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*Research Article*

# Analysis of international scientific production on business accelerators, from 1990 to 2019



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## Abstract

**Purpose**: this paper drew an overview of the state of the art on Startup Accelerators, by mapping, organizing, and systematizing the academic papers on this phenomenon**. Design/methodology/approach**: the methodological approach was qualitative, through a descriptive and systematic literature review. We collected data in Scopus and Web of Science databases, between 1990 and 2019. Data collection gathered 403 articles, which, after applying exclusion criteria, resulted in a sample of 95 papers. **Originality/value**: considering the global dissemination of business accelerators, systematizing the literature enabled presenting the supporting pillars of accelerators, advancing the study on the subject and providing a basis for further research**. Findings**: results show the acceleration processes, consolidated in a structural model of four pillars, decomposed, according to the literature, into eight processes addressed by organizations**. Research, Practical & Social Implications**: the main theoretical contribution is the presentation of the structural acceleration model, followed by an overview of international publications in the area and the identification of new opportunities for research in the area of entrepreneurship and innovation.

**Keywords:** Business accelerators. Systematic review. Field reorganization.

## Resumo

**Objetivo**: por meio do mapeamento, da organização e da sistematização das publicações científicas sobre as aceleradoras de negócios startups, desenvolvemos um panorama sobre o estado da arte desse fenômeno**. Método**: revisão sistemática e descritiva da literatura, com abordagem qualitativa. Os dados foram coletados nas bases Scopus e Web of Science, de 1990 a 2019, totalizando 403 artigos que, após a aplicação de critérios de exclusão, resultou em uma amostra de 95 artigos. **Originalidade/Relevância**: considerando a grande disseminação das aceleradoras de negócios no mundo, a sistematização da literatura viabilizou a apresentação dos seus pilares de sustentação, fazendo o estudo sobre o tema avançar, por fornecer embasamento para a realização de novas pesquisas, com base nas sugestões levantadas**. Resultados**: os resultados mostram os processos de aceleração, consolidados em um modelo estrutural com quatro pilares, decompostos, conforme as definições da literatura, em oito processos trabalhados pelas organizações**. Contribuições teóricas/metodológicas**: apresentação de um modelo estrutural de aceleração, seguido de um panorama das publicações internacionais na área e da identificação de novas oportunidades de pesquisa em empreendedorismo e inovação.

**Palavras-chave:** Aceleradoras de negócios. Revisão sistemática. Reorganização do campo.

## INTRODUCTION

Business accelerators are important for the development of early stage companies, also known as startups, which, by raising investments, move millions of dollars in the international market (Van Huijgevoort, 2012).

In 2021, there were 820 startups valued at over a billion dollars, of which 14 received investments from the accelerator Y Combinator, and six from the Techstars accelerator program (Teare, 2021).

Numerous technology-based companies, of high market value, like Airbnb, Uber, Dropbox, iFood, Gympass, and PagSeguro have also undergone acceleration processes.

According to Pauwels et al. (2016), accelerators are essential for developing a business ecosystem, because they collaborate for the improvement and evolution of innovative startups.

As different types of accelerators have emer&ged in the market, the number of studies on the topic increased (Carayannis & Von Zedtwitz, 2005; Goswami et al., 2018), attesting that acceleration stages can be essential for generating innovation in ventures that seek market competitiveness (Gonzalez-Uribe & Leatherbee, 2018; Pauwels et al., 2016). The existing processes in acceleration environments can expand entrepreneurs' view of the market, providing innovative solutions for products and services (Clayton et al., 2018).

Most studies on firms' acceleration are associated with entrepreneurship and an exploratory investigation of the phenomenon (Crişan et al., 2021). Cohen et al. (2019) followed another route - from different research methodologies, they described the pillars and stages of these accelerators in the market.

Even with all emphasis in the literature on management, marketing, and international business, in addition to the high production of reviews and studies that seek to systematize and synthesize the topic, there is still much to do to unravel this phenomenon. Therefore, the definition and explanation of the acceleration process of startup companies are still insufficient, which calls for further studies (Cohen et al., 2019; Crişan et al., 2021).

Given that the main gap is in explaining the whole set of processes regarding each acceleration stage or pillar (Clayton et al., 2018; Bliemel et al., 2019), this article unifies the definitions of acceleration and the processes involved in each acceleration stage, in order to answer the following research question: *How can researchers advance their studies in the field of startup acceleration, considering the state of the art of this phenomenon*?

The goal was to develop an overview of the scientific publications on business accelerators, mapping the existing academic contributions, organizing, and ranking them to show the state of the art.

Hence, the study provides three contributions: (1) the stages of acceleration, broken down into four pillars and eight processes, based on previous research and identification of gaps; (2) an overview of international publications in the area, between 1990 and 2019; and (3) the applicability of acceleration processes in future studies, addressing the phenomenon in the areas of marketing, entrepreneurship, innovation, and business ecosystems.

## THEORETICAL BACKGROUND

The theoretical framework covers different authors' perspectives on the definition of business accelerators, the distinction between accelerators and incubators, and their application within the university environment.

### What is a business accelerator?

The phenomenon of business accelerators has been investigated since 2003 (Carayannis & Von Zedtwitz, 2005; Mtigwe, 2005; Wiggins & Gibson, 2003), but only since 2013 there was a substantial increase in publications on this topic. However, the definition of accelerators as an environment for early-stage business enhancement (Clayton et al., 2018; Gonzalez-Uribe & Leatherbee, 2018; Pauwels et al., 2016) is not a consensus in the literature yet (Clayton et al., 2018).

Carayannis and Von Zedtwitz (2005) describe accelerators as technology transfer offices, relating them directly to innovation and entrepreneurship programs. This definition considers them a mechanism for companies' support, through mentoring services, physical space, consulting, as well as access to financial resources, research, and case studies.

Different from most studies, Letaifa and Rabeau (2013) define accelerators as collaborative ecosystems for innovation and industrial knowledge, which may have different implications depending on their location. This indicates that the open innovation methodology, in combination with regional factors, can contribute to accelerated companies incorporating the knowledge necessary for their operation in different markets. The network of contacts, created in the accelerator, can provide greater ease for applying agile methodologies.

Bliemel et al. (2019), in turn, define accelerators as a combination of five key factors: standardized packages of seed money; a cohort model; a capacity development program; mentoring; and location/physical space. However, this definition shows weaknesses, since it does not indicate the processes involved in each factor, which makes it difficult to understand the phenomenon.

We commonly find such a problem in the literature on accelerators, which supports, once again, the review we present here. It advances the study on the subject, framing each process practiced in these companies into its fundamental pillars, which can be explored in future research.

### What is the difference between business accelerators and incubators?

Accelerators are organizations that develop business models in a limited time, which distinguishes them from conventional incubators (Pauwels et al., 2016). In this perspective, accelerators quickly stimulate the process of venture creation by providing specific incubation services, focused on mentoring and guidance, during an intensive program, so that the relationship between the accelerator and entrepreneurs stimulates managers' learning.

Pandey et al. (2017) operationalize the concepts of social entrepreneurship and accelerators, in a study that highlights the entry of the latter in the entrepreneurial ecosystem by providing contact with market shareholders. As a result, acceleration can also help the creation of business solutions oriented to society, since mentoring programs assist in raising funds for projects with social goals. However, one of the limitations is the need of further studies that cover the processes of social acceleration and networking, created qualitatively for use in the social field.

Clayton et al. (2018), in turn, define accelerators as a physical space, complemented with resources and financial investment, to offer an intensive schedule, in order to provide entrepreneurs with access to physical facilities, with below-market rates and preferential terms, including mentoring and guidelines. Hence, business accelerators are different from incubators by: (a) having an intensive and short-term process for developing entrepreneurial capabilities; and (b) adopting mentoring programs, since this is not a common practice in

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incubation spaces. Despite presenting a review of the better-informed research in the field, the authors do not fully explain the processes developed at each stage of acceleration, thus leaving a gap to be filled by future studies.

Other attributes that distinguish accelerators from incubators, according to Kreusel et al. (2018), are their teaching structures, with mentoring programs, short investment period, and intensive support, where entrepreneurship is addressed as a form of education. The theoretical bases selected for analysis rely on business models and existing classification of incubation, suggesting that open innovation methodologies provide dynamics for the entrepreneurship ecosystem. However, this study does not specify in depth steps or processes adopted in accelerators.

To Goswami et al. (2018), mentoring is an essential tool for distinguishing between accelerators and incubators, when analyzed by the benchmarks of entrepreneurship ecosystems and their intermediaries. The authors reinforce Letaifa and Rabeau (2013) and Pandey et al. (2017) findings, mentioning the use of mentoring for entrepreneurial networking, since cooperation between accelerators and companies speeds up the maturity of organizations and encourages innovation.

Accelerators are fixed-term programs, with limited duration, based on cohorts, and can be considered modified incubators, since they provide more services for developing companies or startups, compared to a conventional incubator (Mansoori et al., 2019; Ozkazanc-Pan & Muntean, 2018).

Based on the same assumption, Hasan and Koning (2019) operationalize the dependent variables of social interaction, knowledge, advice, and digital messaging, as well as the independent variables of distance and priority of ties. Therefore, they strengthen the relevance of incubators and accelerators as sources of new knowledge, from formal and informal networks.

On the other hand, Mian et al. (2016) identify the evolution of incubation and its unfolding into companies' acceleration, arguing that accelerators originate from public-private collaborations between universities, industry, and government, with the purpose of creating companies capable of solving social and economic issues. Hence, the integration of ecosystems can create value, from the transfer of knowledge between accelerators, incubators, and technology hubs at universities (Van Stijn et al., 2018).

### Business accelerators in the university environment

Studies on knowledge transfer and networking between universities and companies, as one of Rubin et al., (2015), show that firms connected to accelerators and incubators can have access to exclusive information, extending their possibilities for contacts. Thus, accelerators located close to universities tend to create a bridge between knowledge and market innovation. However, there is a gap in that paper – it does not make explicit the difference between accelerators and incubators within universities, and considers that both organizations have the same processes.

Van Stijn et al. (2018) confirm Rubin et al. (2015) findings, that acceleration can take place in corporate environments or universities, through three key pillars: support to startups, university-industry interaction, and managers' education. However, they do not fully explain the processes developed in these environments.

Accelerators fund entrepreneurial internships, by providing seed capital and creating forms of market education for participants, through shared office space and contact with investors (Gonzalez-Uribe & Leatherbee, 2018).

Like Rubin et al. (2015) and Van Stijn et al. (2018), Gonzalez-Uribe and Leatherbee (2018) state that accelerators are ecosystems that promote university entrepreneurship, thus contributing to leverage seed capital investments and spaces for collaborative creation. Hence, in accelerators, innovation is stimulated by venture capital and the development of companies that seek to enhance their knowledge at university environments.

In the last decade, universities have created their own accelerators, in order to develop students' entrepreneurship skills and support technology transfer (Cohen et al., 2019). Therefore, more recent studies analyze the perspective of university accelerators' directors on the role they play, for whom they are designed, as well as the expected outcomes, and the description of their structures and operations (Metcalf et al., 2020).

Thus, we can consider accelerators as extensions of incubation models, which enhance business models by attracting big investments in short periods of time. In general, organizations that accelerate have strict criteria for choosing startups with a certain level of maturity. Accelerators also organize mentoring rounds and physical spaces that enable early-stage firms to enter markets. In addition, accelerator models have the potential to extend networks by covering the academic environment and supporting them through investment and intellectual property contracts.

## METHOD

We used a qualitative approach, through a descriptive systematic literature review. Data were collected in the Scopus and Web of Science databases, and analyzed according to Knopf (2006), Paré et al. (2015) e Kauppi et al. (2018).

We chose these databases because: (a) they contain indexed and internationally certified scientific publications, allowing the search in other databases, such as Scopus, ProQuest, Wiley, and Science Direct, among others (Rossetto et al., 2017); (b) they make available the data provided at the time of extraction; and (c) they have information, like publication data, journal, authors, number of citations, countries, keywords, institutions, etc., that enable parameterizing and generating compatible data and content for use and analysis (Kauppi et al., 2018).

Data were analyzed by the following software: (a) Excel, which allowed the separation, categorization, creation of criteria, and cutouts until the selection of data to apply filters and generate graphics; and (b) Atlas.ti, used as a tool for systematization, precision in searching information, and separation of collected abstracts and articles' content, making it possible to register and separate content/categories (Friese, 2019).

The process of reviewing and writing took place in five stages (Felizardo et al., 2011; Malheiros et al., 2007). The goals, type of review (systematic and descriptive), and research design were defined in Stage 1.

In Stage 2, we chose the following terms and keywords (search strings): "business accelerators", "business accelerator", "accelerator", and "accelerators"; and (TS=Business Accelerator) AND (TS=Business Accelerators) AND (TS=Accelerator) AND (TS=Business Accelerators) AND Language: (English) AND Document Types= (Article). Indexes=Sci-Expanded, Ssci. Timespan=All years.

The choice of these words aimed to limit the results within the research scope, since they were pre-analyzed in an initial search on Google Scholar to check their use in the chosen databases.

We made a time frame, covering the period between 1990 and 2019, due to the relevance of the publications in these decades. We also determined, during criteria creation, that the

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search would occur through scientific production of articles, excluding documents, such as "Bibliographical Items, Books, Book Reviews, Chronology, Correction, Discussion, and Abstract of Published Items".

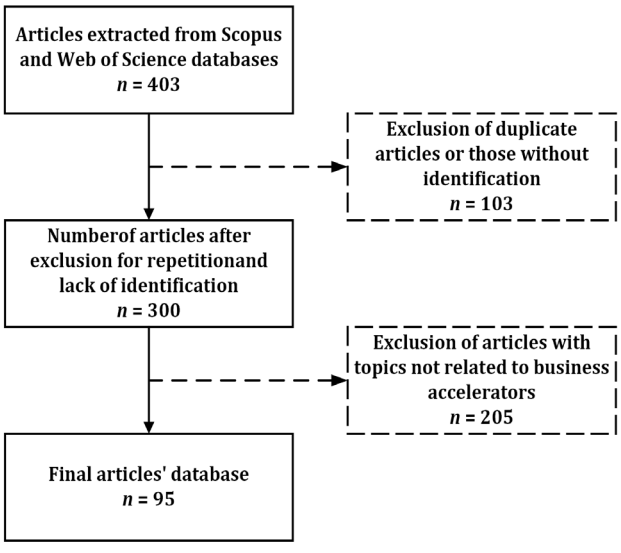
In Stage 3, we collected data, and extracted 403 articles from the two databases, including duplicates. Next, to check if there were articles with missing information, we parameterized the data. The research was then structured to provide a broad understanding of the scientific production on business accelerators, according to the methodology proposed by Paré et al. (2015) and Kauppi et al. (2018). Therefore, we treated the compiled database in order to show the number of extracted articles, the creation of criteria for predefinition and final definition of excluded articles, until we could generate and apply filters.

Hence, the exclusion criteria were applied from merging two databases, which totaled 403 articles. First, we excluded duplicate articles (50) and those without author identification (53). Then, we revised titles, abstracts, and keywords of the remaining 300 articles, to confirm if they were in line with the research topics previously categorized.

The topics mapped and indicated for exclusion addressed: (a) financial accelerators, but with issues associated with the economy and inflation (46 articles); (b) financial crisis, addressing financial acceleration in companies, but facing the crisis of specific countries, economic blocks, or regions (14); (c) particle accelerators in sciences, like mathematics, chemistry and physics (4); (d) macroeconomics and topics related to economics, such as market regulation, infrastructure, politics, international business, FDI, international diversification; issues linked to traditional schools of economic history; and indirect financial acceleration (58); (e) microeconomics and economy-related topics focused on consumer, customer behavior, investment application, purchasing decisions, getting credit, audit, and indirect financial acceleration (15); (f) other unrelated or random topics captured in data extraction, which do not address business entrepreneurship or startups, according to the research scope, such as sustainability, smart cities, fashion, social capital, hybrid genetic algorithm, big data, benchmarking, etc. (68). Here, 205 papers were excluded, leaving the final base with 95 articles (Figure 1).

**Figure 1**

*Sample – database treatment and exclusion stages*




Note: Elaborated by authors (2020).

In Stage 4, we carried out: (a) the analysis of the review metrics, and of the descriptions of authors, journals, citations, keywords, institutions, and countries; (b) the analysis and treatment per article unit, separation, data mining, grouping, and creation of criteria; (c) designing tables, graphs, and applying filters to organize the analysis of the academic production on business accelerators.

Finally, in Stage 5, we did the final analysis of results and their selection for presentation and discussion.

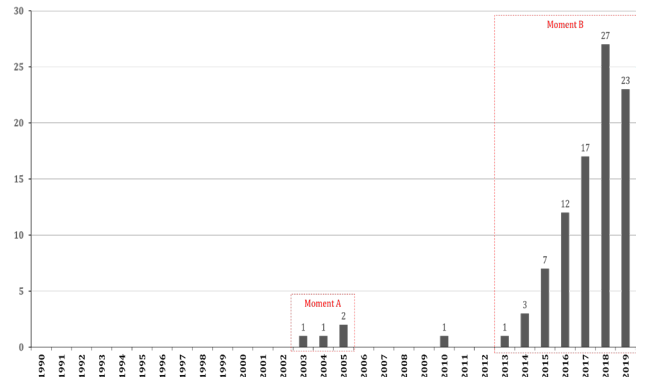
## RESULTS

Between 1990 and 2019, the first article on the topic was "Overview of US incubators and the case of the Austin Technology Incubator", by Wiggins and Gibson (2003), published in the International Journal of Entrepreneurship and Innovation Management. The article provides an overview of business incubation in the US and the case study mentioned in the title. The authors conclude that, to be successful, incubators should do five tasks: (1) establish clear metrics for success; (2) provide entrepreneurial leadership; (3) develop and provide value-added services for member firms - especially because of the explosion of technology-based business accelerators that seek profit; (4) develop a rational process for selecting new firms; and (5) ensure that member firms have access to the necessary human and financial resources.

Most of the extracted articles are concentrated in the period 2013-2019, whose growth in publications was exponential, totaling 90 articles at Moment B, with one in 2010, and four at Moment A (Figure 2).

**Figure 2**

*Evolution of publications per year and their moments*




Note: Elaborated by authors (2020).

Moment A comprises the period 2003-2005, when studies focused on entrepreneurship and international entrepreneurship began, addressing business incubators and accelerators as mechanisms with distinct practices (Carayannis & Von Zedtwitz, 2005; Mtigwe, 2005; Wiggins & Gibson, 2003).

Moment B portrays the current scenario, corresponding to the years 2013 to 2019, where accelerators are explored with a focus on startup development, business entrepreneurship, and innovation.

Mapping publications shows activities in 30 different countries, in the following descending order: United States (30), Germany (8), England (6), Spain (5), Canada (4), Sweden (4), Russia (4), Israel (3), Australia (2), Chile (2), France (2), South Korea (2), Mexico (2), Peru (2), and Portugal (2). South Africa, Brazil, Belgium, Kazakhstan, China, Denmark, Finland, Italy, Nigeria, Czech Republic, Romania, Singapore, Slovakia, Thailand, Switzerland, and Turkey had (1) publication each.

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US ranks first because business acceleration practices are part of the entrepreneurial culture for startup development (Wright et al., 2017), in addition to other factors, associated with numerous local business schools and incentives and research grants for investigating the topic (Crișan et al., 2021). Hence, mapping highlights the representation of studies involving research on business accelerators and entrepreneurship in different regions.

Regarding the highest number of quotes, the 15 most cited articles account for a total number of 1,437 references.

The most cited article is the one by Clayton et al. (2018), "Behind the Scenes: The Intermediary Organizations that facilitate Science Commercialization through Entrepreneurship," published in the Academy of Management Perspectives, which addresses the different mechanisms that facilitate entrepreneurship and innovation in a startup ecosystem, and defines accelerators, coworking spaces, business incubators, and agents, terms, and environments used.

The other articles were published in high impact journals that focus on topics like entrepreneurship and innovation: Journal of Technology Transfer, Technovation, International Journal of Technology Management, Gender Work and Organization, Strategic Entrepreneurship Journal, Journal of Social Entrepreneurship, Review of Financial Studies, Strategic Management Journal, and Journal of Business Research.

Table 2 shows the main information extracted from the journals, the number of articles, and the representation matrix of the top 30 journals with publications on the subject.

Next (Table 3), we identified the most used keywords, which can be used in future studies, through the creation of "groups" of topic subdivision. These are accelerators, startups, entrepreneurship, innovation, and open innovation.

Entrepreneurship, innovation, open innovation, incubator, corporate accelerator, and new venture creation are keywords that allow us to map some groups of the investigated phenomena, which involve the concept of business acceleration.

Checking keywords enables determining the topics of interest investigated, in order to understand how business accelerators operate.

**Tabela 2**

*Quantidade de artigos por periódicos (Top 30)*

| Periódico | Estatísticas | |
|---|---|---|
| | *n* | % |
| Technovation | 4 | 4,21 |
| Journal of Technology Transfer | 4 | 4,21 |
| Revista Espacios | 4 | 4,21 |
| International Journal of Entrepreneurial Behaviour and Research | 3 | 3,16 |
| Academy of Entrepreneurship Journal | 2 | 2,11 |
| Business Horizons Journal | 2 | 2,11 |
| Journal of Technology Management and Innovation | 2 | 2,11 |
| Technology Innovation Management Review | 2 | 2,11 |
| International Journal of Entrepreneurship and Innovation Management | 2 | 2,11 |
| Latin American Business Review | 2 | 2,11 |
| International Journal of Technology Management | 2 | 2,11 |
| International Journal of Innovation and Learning | 2 | 2,11 |
| Journal of Business Research | 2 | 2,11 |
| European Journal of Innovation Management | 1 | 1,05 |
| R&D Management | 1 | 1,05 |
| Entrepreneurship and Sustainability Issues | 1 | 1,05 |
| European Research Studies Journal | 1 | 1,05 |
| Strategic Entrepreneurship Journal | 1 | 1,05 |
| Gender Work and Organization | 1 | 1,05 |
| Journal of Small Business and Entrepreneurship | 1 | 1,05 |
| Entrepreneurship Research Journal | 1 | 1,05 |
| New Space Journal | 1 | 1,05 |
| Independent Journal of Management & Production | 1 | 1,05 |
| Review of Financial Studies | 1 | 1,05 |
| Industry and Higher Education | 1 | 1,05 |
| International Journal of Innovation Management | 1 | 1,05 |
| Innovation Policy and the Economy | 1 | 1,05 |
| Journal of Open Innovation: Technology, Market, and Complexity | 1 | 1,05 |
| International Entrepreneurship and Management Journal | 1 | 1,05 |

Notas: The remaining 45 journals, with only one published article, represent 1.05% each.
Elaborated by authors (2020).

**Table 1**

*The 15 most cited articles*

| Title | Author/Year | Citations |
|---|---|---|
| Behind the scenes: intermediary organizations that facilitate science commercialization through entrepreneurship | Clayton et al. (2018) | 151 |
| Exploring the motives and practices of university-start-up interaction: evidence from Route 128 | Van Stijn et al. (2018) | 129 |
| Architecting gloCal (global-local), real-virtual incubator networks (G-RVINs) as catalysts and accelerators of ... | Carayannis e Von Zedtwitz (2005) | 125 |
| European business venturing in times of digitisation - an analysis of for-profit business incubators in a triple helix ... | Kreusel et al. (2018) | 117 |
| Networking towards (in)equality: Women entrepreneurs in technology | Ozkazanc-Pan e Muntean (2018) | 116 |
| Knowledge flow in Technological Business Incubators: Evidence from Australia and Israel | Rubin et al. (2015) | 105 |
| Understanding a new generation incubation model: The accelerator | Pauwels et al. (2016) | 98 |
| Accelerator expertise: Understanding the intermediary role of accelerators in the development of the Bangalore ... | Goswami et al. (2018) | 96 |
| The influence of the lean startup methodology on entrepreneur-coach relationships in the context of a startup ... | Mansoori et al. (2019) | 79 |
| The Appeal of Social Accelerators: What do Social Entrepreneurs Value? | Pandey et al. (2017) | 73 |
| The Effects of Business Accelerators on Venture Performance: Evidence from Start-Up Chile | Gonzalez-Uribe e Leatherbee (2018) | 72 |
| Prior ties and the limits of peer effects on startup team performance | Hasan e Koning (2019) | 72 |
| Technology Business Incubation: An overview of the state of knowledge | Mian et al. (2016) | 70 |
| Too close to collaborate? How geographic proximity could impede entrepreneurship and innovation | Letaifa e Rabeau (2013) | 67 |
| Accelerators as start-up infrastructure for entrepreneurial clusters | Bliemel et al. (2019) | 67 |

Note: Elaborated by authors (2020).

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**Table 3**

*Ranking of Keywords (Top 15)*

| Ranking | Keyword | Subdivision of topics | Number |
|---|---|---|---|
| 1º | Accelerator | Accelerator | 35 |
| 2º | Startups | Startups | 28 |
| 3º | Entrepreneurship | Entrepreneurship | 20 |
| 4º | Innovation | Innovation | 14 |
| 5º | Open Innovation | Open innovation | 12 |
| 6º | Business Accelerator | Accelerators | 08 |
| 7º | Incubator | Startups | 07 |
| 8º | Corporate Accelerator | Accelerators | 07 |
| 9º | New Venture Creation | Startups | 05 |
| 10º | Business Incubation | Startups | 04 |
| 11º | Entrepreneurial Ecosystems | Open Innovation | 04 |
| 12º | Commercialization | Entrepreneurship | 03 |
| 13º | Corporate venturing | Startups | 03 |
| 14º | Ecosystem | Open Innovation | 03 |
| 15º | Innovational Infrastructure | Innovation | 03 |

Note: Elaborated by authors (2020).

Among the 15 most cited articles, 13 use the qualitative approach, with most exploratory research, which shows little deepening of the topic and confirms the field's initial stage of development. The most commonly used qualitative techniques and methods are literature reviews, narrative reviews, inductive research, and case studies. Only two studies were quantitative (Table 4).

The lack of quantitative research in the field is due to the fact that research on business ecosystems and innovations related to the phenomenon of accelerators began to emerge in 2015 (Figure 2). Therefore, we recommend that future research use quantitative approaches, by applying surveys, with startups as units of analysis, in order to assess the independent and dependent variables that explain the acceleration phenomenon.

The previously listed articles (Table 4) define accelerators associated with various research topics. Clayton et al. (2018) focus on practices in business ecosystems; therefore, they define an accelerator as an intensive program to accelerate forms of financial investment, and provide entrepreneurs with access to physical facilities, below-market rates, and preferential terms. The concept is treated as a new model of incubation, which includes mentoring and guidelines.

Like Clayton et al. (2018), Pauwels et al. (2016) address the evolution from incubation models to acceleration. They define accelerators as organizations with the goal of quickly developing the process of venture creation, by providing specific incubation services focused on mentoring and guidance, during an intensive program of limited time.

On the other hand, Van Stijn et al. (2018) work with the topic of technology transfer in innovation ecosystems, because they believe that acceleration and incubation can be present in universities or companies, based on three fundamental pillars: support to new companies, university-industry interaction, and managers' education.

Carayannis and Von Zedtwitz (2005) also use technology transfer and business ecosystem practices, but mention five pillars for accelerators: access to physical resources, office support, access to financial resources, support to startups, and access to networks. Hence, accelerators are seen as technology transfer offices; venture programs; and mechanisms that offer support to companies, like mentoring services, mandatory internships, academic consulting, access to research and case studies on entrepreneurship and engineering, contribution to product development, and courses on entrepreneurship, among others.

**Table 4**

*Approaches and methods adopted in the 15 most cited articles*

| Authors (Year) | Approach/Method |
|---|---|
| Clayton et al. (2018) | Qualitative/Literature review |
| Van Stijn et al. (2018) | Qualitative/Exploratory research |
| Carayannis e Von Zedtwitz (2005) | Qualitative/Narrative review |
| Kreusel et al. (2018) | Qualitative/Inductive research |
| Ozkazanc-Pan e Muntean (2018) | Qualitative/Exploratory research |
| Rubin et al. (2015) | Qualitative/Multiple Case study |
| Pauwels et al. (2016) | Qualitative/Multiple Case study |
| Goswami et al. (2018) | Qualitative/Exploratory research |
| Mansoori et al. (2019) | Qualitative/Ethnographic |
| Pandey et al. (2017) | Quantitative/Online survey |
| Gonzalez-Uribe e Leatherbee (2018) | Quantitative/Discontinuous regression |
| Hasan e Koning (2019) | Quantitative/Experiment |
| Mian et al. (2016) | Qualitative/Literature review |
| Letaifa e Rabeau (2013) | Qualitative/Multiple case study |
| Bliemel et al. (2019) | Qualitative/Exploratory research |

Note: Elaborated by authors (2020).

Kreusel et al. (2018) also operationalize the practices in business ecosystems. For them, accelerators are teaching structures, with mentoring programs, in a short investment period and with intensive support. Investments are made in business know-how or funding of smaller amounts (from € 20,000 to € 30,000), and small equity stakes, which differentiate accelerators from incubators.

Ozkazanc-Pan and Muntean (2018) focus on the topic of gender entrepreneurship and practices in incubators and accelerators. According to the authors, accelerators provide services similar to incubators, but have a competitive application process, and are based on structured programs that range from a few weeks to a few months, during which entrepreneurs' cohorts spend time there and leave with their startups ready to get investments and operate their business models.

Pandey et al. (2017) also define accelerators as a new organizational body in the entrepreneurial ecosystem, providing support through greater market interactions and connections with potential funders.

The role of business accelerators in building networking, in acceleration spaces, is the topic of Rubin et al.'s paper (2015). To them, accelerators are organizations that catalyze the economic development of companies, providing entrepreneurs with resources for administrative, financial, business, and marketing services.

For Goswami et al. (2018), who address corporate development in the business ecosystem, an accelerator is a kind of organization that provides support to firms. The acceleration process usually focuses on the development of individual startups, but can also help developing business ecosystems, fixed-term cohort programs, including guidelines, in an event usually called Demo Day.

Mansoori et al. (2019), in turn, focus on the relationship between entrepreneurs, mentors, and startups' lean development. In their article, accelerators are defined as programs of limited duration, intended to help entrepreneurs define their ideas and build their first prototypes. The

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accelerator is seen as an incubator's mutation, providing more services than traditional incubators, besides being time-limited and based on cohorts.

Gonzalez-Uribe and Leatherbee (2018) distinguish accelerators from other early-stage funders by their strong emphasis on entrepreneurship education. These organizations provide: (a) venture capital to participants, who would not get it otherwise; (b) a combination of money, shared office space, and entrepreneurship education to startups. Therefore, the focus is on business ecosystem practices.

In the same line of reasoning, Hasan and Koning (2019) and Mian et al. (2016) show that incubators and accelerators are important sources of new knowledge for individuals and their teams, as well as for young entrepreneurs, who work in startups. The value of both organizations stems from the new social interactions they create, ensuring not only the strengthening of existing connections, but new ones.

Letaifa and Rabeau (2013) and Bliemel et al. (2019) also address practices in business ecosystems. To the former, accelerators are ecosystems that collaborate for innovation and industrial self-knowledge, and geographic instances can have implications in the process of entrepreneurship acceleration. For the latter, accelerators are a combination of five key factors: standardized packages of seed investment, company participation and exit by cohort model, a program structured on the development of entrepreneurial capacities, mentorship, and location/physical space.

We found the following results for the relationship between the phenomenon of acceleration in startups and the topics of entrepreneurship and innovation, considered as research axes where acceleration takes place. We segmented the theoretical framework, the readings, the registrations, and the discussion and classification of these articles: (a) 10 articles relate accelerators to innovation; (b) 17 papers relate accelerators to entrepreneurship; (c) 60 relate accelerators to innovation and entrepreneurship; and (d) 8 articles address only accelerators, and do not relate them either to innovation or to entrepreneurship.

## DISCUSSION

In light of the presented results, the main contribution of this study suggests a structural model of acceleration that consolidates the main outputs of the analyzed articles, grouping them into four pillars: (1) development of products and services; (2) legal and financial support; (3) physical space; and (4) mentoring. They trigger at least eight processes, which should be addressed in business accelerators, as explained below.

**Development of products and services:** based on Carayannis and Von Zedtwitz (2005), Mian et al. (2016), Clayton et al. (2018), and Bliemel et al. (2019) surveys, developing products and services and improving market offerings are essential for accelerators. Both need the help of mentoring processes and technological knowledge transfer, through networking, whose contacts are made during the startup acceleration process. Accelerators generally provide training programs, organized by managers, so that a company can develop organizational capabilities and improve its market offerings.

**Legal and financial support:** based on Pauwels et al. (2016), Kreusel et al. (2018), Goswami et al. (2018), and Gonzalez-Uribe and Leatherbee (2018), legal and financial support are linked to keeping contracts, licenses, and issues concerning intellectual property rights on the products/processes developed by startups. However, many companies do not have a legal department or budget for hiring professionals to provide legal support for keeping investment contracts or intellectual protection of projects and business models. In this pillar, access to seed money, venture capital, angel investors, and other types of shareholders, is usually guided by instructions obtained in acceleration spaces, that is, through mentoring, which allows entrepreneurs to get specific resources for trying to achieve business success.

**Physical space:** as discussed by Letaifa and Rabeau (2013), Van Stijn et al. (2018), Ozkazanc-Pan and Muntean (2018), and Hasan and Koning (2019), these spaces in accelerators are important factors in the initial cost structure of startups. Called places or venues, they can be physical or virtual, and companies choose to establish themselves in university settings or in a business incubator, so they tend to provide mentoring programs. The cohort model may vary for each accelerator, given their function of improving more viable projects to participate in acceleration programs. Therefore, they establish criteria for the selection process and the business model of participating startups, facilitating transparency, both for accessing capital and triggering the interest of investors who seek profitable business models.

**Mentoring:** according to Rubin et al. (2015), Pandey et al. (2017), Van Stijn et al. (2018), and Mansoori et al. (2019), mentoring in accelerators is embedded in the learning programs, involving directly product and service development. In general, mentoring supports the development of business models by providing a direction for the creation of financial, marketing, legal, and administrative processes. In addition, through mentoring, entrepreneurs can receive training to improve their sale pitches and use them to attract investments for the accelerator and business rounds, offered in specific events for startups and investors.

The consolidation of the mentioned pillars and processes, according to our interpretation, is shown in Figure 3.

All references related to each pillar (Figure 3) were analyzed and separated to enable future research (Table 5), allowing scholars to draw research agendas to explore each activity experienced in business accelerators. Additionally, for each pillar, we prepared research suggestions, which emerged from the literature review, and can collaborate to define paths for future studies.

Finally, we recommend using accelerators' pillar structure as a guide for researchers who want to develop future studies on the subject.

## CONCLUSION

To answer the research question that guided this article (How can researchers advance their studies in the field of startup acceleration, considering the state of the art of this phenomenon?), we showed the overview of scientific publications on business accelerators, in two distinct moments of academic production - A and B. The latter, and more recent, represents an exponential rise in research on the subject. Therefore, we see that the field is at an early stage of development, given the number of qualitative and exploratory research found.

There are several possibilities for the evolution of studies related to the startup acceleration (highlighted in next topic), including the application of different research approaches and methods, with special emphasis to the need for quantitative studies.

### Avenues for future research

The suggestions presented earlier (Table 5), which consider the identified pillars, show opportunities for exploring each of these aspects of business accelerators. To this end, and in order to understand the current availability, as well as the gaps, and

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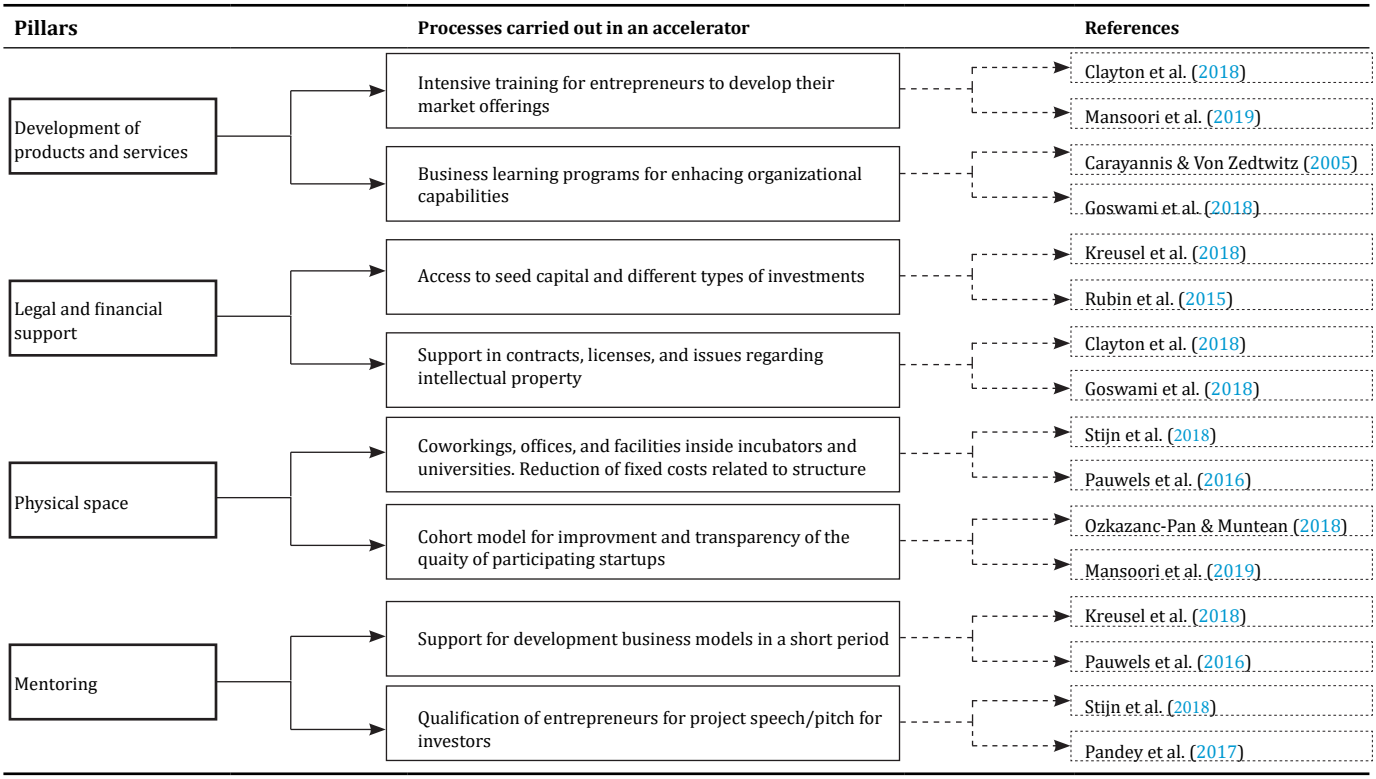
**Figure 3**

*Accelerators' supporting pillars*




Note: Elaborated by authors (2020).

**Table 5**

*Business accelerators' pillars and suggestions for future research*

| Pilars | References | Suggestions for future research |
|---|---|---|
| Development of products and services | Bliemel et al. (2019); Carayannis & Von Zedtwitz (2005); Clayton et al. (2018); Cohen et al. (2019); Crişan et al. (2021); Mian et al. (2016); Pauwels et al. (2016); Van Huijgevoort (2012); Wright et al. (2017). | • To explore business accelerators as infrastructure providers for technology startups in business clusters.<br>• To investigate the success of products and services developed in acceleration programs, through metrics such as companies' income, job creation, and other performance indicators.<br>• To explore race and gender issues in leaders' participation in acceleration programs, with emphasis on technological products and services' teams.<br>• To map the differences between accelerators' types and their impacts on the entrepreneurial process, in order to identify best practices for implementing a strategy of customized acceleration for startups. |
| Legal and financial support | Bliemel et al. (2019); Crişan et al. (2021); Gonzalez-Uribe & Leatherbee (2018); Goswami et al. (2018); Leatherbee (2018); Pauwels et al. (2016); Van Huijgevoort (2012); Wright et al. (2017). | • To quantify the temporal evolution of access to seed money, venture capital, angel investors and other types of shareholders in acceleartion spaces, to better understand specific fundraising.<br>• To investigate the endogenous nature of community capital in the entrepreneurial process.<br>• To explore the motivations of companies that prioritize the involvement with university accelerators, regarding legal and financial support, compared to other types of business accelerators.<br>• To develop taxonomies of the different aspects of support mechanisms in the academic entrepreneurial ecosystem |
| Physical space | Carayannis & Von Zedtwitz (2005); Cohen et al. (2019); Crişan et al. (2021); Hasan e Koning (2019); Kreusel et al. (2018); Letaifa e Rabeau (2013); Mtigwe (2005); Ozkazanc-Pan & Muntean (2018); Van Stijn et al. (2018); Wiggins e Gibson (2003); Wright et al. (2017). | • To investigate how acceleration stages and pillars help developing business capacities and competencies in local and international markets; to map if these structures can be adapted, according to each accelerator.<br>• To investigate the differences between a company being in a physical versus a virtual space, pointing out which locations are more efficient for acceleration, by analyzing issues related to cost reduction.<br>• To analyze the impact on the local ecosystem caused by business accelerators, compared to other models of workspace provision.<br>• To measure the local impact of the accelerator in its headquarters region, through the number of accelerator graduates working in other companies, serving as mentors, or investing capital in the entrepreneurial ecosystem. |
| Mentoring | Cohen et al. (2019); Crişan et al. (2021); Mansoori et al. (2019); Mian et al. (2016); Pandey et al. (2017); Rubin et al. (2015); Teare (2021); Van Huijgevoort (2012); Van Stijn et al. (2018); Wiggins e Gibson (2003); Wright et al. (2017). | • To check if mentoring can stand among other pillars, so that future studies can quantify its relevance for the success of accelerating startup companies, considering that it can be used in the pillars of legal and financial support, physical space, and development of products and services.<br>• To investigate how mentors' style (level of authoritarianism) affects the relationship with entrepreneurs.<br>• To evaluate how well the methodology used by mentors fits into ventures with lower levels of technology and other characteristics that affect the heterogeneity of the acceleration program.<br>• To explore the relationship between the mentor's level of seniority and the use of methodologies during the acceleration program. |

Note: Elaborated by authors (2020).

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to better organize the provision of accelerated companies to the market, it is necessary to map the organizational capabilities developed and enhanced in the acceleration programs.

In addition, one can investigate how the acceleration stages and pillars assist in developing capabilities and competencies for local and international markets, and if these structures can be adapted according to each accelerator.

Another study front, which crosses the four pillars presented, is to investigate the types of companies and their interests regarding acceleration processes, the business ecosystem, and innovation. These suggestions cover the areas of marketing, entrepreneurship, innovation, and business ecosystems.

Last, it is crucial to follow up the opportunities and changes that stem from the Covid-19 pandemic, since pillars such as place, especially virtual, gained increased relevance, according to studies that explored the experience of participants in accelerator programs that migrated to the online model (Le, 2021).

## Conflit of interest statement

*The authors declare that there is no conflict of interest.*

## Authors' statement of individual contributions

| Roles | Authors contributions | | | |
|---|---|---|---|---|
| | Noronha MES | Majorana CDB | Longo LR | Avrichir I |
| Conceptualization | ■ | ■ | ■ | ■ |
| Methodology | ■ | ■ | ■ | ■ |
| Software | ■ | ■ | | |
| Validation | ■ | ■ | ■ | ■ |
| Formal analysis | ■ | ■ | | |
| Investigation | ■ | ■ | | |
| Resources | ■ | ■ | | ■ |
| Data Curation | ■ | ■ | | |
| Writing - Original Draft | ■ | ■ | ■ | ■ |
| Writing - Review e Editing | ■ | ■ | ■ | |
| Visualization | | | ■ | |
| Supervision | ■ | ■ | | ■ |
| Project administration | ■ | ■ | | |
| Funding acquisition | N.A. | | | |

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