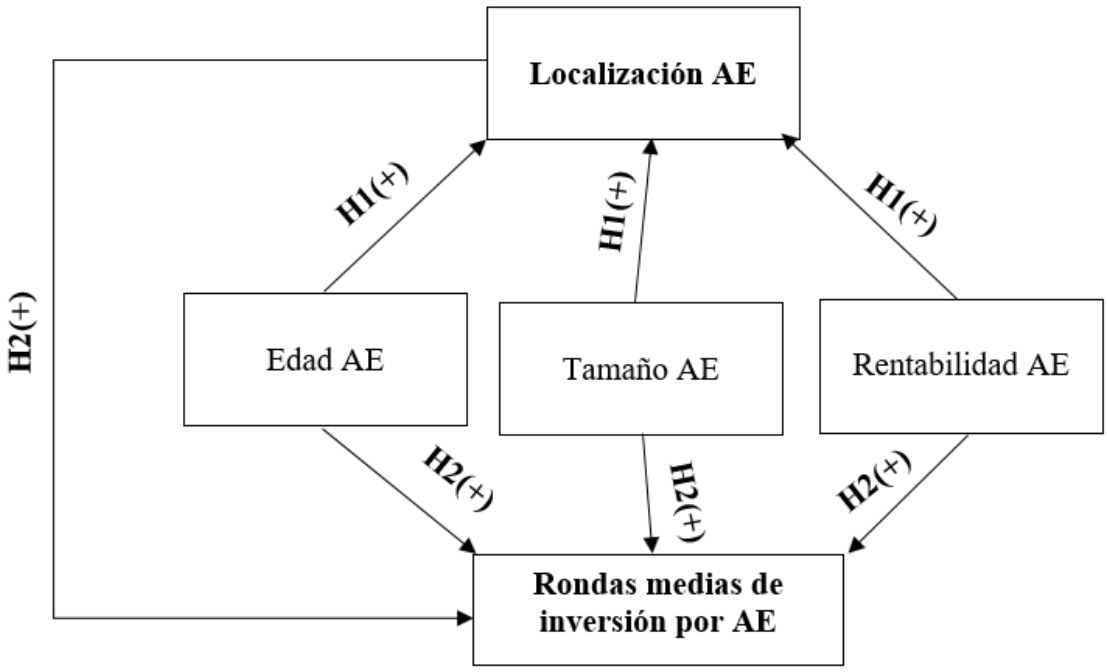
Modelos de análisis

Los modelos presentados en los capítulos 3, 4 y 5 proponen diferentes variables para medir el desempeño de las AE, pero también de sus empresas aceleradas.

- El propósito del Capítulo 3 es arrojar nueva luz sobre el campo de las AE al evaluar empíricamente por primera vez el desempeño y las perspectivas de estas organizaciones a través de una muestra de 116 aceleradoras. Para ello, construimos un modelo basado en la literatura de las IE bajo tres categorías, que cubren variables de tamaño, ubicación, edad y rentabilidad, lo que nos lleva a contrastar dos hipótesis. La primera hipótesis predice que las AE ubicadas en los EE.UU. tienden a ser más grandes y superan a sus contrapartes extranjeras, en términos de índices de rendimiento clave de las aceleradoras. La segunda hipótesis espera que las AE con un mayor número promedio de rondas de inversión por compañía acelerada superen al resto en las principales relaciones de rendimiento.

  La figura 3 especifica el modelo de análisis con estas dos hipótesis.

Figura 3. Modelo de análisis en Capítulo 3

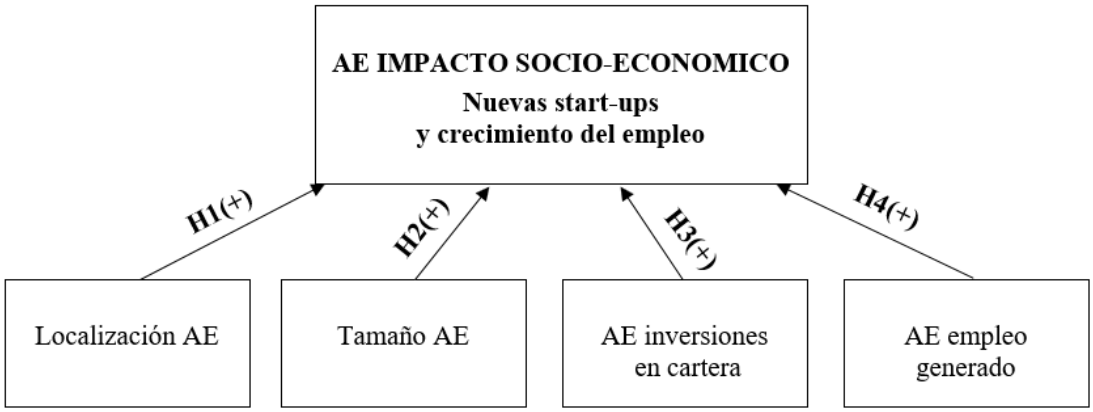


Fuente: elaboración propia

- En el Capítulo 4, investigamos de forma exploratoria el desempeño de las AE, identificando las variables que afectan más intensamente el establecimiento de nuevas empresas y sus niveles de empleo, lo que lleva a plantear cuatro hipótesis. La primera hipótesis espera que las AE ubicadas en los EE.UU. ayuden a crear más empresas nuevas y, en general, logren un desempeño más alto que las ubicadas en otros países. La segunda hipótesis predice que las AE que invierten en nuevas empresas en una etapa más avanzada de desarrollo y con un mayor número de empleados por empresa, superan al resto en los principales indicadores de desempeño. La tercera hipótesis espera que las AE con al menos una start-up acelerada con más de un millón de dólares en inversión, generen más empleo y superen al resto en los principales indicadores de desempeño. La cuarta hipótesis predice que, de todas las variables de desempeño de las AE, aquellas que están directamente relacionadas con un mayor número de empleados por empresa determinan las expectativas de impacto de las aceleradoras, en términos de empleo generado e impacto social.

  La figura 4 especifica el modelo de análisis con las cuatro hipótesis.

Figura 4. Modelo de análisis en Capítulo 4

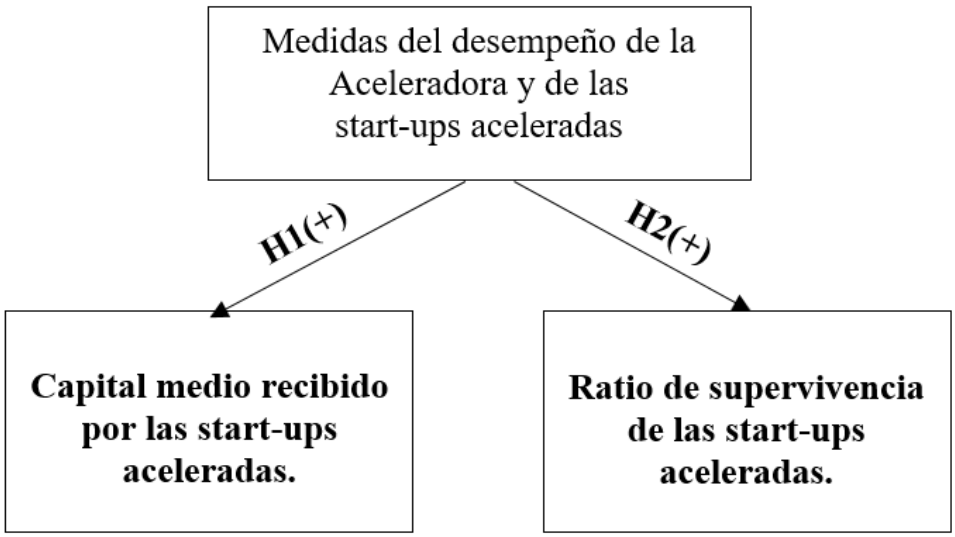


Fuente: elaboración propia

- El propósito del Capítulo 5 es evaluar empíricamente el desempeño y las perspectivas de las AE y sus nuevas empresas aceleradas utilizando dos muestras pioneras. Para ello, construimos un modelo basado en las variables utilizadas en la literatura más reciente sobre aceleración de empresas bajo dos perspectivas, la de la Aceleradora y la de sus start-ups aceleradas. Este modelo nos lleva a contrastar dos hipótesis. La primera hipótesis espera que la financiación media recibida por las nuevas compañías aceleradas y proveniente de los recursos de capital de la Aceleradora, esté influenciada por un conjunto de variables asociadas tanto a la AE como a las nuevas compañías. La segunda hipótesis espera que la tasa de supervivencia de las nuevas compañías dependa de ciertas características asociadas tanto a la Aceleradora como a las compañías aceleradas.

  La figura 5 especifica el modelo de análisis con las dos hipótesis.

Figura 5. Modelo de análisis en Capítulo 5



Fuente: elaboración propia

Técnicas estadísticas en la tesis doctoral

Los resultados y hallazgos de esta tesis doctoral se ofrecen a través de tres estudios interrelacionados y en el formato de articulo de revista de investigación. A continuación exponemos brevemente la metodología y la elección de las técnicas estadísticas empleadas en los Capítulos 3, 4 y 5.

Para poder ofrecer la mejor respuesta posible a las preguntas de investigación expuestas en cada capítulo y cumplir con los objetivos de la tesis doctoral, hemos llevado a cabo tres estudios cuantitativos que incluyen respectivamente un análisis descriptivo, un análisis bivariante y una regresión lineal multivariante, siguiendo los siguientes pasos:

1) Primero se realizó un análisis descriptivo de las principales variables objeto de estudio de cada modelo, donde se incluyó la prueba de normalidad de las variables cuantitativas para saber si debíamos aplicar test paramétricos o no paramétricos en los futuros contrastes de hipótesis.

2) Segundo, se comprobó la correlación de las variables de cada modelo para conocer el grado de variación conjunta existente entre las mismas. Para ello nos centramos en el estudio de la relación lineal simple entre dos variables (la variable dependiente con respecto a cada variable independiente).

3) Tercero, proseguimos con el test de independencia para comprobar si las principales variables de los modelos propuestos eran independientes respecto a ciertas variables que utilizamos como factores. Para ello, recurrimos a comparar las medias de las distribuciones de las variables cuantitativas en los diferentes grupos establecidos por las variables categóricas. Posteriormente, para realizar los test paramétricos se utilizó la prueba de la T de Student para las variables categóricas con dos categorías, mientras que en las variables con tres o más categorías la comparación de medias se realizó a través del análisis de la varianza ANOVA. Este paso es importante ya que garantiza que las variables independientes funcionen como buenos predictores de la variable dependiente. Dentro de los test no paramétricos, cuando las variables categóricas están compuestas por dos categorías utilizamos el test U de Mann-Whitney y para las que presentan tres o más grupos se realizó la prueba de Kruskal Wallis. Además, la prueba de Kruskal Wallis es el método más apropiado para comparar poblaciones que no

siguen una distribución Normal, como es el caso de algunas variables en los modelos presentados en los capítulos 3, 4 y 5. El nivel de significación con el que se hicieron las comparaciones fue siempre del 95%.

La Tabla 4 resume las técnicas estadísticas aplicadas en cada capítulo.

Tabla 4. Resumen de las metodologías empleadas

Capitulo	***Metodología***
Capítulo 3: Una visión pionera y comparativa del rendimiento de las aceleradoras de empresas.	(1) Análisis descriptivo (2) Análisis bivariante (3) Análisis multivariante
Capítulo 4: Impacto social y económico de las aceleradoras de emprendimiento: análisis de factores condicionantes e implicaciones para la innovación social.	(1) Análisis bivariante (2) Análisis multivariante
Capítulo 5: Un modelo cuantitativo para evaluar el desempeño de las nuevas empresas aceleradas.	(1) Análisis descriptivo (2) Análisis bivariante (3) Análisis multivariante

Fuente: elaboración propia

ESTRUCTURA DE LA TESIS

Esta tesis está estructurada en seis capítulos. En términos generales, la tesis se divide en dos áreas principales: Capítulo 2 y capítulos 3, 4, 5.

La primera área (Capítulo 2) constituye el marco teórico de la tesis doctoral. Este capítulo revisa la literatura general sobre el origen, los efectos y el rendimiento de las aceleradoras. Este marco teórico comienza con una introducción al ecosistema del emprendimiento, ya que es el contexto en el que se crean IE y AE, definiendo conceptos críticos, como el emprendimiento, el emprendedor y los ecosistemas emprendedores, seguido del concepto de innovación y los ecosistemas innovadores.

La siguiente parte incluye una introducción a la literatura de las aceleradoras para abordar su origen y evolución. Más específicamente, se presentan las teorías y enfoques que pueden explicar el origen y el desempeño de las IE y AE, así como sus efectos socioeconómicos en la región donde se encuentran debido al estímulo del emprendimiento y la innovación.

Finalmente, la revisión del marco teórico general termina introduciendo el papel de dos enfoques teóricos clave: la reconocida teoría basada en los recursos y las capacidades, y la teoría de incubación. Ambas proporcionan el marco teórico principal para entender y medir el impacto y el rendimiento de las IE y las AE.

La segunda área principal (capítulos 3, 4 y 5) corresponde a la investigación empírica. En estos capítulos, el desempeño de las aceleradoras de negocios y las nuevas empresas aceleradas se analiza teniendo en cuenta diferentes aspectos, como su ubicación, creación de empleo, recursos financieros y capacidades de inversión. Del mismo modo, también se explora la forma en que las AE influyen en el proceso de creación de nuevas empresas de tecnología y sus efectos en la innovación social.

El Capítulo 3 incluye una revisión en profundidad de la literatura que integra las principales investigaciones teóricas y empíricas sobre el rendimiento de las incubadoras. A continuación, se construye un modelo empírico sobre una muestra de aceleradoras de todo el mundo, basándonos en la teoría de incubación de negocios y la teoría de los recursos. Este modelo incluye tres categorías de variables: (1) tamaño, (2) ubicación y edad, y (3) ratios de rentabilidad. Los resultados confirman a niveles estadísticamente significativos un mayor tamaño y rendimiento en las AE estadounidenses. Este capítulo contribuye clasificando los principales indicadores del rendimiento de las aceleradoras, determinando un nuevo modelo conceptual para el análisis empírico e identificando oportunidades para futuras investigaciones.

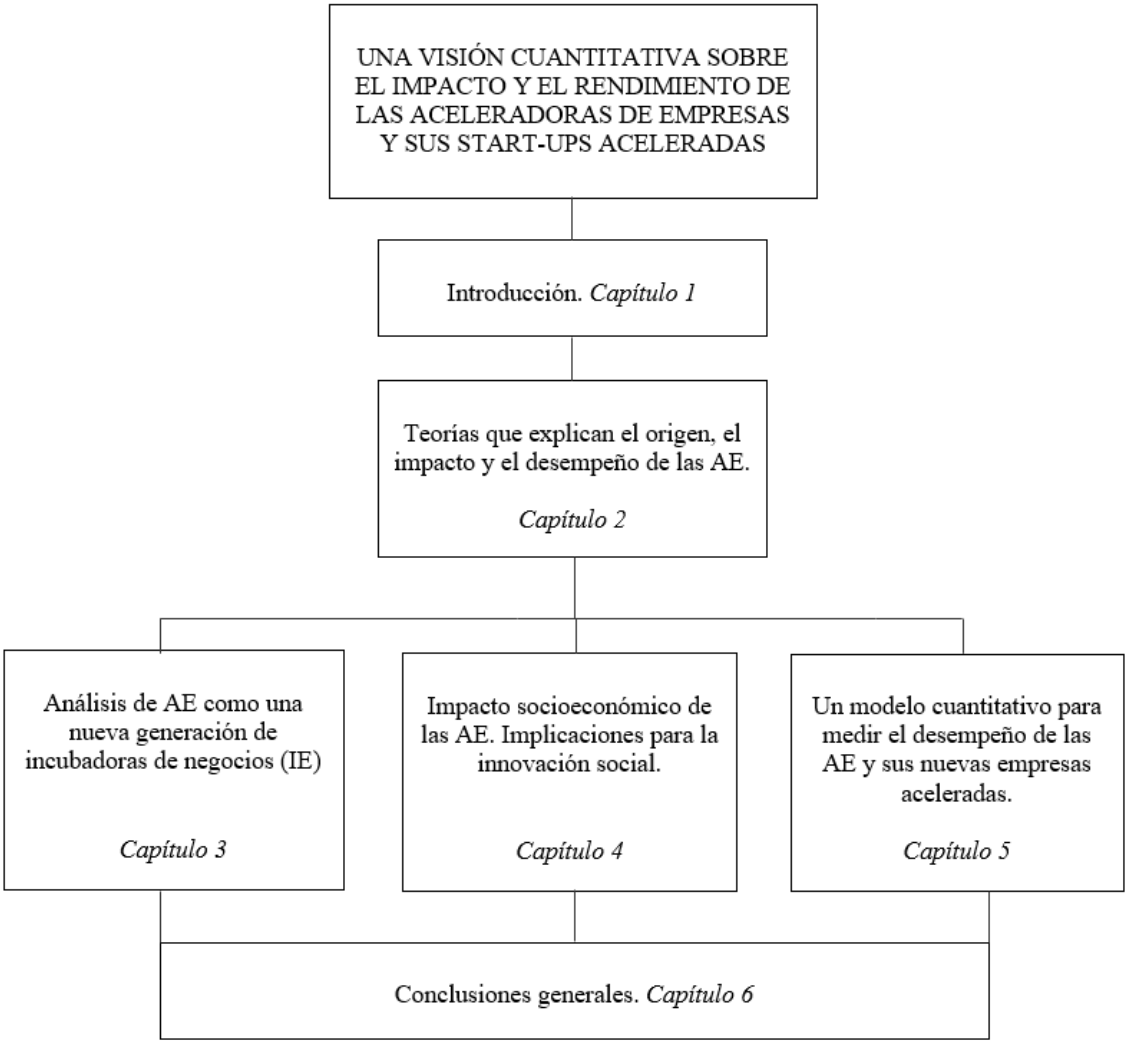
El Capítulo 4 explora de manera pionera y exploratoria el desempeño de las aceleradoras en términos del empleo generado por sus nuevas compañías aceleradas. Los resultados revelan que las AE ubicadas en los Estados Unidos estimulan la creación de un mayor número de nuevas empresas y nuevos empleos, en comparación con las AE ubicadas en otros países. Además, el estudio identifica las variables que afectan más intensamente la creación de nuevas empresas y sus niveles de empleo.

El Capítulo 5 evalúa el desempeño de las nuevas empresas aceleradas para determinar las características más críticas e influyentes de las aceleradoras que afectan a su supervivencia y crecimiento. Para ello, se realiza un análisis cuantitativo basado en las variables utilizadas en la literatura de las AE más reciente. Los resultados confirman a niveles estadísticamente significativos que el tamaño de la cartera de start-ups de la Aceleradora, la tasa de supervivencia de las nuevas empresas y la proporción de empleados en las empresas aceleradas, conlleva un efecto positivo en el valor medio de la financiación recibida por las nuevas empresas aceleradas proveniente de los propios fondos de la AE. Además, las aceleradoras ubicadas en los Estados Unidos, y aquellas que llevan funcionando durante un período de tiempo más largo, muestran un mayor impacto en las tasas de supervivencia de las nuevas empresas. Estos resultados contribuyen con la literatura cuantitativa aún escasa sobre el desempeño de las aceleradoras, y proporciona importantes implicaciones de gestión utilizando un enfoque doble: el de la Aceleradora y el de las nuevas empresas aceleradas.

Además de los resultados específicos de cada capítulo, la tesis termina en el Capítulo 6 con las conclusiones generales, que resumen los principales hallazgos y contribuciones de los Capítulos 3, 4 y 5. Las implicaciones académicas, empresariales, estratégicas y políticas se discuten más adelante. seguido por las líneas propuestas para futuras investigaciones.

La Figura 6 muestra un resumen de la pregunta de investigación general planteada en esta tesis y su estructura a lo largo de los capítulos.

Figura 6. Esquema de la tesis doctoral para responder a la pregunta general de investigación.



Fuente: elaboración propia

CONCLUSIONES

Esta tesis tiene como objetivo obtener una mejor comprensión en el desempeño de las aceleradoras de emprendimiento.

Si bien los programas de aceleración han proliferado, todavía no existe un análisis consensuado sobre cómo medir el desempeño de las AE. Adicionalmente, sigue siendo poco explorado el papel y el impacto de las AE en la creación de empleo, en la estimulación de la inversión, en las tasas de supervivencia iniciales, y en general en el crecimiento económico. Consideramos que esta información es crítica para los fundadores de estas iniciativas empresariales y para las partes interesadas.

La revisión de la literatura realizada nos demostró que encontrar estudios contrastados y con análisis cuantitativos robustos sobre el desempeño de este tipo de organizaciones es una tarea difícil. Hoy en día todavía existe una gran confusión y debate con respecto a cómo se debe medir el rendimiento de una Aceleradora (Cohen y Hochberg, 2014), por lo que el emprendedor interesado en participar en uno de estos programas lo hace con incertidumbre y desinformación.

En base a estos hechos, el primer objetivo principal de esta tesis doctoral fue tratar de reunir y clasificar las diferentes referencias hacia el fenómeno de las AE, para proporcionar modelos que exploran el desempeño de las aceleradoras utilizando dos enfoques que actualmente se enfrentan en la literatura: (1) las aceleradoras como una nueva versión avanzada de incubación empresarial (Capítulos 3 y 4), y (2) las aceleradoras como entidades únicas, diferenciadas de las incubadoras (Capítulo 5).

En esta tesis ambas perspectivas han sido probadas, construyendo tres modelos de análisis que proporcionan un conjunto de variables de indudable valor. De esta forma, los resultados de nuestra investigación pretenden aportar información relevante para los gestores, inversores, emprendedores e instituciones públicas relacionados con este tipo de iniciativas emprendedoras.

La siguiente tabla resume las principales conclusiones de esta investigación, correspondientes a los capítulos donde tres modelos han sido probados empíricamente.

La tabla incluye las preguntas de investigación cubiertas en cada capítulo, los datos y los métodos estadísticos utilizados, los principales resultados de cada análisis, así como sus implicaciones respectivas.

Tabla 5. Resumen de las principales conclusiones de la tesis doctoral

Capítulo	***Pregunta de investigación***	***Datos y método***	***Resultados e implicaciones***
#3	¿Cómo se mide el desempeño de las AE como una nueva generación de incubadoras de empresas?	Un análisis descriptivo, análisis bivariante y multivariante de 116 aceleradoras	(1) Las aceleradoras ubicadas en los EE. UU. atraen más fondos para sus nuevas empresas participantes. (2) Las AE con más posibilidades de cerrar rondas de inversión para la puesta en marcha de sus participadas son aquellas que reciben mayor financiación total y con más empleados por empresa.
#4	¿Las AE proporcionan efectos socioeconómicos positivos en la región donde se ubican?	Un análisis bivariante y multivariante de 116 aceleradoras	(1) La incorporación de contenido social en las AE refuerza su impacto y contribuye al progreso social. (2) Las inversiones privadas en nuevas empresas sociales son un elemento clave para cumplir con la misión social de las aceleradoras.

#5	¿Cómo medimos el desempeño de las AE como una tipología de organización nueva y diferente?, ¿y el rendimiento de sus start-ups aceleradas?	Un análisis descriptivo, análisis bivariante y multivariante de 131 aceleradoras y de 10.116 empresas aceleradas.	El desempeño de las aceleradoras depende de: (1) El número de inversiones realizadas. (2) El número de salidas de inversión. (3) El número de empresas en cartera. (4) La ubicación. (5) Los años en funcionamiento. El desempeño de las start-ups aceleradas depende de: 1) La tasa de supervivencia de las empresas en cartera. 2) El tamaño en términos de empleo. 3) La financiación recibida.

Fuente: elaboración propia

A continuación, resumimos las contribuciones principales que surgen de cada capítulo. También exponemos implicaciones relevantes tanto para académicos como para profesionales, y limitaciones e instrucciones para futuras investigaciones.

Conclusiones sobre el capítulo 3

Como el fenómeno de las aceleradoras es todavía bastante novedoso, prevalece un elevado nivel de incertidumbre sobre las perspectivas y condiciones relevantes para su éxito futuro (Pauwells et al, 2016). Este capítulo explora la eficiencia y el rendimiento general de una amplia gama de iniciativas etiquetadas como Aceleradora, basadas en la literatura de la incubación empresarial.

Este estudio ofrece ideas relevantes sobre el proceso acelerador para nuevas empresas, explorando el concepto de Aceleradora, examinando las similitudes entre IE y AE, y proporcionando una nueva propuesta para la evaluación cuantitativa del desempeño de las aceleradoras, utilizando tres categorías de variables: (1) tamaño, (2) ubicación y edad, y (3) ratios de rentabilidad.

El perfil característico de una Aceleradora surge como consecuencia de los resultados obtenidos por nuestro estudio empírico:

• Las aceleradoras ubicadas en los Estados Unidos sólo superan a las ubicadas en otros países en su capacidad de atraer fondos de inversión para la puesta en marcha de las start-ups participadas.

• Las AE con más posibilidades de cerrar rondas de inversión para sus start-ups aceleradas son aquellas que reciben cantidades más amplias de financiación total y que albergan más empleados. Los inversores parecen preferir start-ups en una etapa más avanzada de desarrollo.

Otro tema clave es el papel de las AE como promotoras de empleo. A primera vista, la cantidad de empleo, tanto en general como por empresa, puede parecer pequeña dada la reducida edad de estas empresas. El impacto de las aceleradoras en la generación de nuevos empleos es difícil de medir, ya que generalmente tiene lugar en etapas posteriores al desarrollo de las empresas aceleradas, este proceso es generalmente conocido como la fase de escalabilidad. No obstante, en la actualidad, el número de nuevas empresas que se crean es notable y, en términos de empleo, los resultados son realmente prometedores.

Una revisión a finales de 2018 de las principales AE en términos de financiación total (Crunchbase, 2018), nos reveló que tan sólo el 3-6% de las nuevas empresas alojadas contaba con más de 100 empleados, ranking liderado por UpWest Labs (7,94%), AngelPad (6,54%) y 500 Start-ups (5,36%).

Tabla 6. Posicionamiento de las aceleradoras más grandes del mundo en términos de financiación otorgada a sus start-ups aceleradas en el año 2018.

Aceleradora	País	Año fund.	Importe total financ. 2014	Importe total financ. 2018	Importe medio financ. 2014	Importe medio financ. 2018	Núm. salidas invers. 2014	Núm. salidas invers. 2018
Y Combinator	U.S.	2005	2200	23000	3,7	15	57	188
Techstars	U.S.	2006	500	5100	2	5	29	129
500 Start-ups	U.S.	2010	97	1800	0,46	2,6	10	158
AngelPad	U.S.	2010	148	1000	2	7,4	10	22
DreamIT Ventures	U.S.	2007	97	750	1,1	3,8	3	17
SeedCamp	U.K	2007	80	620	0,73	5,3	6	26
Amplify.LA	U.S.	2011	9,5	350	0,41	9,7	1	11
RockHealth	U.S.	2010	37,5	340	0,77	7	1	13
Imagine K12	U.S.	2011	33	300	0,92	4	0	5
UpWest Labs	U.S.	2012	4,5	290	0,27	6,9	0	10
Launchpad LA	U.S.	2009	39,2	230	1,5	7	0	6
Portland Incubator	U.S.	2009	52,4	150	2,4	5,1	0	5
StartMate	AU	2010	6,9	100	0,33	2,2	1	2

Fuente: Crunchbase (2018)

Los datos comparativos que se muestran en la Tabla 6 para 2014 y 2018 revelan un aumento notable en dos indicadores clave del desempeño: la financiación promedio y el número de salidas de inversión por Aceleradora. Este salto sobresaliente en ambos indicadores confirma la creciente credibilidad y popularidad ganada por los programas de aceleración entre los inversores y los fundadores de nuevas empresas, sin importar su ubicación. También vale la pena señalar la proporción significativa de las start-ups aceleradas que recibieron una financiación superior a un millón de dólares.

Sin embargo, el desempeño en términos de número de salidas de inversión no es tan positivo para las AE que albergan en su cartera start-ups con una financiación superior a un millón de dólares. Dentro de las 20 principales aceleradoras en términos de financiación, este hito se alcanzó sólo en 8 AE en 2018. Este resultado confirma que una salida sustancial de inversión, el principal sueño de la mayoría de los fundadores de start-ups, requiere períodos de actividad superiores a los pocos meses de aceleración que ofrecen los PAE.

En relación con la mayoría de los estudios anteriores, nuestros hallazgos sugieren que las AE juegan un papel sustancial y de apoyo para mejorar las perspectivas y expectativas de la mayoría de las start-ups aceleradas. Sin embargo, la literatura aún no ha respaldado de manera definitiva una mayor tasa de supervivencia en las empresas aceleradas.

Las características y los recursos necesarios para diseñar una Aceleradora de forma efectiva sigue siendo un reto difícil de cuantificar ya que depende de muchas actividades interdependientes, al menos hasta que un gran número de estudios empíricos llegue a un acuerdo amplio sobre el desempeño y las expectativas específicas de las AE.

Conclusiones sobre el capítulo 4

Este capítulo aporta resultados de los que se pueden derivar valiosas recomendaciones sobre el proceso acelerador y su función como impulsor del emprendimiento, a través de la creación de nuevas start-ups y oportunidades de empleo.

El estudio propone un modelo que trata de aproximarnos al desempeño de las AE con especial énfasis en la generación de empleo que propician de forma indirecta a través de la creación de nuevas start-ups. Ante la escasa literatura existente sobre las AE, y menos aún

sobre su desempeño, los resultados de este análisis pionero suponen un avance sobre el comportamiento de este tipo de empresas.

Primero, el apoyo público y privado hacia las start-ups es imprescindible para lograr un crecimiento sostenible de empleo regional, especialmente durante sus primeros años de vida. El apoyo a aceleradoras como vivero de estas nuevas empresas es sólo un elemento del entorno a favor del emprendimiento innovador y tecnológico, que debe ser completado por una amplia variedad de acciones en ámbitos como el formativo, el de monitorización y el de inversión.

Segundo, la incorporación de contenido social al formato Aceleradora es una alternativa plausible que reforzaría el impacto y notoriedad de estas iniciativas, dejando patente su contribución al progreso social. La excelente acogida y esperanzadores resultados obtenidos por incubadoras y aceleradoras de carácter social, como Akhoka o Socialnest, demuestran la viabilidad y los beneficios vinculados a impulsar empresas más arraigadas al entorno, y orientadas a la resolución de problemas por medio de la innovación social.

El fomento de AE orientadas total o parcialmente al emprendimiento social reviste interés y adquiere pleno sentido en el contexto actual. El número y calidad de proyectos de innovación social crece con rapidez, a tenor de la excelente acogida de programas y concursos que tienen a los proyectos sociales como eje fundamental. Su despegue definitivo dependerá de la capacidad para arbitrar medidas de apoyo público y recabar patrocinios privados.

La Unión Europea muestra su sensibilidad hacia el emprendimiento social y especialmente ecológico a través de su conocido programa Climate-KIC, formado por una red de aceleradoras dirigidas a fomentar proyectos ecológicos y de energías renovables, con un impacto creciente en términos de empresas creadas y empleo generado. Por ello, y por la excelente aceptación de este programa y de las primeras aceleradoras de emprendimiento social, cobra sentido priorizar programas específicos dentro de aceleradoras existentes destinados a albergar proyectos empresariales con un alto contenido de innovación social.

En todo caso, el apoyo privado es ineludible, en especial en el apartado relativo a la inversión en las empresas aceleradas.

Nuestro estudio confirma que los inversores son una parte esencial de este apoyo privado.

La participación en start-ups mediante operaciones financieras y de inversión constituye un elemento clave para cerrar el círculo PAE y para que las aceleradoras cumplan con una misión social. La generación de empleo a niveles significativos sólo se alcanza en las pocas start-ups que logran superar con éxito el examen de las sucesivas rondas de inversión y acaban consolidándose o, más a menudo, siendo vendidas a otras empresas.

Finalmente, una mejor comprensión de las diferencias entre AE según criterios como los propuestos en nuestro modelo ayudará a los emprendedores a elegir qué modalidad de aceleración escoger para poder desarrollar su proyecto, dónde localizarse, qué posibilidades de crecimiento pueden alcanzar, así como las ventajas e inconvenientes de esta elección.

Conclusiones sobre el capítulo 5

Este estudio ofrece información valiosa sobre el perfil de la Aceleradora para evaluar las mejores perspectivas de las empresas aceleradas y su desempeño, utilizando un enfoque centrado en dos perspectivas: el de la Aceleradora y el de las start-ups aceleradas.

Las nuevas empresas son críticas para la evolución de la sociedad y el crecimiento de la economía, ya que ayudan a crear puestos de trabajo, aumentan la diversidad del mercado y aportan capital a las áreas donde se encuentran. Los emprendedores necesitan apoyo para desarrollar sus ideas y convertirlas en realidad, es por ello que existen diferentes entidades como gobiernos, universidades e inversores que fomentan el desarrollo de nuevas empresas. Sin embargo, estas organizaciones carecen de un sistema de soporte completo para nutrir a las empresas de tipo start-up en sus primeras etapas de crecimiento. Esta brecha se cierra en gran medida con incubadoras y aceleradoras de negocios. En este estudio, elegimos centrarnos en las AE debido a su creciente presencia en todo el mundo y por la escasez de investigación cuantitativa con respecto a dichos programas, específicamente bajo el punto de vista del rendimiento (Alina y Zhu 2017).

La literatura existente sugiere que las AE, como una nueva generación de incubadoras de negocios, deben ser evaluadas nuevamente porque los modelos existentes no pueden aplicarse sin comprometer al modelo de aceleración. Esto nos llevó a cuestionar qué componentes dependiendo de la Aceleradora afectan al rendimiento de sus nuevas empresas.

Por lo tanto, en este capítulo buscamos obtener una comprensión más amplia y más profunda de los factores internos y externos asociados al desempeño de las AE, aquellos que son más críticos e influyentes en la financiación y en la supervivencia de las nuevas empresas aceleradas.

Más allá del nivel de análisis de la start-up acelerada, la evidencia inicial sobre el efecto de los programas de las aceleradoras en el ecosistema local sigue siendo limitada, quedando cuestiones sin resolver en relación a cómo los programas aceleradores impactan e interactúan con sus ecosistemas locales (Cohen et al.2019). En cualquier caso, se espera que la llegada de AE a una región sirva como catalizador para la entrada de nuevos inversores, gracias a sus intensos esfuerzos por tratar de recaudar fondos para sus nuevas empresas aceleradas. Esta expectativa no siempre se cumple debido a las enormes divergencias entre las aceleradoras en la capacidad de obtener fondos de inversión.

A pesar de que la relación entre la Aceleradora y la supervivencia de la empresa sigue sin estar clara y sería necesario reunir evidencia adicional para determinar si logran este propósito o no, la mayoría de los encargados de formular políticas brindan apoyo a dichos programas con la intención de estimular la actividad de inicio y fomentar el crecimiento económico, ya sea dentro de una región específica o dentro de un dominio tecnológico específico (Del Sarto et al., 2020).

Además, en un contexto de creciente globalización y movilidad internacional, las nuevas empresas apoyadas por las aceleradoras no permanecen necesariamente en la región donde nacieron. Especialmente en regiones con un ecosistema empresarial débil, la mayoría de las empresas prometedoras, tan pronto como termina su participación en un programa acelerador, tienden a mudarse a otra región en busca de mejores oportunidades de financiación o mercados más grandes.

Contribuciones a la literatura de las aceleradoras de empresas

Esta tesis contribuye de varias maneras al debate actual sobre el impacto de las aceleradoras de emprendimiento.

Primero, contribuimos con la literatura de emprendimiento tecnológico, innovación social y medidas de desempeño, agregando una nueva visión y continuando con la investigación académica sobre el propósito y la efectividad de las AE en los ecosistemas de emprendimiento, explicando su función, misión e impacto en la economía en su etapa inicial.

Esta investigación supone que algunas de estas contribuciones sean pioneras con respecto a la literatura existente mediante los resultados derivados de los tres estudios empíricos y cuantitativos expuestos en los capítulos 3, 4 y 5. Primero, adoptando una visión dinámica sobre la investigación de incubadoras y aceleradoras, y segundo, explicando la heterogeneidad de las medidas de desempeño existentes.

Esta tesis doctoral contribuye con la investigación empírica existente mediante tres modelos estadísticos para medir el rendimiento de las aceleradoras, y establecer su concepto como una generación nueva y más avanzada de la tradicional incubadora de empresas.

Con este fin, hemos utilizado variables existentes en la literatura de las IE y AE, con algunas modificaciones originales que hemos considerado apropiadas para validar los problemas de investigación de esta tesis doctoral.

Para lograr esta tarea, primero tuvimos que abordar de manera consistente la base teórica y los enfoques existentes para los modelos de incubación, y su evolución, siguiendo con el modelo establecido por Hackett y Dilts (2004). Durante este proceso consideramos los modelos híbridos, ya que la variedad de modelos de incubación no sólo está impulsada por la evolución de los requisitos de las start-ups aceleradas y sus necesidades, sino también por los objetivos de los inversores.

En segundo lugar, la extensa revisión de la literatura nos dio una visión más matizada sobre la relevancia de las aceleradoras, su papel en el ecosistema emprendedor y sus implicaciones para la innovación social. Además, aunque las AE sirvan como intermediarias dentro de sus ecosistemas locales para ofrecer apoyo a los emprendedores

(Clayton et al., 2018), también exploramos cómo las AE a su vez se benefician de los intermediarios institucionales.

Nuestra investigación ha ayudado a demostrar que las AE son entidades que, en lugar de ser simplemente un mecanismo para la creación rápida de empresas, representan desarrollos organizacionales que sirven para ampliar el panorama de financiación e innovación, atrayendo inversiones y creando trabajo por cuenta propia en los lugares donde se implementan.

En tercer lugar, con esta tesis doctoral respondemos a las llamadas de artículos en revistas de alto impacto que surgieron desde 2014, y que buscan profundizar en el conocimiento y la investigación acerca del proceso de incubación y aceleración, con el objetivo de encontrar prácticas y estrategias que conlleven a mejores resultados en el desempeño de las aceleradoras y de sus start-ups alojadas (Hochberg, 2016; Hallen et al., 2014).

En resumen, hemos querido contribuir con la expansión del conocimiento sobre la cuestión general de esta investigación desde un punto de vista teórico: cómo medir y evaluar el desempeño de las AE y de sus start-ups aceleradas.

Implicaciones para fundadores de aceleradoras, emprendedores, inversores y formuladores de políticas

Los capítulos 3, 4 y 5 ofrecen tres perfiles de desempeño de las AE basados en la literatura de la incubación y aceleración que conllevan una serie de implicaciones prácticas para los fundadores y gerentes de las aceleradoras, emprendedores, inversores y formuladores de políticas.

Las partes interesadas y participantes de una Aceleradora obtienen con esta tesis doctoral información más precisa sobre las expectativas clave relacionadas con el tamaño, la edad, la ubicación, la inversión necesaria en las aceleradoras, así como la supervivencia, el tamaño y la financiación de sus nuevas empresas aceleradas.

Para los emprendedores esta información puede ayudarles en el proceso de elegir la mejor Aceleradora para albergar sus proyectos empresariales. Una mejor comprensión de las diferencias entre las AE, según criterios como los propuestos en nuestros modelos, ayudará a los empresarios a elegir, no sólo la mejor opción para desarrollar su proyecto, sino

también dónde ubicarse, qué posibilidades de crecimiento pueden lograr y las ventajas y desventajas de esta elección.

Los índices de rendimiento son especialmente útiles para los inversores que se preocupan principalmente por el retorno de la inversión, su período de recuperación, y por las rondas necesarias para lograr una salida de la inversión.

Esta tesis doctoral resalta además el papel que las AE desempeñan como impulsoras de empleo, una característica importante a considerar por los responsables políticos.

Para los gerentes de las AE, esta tesis doctoral destaca la importancia que tiene la participación y el importe invertido por la red de inversores privados conectada a la misma, tanto directamente en la Aceleradora como en las start-ups aceleradas. Los resultados obtenidos en los capítulos 3, 4 y 5 muestran que el apoyo privado constituye una parte esencial para el desarrollo exitoso de un PAE y para el apoyo de las empresas aceleradas.

Limitaciones de la tesis doctoral

Este estudio no está exento de limitaciones, sin embargo, al mismo tiempo, creemos que abren oportunidades para futura investigación.

Primero, reconocemos la limitación existente con respecto a la escasez de datos obtenidos para las muestras de las aceleradoras. Las descripciones mixtas en la categoría de inversión encontradas en la fuente secundaria utilizada Crunchbase (acelerador, incubadora, capital de riesgo, micro fondo, ángel, etc.) y los valores "cero" en muchas de las variables utilizadas, nos obligaron a reducir la muestra I de 191 a 116 AE, y la muestra II de 324 a 131 AE. Debido a esta falta de datos, existen numerosas AE recién creadas que no se han podido tener en cuenta. Por este mismo motivo las AE localizadas en otros países diferentes a Estados Unidos están en comparación menos representadas.

En segundo lugar, las variables relacionadas con la financiación de nuevas empresas capturan el capital invertido en las start-ups aceleradas, pero no tienen en cuenta otros recursos, como las contribuciones de los mentores, o el apoyo de infraestructura, de la red de contactos, de las instituciones, u otros gastos generales soportados por la Aceleradora.

En tercer lugar, las AE toman acciones o participaciones en cada una de las nuevas compañías creadas a cambio del apoyo y financiación ofrecida, esperando obtener ganancias a través de las salidas de inversión o la venta de acciones. Sin embargo, si las acciones de una nueva empresa no se venden o si los nuevos inversores no compran el porcentaje que la Aceleradora está dispuesta a liberar, esto no significa que la empresa no esté generando un retorno de la inversión, por ejemplo a través de la distribución de dividendos al final del año fiscal. La existencia de información y datos adicionales sobre estos indicadores de rentabilidad, permitirían una evaluación más precisa del desempeño de las AE y de sus empresas aceleradas.

Finalmente, las AE no son entidades homogéneas y, en consecuencia, los resultados de nuestros análisis empíricos podrían estar ocultando algunas diferencias importantes entre varios tipos de aceleradoras.

Direcciones para futuras investigaciones

Esta tesis doctoral proporciona un modelo general y representativo para comprender y medir el rendimiento de las aceleradoras y las nuevas empresas aceleradas en la actualidad.

Aunque el crecimiento de las AE se ha extendido rápidamente por todo el mundo y las conclusiones de la mayoría de los estudios han sido generalmente positivas, las AE no están exentas de críticas.

Futuros estudios deberían intentar realizar un análisis sobre los diferentes aspectos del modelo de negocio de una Aceleradora, de esta forma sería posible agruparlos según las categorías de empresas en las que invierten o según sus estrategias de aceleración, y así obtener información específica sobre el rendimiento de cada tipo.

Por otra parte, sería interesante analizar los problemas observados por los emprendedores de nuevas empresas aceleradas, el valor que perciben y los beneficios obtenidos después de participar en un programa de aceleración. Los investigadores interesados podrían intentar obtener más información sobre la relación entre participar en un PAE, y el aumento de las posibilidades de financiación futura y la supervivencia de la start-up acelerada. Esta sugerencia podría extenderse a un análisis más detallado del modelo de financiación de la

Aceleradora, con especial atención al flujo de capital internacional destinado a financiar estas organizaciones por parte de inversores de diferentes países.

También sugerimos que la investigación futura recopile más datos sobre los programas de aceleración existentes en todo el mundo y amplíe las bases de datos existentes. Una imagen más integrada del panorama actual permitiría a los investigadores realizar comparaciones y predicciones con mayor precisión. Adicionalmente, los empresarios, los inversores y las instituciones públicas se beneficiarían de escalas de datos a largo plazo sobre las tasas de supervivencia de las empresas aceleradas.

En futuras investigaciones nos gustaría expandir la base de datos actual sobre start-ups aceleradas y trabajar con dos muestras diferentes de nuevas empresas, las que han participado en un PAE y las que no, para comprobar de forma rigurosa la efectividad de estos programas. También desearíamos recopilar información sobre la generación de empleo por parte de estas nuevas empresas, de acuerdo con la industria a la que pertenecen y sus áreas funcionales: técnicas, gerenciales, comerciales y otras. Además, pensamos que este tipo de análisis se beneficiaría utilizando métodos estadísticos mixtos, análisis cualitativos y cuantitativos que mejorarían en gran medida el análisis del modelo de rendimiento de la Aceleradora. Y en un futuro cercano, tan pronto como se consolide un número suficiente de AE con orientación social, desearíamos comparar el desempeño de estos programas con el de los PAE convencionales, en términos de impacto social, empleo sostenible y generación de riqueza a largo plazo.

En resumen, las AE son organizaciones que han evolucionado a lo largo de los años exponencialmente en número pero también en características. En este contexto cambiante, sugerimos que se introduzcan nuevos criterios para evaluar cada tipo de Aceleradora para tener en cuenta una serie de características particulares, como la conexión de la AE con el ecosistema de emprendimiento, la capacitación impartida y la naturaleza del apoyo a la inversión.

Esperamos que nuevos estudios continúen explorando y midiendo de una forma amplia y precisa el impacto de las AE en los ecosistemas empresariales, y confiamos que esta tesis doctoral haya contribuido con este objetivo.

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