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STARTUP ACCELERATORS: RESEARCH DIRECTIONS AND GAPS

Introduction

Startup accelerators are a relatively new, but rapidly growing phenomenon [Cohen et al., 2019; Ismail, 2020]. Acceleration programs are also known as business accelerators, startup accelerators, and seed accelerators. The accelerators are programs of a specific duration (usually 3 to 6 months) that are designed to support the growth of startups [Cohen, Hochberg, 2014]. The assistance involves the financial support, a collaboration platform, and facilitation of contacts with the mentors [Cohen et al., 2014]. Startup accelerators originated as a form of incubator focused on supporting more mature entities [Mian, Lamine, Fayolle, 2016] and are considered to be the new generation of incubation [Cohen et al., 2019].

In recent years, interest in the topic of startup acceleration has grown [Pauwels, Clarysse, Wright, Van Hove, 2016]. A significant number of publications discuss the accelerators' underlying principles, their role and their impact on the startup ecosystem. Table 1 presents the summary of topics covered by the authors studying the startup acceleration phenomenon.

The analysis shows that most of the articles are empirically oriented. However, the empirical evidence published to date has not been comprehensively summarized and systematized. Therefore, this research aims to systematize startup acceleration knowledge. The goal will be attained through 1) analysis of the current state of the

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art concerning on startup accelerators, 2) mapping and synthesis of current research efforts, and 3) identification of gaps and opportunities for further research.

Table 1. Topics raised in the publications concerning startup acceleration

Number	Paper	Description of the Content
1	Boni, Gunn, 2021; Brown, Mawson, Lee, Peterson, 2019; Cánovas-Saiz, March-Chordà, Yagüe-Perales, 2018; Cánovas-Saiz, March-Chordà, Yagüe-Perales, 2020; Cohen, Hochberg, 2014; Crișan, Salanță, Beleiu, Bordean, Bunduchi, 2021; Garcia, Castillo, Nicholls, 2019; Gür, 2021; Gutmann, Kanbach, Seltman, 2019; Haines, 2014; Hochberg, 2016; Ismail, 2020; Jackson, Richter, 2017; Jung, 2018; Kohlert, 2019; Onetti, 2021; Pielken, Kanbach, 2020; Tripathi, Oivo, 2020; Urbaniec, Żur, 2021 Zarei, Rasti-Barzoki, Moon, 2022	Operations and essence of startups, startup accelerators and open innovations
2	Jung, 2018; Shankar, Shepherd, 2019; Urbaniec, Żur, 2021	Reasons for setting up accelerators
3	Butz, Mrożewski, 2021; Carvalho, GRilo, Pina, Zutshi, 2017; Cohen, Hochberg, 2014; Garcia et al., 2019; Gutmann, 2019; Jackson, Richter, 2017; Kanbach, Stubner, 2016; Kurpjuweit, Wagner, 2020; Kwiatkowska, Gębczyńska, 2019; Moschner, 2019; Fink, Kurpjuweit, Wagner, Herstatt, 2019; Pielken, Kanbach, 2020; Tripathi, Oivo, 2020; Yang et al., 2018	The difference between accelerators, startups and open innovations
4	Azinheiro, Zutshi, Grilo, Pina, 2017; Cohen et al., 2019; Connolly et al., 2018; Garcia-Herrera, Perkmann, Childs, 2018; Gutmann, Maas, Kanbach, Stubner, 2020; Heinzelmann, Selig, Baltes, 2020; Hutter, Gfrerer, Lindner, 2021; Ismail, 2020; Järvi, Mäkilä, Hyrynsalmi, 2013; Kanbach, Stubner, 2016; Kupp, Marval, Borchers, 2017; Mahmoud-Jouini, Duvert, Esquirol, 2018; Prexl, Hubert, Beck, Heiden, Prügl, 2019; Richter, Richter, Schildhauer, 2018; Ruseva, Ruskov, 2015; Shankar, Shepherd, 2019	A framework for designing, launching and running accelerators, startups
5	Cánovas-Saiz et al., 2020; Cohen et al., 2019; Yang, Kher, Lyons, 2018	Methods for measuring the effectiveness of acceleration programs
6	Butz, Mrożewski, 2021; Cánovas-Saiz et al., 2020; Garrido, Lema, Duréndez, 2020; Heinz, Stephan, Gilling, 2017; Kim, Wagman, 2014; Poandl, 2019; Yin, Luo, 2018	Analyze the process of evaluating and picking up start-ups and what is expected of them
7	Ainamo, Pikas, Mikkelä, 2021; Carmel, Káganer, 2014; Cwik, Kozlov, French, Shapiro, Sewall, 2020; Fernandes, Castela, 2019; Glinik, 2019; Hilton, 2012; Ivashchenko, Bodrov, Tolstoba, 2016; Komarek, Knight, Kotys-Schwartz, 2016; Kunes, 2019	A study on the operation of accelerators and/or startups
8	Bustamante, 2019; Cánovas-Saiz et al., 2020; Haines, 2014; Jackson, Richter, 2017; Kuebart, Ibert, 2019; Sota, Farelo, 2017	Examining of the impact of an accelerators' and/or startup's background on its performance
9	Haines, 2014; Jackson, Richter, 2017; Mansoori, Karlsson, Lundqvist, 2019; Ramiel, 2021; Sota, Farelo, 2017; Wójcik, Obłój, Wąsowska,Wierciński, 2020	Ethnographic research and its derivatives
10	Hilliger, Miranda, Pérez-Sanagustín, De la vega, 2017; Leatherbee, Katila, 2020; Poandl, 2019; Ramiel, 2021; Seet, Jones, Oppelaar, Corral de Zubielqui, 2018	On education science and entrepreneurship teaching

Number	Paper	Description of the Content
11	Azinheiro et al., 2017; Boni, Gunn, 2021; Kuebart, Ibert, 2019; Poandl, 2019; Wallin, Fuglsang, 2017	Digitization links
12	Haines, 2014; Harris, Wonglimpiyarat, 2019; Seo, Hwangbo, Ha, 2014; Shenkoya, 2021	Regions with low popularity of accelerators and/or startups
13	Butz, Mrożewski, 2021; Connolly, Turner, Potocki, 2018; Harris, Wonglimpiyarat, 2019; Shenkoya, 2021	Links to sustainable development
14	Fernandes, Castela, 2019; Gutmann et al., 2019	Links to Industry 4.0
15	Charoontham, Amornpetchkul, 2021; Kim, Wagman, 2014	Information management by accelerators and startups

Source: own analyses based on data extracted from the Scopus database.

This paper presents a comprehensive, systematic review of the startup literature. This is an in-depth review because the authors:

- used dynamic systematic analysis of the literature network to systematize the existing knowledge on the topic under study,
- presented a literature analysis using systematic review, bibliographic literature review networks, and burst detection,
- contributed to the current scientific literature by using Citation Network Analysis (CNA), Global Citation Score (GCS), and author keyword analysis supplemented by the Burst Detection analysis to cluster the knowledge base on startup accelerators into thematic clusters.

The paper proceeds as follows. It starts with an introduction, followed by the methodological part with detailed description of the defined research goal, and the description of research methods and software used. Then the selection process of the publications for analysis is described along with the data analysis. The paper is summarized with a discussion and conclusions, including research limitations.

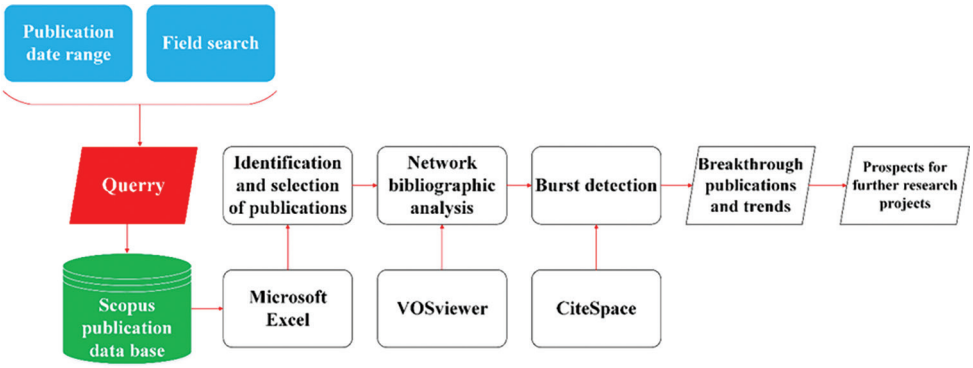
1. Methodology/Research methods

The research aims to systematize startup acceleration knowledge. In response to the set ultimate goal, two general and three specific research questions were posed:
Q1: What is the current state of knowledge in the field of startup acceleration?
Q2: What are the major areas of research based on the input dataset?

- How do these major areas interconnect, and through which specific articles?
- Which areas are the most active?
- What characterizes each area? Where can one find the seminal papers for each area?

Have there been significant shifts in the evolution of this field? Where can the pivotal moments or 'turning points' be identified? In order to answer the above questions, the Systematic Literature Network Analysis (SLNA) methodology was used. A diagram with the research procedure is shown in Figure 1.

Figure 1. Adopted research methodology



Source: own elaboration.

Publications for this analysis were extracted from the Scopus scientific database. The Scopus database contains over 75 million publications, including articles, scientific journals and books. The database includes high quality publications, is widely acknowledged in the scientific community, and thus remains one of the most widely used databases by both theoreticians and practitioners. It has been maintained by Elsevier B.V. publishing house since 2014, and its collections cover records from 1970 to the present day. It thus provides a comprehensive overview of research results in scientific fields such as medicine, social sciences, technology, etc. The documents indexed in the database undergo to a two-phase evaluation process:

- verification of compliance with the minimum requirements;
- expert evaluation by the Content Selection and Advisory Board [*Scopus content selection and advisory*, n.d.].

The Scopus database search tools allow users to track changes in searched results, conduct bibliometric analysis, and visualize the acquired data [*How Scopus works: Information about Scopus product features*, n.d.; *Scopus – Content coverage guide*, 2020; *Scopus – Global research fact sheet 2019*, n.d.].

The research is based on the SLNA analysis, which involves two components: (1) Systematic Literature Review (SLR) and (2) Bibliographic Network Analysis. SLR, being the first phase, identifies, assesses, and summarizes the state-of-the-art on a specific topic in selected publications. In this paper, the systematic review enabled

to define the scope of the study and thus develop the research problem. In addition, it allowed to outline the answer to the first research question. These analyses were performed using Microsoft Excel software. The second step, Bibliographic Network Analysis and visualization, enabled verification of the SLR results and identification and characterization of the development of significant and emerging trends in startup accelerators research using network analyses, including Citation Network Analysis (CNA) and Keyword Co-occurrence Analysis [Ejsmont, Gladysz, Kluczek, 2020; Mengist, Soromessa, Legase, 2020]. The Bibliographic Network Analyses were performed with the following software packages: VOSviewer and Citespace.

The VOSviewer software proved particularly useful for displaying large bibliographic maps, as it allowed for comprehensive interpretation, offering an option of showing the maps in different ways and highlighting a different aspect each time. The creation of co-occurrence networks the software allowed in turn to select the analysis (for example, citations) and its unit (for example, keywords), the type of count (for example, full), and to provide threshold values (for example, citations, keywords).

The Citespace application was used to analyze and create visualizations of co-citation networks. CiteSpace is an information visualization software designed by Chen C.M. [Wei et al., 2020; Chen, 2014]. Using the application involves multiple processes: data activation, data processing, parameter selection, visualization and interpretation. The software supports multiple data sources, including Web of Science (WoS), Scopus and Derwent, and other multi-scale databases. Citespace allows for the selection of features (time zone, citation threshold, and node) that drive the ordering of the analyzed data. While Citespace offers different visualization methods, the application defaults to a cluster view [Wang, Lu, 2020]. This software was applied to citation visualization to analyze the knowledge contained in the scientific literature on startup accelerators [Wang, Lu, 2020]. The analysis helped identify the structure and dynamics of this knowledge domain, describe the main research areas and their links, characterize these areas in detail, and identify critical transformations and turning points [Chen, 2014].

2. Selection of publications for analysis

2.1. Search strategy

According to the adopted methodology, the first step of the analysis was the exploration of the Scopus database in search of publications relevant to the purpose of the study. The starting point was establishing the strict search criteria, that is the formula and timeline of publications. Due to the low expected number of results and the purpose of the study, restrictive conditions were imposed only on the first

criterion. The query formula had to cover the leading phrases that appear in the field of startup acceleration and focus only on the defining parts (fields) of the indexed publications, that is titles, abstracts, and keywords. All existing synonyms and spelling variants of these phrases [*Startup accelerator*, n.d.; *Corporate accelerator*, n. d.] and their possible declension variants should have been considered in the same manner. Given the above the following command was entered according to the formula language effective in the database, forming a system of field codes, operators and wildcards [*How do I search for a document?*, n.d.; *How can I best use the advanced search?*, n.d.]:

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TITLE-ABS-KEY (("startup*" OR "start-up*" OR "startup compan*" OR "start-up compan*") AND ("start-up* accelerator*" OR "startup* accelerator*" OR "seed accelerator*" OR "corporate accelerator*"))
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2.2. Selected and rejected publications

As a result, 81 publications were screened for their relevance to the study. This screening encompassed both the titles and abstracts of publications.

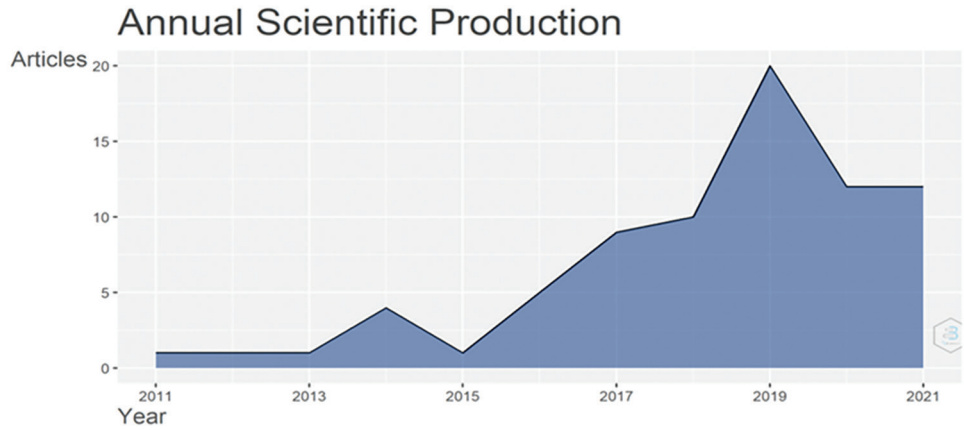
Based on the procedure mentioned, 5 publications were excluded from further analysis. Two of these publications used the startup accelerator environment merely as a case study within the framework of an ethnographic analysis of dynamic employee communities. Their primary focus was on aspects of interpersonal relationships in organizations and the drivers of work activities [Katila, Kuismin, Valtonen, 2020; Krishnan et al., 2021]. The third publication that was excluded discussed electrical engineering, and the term "startup accelerator" was used in its literal sense [Liu et al., 2012]. The fourth paper dealt with new organizational arrangements at Airbus, inspired in part by practices known from corporate accelerators. However, the paper itself did not strictly adhere to the central topictopic [Coste, Gatzke, 2017]. The last rejected was discovered to be a duplicate, with minor differences in some fields. Only after comparing their full texts was it confirmed that they were identical [Hilton, 2012].

2.3. General analysis

The research covered the period of 2011–2021 and encompasses 76 publications. Figure 2 illustrates the number of papers published per year in the analyzed area. A continuous increase in the number of publications on startups is evident in the study period until 2019, with a small decline in 2015. In the following years, interest in startup topics declined. The shrinking interest is likely influenced by the COVID-19 pandemic that broke out in late 2019. However, it should be noted that the number of publications from the first half of 2021 is the same as the number of papers published

in 2020. From the trends shown, it appears that interest in the topic is likely to increase in the years to come.

Figure 2. Number of publications per year for the period 2011–2021



Source: Scopus.

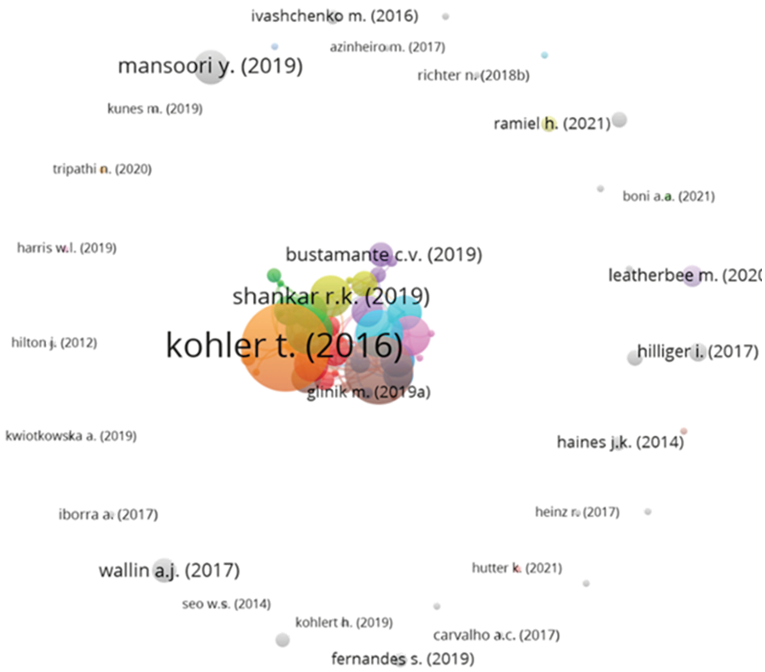
There is a wide variety of journals publishing papers on corporate accelerators, with no clear leader emerging. While many authors address the topic of startup accelerators – and the Scopus database lists 159 such authors – their publication records on this topic are not extensive in terms of numbers. To date, D.K. Kanbach [Gutmann et al., 2019; Gutmann et al., 2020; Kanbach, Stubner, 2016; Gutmann et al., 2020] has the highest number of publications on startup accelerators, with four. T. Gutmann, P. Jackson, and N. Richter have each contributed to three publications. M. Glinik, Grilo A., H, Y.V. Hochberg, S. Kurpjuweits, I. March-Chorda, T. Schildhauert, S. Stubner, M. Wagner, R.M. Yague-Perales, and A. Zutshi have all published two papers each. All other authors have published just one paper each.

3. Results

3.1. Citation Network Analysis

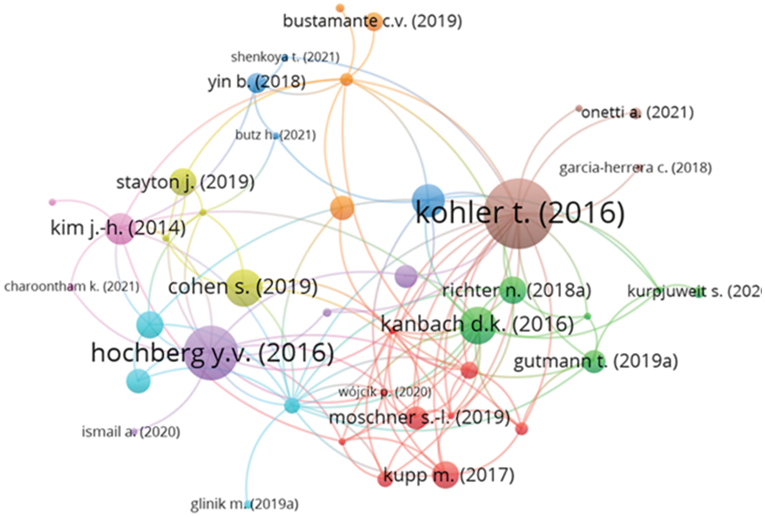
Figure 3 shows the Document Citation Network, which allowed us to identify the publications with the highest number of citations in the overall generated network. The number of citations in the Scopus database is presented by the size of the circle symbolizing a given publication.

Figure 3. Citation Network



Source: own analyses based on data extracted from the Scopus database using VOS Viewer software.

Figure 4. Citation Network – the largest set of linked items



Source: own elaboration based on data from the Scopus database using VOS Viewer software.

The network shown in Figure 3 consists of 76 nodes and 122 links. The network is made up of 43 clusters, with the largest set of linked items containing 42 documents. This set is visible in the central part of the network and we can distinguish 9 clusters in it. Due to the fact that much more information can be obtained from larger clusters, the set with the largest number of linked items, which is shown in Figure 4, will be further analyzed.

Table 2 below shows the breakdown into clusters of the largest set of linked items highlighted in Figure 4.

Table 2. Publications occurring in the largest set divided into clusters

Cluster	Publication	Source Title	Citations	Total link strength
1	Connolly et al., 2018	International Food and Agribusiness Management Review	6	5
	Gutmann et al., 2019	Problems and Perspectives in Management	13	6
	Gür, 2021	FGF Studies in Small Business and Entrepreneurship	0	9
	Kupp et al., 2017	Journal of Business Strategy	18	7
	Mahmoud-Jouini et al., 2018	Research Technology Management	7	8
	Moschner et al., 2019	Business Horizons	13	6
	Pielken, Kanbach, 2020	Journal of Applied Business Research	0	14
	Urbaniec, Żur, 2021	International Entrepreneurship and Management Journal	1	7
	Wójcik et al., 2020	Journal of Organizational Change Management	0	8
2	Gutmann, 2019	Management Review Quarterly	4	7
	Gutmann et al., 2020	International Journal of Entrepreneurship and Innovation Management	1	4
	Heinzelmann et al., 2020	Proceedings – 2020 IEEE International Conference on Engineering, Technology and Innovation, ICE/ITMC 2020	0	5
	Kanbach, Stubner, 2016	Journal of Applied Business Research	33	13
	Kurpjuweit, Wagner, 2020	California Management Review	3	1
	Richter et al., 2018	Creativity and Innovation Management	18	7
3	Butz, Mrożewski, 2021	Sustainability (Switzerland)	0	3
	Shankar, Shepherd, 2019	Journal of Business Venturing	25	7
	Shenkoya, 2021	African Journal of Science, Technology, Innovation and Development	0	2
	Yin, Luo, 2018	IEEE Transactions on Engineering Management	10	4

cont. Table 2

Cluster	Publication	Source Title	Citations	Total link strength
4	Cánovas-Saiz, March-Chordà, Yagüe-Perales, 2021	Entrepreneurship and Regional Development	1	6
	Cohen et al., 2019	Research Policy	32	5
	Cánovas-Saiz et al., 2020	European Journal of Management and Business Economics	1	4
	Stayton, Mangematin, 2019	Journal of Technology Transfer	18	4
5	Hochberg, 2016	Innovation Policy and the Economy	68	15
	Ismail, 2020	Entrepreneurship Research Journal	1	1
	Prexl et al., 2019	R and D Management	2	3
	Yang et al., 2018	Entrepreneurship Research Journal	13	3
6	Brown et al., 2019	European Planning Studies	17	6
	Crisan et al., 2021	Journal of Technology Transfer	6	16
	Glinik, 2019	International Journal of Engineering Pedagogy	2	1
	Seet et al., 2018	Asia Pacific Business Review	14	3
7	Bustamante, 2019	Journal of Business Research	9	1
	Carmel, Káganer, 2014	Journal of Business Economics	2	1
	Garcia et al., 2019	International Journal of Intellectual Property Management	4	10
	Jackson, Richter, 2017	International Journal of Innovation Management	15	3
8	Richter et al., 2018	Proceedings of International Design Conference, DESIGN	1	1
	Jung, 2018	FGF Studies in Small Business and Entrepreneurship	0	1
	Kohler, 2016	Business Horizons	0	0
	Onetti, 2021	Journal of Business Strategy	3	1
9	Charoontham, Amornpetchkul, 2021	Economics of Innovation and New Technology	0	2
	Kim, Wagman, 2014	Journal of Corporate Finance	24	10
	Garrido et al., 2020	International Journal of Entrepreneurship and Innovation Management	1	1

Source: own analyses based on data extracted from the Scopus database.

The papers with the highest number of citations were analyzed to define the key re-search topics for the clusters. Due to the fact that authors also cite papers in their publications that are not directly related to the main topic of the article they are discussing, it is not necessary that the main topic of all publications is strongly related to the main topic of a particular cluster.

The CNA method showed that research on the startup acceleration is multidisciplinary and fragmented. As a result of the CNA, the nine most prominent clusters were identified.

Cluster 1 focuses on topics related to the study of the corporate accelerators' operation. Connolly et al. [2018] address corporate accelerators and their impact on the startup ecosystem, primarily in industries such as food, ag-tech, and agribusiness. The authors present recommendations that should be taken into account when planning an accelerator. Gutmann et al. [2019] focus on presenting the benefits and insights of cooperation between startups and accelerators on the example of SAP Industry 4.0 Startup Program. Gür [2021] presents a literature review that draws conclusions about how technology collaborates with corporate accelerators. To validate the conclusions, the author created a model based on the concept of absorptive capacity and analyzed data from a number of case studies. Kupp et al. [2017] conducted a case study of a corporation's accelerator program, examining the company's multi-year experience in managing its operations and the impact of its activities on the supported start-ups. In the article, the authors proposed the five most critical elements for the success of accelerator programs. Mahmoud-Jouini et al. [2018] also presented a case study of a corporate accelerator, focusing on a global company. Their study results highlighted two key factors for building a successful capability: a differentiated value proposition for the entities participating in the accelerator program and ensuring an appropriate relationship management process between the participants.

The main topic raised in [Moschner et al., 2019] is an overview of different types of corporate accelerators, listing their characteristics and features. The article aims at categorize the programs and suggests how a company can choose the right type of accelerator. Pielken & Kanbach [2020] identify corporate accelerators set up by the German family-run companies as a distinct type, due to the specificity of how these companies operate. Urbaniec & Żur [2021] examine issues related to the corporations working with startups and identify the advantages and barriers of this business model type. Wójcik et al. [2020] explore corporate accelerators in terms of emotional dynamics from a systems psychodynamics perspective. The study considers the viewpoints of both corporations and startups. This approach allows the authors to gain a deeper understanding of the relationship between the two entities and offers insights on how to manage accelerators more effectively to boost innovation.

Cluster 2 addresses the key concepts related to corporate accelerators. Guttman [2019] presents a systematization of the multiple forms of corporate venturing including accelerators, incubators, and venture capital. The article offers an ordering of the literature, an analysis of the measures of categorization of these forms, and a unification and normalization of their framework based on the criterion of innovation flow. The challenge of providing adequate resources to startups by corporate accelerators is also addressed in other publications by the same author [Guttmann et al., 2020]. Heinzelmann et al. [2020] explore the impact of preparatory activities for entrepreneurship programs (CE) on the efficiency and effectiveness when multiple programs are applied concurrently. Kanbach & Stubner [2016] provide

an empirical analysis of several corporate accelerator programs. The authors of this paper focused on discussing and classifying concepts related to this accelerator type. Kurpjuweit & Wagner [2020] describe the model of cooperation with startups used in practice and discuss empirical data of enterprises where the implementation of such programs has been successful. This paper highlights the fundamental components of accelerator programs and outlines how to implement them successfully. An empirical explanation of the genesis of the characteristics of corporate accelerator programs (strategy, resources, role and structure) is presented by Richter et al. [2018].

Cluster 3 deals with corporate acceleration processes. Butz & Mrożewski [2021] address issues related to the operation of corporate accelerators in line with sustainable development. The paper primarily highlights the startup selection process and the evaluation criteria used. The authors mainly focus on various practices known from commercial programs. A study of how and why corporations design and run such programs was carried out by Shankar & Shepherd [2019]. This paper presents inductive models of corporate acceleration processes, where the components of basic corporate acceleration processes are outlined, and the results of the two acceleration paths (ecosystems or maintenance of innovation) are explained. Shenkoya [2021] delves into the factors that influence accelerators' performance. The paper develops and analyses the theory of 'sustainable startup growth'. The findings confirmed that the quality of the services offered is more important than the number of accelerated startups. Yin & Luo [2018] addressed the topic of the startup selection by top accelerators to improve the decision-making processes of accelerator managers.

Cluster 4 deals with evaluation of seed accelerators. Cánovas-Saiz et al. [2021] present an empirical evaluation of the performance of seed accelerators and the prospects of the companies they support. Cohen et al. [2019] analyzed the relationship between design, operation, and accelerator performance. Cánovas-Saiz et al. [2020] focus on an empirical assessment of the performance and prospects of organizations, based on a survey of over 100 seed accelerators. Meanwhile, Stayton & Mangematin [2019] concentrated on an analysis of mechanisms to reduce the time required for startup development.

Cluster 5 deals with structuring the operation and role of startups in the entrepreneurship ecosystem. Hochberg [2016] presents the operation of startup accelerators focused on studying their role and impact on regional entrepreneurship. Cohen & Hochberg [2016] developed a framework and iterative process for designing accelerator programs. It includes the development of a model that considers the processes involved in an accelerator program (design, monitoring and adaptation), which takes into account internal and external factors. Prexl et al. [2019] identified the heterogeneity of accelerators (considering the differences that occur in the selection, graduation and business support process) and structured the heterogeneity (dividing it into five types of accelerators). Yang et al. [2018] focuses on the positioning of

startup accelerators in the entrepreneurial ecosystem (as an extension of the incubation process). The paper also illustrates how accelerators support company growth.

Cluster 6 is a cross-over cluster that addresses the topics of academic acceleration, transnational entrepreneurship, and acceleration and social capital in startup accelerators. Brown et al. [2019] provide an analysis of the role of accelerator programs in promoting transnational entrepreneurship. Crișan et al. [2021] present a review of existing studies on accelerators. The paper presents methodological and theoretical gaps in past research and identifies ways for future investigations. Glinik [2019] describes good practices of academic acceleration, drawing from an analysis of a case study of program development (evolving from a course for students to a professional startup accelerator). Seet et al. [2018] delve into the topic of strengthening human capital with social capital in startup accelerators. This paper analyses the impact of social capital, and examines the relationship between "know-how", "know-who", and "know-what".

Cluster 7 addressees the issue of collaboration and sourcing. Bustamante [2019] discusses the importance of contracting skills and institutional distance in developing insourcing and outsourcing concepts for startups. Carmel & Káganer [2014] present a case study of a crowdsourcing company's collaboration with startup accelerators. The state of research on startup accelerators up to 2019 is presented by Garcia et al. [2019]. Jackson & Richter [2017] present the causes of disruption between corporate accelerator and startups.

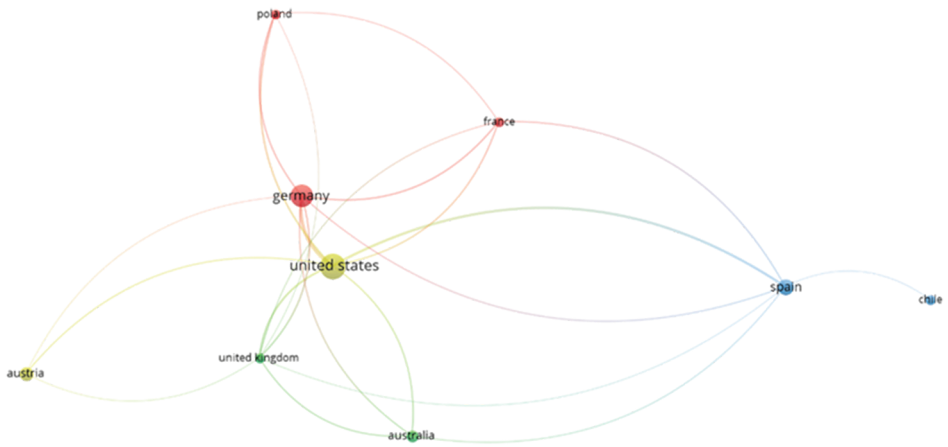
Cluster 8 addresses the topic of collaboration between corporations and startups, as well as the patterns used for joint projects. Garcia-Herrera et al. [2018] focus on presenting a framework that is useful when designing startup accelerators dedicated to the industrial sector. Jung [2018] covers the topic of innovation development – startups and problems (occurring in many companies) related to the area of innovation, corporate culture and organization. Onetti [2021] presented a review of good practices used in the collaboration of corporations and startups and Open Innovation, and identified barriers, trends and good practices occurring in these collaborations. The results of a survey of corporate accelerators, which aimed to identify universal patterns for shaping such ventures, are presented by Kohler [2016]. The aim of the study was to identify an effective acceleration strategy and conditions that facilitate the cooperation of startups with corporations. The analysis identified frameworks and strategies for designing corporate accelerators.

Cluster 9 focuses on examining the factors influencing the selection of ventures by accelerators. Charoontham & Amornpetchkul [2021] addressed the impact of an accelerator's reputation on its performance and information policy (informing investors about the quality and fairness of startup reviews). The paper identified factors affecting the fairness of venture evaluation. The information management policy and the selection of startups by accelerators are analyzed by Kim and Wagman [2014]. The paper includes a study of the role of the accelerator, which focuses on the aspect of

disclosure of information about companies according to their position. The authors also identify the factors that motivate venture completion. While Garrido et al. [2020] discusses the criteria for project selection by accelerators. The publication fills a gap in the subject of the study of variables affecting the evaluation of projects (degree of innovation, speed of acceleration, degree of team cohesion and degree of investability).

The analysis of the citation network according to country of origin allows to identify the countries with the highest number of citations in the overall generated network. In order to show clear clusters of citation by country, restrictions were imposed on the minimum number of papers per country (minimum 3 papers). The network presented consists of 11 nodes and 22 links. The network is composed of 6 clusters, with the largest set of linked items containing 9 documents and we can distinguish 4 clusters within it. As we can obtain much more information from larger clusters, the set with the largest number of linked items was further analyzed. The number of links for the largest set of linked items is 22, while the total strength of links for the largest set of linked items is 118.

Figure 5. Analysis of citations by country



Source: own analyses based on data extracted from Scopus database using VOS Viewer software.

The Top11 most influential countries on the startup accelerator theme (Table 3), ranked by total link strength.

The analysis of citations by country identified the 11 most research-relevant countries whose authors have made significant contributions to the body of research on the topic of startup accelerators. The unrivalled leader in this respect is the United States. Additionally, the Global Startup Ecosystem Report 2020 shows that the majority of these ventures are created in Silicon Valley, New York, London, Los Angeles, Seattle,

Beijing, Boston, Paris, and 17 percent hailing from Europe [Sturtup Genome, 2021]. The citation analysis reveals that the United States leads with 327 citations and a total link strength of 75. Germany takes the runner-up position with 122 citations and a total link strength of 53, while Spain occupies third place with 10 citations and a total link strength of 26.

Table 3. Top 11 most influential countries for startup accelerators' theme

Number	Country	Documents	Citations	Total link strength
1	United States	19	327	75
2	Germany	15	122	53
3	Spain	8	10	26
4	United Kingdom	3	24	25
5	France	3	43	19
6	Poland	3	1	16
7	Australia	4	48	15
8	Austria	6	4	6
9	Chile	3	21	1
10	Finland	4	13	0
11	Portugal	3	4	0

Source: own analyses based on data extracted from Scopus database using VOS Viewer software.

3.2. Global citation score analysis

The Global Citation Score (GCS) is an indicator of the total number of citations a publication receives in the overall database. Analyzing this score helps identify the most relevant publications. Articles with a high GCS value are generally considered to be key papers in the field or to have had a significant impact on the development of research in that area. However, it is worth noting that a high index does not necessarily indicate the paper made a groundbreaking scientific contribution to the field. To provide a more nuanced perspective, a standardized GCS was calculated. The index evaluates publications based on their "lifespan", which allows for a more comprehensive analysis as it it considers the during which the publication has been in circulation.

The value of the standardized GCS was calculated in two ways: (1) the ratio of the GCS value in 2020 to the total number of years since the article was published [Strozzi et al., 2017], (2) the ratio of the summed citations in the Scopus database up to 2020 to the total number of years since the document was published [Khitous et al., 2020].

In addition, GCS was compared with CiteScore values. The CiteScore is used to determine the average citability of a document and is the value of the average number

of citations in a given year. The CiteScore is calculated as the sum of citations of a given publication in a database (for example, Scopus) in a given year divided by the number of documents indexed in the previous three years. Table 4 shows the 12 publications that were cited most frequently. The papers were ranked according to the diminishing value of the standardized GCS.

Table 4. Publications occurring in the largest set divided into clusters

Rank	Publication	GCS	Appear in the Nine Biggest Citation Clusters	GCS in 2020/ years Since Publication	Cumulative GCS up to 2020/years Since Publication	CiteScore 2020
1	Kohler, 2016	112	Yes	7.2	14	11.3
4	Cohen et al., 2019	32	Yes	6	0	11.4
5	Shankar, Shepherd, 2019	25	Yes	6	4	13.3
7	Stayton, Mangematin, 2019	18	Yes	3	0	5.2
2	Hochberg, 2016	68	Yes	2.8	8.25	5.1
8	Mansoori et al., 2019	18	No	2.5	1	8.8
11	Brown et al., 2011	17	Yes	2	4	11.3
9	Richter et al., 2018	18	Yes	1.7	2.5	1.9
10	Kupp et al., 2017	18	Yes	1.5	2	10.4
12	Jackson, Richter, 2017	15	Yes	1	1.6	5.1
6	Kim, Wagman, 2014	24	Yes	0.9	2.6	4.9
3	Shankar, Shepherd, 2019	33	Yes	-	-	0.9

Source: own analyses based on data extracted from the Scopus database using the VOS Viewer software.

Analyzing the summary in Table 4, it can be seen that 11 out of 12 publications belong to the nine largest clusters identified during the citation co-occurrence analysis.

Kohler [2016] is ranked first in the ranking. This may indicate a ground-breaking publication that has significantly influenced subsequent research on startup accelerators. The aim of the study was to isolate universal patterns of venture formation by identifying factors that support corporations' collaboration with startups and developing an effective strategy. Special attention should be paid to articles by Cohen et al. [2019] and Shankar and Shepherd [2019]. Cohen et al. [2019] present the results of a study of the links between performance and projects that have completed accelerator programs. Moreover, it consolidates various research on the topic and deepens the understanding of startup accelerators. In contrast, Shankar and Shepherd [2019] address the topic of corporate accelerators. The authors focus on the issues of how corporations design and operate their programs. The research presents the fundamental processes of acceleration and shows how corporations engage in innovative ventures to increase their own entrepreneurship. The aforementioned articles [Cohen

et al., 2019; Kohler, 2016; Shankar, Shepherd, 2019] also obtained the highest values of CiteScore for 2020, indicating their significant contribution to the development of startup acceleration research.

Only one of the ranked publications (Table 4) was not assigned to the largest clusters during the citation co-occurrence analysis. Mansoori et al. [2019] address the harmonization of the role of coaches/mentors in accelerators with lean startup methodology. The publication presents a study that analyses the interdependencies of entrepreneur and coach occurring in a university accelerator. Other papers are described in the analysis. The papers focus on discussing the basic concepts associated with a corporate accelerator [Kanbach, Stubner, 2016] and issues such as the role, strategy, resources and structure of accelerators [Richter et al., 2018], the role of accelerator programs in developing entrepreneurship [Brown et al., 2019; Hochberg, 2016].

Table 4 also includes publications that present research aimed at: identifying the causes of disruptions in the collaboration between accelerators and startup managers [Jackson, Richter, 2017], investigating startup launch times and the mechanisms that slow them down [Stayton, Mangematin, 2019], analyzing the selection of startups by accelerators [Kim, Wagman, 2014].

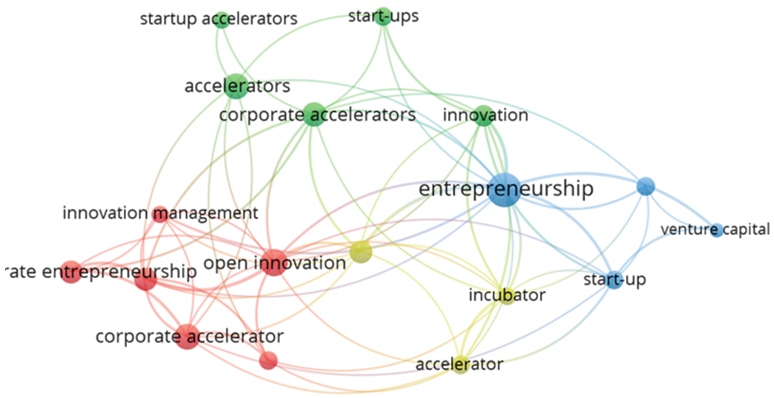
3.3. Co-occurrence network of authors' keywords

Because the CNA analysis does not include publications that are not associated with any citation, the study is not comprehensive. Relevant papers such as recently published studies might be are omitted. To complement the CNA analysis, an analysis of the authors' keywords was performed.The foundation of the analysis is the assumption that the keywords of the publications adequately reflect the topic or are closely links to the problem under study [Callon, Courtial, LaVille, 1991]. When the "co-occurrence" of keywords is low, it is assumed that there is no close connection or much relevance in the context of the articles being studied [Law, Whittaker, 1992]. For the analysis of the authors' keywords, a co-word (co-occurrence) network was constructed. The network consists of nodes that group into clusters (each color represents one cluster). The nodes represent individual authors' keywords, while the link weights indicate the frequency of occurrence of a given word in the articles.

The study consists of three phases: data collection, standardization, and data mapping [Ding, Chowdhury, Foo, 2001]. In the first step, 216 keywords were identified and selected based on the analysis of abstracts in the Scopus database. The next step was to organize the data. Given that related concepts can be represented by different expressions and words, synonyms should be combined, differences in notation should be verified and abbreviations should be linked to full terms. A map is then generated based on the standardized data. In order to display clear clusters of citations by author, restrictions were imposed regarding the minimum number of co-occurrences

of authors' keywords (the threshold for occurrence is 3).The network generated by VOSviewer (Figure 6) consists of 18 nodes that were grouped into four non-overlapping clusters (each keyword belongs to only one cluster). There are 67 links in the network for elements that satisfied the constraints. The strength of the links is 106. This value indicates the number of documents in which the co-occurrence of keywords was observed.

Figure 6. Co-occurrence network of authors' keywords



Source: own analyses based on data extracted from Scopus database using VOS Viewer software.

A breakdown of the keywords from Figure 6 is presented below in Table 5. The table provides details of the clusters and their associated keywords. The network comprises four clusters, each describing a distinct research topic. The authors' keywords are arranged in descending order based on their co-occurrence value.

Cluster 1 concerns the interaction of corporations with startups. A systematization of the state of knowledge about accelerators, along with identification of trends and gaps in the literature, is described by Garcia et al. [2019]. The cluster composes papers that describe series of case studies corporate accelerators [Azinheiro et al., 2017; Kupp et al., 2017; Mahmoud-Jouini et al., 2018]. Kurpjuweit and Wagner [2020] present a model of collaboration between corporations and startups that is put into practice. Mosnacher et al. [2019] provide an overview of different types of corporate accelerators, along with their features and characteristics. Gutmann [2019] systematizes forms of corporate venturing. Onetti [2021] presents a review of good practices used in cooperation between corporations and startups, as well as open innovation. Gutmann et al. [2020] tackle the challenge of ensuring startups receive adequate resources from corporate accelerators. Heinzelmann et al. [2020] discuss the impact of using preparatory activities for parallel implementation of multiple entrepreneurship

programs on their efficiency and effectiveness. Shankar and Shepherd [2019] focus on examining how and why corporations design and run accelerators. Urbaniec and Żur [2021] contribute to this discussion by highlighting the factors that motivate corporations to work with startups, along with the advantages and barriers of such cooperation. Shenkoya [2021] focuses on identifying factors affecting the performance of accelerators. Garcia-Herrera et al. [2018] offer a valuable framework and industry guidelines for designing startup accelerators. Lastly, Gutmann et al. [2019] enumerate the benefits and insights of cooperatives regarding the utilization of accelerators. Hutter et al. [2021] aim to increase the knowledge of the barriers present in the different stages of accelerator programs. Ruseva and Ruskov [2015] developed a business model that is based on a discovery-driven approach. The model was designed with young technology startups in mind. Kohlert [2019] presents assumptions that, if met, lead to the successful use of incubators and accelerators in a technical context. Tripathi and Oivo [2020] present types of accelerators, incubators, mentoring co-working spaces, venture capital funds and discuss similarities, differences, and types of ventures that the entities focus on.

Table 5. Research topics in clusters based on authors' keywords

Cluster	Authors' keywords	Occurrences	Total link strength
1	Open innovation	10	20
	Corporate accelerator	9	13
	Corporate entrepreneurship	7	10
	Corporate venturing	7	17
	Startup	5	9
	Innovation management	4	7
2	Accelerators	9	7
	Corporate accelerators	8	15
	Innovation	6	15
	Start-ups	5	5
	Startup accelerators	4	2
3	Entrepreneurship	15	28
	Start-up	5	13
	Start-up accelerator	5	6
	Venture capital	3	6
4	Startups	7	14
	Accelerator	5	12
	Incubator	4	13

Source: own analyses based on data extracted from the Scopus database.

Cluster 2 raises issues related to the analysis of the performance of startups and accelerators. Crișan et al. [2021] and Garcia et al. [2019] provide an overview of existing scientific research on accelerators, organizing the current state of the literature, identifying knowledge gaps, and highlighting research trends. In contrast, Gür [2021] conducts a literature review and draws conclusions on the interaction of innovation with corporate accelerators. Jackson and Richter [2017] present an empirical explanation of the characteristics of corporate accelerator programs, touching on strategy, resources, role and structure. Brown et al. [2019] delve into the role of accelerator programs in promoting transnational entrepreneurship, while Shankar and Shepherd [2019] explain the objectives and methods employed by corporations in running startup accelerator programs, defining models of acceleration processes. Cánovas-Saiz et al. [2021] propose an empirical assessment of seed accelerators performance and the prospects of the companies they support. Shenkoya [2021], on the other hand, investigates factors affecting accelerator performance. This cluster also contains publications that analyze the impact of accelerator reputation on performance and information policy, including works by [Carvalho et al., 2017; Charoontham, Amornpetchkul, 2021; Cánovas-Saiz et al., 2020]. These analyses lead to identification of factors influencing the fairness of startup evaluations. Mahmoud-Jouini et al. [2018] identify two key factors essential for building effective capacity: developing a broad value proposition for startups by capitalizing on corporate assets and designing a process to manage the relationship between the startup and the corporation. Research on accelerators encompasses a diverse range of topics. [Kohler, 2016] delved into identifying universal patterns of venture formation. [Stayton, Mangematin, 2019], explored at which startups are launched and identified mechanisms to minimize startup lag time. [Azinheiro et al., 2017] presented an analysis of how accelerators use digital marketing. Kuebert and Ibert [2019] offered insights into knowledge brokering within entrepreneurial ecosystems. Iborra et al. [2017] provided recommendations tailored for technology incubators and entrepreneurship programs, focusing specifically on the development of technology startup accelerators. Kohlert [2019] elucidated the essence and operations of incubators and corporate accelerators, offering recommendations to enhance their efficacy. Cánovas-Saiz et al. [2018] focus on the analysis of employment generated by accelerators and startups. The paper presents the most relevant variables influencing job creation and overall employment levels in these entities. Cluster 3 focuses on bridging startups and entrepreneurship. Kohler [2016] identified universal patterns of venture formation. Garrido et al. [2020] analyze business factors for project selection, such as degree of innovation and management skills by accelerators. Sota and Farelo [2017] identify key reasons for startups' progress (economic, demographic and institutional), differentiate people starting up their businesses on socio-demographic grounds and identify the relationship between entrepreneurs

and the nature of their businesses. Garcia-Herrera et al. [2018] develop a framework for designing and managing an industry-led accelerator. In contrast, Ruseva and Ruskov [2015] provide a framework for business modelling (treated as a separate element of management) and the concept of entrepreneurship (activity-oriented). Azinheiro et al. [2017] focus on identifying the relationship between the accelerator profile and its marketing activities. Fernandes and Castela [2019] focused on studying innovation, innovation persistence and interest in open innovation. Results of their study confirm that more ideas can be achieved by inviting the right partner. Haines [2014] covers impact analysis of startup accelerators on ecosystem development and technological progress. Connolly et al. [2018] indicate how to achieve a high number of applications within a startup ecosystem. Carmel and Káganer [2014] describe issues arising within company-startup collaboration after entering a new market. Cohen et al. [2019] explore the key differences in the antecedents, organizational design and operation of accelerator programs, whereas Järvi et al. [2013] describe the design of accelerator programs that target start-up game developers. These guidelines are aimed to present how to increase the possibility for developers to succeed and minimize risk for investors. Zarei et al. [2022] analyses the interactions between startups, accelerators and investors using game theory. The publication addresses how accelerators prioritize services and identifies the macroeconomic and legal factors that influence accelerator performance.

Cluster 4 focuses on the drivers of planning, operation, and development of startups. Bustumante [2019] emphasizes the significance of contracting capacity and institutional distance in concretizing insourcing and outsourcing decisions, identifying both firm and country characteristics as important factors in decision-making. Tripathi and Oivo [2020] spotlight entities that support startups, including accelerators, incubators, co-working spaces, events, and mentors. Additional studies in this cluster, such as those by [Cohen et al., 2019; Butz, Mrożewski, 2021] examine how corporate accelerators address sustainability issues. Both Connolly et al. [2018] and Kupp et al. [2017] indicate the crucial success factors for accelerator programs and offer recommendations for the design. Sota and Farelo [2017] deal with identifying and investigating the causes of startup development, including economic, demographic and institutional factors. Hutter et al. [2021] presents guidelines to help overcome barriers that occur at different stages of corporate acceleration. In contrast, Jackson and Richter [2017] discern challenges in collaborations between corporate accelerator participants and startup managers. Further, Garrido et al. [2020] provide guidelines to improve the decision-making processes of accelerator managers.

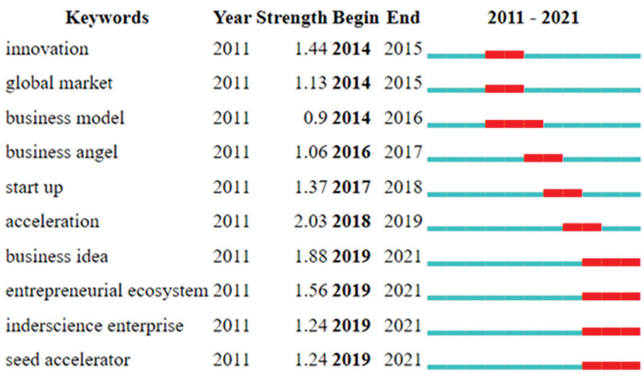
The clusters described above raise important topics related to startup acceleration process. Notably, their orientation leans towards operations rather than specific topics, suggesting that for startup accelerators, the nature of company's operations often takes precedence over its primary focus.

3.4. Burst Detection Analysis

Burst Detection process uses Kleinberg's Burst Detection algorithm to explore the evolution of literature in a particular field. The rise and fall in visibility of a particular topic is identified over time, allowing the data to be structured [Kleinberg, 2003]. Burst Detection uses a flux model of generated keywords that correspond to specific research topics. "Burst Detection" method reports the appearance of a particular keyword [Kleinberg, 2003]. When the intensity of a topic's occurrence stabilizes, it is no longer considered a burst [Pollack, Adler, 2015]. Due to the methodology, Burst Detection analysis differs significantly from keyword frequency study over time. Investigating keywords using frequency analysis involves the occurrence of limitations. Therefore, burst analysis should be additionally performed to verify the studied words in terms of change in emphasis over time [Pollack, Adler, 2015].

With series detection, it is possible to examine the popularity of author keywords within a certain timeframe, which provides an opportunity to deepen the analysis of co-occurrence networks for author keywords. CiteSpace software was used for series detection. An important factor affecting the results is the standardization of keywords in the publications in question. The standardization involved removing plurals, standardizing word tags (to lower case) and deleting acronyms and dots occurring in initials. The results are presented in Figure 7.

Figure 7. Result of series detection for normalized keywords of authors in 2011–2021



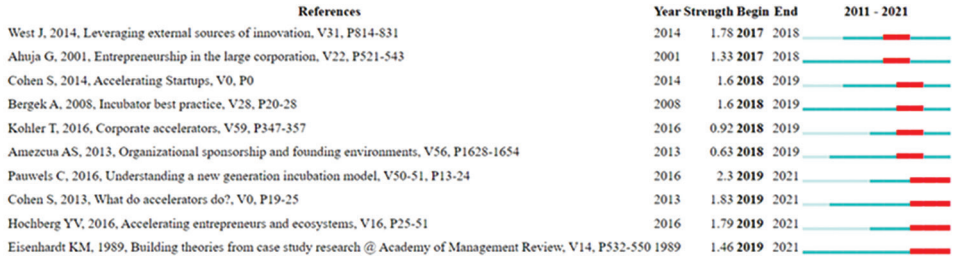
Source: own analyses based on data extracted from the Scopus database using the CiteSpace software.

The analysis identified ten keywords that exhibited bursts of activity. Between 2014 to 2017 there was a pronounced interest in topics related to innovation and business. Starting from 2017, research interest shifted towards startups and accelerators, as suggested by the emerging keywords. It is worth noting that from 2019 onwards, there

was a surge in publications focusing on entrepreneurship and seed accelerators. The prominence of these keywords is also worth noting.The burst detection enriched our previous analyses by pinpointing primary research themes associated with startup acceleration. This helped in refining the central research questions and highlighting discrepancies between the author's keyword co-occurrence network analyses and the CNA and GCS. For example, research related to the global market and startup investments were not included in the co-occurring keyword networks analysis. Burst Detection deepens and consolidates the findings obtained from otherbibliometric tools.

In the next step, we conducted a burst detection analysis on the publications that garnered the most citations. The results are illustrated in Figure 8.

Figure 8. Result of series detection for highly cited publications from 2011–2021



Source: own analyses based on data extracted from the Scopus database using the CiteSpace software.

CiteSpace detected the Top 10 articles characterized by bursts of activity. Since 2017, there has been significant interest in the topics such as innovation, startups, and accelerators. Among these, five articles by Cohen [2013], Hochberg [2016], Eisenhardt [1989], Pauwels et al. [2016] and West and Bogers [2014] showing the most activity. Notably, four of these publications were not highlighted in previous analyses.

In summary, the Burst Detection algorithm is complementary to the other bibliometric tools and the results of the analysis confirm the advantages of using Burst Detection.

Discussion and conclusions

The completed research revealed a gap in the literature. The literature lacks publications focusing on a comprehensive analysis of startup accelerators, and there is a need for a systematic approach to the topic. Current literature primarily addresses the operation and essence and essence of startups, startup accelerators, and open innovation highlighting their differences in the ecosystem. Furthermore,

the motivations for establishing accelerators and the factors influencing their operations have been explored. Many publications identify frameworks for the design, launch, and management of accelerators and startups and delve into the information management processes between partners. The aim of some studies was also to analyze methods of measuring the effectiveness of acceleration programs and the the procedures for evaluating and selecting startups by accelerators. Connections between accelerators, Industry 4.0, sustainability, and digitalization has been discussed. However, no publication in the Scopus database has sought to provide a comprehensive analysis of startup acceleration or to systematically organize the contributions of researchers in this domain.

This study made a significant contribution to the literature review through bibliographic analysis. The findings can guide researchers in gauging the level of interest in the subject and can further the understanding of startup accelerators. The aim of the publication was to systematize the existing literature knowledge on startup accelerators. To achieve this, specific quantitative bibliometric analyses were applied. The authors identified the main research trends and illustrated the progress of research over time.

By far, the largest number of publications are articles, accounting for almost 70 percent of all papers. The United States is the country with the most extensive body of literature; an overwhelming number of articles are written there. However, the author who has significantly contributed to the development of the literature base is D.K. Kanbach.

The analyses conducted by the authors allowed to answer the research questions posed:

Q1 What is the current state of knowledge in the field of startup acceleration?

The literature base is growing annually with a notable surge in publications in recent times. Despite the growth, the current number of articles is not overwhelmingly high. The year 2016 marked a significant spike in research publications related to startup accelerators, with the number of papers doubling annually. However, a decline in publications was observed in 2019, likely due to the COVID-19 pandemic, which might have negatively impacted research related to startup accelerators. The analysis covered a set of 76 publications related to startup accelerators, with the vast majority being empirical research studies. The topics undertaken by the researchers are very diverse; however, the primary focus is on accelerators, corporate acceleration, acceleration programs, and startup accelerators. Increasingly, authors address issues related to the basic concepts of accelerators likely aiming to establish a robust definitional base. Additionally, themes of digitalization and sustainability are being increasingly explored, but predominantly from an operational perspective.

Q2 What are the main areas of research based on the input dataset?

The compilation of CNA cluster analysis, supplemented by GCS and the authors' keyword analysis, shows that the primary research areas on startup accelerators are

(1) corporate accelerators, (2) collaboration and cooperation between corporations and startups, and (3) the role of startups within the entrepreneurial ecosystem.

A detailed analysis of these areas reveals several topics of significant interest. Topics concerning the operation of startup accelerators, their role in the entrepreneurial ecosystem, and key concepts are frequently discussed, as seen in works by authors such as [Gutmann, 2019; Gutmann et al., 2020; Heinzelmann et al., 2020; Kanbach, Stubner, 2016; Kurpjuweit, Wagner, 2020; Richter et al., 2018]. Research areas describing acceleration processes are also popular [Butz, Mrożewski, 2021; Shankar, Shepherd, 2019; Shenkoya, 2021; Yin, Luo, 2018], and often include performance evaluation and acceleration assessment methods. The operations and essence of startups, startup accelerators, and open innovation [Connolly et al., 2018; Gür, 2021; Gutmann et al., 2019; Kupp et al., 2017; Mahmoud-Jouini et al., 2018; Mosnacher et al., 2019; Pielken, Kanbach, 2020; Urbaniec, Żur, 2021; Wójcik et al., 2020], structuring of the operation and role of accelerators [Cohen, Hochberg, 2014; Gür, 2021; Ruseva, Ruskov, 2015] identification of factors influencing venture selection, design or development of accelerators [Butz, Mrożewski, 2021; Cánovas-Saiz et al., 2020; Cánovas-Saiz et al., 2021; Cohen et al., 2019; Stayton, Mangematin, 2019] are also among popular topics.

Among publications on corporations, several topics are prominent. Publications that describe factors influencing a corporation's selection of a startup are frequent, as seen in works by [Charoontham, Amornpetchkul, 2021; Garrido et al., 2020; Kim, Wagman, 2014]. There is also notable in the collaboration of accelerators with corporations, highlighted in studies by [Garcia-Herrera et al., 2018; Jung, 2018; Kohler, 2016; Onetti, 2021]. Additionally, sourcing as explored by authors like [Bustamante, 2019; Carmel, Káganer, 2014; Garcia et al., 2019; Jackson, Richter, 2017], is a recurring theme.

An important issue is the limitations of the analysis. Firstly, keywords may not always accurately reflect the content of an article. Moreover certain keywords might be excluded from network construction due to not meeting specific analysis criteria, such as coexistence conditions. As a result, the analysis might encompass keywords that don't fully represent the authors' contributions to a particular topic. It's also common for documents with a significant number of citations to be cited merely because of the reputation and popularity of the article, a phenomenon known as the "Matthew effect". Another limitation is the exclusive reliance on the Scopus database for bibliometric analyses.Despite the popularity of this database, it does not include all publications within a certain thematic area.

In terms of theoretical implications, the article substantially enhances the knowledge focused on the topic of startup accelerators. Moreover, it makes an important contribution to the current literature by analyzing the evolution of the concept, pinpointing the primary themes, and highlighting emerging trends over time. The selected research methodology ensured a comprehensive representation of the field

under study". Citation networks and the author's keyword network were used toto obtain a comprehensive view. The clusters we identified enabled us to enumerate key publications and, crucially, to delineate the most pertinent research topics.GCS and a burst detection algorithm were applied to confirm and extend the analysis, which complemented the research in the methodology used. This publication can provide a basis for identifying future research directions. Topics for further analysis in the area can be identified using the trends, key issues, research problems and research development trajectory detailed in the article. The article provides a comprehensive analysis of the literature on the selected topic, which presents information on the current state of knowledge and thus contributes to the identification of future research directions.

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STARTUP ACCELERATORS: RESEARCH DIRECTIONS AND GAPS

Abstract

Over the past years, startup accelerators have become popular. The research aims to systematize startup acceleration knowledge. The goal is attained through 1) analysis of the current state of the art concerning startup accelerators, 2) mapping and synthesis of current research efforts, and 3) identification of gaps and opportunities for further research. This paper is based on systematic network analysis methodology, which combines a systematic literature review with literature network research. The Scopus database was used to develop a comprehensive review of the study findings. VOSviewer was used to carry out bibliographic network analyses focusing on a hand-picked group of articles. Citespace was used to carry out the analysis and set up a visualization of the co-citation network. This paper provides a literature review of existing studies on start-up accelerators. Many authors discuss the operation of accelerators, the interaction between corporations and startups and examine the impact of cooperation on the startup ecosystem. Moreover, a significant number of publications deal with performance evaluation and activity of startups supported by accelerators, as well as the analysis of drivers of planning, operation and development of startups. Nevertheless, none of the publications included in the Scopus database aimed to comprehensively analyze startup acceleration and systematize the output of researchers in this field.

Keywords: accelerator, start-up, start-up accelerator, corporate accelerator

JEL classification code: M13

AKCELERATORY STARTUPÓW: KIERUNKI I LUKI W BADANIACH

Streszczenie

W ostatnich latach akceleratory startupów cieszą się dużą popularnością. Celem badania jest usystematyzowanie wiedzy dotyczącej akceleracji start-upów poprzez 1) analizę aktualnego stanu wiedzy na temat akceleratorów startupów, 2) mapowanie i syntezę bieżących wysiłków badawczych oraz 3) identyfikację luk i możliwości dalszych badań. Artykuł opiera się na metodologii systematycznej analizy sieci, która łączy systematyczny przegląd literatury z badaniem sieci literatury. Do opracowania kompleksowego przeglądu wyników badań wykorzystano bazę danych Scopus. VOSviewer został wykorzystany do przeprowadzenia analiz sieci bibliograficznych skupiających się na wyselekcjonowanej grupie artykułów. Do przeprowadzenia analizy i stworzenia wizualizacji sieci współcytowań wykorzystano Citespace. W artykule dokonano przeglądu literatury na temat istniejących badań dotyczących akceleratorów start-upów. Wiele artykułów dotyczących startupów omawia działanie akceleratorów, interakcję korporacji ze startupami oraz bada wpływ współpracy na ekosystem startupowy. Ponadto znaczna liczba publikacji dotyczy oceny wyników i działalności startupów wspieranych przez akceleratory, a także analizy czynników planowania, działania i rozwoju startupów. Niemniej jednak brakuje kompleksowej analizy akceleracji startupów i usystematyzowania dorobku badaczy w tej dziedzinie. Niniejszy artykuł wypełnia tę lukę.

Słowa kluczowe: akcelerator, start-up, akcelerator start-upów, akcelerator korporacyjny

Kod klasyfikacji JEL: M13