New evidence on accelerator performance based on funding and location

Lydia Cánovas-Saiz, Isidre March-Chordà and Rosa Maria Yagüe-Perales
Facultat d'Economia, Universitat de València, Valencia, Spain

Received 23 October 2017
Revised 12 July 2018
26 March 2019
22 October 2019
18 January 2020
Accepted 19 January 2020

Abstract

Purpose – 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 its 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.

Design/methodology/approach – 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.

Findings – Some remarkable findings arise after implementation of both bivariate and multivariate analysis. The results confirm a higher size and performance in the US and in the oldest SAs at statistically significant levels.

Research limitations/implications – 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.

Practical implications – 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.

Social implications – 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.*, 2017).

Originality/value – SAs are a very recent phenomenon which is blooming all over the world, especially in developed countries. SAs are therefore considered a key agent in the prospects of any entrepreneurial ecosystem. However, no studies have so far analysed 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.

Keywords Performance, Innovation, Start-ups, Entrepreneurship, Business incubator, Seed accelerator

Paper type Research paper

European Journal of Management and Business Economics
Vol. 29 No. 3, 2020
pp. 217-234
Emerald Publishing Limited
e-ISSN: 2444-8494
p-ISSN: 2444-8451
DOI 10.1108/EJMBE-10-2017-0029

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, specialising in the software and Internet industry. Today, more than 200 seed accelerator programmes (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.*, 2014).

An SA is usually described as a new type of early-stage development programme 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 programmes.

An SA is typically an independent, private organisation 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 enrol 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 US SAs are the leading SAs worldwide and identify their main advantages, if any, over non-US 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 prioritise 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 an 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.

2. Literature review

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, specialising 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 its initial stages in the market. 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, capitalising 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 organisational 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 programmes such as the Global Social Venture Competition. Some universities back entrepreneurship programmes 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 programme culminates with the presentation of the most successful projects to investors in a public pitch event known as "demo day" (Figure 1).

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 programmes. This lack of such databases prevents researchers from evaluating the impact of these programmes (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 programmes (Smith and Hannigan, 2015; Cohen *et al.*, 2019; Fehder and Hochberg, 2019; Hallen *et al.*, 2019); 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, 2019). Table 1 summarises 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).

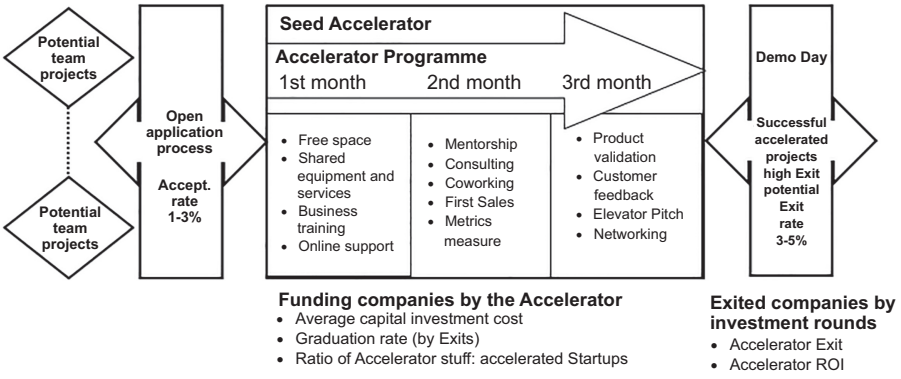

Figure 1.
Seed Accelerator Programme (Pauwels *et al.*, 2016)

Authors	Dependent variable/ research focus	Method	Data	Summary and findings
(1) Conceptual descriptions of the accelerator model				
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 organisations, (2) proof-of-concept centres and (3) accelerators
Hochberg (2016)	Accelerator model definition	Conceptual		Evidence on the effects of the accelerator models on the regional entrepreneurial environment
(2) Qualitative analyses assessing accelerator performance				
Kim and Wagman (2014)	(1) Accelerator portfolio size choice; (2) Profit-maximising 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 US accelerators	Exploratory case study examining how accelerator programs connect start-ups with potential investors
Cohen (2013)	Accelerators organisational learning	Qualitative	70 interviews from 9 US 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, Bingham and Hallen (2018)	Accelerators' choices: (1) Consultation intensity ; (2) Disclosure level; (3) Extent of customisation	Qualitative	8 US 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 minimise start-up time

(*continued*)

Table 1. Accelerators studies

Authors	Dependent variable/ research focus	Method	Data	Summary and findings
(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 US 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, Fehder, Hochberg and Murray (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 US 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 US accelerators	Impact of an accelerator's arrival on the volume of seed and early-stage VC deals completed in the region
Hallen, Bingham and Cohen (2019)	(1) Accelerated start-up outcomes; (2) Time to fundraising; (3) Start-up learning process; (4) Consultation in focal Accelerators; (5) Inter-organisational learning mechanisms	Quantitative and qualitative	8 US 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 accelerators' negative or inconclusive effect on the outcomes of accelerated start-ups				
Smith, Hannigan and Gasiorowski (2013)	(1) Accelerated start-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

Table 1. (*continued*)

Authors	Dependent variable/ research focus	Method	Data	Summary and findings
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 (2019)	(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(s): Own compilation from the literature revision; Compiled by the authors from the literature review

Table 1.

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 programme (Start-up Chile) and found that access to certain basic services, such as the coworking space provided by the programme, had a limited impact on the future performance of Start-up Chile graduates. Cohen *et al.* (2019) used a sample of 146 US 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.* (2019) used a matched sample from four cohorts of eight top US accelerator programmes 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 (2019) compared start-ups affiliated with 13 accelerator programmes 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.

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 Thursby, 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 (Özdemir and Sehitôglu, 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 programmes 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.*, 2014). 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 globalisation, it is still the undisputed leader in terms of the number of acceleration programmes. 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.

H1. Accelerators located in the United States tend to be larger and surpass their foreign counterparts in terms of key SA performance ratios.

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 (Bertoni *et al.*, 2011; Colombo and Grilli, 2010; Puri and Zarutskie, 2008). 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.

H2. Accelerators with higher levels of average total rounds per company outperform others in the main performance ratios.

3. Empirical analysis

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 organisations. In addition, most results and findings are inconclusive and somewhat contradictory. Table 2 summarises some of the most significant variables that have previously been used in the BI literature.

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) Total funding: total amount of capital invested in the participating companies; (2) Total employees: total number of employees in the participating companies; (3) Total rounds: total number of investment rounds; (4) Total companies: total number of accelerated companies in each accelerator.

(2) Location and age. This category comprises two typical control variables: (1) Country: location of the accelerator (United States or elsewhere); (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): (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; (2) Average total exits per company (total exits/total companies); (3) ROI (return on investment) factor (total exits/total funding) $\times$ 100, which reflects the return on investment by the accelerator through company exits; (4) Average total funding per company (total funding/total companies); (5) Average total investment rounds per company (total rounds/total companies); (6) Average employees per company (total employees/total companies).

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 programme features and the companies that enter and graduate from the programmes (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:

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

Table 2. Variables to measure performance used in previous BI studies

(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 [1] 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, 2019). 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.

4. Results

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.

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 4).

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

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.

Min-max rates per period and total SA survey	1999–2005	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(s): Own compilation

Table 3.
Descriptive analysis of rates per period

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. US accelerators (72 in total) were thus distinguished from non-US accelerators (44 in total). Table 5 summarises 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.

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:

$$\text{Country} = A(\beta_1 + \beta_2 \text{Foundation} + \beta_3 \text{Average Total Funding}) + \mu_i$$

The results are displayed in Table 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.

Accelerators' evolution	Total SA Global survey	US (%)	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	116		

Source(s): Own compilation

Table 4. Descriptive analysis of Accelerators evolution

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*

Source(s): Own compilation

Table 5. Differences analysis based on country of origin: US vs Non-US: Survey 1 ($N = 116$)

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*		

Source(s): Own compilation

Table 6.
Logistic regression results

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

To test Hypothesis 2, we applied a Tweedie distribution for generalised 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 7, these are the three key factors that SAs should prioritise to outperform others in terms of ability to close more investment rounds for start-ups participating in their programmes.

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*		

Source(s): Own compilation

Table 7.
GLM model: Results

5. Discussion

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

(1) US 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 US 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 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 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.

Accelerator	Country	Found year	Total funding 2014	Total funding 2018	Average funding 2014	Average funding 2018	*N.* exits 2014	*N.* exits 2018
Y Combinator	US	2005	2200	23000	3.7	15	57	188
Techstars	US	2006	500	5100	2	5	29	129
500 Startups	US	2010	97	1800	0.46	2.6	10	158
AngelPad	US	2010	148	1000	2	7.4	10	22
DreamIT Ventures	US	2007	97	750	1.1	3.8	3	17
SeedCamp	UK	2007	80	620	0.73	5.3	6	26
Amplify.LA	US	2011	9.5	350	0.41	9.7	1	11
RockHealth	US	2010	37.5	340	0.77	7	1	13
Imagine K12	US	2011	33	300	0.92	4	0	5
UpWest Labs	US	2012	4.5	290	0.27	6.9	0	10
Launchpad LA	US	2009	39.2	230	1.5	7	0	6
Portland Incubator	US	2009	52.4	150	2.4	5.1	0	5
StartMate	AUS	2010	6.9	100	0.33	2.2	1	2

Source(s): Crunchbase, 2018

Table 8. Top SAs in the world

6. Conclusions and implications

As the SA phenomenon is still so new, there remains widespread uncertainty about SAs' prospects and the conditions required for SAs to succeed (Pauwells *et al.*, 2016). This study breaks new ground in the SA field by exploring the efficiency and overall performance of a wide array of initiatives labelled as SAs.

This paper offers a new proposal for the quantitative performance assessment of SAs using three categories of variables: size, location and age and performance ratios. Our findings provide valuable insight into the accelerator process for new ventures. A profile of SAs can be identified from the results of our empirical study:

(1) Accelerators located in the United States only outperform those located elsewhere in their capacity to attract funding for participating start-ups.

(2) SAs with greater chances of closing investment rounds for their tenant start-ups are those that receive larger amounts of total funding and that host new ventures with more employees per company. Investors seem to prefer start-ups in a more advanced stage of development.

This profile has a range of practical implications for SA managers, entrepreneurs and investors. SA stakeholders now have access to more accurate information about key expectations linked to the size, age and location of SAs. Entrepreneurs are better informed in the process of choosing the best accelerator to host their business projects. Performance indicators are especially helpful for investors, who are primarily concerned with the percentage ROI factor, the period and the investment rounds needed to achieve an exit.

Another key issue is the SA's role as an employment seedbed. The impact of SAs on the generation of employment is difficult to measure because it usually occurs in the tenant companies' later stages of development (the so-called scale-up process). Nonetheless, the number of new companies born today is remarkable, and in terms of employment, the results are promising.

Our findings also offer important implications for entrepreneurs, venture investors and policymakers. Entrepreneurs can gain insight into how to take full advantage of participating in an SAP.

A review at the end of 2018 of the top 20 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 shown in Table 8 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 20 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.

This study is not free from limitations. First, the data on many of the SAs in our sample came from Seed-DB, a global online SA data set mostly biased towards US accelerators. Consequently, SAs located elsewhere are largely underrepresented. In addition, this public database of accelerators has a number of disclaimers, including incomplete data and missing programmes, companies and values. Missing data and zero values forced us to reduce the initial sample of 191 SAs to just 116. Further, many newly created SAPs were not considered.

Second, some performance indicators suffer from data scarcity, especially the two key profitability ratios: *ROI factor* and *total number of exits completed*. Neither of these start yielding results until the participating companies have traded for at least five years. Almost all of the companies supported by the youngest accelerators are at too early a stage to exit the programme.

Third, the meaning and implications of *total funding* might be misleading because this variable only captures the money invested in start-ups, ignoring the contributions made by mentors and the infrastructure and overhead support of the SAs.

Fourth, SAs take equity in start-ups in exchange for support and funding. They expect to harvest profits through exits, measured using the % ROI factor. However, if a start-up is not sold or new investors fail to buy out the percentage that the SA is willing to release, this does not mean that the company is not creating some return on investment for the SA through either profit sharing or, for example, dividend distribution. Data on these additional profitability indicators would enable a more accurate evaluation of the returns to the companies and the SAs.

Finally, a methodological limitation that is difficult to overcome lies in how to gauge the actual role played by the accelerators in the success of participating firms. Their role in the early stages seems crucial, but the question of whether these start-ups would have been equally successful without SA intervention remains unanswered.

Accelerators are likely to continue to evolve and their impact may change further. Thus, additional research is needed to examine the consistency of our findings in newer accelerators. Undoubtedly, further research is needed to address the following questions, amongst many others: What proportion of start-ups might have prospered without the aid of an accelerator, and what can we learn from the effect of dilution?

Note

1. The Seed Database. This database (available at http://www.http://www.seed-db.com/) is updated and synchronised daily using data from Crunchbase (2018) and AngelList (2018). Updates are completed by SA managers registered on this website. At the time of our last consultation (November 18, 2018), the number of registered accelerators was 147. Although these data are global, they largely relate to U.S. SAs.

References

Abetti, P.A. (2004), "Government-supported incubators in the Helsinki region, Finland: infrastructure, results, and best practices", *The Journal of Technology Transfer*, Vol. 29 No. 1, pp. 19-40.

Aerts, K., Matthyssens, P. and Vandenbempt, K. (2007), "Critical role and screening practices of European business incubators", *Technovation*, Vol. 27 No. 5, pp. 254-267.

Akçomak, I.S. (2009), "Incubators as tools for entrepreneurship promotion in developing countries", Research paper/UNU-WIDER 2009.52.

Aldrich, E.H. and Yang, T. (2012), "What did Stinchcombe really mean? Designing research to test the liability of newness among new ventures", *Entrepreneurship Research Journal*, Vol. 2 No. 3, pp. 2157-5665.

Bergek, A. and Norman, C. (2008), "Incubator best practice: a framework", *Technovation*, Vol. 28 No. 1, pp. 20-28.

Bertoni, F., Colombo, M.G. and Grilli, L. (2011), "Venture capital financing and the growth of high-tech start-ups: disentangling treatment from selection effects", *Research Policy*, Vol. 40, pp. 1028-1043.

Bliemel, M.J., Flores, R.G., de Klerk, S., Miles, M.P., Costa, B. and Monteiro, P. (2016), "The role and performance of accelerators in the Australian startup ecosystem", *UNSW Business School Research Paper Series, Department of Industry, Innovation and Science*.

Bottazzi, L. and Da Rin, M. (2002), "Venture capital in Europe and the financing of innovative companies", *Economic Policy*, Vol. 17 No. 34, pp. 229-270.

Chen, C.J. (2009), "Technology commercialization, incubator and venture capital, and new venture performance", *Journal of Business Research*, Vol. 62 No. 1, pp. 93-103.

Christiansen, J.D. (2009), "Copying Y combinator: a framework for developing seed accelerator programs", MBA Dissertation at Judge Business School and Jesus College, University of Cambridge, Cambridge.

Clarysse, B., Wright, M., Lockett, A., Van de Velde, E. and Vohora, A. (2005), "Spinning out new ventures: a typology of incubation strategies from European research institutions", *Journal of Business Venturing*, Vol. 20 No. 2, pp. 183-216.

Cohen, S.G. (2013), "What do accelerators do? Insights from incubators and angels", *Innovations: Technology, Governance, Globalization*, Vol. 8 Nos 3-4, pp. 19-25.

Cohen, S.G. and Hochberg, Y.V. (2014), "Accelerating startups: the seed accelerator phenomenon", SSRN 2418000, pp. 1-16, available at: http://ssrn.com/abstract=2418000 (accessed 13 June 2018).

Cohen, S.L., Bingham, C.B. and Hallen, B.L. (2018), "The role of accelerator designs in mitigating bounded rationality in new ventures", *Administrative Science Quarterly*, 0001839218782131, available at: https://journals.sagepub.com/doi/10.1177/0001839218782131 (accessed 4 October 2018).

Cohen, S., Fehder, D.C., Hochberg, Y.V. and Murray, F. (2019), "The design of startup accelerators", *Research Policy*, Vol. 48 No. 7, pp. 1781-1797.

Colombo, M.G. and Delmastro, M. (2002), "How effective are technology incubators? Evidence from Italy", *Research Policy*, Vol. 31 No. 7, pp. 1103-1122.

Colombo, M.G., Grilli, L. and Piva, E. (2006), "In search for complementary assets: the determinants of alliance formation of high-tech startups", *Research Policy*, Vol. 35 No. 8, pp. 1166-1199.

Colombo, M.G. and Grilli, L. (2010), "On growth drivers of high-tech startups: the role of founders' human capital and venture capital", *Journal of Business Venturing*, Vol. 25, pp. 610-626.

CrunchBase website (2018), available at: http://www.crunchbase.com (accessed 13 June 2018).

CSES (2002), *Benchmarking of Business Incubators. Sevenoaks: Centre for Strategy and Evaluation Services*, European Commission.

Davila, A., Foster, G. and Gupta, M. (2003), "Venture capital financing and the growth of startup firms", *Journal of Business Venturing*, Vol. 18, pp. 689-708.

Dempwolf, C., Auer, J. and D'Ippolito, M. (2014), "Innovation accelerators: defining characteristics among startup assistance organizations", *Small Business Administration Government*, available at: https://www.sba.gov/sites/default/files/rs425-Innovation-Accelerators-Report-FINAL.pdf (accessed 13 June 2018).

Denis, D.J. (2004), "Entrepreneurial finance: an overview of the issues and evidence", *Journal of Corporate Finance*, Vol. 10, pp. 301-326.

Etzkowitz, H., de Mello, J.M.C. and Almeida, M. (2005), "Towards 'meta-innovation' in Brazil: the evolution of the incubator and the emergence of a triple helix", *Research Policy*, Vol. 34 No. 4, pp. 411-424.

Fehder, D. and Hochberg, Y. (2019), *Spillover Effects of Startup Accelerator Programs: Evidence from Venture-Backed Startup Activity*, University of Southern California, Working Paper, available at: http://yael-hochberg.com/assets/portfolio/FH.pdf (accessed 4 October 2019).

Gompers, P.A. and Lerner, J. (2001), "The venture capital revolution", *Journal of Economic Perspectives*, Vol. 15, pp. 145-168.

Gonzalez-Uribe, J. and Leatherbee, M. (2017), "The effects of business accelerators on venture performance: evidence from Start-up Chile", *The Review of Financial Studies*, Vol. 31 No. 4, pp. 1566-1603.

Hallen, B.L., Cohen, S. and Bingham, C. (2017), "Do accelerators work? If so, how? The impact of intensive learning from others on new venture development", Working paper, available at SSRN: https://ssrn.com/abstract=2719810.

Hallen, B.L., Cohen, S. and Bingham, C. (2019), "Do accelerators accelerate? If so, how? The impact of intensive learning from others on new venture development", *Organization Science Forthcoming*, SSRN, available at: https://papers.

Hochberg, Y.V. (2016), "Accelerating entrepreneurs and ecosystems: the seed accelerator model", *Innovation Policy and the Economy*, Vol. 16 No. 1, pp. 25-51.

Hsu, D.H. (2006), "Venture capitalists and cooperative startup commercialization strategy", *Management Science*, Vol. 52, pp. 204-219.

Kim, J.H. and Wagman, L. (2014), "Portfolio size and information disclosure: an analysis of startup accelerators", *Journal of Corporate Finance*, Vol. 29, pp. 520-534.

Löfsten, H. and Lindelöf, P. (2002), "Science Parks and the growth of new technology-based firms—academic-industry links, innovation and markets", *Research Policy*, Vol. 31 No. 6, pp. 859-876.

Mian, S.A. (1997), "Assessing and managing the university technology business incubator: an integrative framework", *Journal of Business Venturing*, Vol. 12, pp. 251-285.

Mubaraki, A.H. and Busler, M. (2010), "Business incubators findings from a worldwide survey, and guidance for the GCC states", *Global Business Review*, Vol. 11 No. 1, pp. 1-20.

Özdemir, Ö.Ç. and Şehitoğlu, Y. (2013), "Assessing the impacts of technology business incubators: a framework for technology development centers in Turkey", *Procedia-Social and Behavioral Sciences*, Vol. 75, pp. 282-291.

Page, W. and Garbuio, M. (2016), "Corporate accelerators: a new approach to building entrepreneurial communities", *SMS Special Conference*, pp. 1-2.

Pauwels, C., Clarysse, B., Wright, M. and Van Hove, J. (2016), "Understanding a new generation incubation model: the accelerator", *Technovation*, Vols 50-51, pp. 13-24.

Peña, I. (2004), "Business incubation centers and new firm growth in the Basque country", *Small Business Economics*, Vol. 22 Nos 3-4, pp. 223-236.

Phan, P.H., Siegel, D.S. and Wright, M. (2005), "Science parks and incubators: observations, synthesis and future research", *Journal of Business Venturing*, Vol. 20 No. 2, pp. 165-182.

Puri, M. and Zarutskie, R. (2008), "On the lifecycle dynamics of venture-capital- and non-venture-capital-financed firms", CES Working Paper No. 8-13.

Radojevich-Kelley, N. and Hoffman, D.L. (2012), "Analysis of accelerator companies: an exploratory case study of their programs, processes, and early results", *Small Business Institute Journal*, Vol. 8 No. 2, pp. 54-70.

Ratinho, T. and Henriques, E. (2010), "The role of science parks and business incubators in converging countries: evidence from Portugal", *Technovation*, Vol. 30 No. 4, pp. 278-290.

Rothschild, L. and Darr, A. (2005), "Technological incubators and the social construction of innovation networks: an Israeli case study", *Technovation*, Vol. 25 No. 1, pp. 59-67.

Salido, E., Sabás, M. and Freixas, P. (2014), *The Accelerator and Incubator Ecosystem in Europe*, Telefonica report, Madrid.

Schwartz, M. and Göthner, M. (2009), "A multidimensional evaluation of the effectiveness of business incubators: an application of the PROMETHEE outranking method", *Environment and Planning C: Government and Policy*, Vol. 27 No. 6, pp. 1072-1087.

Schwartz, M. and Hornych, C. (2008), "Specialization as strategy for business incubators: an assessment of the Central German Multimedia Center", *Technovation*, Vol. 28 No. 7, pp. 436-449.

Schwartz, M. and Hornych, C. (2010), "Cooperation patterns of incubator firms and the impact of incubator specialization: empirical evidence from Germany", *Technovation*, Vol. 30 No. 9, pp. 485-495.

Schwartz, M. (2013), "A control group study of incubators' impact to promote firm survival", *The Journal of Technology Transfer*, Vol. 38 No. 3, pp. 302-331.

Shah, S.K. and Pahnke, E.C. (2014), "Parting the ivory curtain: understanding how universities support a diverse set of startups", *The Journal of Technology Transfer*, Vol. 39 No. 5, pp. 780-792.

Smith, S.W., Hannigan, T.J. and Gasiorowski, L. (2013), "Accelerators and crowd-funding: complementarity, competition, or convergence in the earliest stages of financing new ventures? University of Colorado-Kauffman foundation crowd funding conference, Boulder, CO, July 12-13, 2013", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2298875 (accessed 13 June 2018).

Smith, S.W. and Hannigan, T.J. (2015), "Swinging for the fences: how do top accelerators impact the trajectories of new ventures?", *Paper Presented at DRUID15, Rome, June 15-17 2015*.

Soetanto, P.D. and Jack, L.S. (2013), "Business incubators and the networks of technology-based firms", *The Journal of Technology Transfer*, Vol. 38 No. 4, pp. 432-453.

Stayton, J. and Mangematin, V. (2019), "Seed accelerators and the speed of new venture creation", *The Journal of Technology Transfer*, Vol. 44 No. 4, pp. 1163-1187.

Yin, R. (2009), *Case Study Research: Design and Methods*, 4th ed., Sage, Thousand Oaks, CA.

Yu, S. (2019), "How do accelerators impact the performance of high-technology ventures?", *Management Science*, in press.

Further reading

Aaboen, L. (2009), "Explaining incubators using firm analogy", *Technovation*, Vol. 29 No. 10, pp. 657-670.

Carayannis, E.G. and Zedtwitz, M.V. (2005), "Architecting gloCal (global-local), real-virtual incubator networks (G-RVINs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: lessons learned and best practices from current development and business incubation practices", *Technovation*, Vol. 25, pp. 95-110.

Dee, N., Gill, D.E., Livesey, T.F. and Minshall, T.H.W. (2011), *Incubation for Growth: A Review of the Impact of Business Incubation on New Ventures with High Growth Potential*, Nesta report.

Hackett, S.M. and Dilts, D.M. (2004), "A systematic review of business incubation research", *The Journal of Technology Transfer*, Vol. 29 No. 1, pp. 55-82.

Rothaermel, F.T. and Thursby, M. (2005), "Incubator firm failure or graduation? The role of university linkages", *Research Policy*, Vol. 34, pp. 1076-1090.

Teo, T.S. and Ranganathan, C. (2004), "Adopters and non-adopters of business-to-business electronic commerce in Singapore", *Information and Management*, Vol. 42 No. 1, pp. 89-102.

UKBI, United Kingdom Business Incubation (2009), *UK Incubators – Identifying Best Practice*, Business Incubation Limited, Birmingham.

Corresponding author
Isidre March-Chordà can be contacted at: isidre.march@uv.es