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How to support innovative small firms? Bibliometric analysis and visualization of start-up incubation

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Abstract

Supporting the birth and development of innovative small firms, i.e., start-up incubation, has emerged as a critical factor in fostering entrepreneurship, innovation, regional development, and more recently, sustainability. This bibliometric review aims to comprehensively understand and visualize different research perspectives on how start-ups are successfully incubated. A total of 1116 Scopus articles were selected and synthesized using a qualitative approach. The study applies novel visualization techniques (Citation Network Analysis, Global Citation Score, Burst Detection Analysis and Co-Occurrence Networks of Keywords) to map the scientific structure of start-up incubation research, including the clusters of the leading research topics based on citation networks, the most cited articles, and the keywords with the most substantial citation bursts as well as their co-occurrence. We evaluate research on start-up incubation from 1972 to 2023 and show how the topic has advanced by scholars' changing interests over time. We identify five clusters that reflect distinct study themes and their most cited references. The findings contribute to a more comprehensive understanding of the evolution of start-up incubation research, which developed from a focus on biotechnology and technology transfer toward the current research trends on accelerators and (entrepreneurial) ecosystems. This paper also provides insights for policymakers and start-up incubation managers to make informed decisions.

Keywords: Start-up, Incubation, Bibliometric analysis, Visualization analysis

JEL Classification: O31, O32, O38, M13

Introduction

Start-up incubation is the process of nurturing new businesses. Researchers and policymakers alike have recognized the value of start-up incubation in promoting innovation and economic growth. Start-ups refer to starting a business in an uncertain environment (Wang, 2022). Through creative destruction, start-up firms play a crucial role in the progress of the economy and society (Schumpeter, 1934). Start-ups introduce new products and services that generate revenue, employment, and customer value, raise living standards, and address global challenges (Fini et al., 2018). Start-ups do not develop in a vacuum but connect closely with their environment by constantly utilizing available

and scarce resources and exchanging with other firms (Gnyawali & Fogel, 1994; Spigel & Harrison, 2018). The actors and factors that interact in a system to foster the development and successful growth of start-ups are understood as a Start-up Incubation Ecosystem (SUPIE) (Novotny, 2020).

Resources invested in encouraging the creation, growth, and impact of start-ups have been increasing at both national (Audretsch et al., 2020) and university levels (Eesley & Lee, 2021). These initiatives include entrepreneurship education (Belitski & Heron, 2017), access to laboratory and office space, as well as technology transfer and business development services provided through government programs, incubators, and accelerators (Breznitz & Feldman, 2012; Soetanto & Jack, 2016). While literature reviews are abundant on licensing, patenting (Åstebro et al., 2012), and companies founded by universities, i.e., spin-offs (Corsi & Prencipe, 2016; Miller & Acs, 2017), far less knowledge is available on the successful incubation of a broad range of start-ups and the role of the incubation context or ecosystem (Novotny, 2020; Wright et al., 2017). Incubation success can be measured by incubatee graduation rate, number of jobs created, ecosystem connections created, and business support utilization rate (McIver-Harris & Tatum, 2020); while incubatee (start-up) success is typically reflected by various firm growth and development measures in addition to graduation (Hackett & Dilts, 2004).

There has been some evidence that incubation has a positive impact on start-up performance (Schmutzler & Presse, 2021; Stokan et al., 2015). However, incubators support start-ups in various ways (Bruneel et al., 2012; Theodorakopoulos et al., 2014; van Rijnsoever, 2020), and we know little about which form of support best contributes to firm development (van Rijnsoever & Eveleens, 2021). A major issue is that the field is still lacking theories to build on (Kraus et al., 2022). Hence, we have scant and inconsistent knowledge on "what" the key support services in different phases of the start-up process are, not to speak of "how", "why", and "in what context" these factors are interrelated (Hackett & Dilts, 2004). Studies do not show clearly how the type and quality of services are associated with the different interpretations of performance. For instance, intermediary benefits (e.g., resources, knowledge, learning, and social capital) can improve and worsen start-up performance, depending on the type of benefit and the performance measure used (Eveleens et al., 2017). Several researchers classify incubators and their services (e.g.,Barbero et al., 2014; Leitão et al., 2022), but it is unknown what services are most helpful for start-ups in each type of incubator, neither the differences of incubators and services located in different countries, socio-economic environments or ecosystems (Zedtwitz & Grimaldi, 2006) Further discovering the impact of different types of incubators on the different stages of the entrepreneurial process in various contexts would also help identifying best practices (Pauwels et al., 2016). Comparing samples of incubated and non-incubated entrepreneurs can lead to a better understanding of the benefits of incubators to entrepreneurial learning and the most useful strategies (e.g., laissez-faire *versus* assertive) for incubating various firms. As incubation is rarely a short process, longitudinal studies are needed to identify patterns and predictabilities, and to develop incubator theory further (Vincent & Zakkariya, 2021).

Within the start-up incubation ecosystem, accelerators are receiving growing attention; however, a taxonomy of innovation and entrepreneurship intermediaries is still lacking, making it hard to compare across different support programs (Cohen et al., 2019). It also

needs to be clarified how start-ups with sustainability-oriented innovations succeed and transform markets toward sustainable development (Horne & Fichter, 2022). Start-ups often develop technologies with an effect on the economy, society, culture, health, and quality of life; however, our understanding of start-ups as enablers of a broader societal impact is limited (Fini et al., 2018; Guckenbiehl et al., 2021). Some incubators are focusing on supporting start-ups to introduce a positive social impact (Sonne, 2012). Still, it needs to be clarified how social incubators should be defined, and what differences in services there are between social incubators and other types of incubators (Sansone et al., 2020). Based on the above considerations, there is a strong need to review the evolution of different research perspectives to understand how different start-ups are incubated successfully. Two research questions guide the present research to accomplish this goal, as follows:

RQ1. What factors can contribute to successful start-up incubation ecosystems?

RQ2. What are the main approaches, methodologies, frameworks and tools that should be considered to integrate sustainability into start-up incubation?

Considering those above, this bibliometric analysis aims to assist start-up incubation researchers in reviewing the evolution of different research perspectives and considering a wider area of concepts and theories related to the start-up incubation domain. Developing theories to nuance findings requires multiple research methods and examining other research fields. Incubation–incubator researchers may find it beneficial to draw from theories used to explain new venture formation and development, innovation and new product development, technology transfer, entrepreneurial ecosystems, sustainability, and business assistance. By drawing on different fields and adopting a multi-dimensional perspective, this analysis also calls for using new data and methods to understand better the incubation process and the broader socio-economic impacts of start-up incubation.

A bibliometric review is an effective tool for synthesizing research trends, identifying gaps, and providing insights for future research. Together with visualization analyses they can provide a clear and comprehensive view of the research landscape, a broad map of the different perspectives taken by researchers coming from various fields to investigate start-up incubation. We searched and evaluated the most published evidence related to start-up incubation, including empirical studies, case studies, and review papers. Visualization analysis can identify patterns, trends, and gaps in the literature and provide a clear and comprehensive view of the research field (Iscaro et al., 2021). We used citation network analysis, co-citation analysis, and keyword analyses to depict dominant research topics, influential authors, publication timelines, and emerging research themes. By combining bibliometric review and visualization, this paper highlights the importance of understanding the multifaceted nature of start-up incubation and incubators' role in the start-up ecosystem. It also gives valuable insights for policymakers and practitioners and provides a research agenda for entrepreneurship scholars and scholars in other fields interested in contributing to start-up incubation research.

Materials and methods

We built our analysis on Scopus since it is one of the most used databases for literary research. Due to its restricting and indexing techniques, the content of Scopus is recommended for separating publications by writers with identical names (Powell & Peterson, 2017). The Scopus database was chosen also because it provides a broader and more

comprehensive coverage of content (Pranckutė, 2021). Second, Scopus has individual profiles for authors, institutions, and series sources, which makes it more convenient to use in practice. Third, the impact indicators used by Scopus perform as well or better than those provided by, e.g., Web of Science and are less susceptible to manipulation. In addition, Scopus as a database provides free access to author and source information, including metrics. Moreover, Scopus bibliographic database is selected for its size and variety of publications. Indeed, when compared to its peers, Scopus encompasses a wider range of journals and offers the possibility for citation analysis especially for papers published after 1995 (Falagas et al., 2008).

A Systematic Literature Network Analysis (SLNA) was used to choose and evaluate the literature. Two major components make up this SLNA approach (Fig. 1). The first phase entails doing a bibliometric review. At this point, transparency, inclusivity, explanatory, and heuristic nature are essential areas of diversity from other literature review methodologies (Tranfield et al., 2003). These characteristics enable a more objective evaluation of the search results and obviate the possibility of biases (Clark, 2010). Bibliographic Network Analysis and Visualization (BNAV) enable the identification of current and reliable emerging research topics and themes using, e.g., Citation network analysis (CNA), Global citation score (GCS), Burst detection analysis (BDA), and Co-occurrence networks of keywords (CONK).

CNA is an area of bibliometric analysis that employs a multitude of citation analysis techniques to determine connections between research streams. It is predicated on the notion that interconnected channels identified as a citation network transform scientific information or knowledge. This concept is conceivable because scholars from the same organization frequently cite one another to contextualize their work within a larger body of knowledge or a prior study (Hummon & Dereian, 1989). Network analysis is often

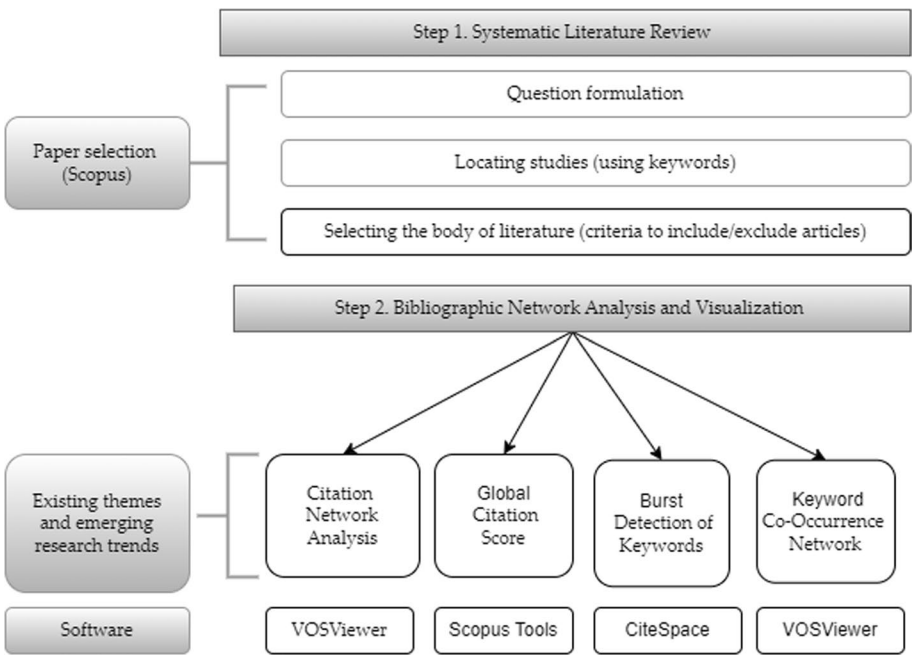

Fig. 1 Research methodology of the review

carried out when extensive research clusters are detected to represent the scope of the discipline (Fahimnia et al., 2015). The study uses a methodology aligned with respected review articles in the start-up incubation field.

In addition, it enables a thorough description of qualitative components that ideally support the bibliometric analysis. The titles, abstracts, and keywords of academic studies have all been evaluated. According to content analysis, the technique also lessens study bias while improving the validity and repeatability of the predefined constructs. VOSviewer (1.6.18) offers unrestricted access to bibliometric mapping data taken from Scopus that can be used for analysis. The Visualization of Similarities (VOS) algorithm enables the visualization of relationships between items so that direct and indirect linkages affect the closeness of the entities on the map. The proximity of the elements' locations implies that they appear together more frequently in certain groups than in others. In addition, an element occurs in the middle of the map. In that case, it can be assumed that it belongs to a broader and more varied group of other elements, e.g., the most substantial cluster color-coded in the properly constructed view (Waaijer et al., 2011). As a result, VOSviewer was used to create a citation network (CNA) and a co-occurrence of keywords (KCON). This overview allows us to identify, i.e., key journals, prolific authors, and influential research clusters providing a comprehensive understanding of the landscape and structure of the literature.

Utilizing the global citation score analysis (GCSA), one of the normalized bibliometric techniques supplied by Scopus was also applied to review the most cited literature on the concepts of start-ups and incubation. Nevertheless, the CiteSpace tool, trends, and transitional patterns in the scientific literature are identified and visualized (Chen, 2006). CiteSpace focuses on identifying pivotal intellectual instances that have influenced the growth of a specific field or body of knowledge. In addition to offering insights into the collaboration networks and subject-matter expertise within the start-up incubation sector, this method can assist in identifying the leading authors in the field and their affiliations.

A crucial component of bibliometrics that has received much attention recently is the Burst Detection Analysis of citations. The purpose of this study is to give a description of a BDA with CiteSpace (6.1.3 version) and its use in evaluating citation trends in start-up incubation perspectives. The burst detection technique enables the computation output to locate a temporal list of frequently used terms or topics (Chen et al., 2010). By applying this method to the start-up incubation literature review, for instance, emerging trends, innovative concepts, and evolving research areas can be uncovered within the field.

Results

Systematic literature review

Based on the identification of accessible research using specified keywords, we conducted a review of the literature on the interconnectedness of start-up and incubation research streams. We concentrated on creating a search list when considering publications pertinent to the preliminary or tentative bibliographic search. Various phrases, synonyms, and abbreviations associated with the words "start-up" and "incubation" were included in the research query. The most cited literature review in Scopus was examined

to determine all the appropriate terminology, synonyms, and abbreviations for the words above (Table 1). In this condition, search phrases reflecting the keyword "start-up" were initially employed to prevent article duplication: (startup* OR start-up*) and in academic research (spinout* OR spin-off*), and "incubation" (incub*). The following query was developed taking the aforementioned factors into account (Eq. 1):

$$((\text{startup} * \text{ OR start} - \text{up} * \text{ OR spinout} * \text{ OR spin} - \text{off}) \text{ AND incub}*) \quad (1)$$

At the end of December 2022 (31.12.2022), the search was conducted in Scopus. It included title, abstract, and keyword searches. Only English-language articles, conference presentations, book chapters, books, reviews, conference overviews, short surveys, notes, and editorials (including those printed in the press) were considered for further analysis. At the time of the search, Scopus included 1184 such articles. The Scopus database search results were chosen for additional SLNA. The purpose was to investigate how research on incubation and startups are related, i.e., to discover the interconnectedness of the two research areas. Studies from a wide range of disciplines were chosen. The field of science commercialization should be considered distinct from other fields; scholars interested in science-based start-ups are often rooted in their home disciplines and do research in other fields as well (Fini et al., 2018). Regarding the subject areas covered by our Scopus search, e.g., engineering (14.2%), social sciences (11.9%), economics and econometrics (11.3%), finance, computer science (7.7%), decision sciences (5.0%), environmental sciences (3.9%), energy ones (2.1%) and others (10.1%), one-third (30.2%) of the research topics are in business, management, and accounting.

Table 1 Topics for research based on the most significant clusters in the citation network

Cluster	Nodes	Links	Topics	Top 3 cited papers*	Period	Size** (%)
1	21	141	Incubation strategies, policy implications of spin-offs, commercialization of research and technology	Clarysse et al., (2005) Lockett et al., (2005) (Markman et al., 2008)	2005–2021	13
2	14	70	Accelerator as a new generation of incubation model	(Neck et al., 2004) (Weiblen & Chesbrough, 2015) (Pauwels et al., 2016)	2004–2020	9
3	13	52	Business incubators, the economic development of a community and/or region	(Collinson & Gregson, 2003) (Al-Mubaraki & Busler, 2010) (Van Rijnsoever et al., 2017)	2003–2019	8
4	12	80	Human capital, business network and the survival of ventures	(Tötterman & Sten, 2005) (Gimmon & Levie, 2010) (Schwartz, 2013)	2005–2019	7
5	12	65	Classification and role of incubators, and service profiles of incubators	(Cooper, 1985) (von Zedtwitz, 2003) (Zedtwitz & Grimaldi, 2006)	1985–2019	7
6	11	43	Tools to identify indicators to assess start-ups' success and business incubators' performance	(Siegel et al., 2008) (Somsuk & Laosirihongthong, 2014) (Saura et al., 2019)	2003–2020	7
7	10	350	Academic entrepreneurship, spin-off, and technology transfer	(Moray & Clarysse, 2005) (Salvador, 2011) (Fernández-Alles et al., 2014)	2005–2019	6

* Minimum citations = 34

** $N = 164$ (100%)

In terms of geographical location, the United States produced the largest number of studies (215), followed by the United Kingdom, Italy, India, and the Netherlands with 85, 71, 65, and 61 studies, respectively. Overall, 44% of the papers were produced in the European region, 23% in the Americas, 21% in Asia, 4% in Africa, 3% in Australia and New Zealand, and 5% in unspecified locations. The distribution of the research across continents and nations may indicate that the topic under discussion is of global importance. This can be explained by the fact that several countries are pursuing national plans to develop start-up incubation, entrepreneurship education, and the commercialization of public science.

Finally, 1116 relevant papers were chosen after carefully screening the identified materials. Following the initial period between 1972 and 2001, scholarly interest increased in start-up incubation: the number of publications rose to 11 articles in 2002, then tripled in 2010 (33). Although the number of publications somewhat declined in 2011 and 2012 (27), there was significant growth between 2014 and 2022. In 2020, the number of studies was 125 (Fig. 2).

Bibliographic network analysis and visualization

Citation network analysis (CNA)

CNA is a method in which papers are represented as nodes and citations as linkages between them. The capacity to trace the citation network made available for a better insight into how earlier studies influenced subsequent ones and the ability to detect knowledge flows. As a result, smaller networks (clusters) that comprise papers are isolated, and everyone in the cluster has at least ten references with another. CNA enables the identification of papers that have received the most citations within the entire author network (weights) (Hummon & Dereian, 1989).

Figure 3 depicts a document's Citation Network Map (CNM) (overlay view). CNA is a methodology for specifying the scope of topic clusters. This approach gives a network with 164 nodes and 509 linkages. The CNA is thought to produce the best results in clusters with many nodes since the amount of data obtained is substantially more than in small clusters (Ejsmont et al., 2020). Based on this assumption, the seven (out of 17) most significant clusters are formed by VOSviewer, along with the essential information related to them (Table 1).

The crucial study topics of the clusters and their most cited references, for instance the three publications with the most significant citations, are examined. Not all works designated to a cluster must be strongly related to its primary issue, as in the case of review articles. The CNA claims that most research on integrating start-up incubation has concentrated on a small number of crucial areas that are all related, mutually beneficial, and complimentary. The research subjects covered include academic entrepreneurship, start-up ecosystems, incubation strategies, accelerators, spin-offs, and commercial networks. CNA enabled the identification of seven clusters.

Cluster 1 illustrates incubation strategies, spin-off policy implications, and research and technology commercialization. The various incubation models have highly diverse resource implications for managing the process, such as differences in money, organization, human resources, technology, network, and infrastructure (Clarysse et al., 2005). The management and policy implications of the emergence of spin-offs at Public

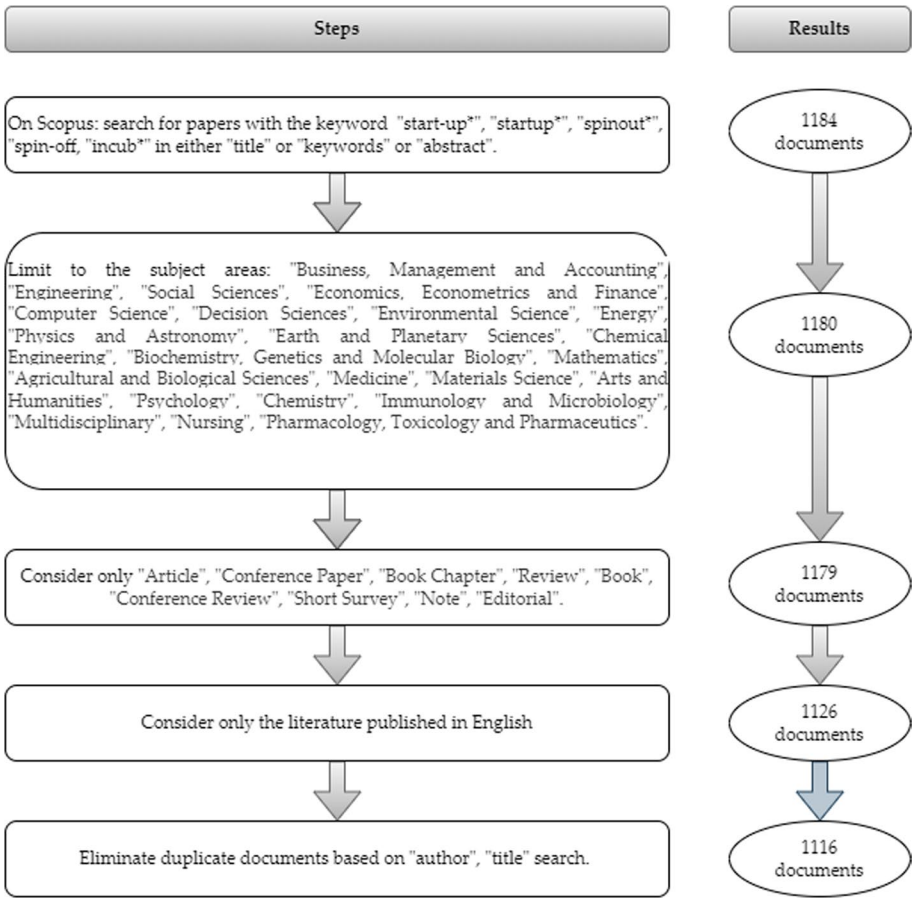

Fig. 2 Paper selection procedure and results

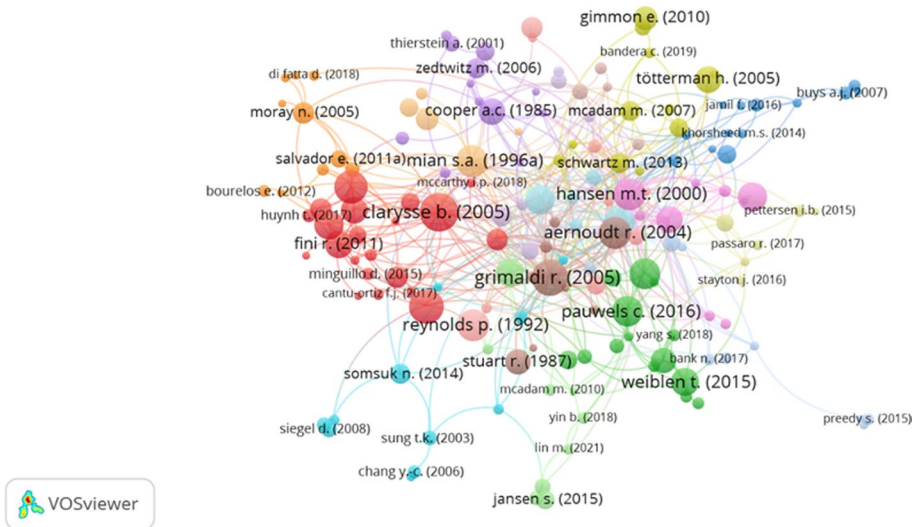

Fig. 3 Citation Network Map

Research Institutions (PRIs) are founded on a firm's knowledge-based view (Lockett et al., 2005). A taxonomy of commercialization development approaches considers internal strategies (such as incubators), university research parks, regional clusters, academic spin-offs and start-ups, licensing, corporate venture capital, and open science and innovation (Markman et al., 2008). The effectiveness of university-based business incubators and technology parks is frequently decided by how technology is moved from labs to start-up enterprises. Universities should consider regional differences to establish successful spin-off support policies (Fini et al., 2011). Mascarenhas et al. (2017) showed that universities are increasingly dedicated to the commercialization of knowledge. As a result, entrepreneurial universities that concentrate on shifting the paradigm of higher education have emerged, and academic entrepreneurship is the commercialization of knowledge. Spin-off creation is a key component in the development of technology-based businesses. Other research describes entrepreneurial universities as giving tools for selecting a commercialization approach, financing a start-up, promoting a product, and preparing an exit (Yetisen et al., 2015).

Cluster 2 depicts the accelerator as a new generation of incubation model (Pauwels et al., 2016). Managers must systematically and thoroughly evaluate the concept, process, people, and place design elements to leverage start-up innovation and make corporate accelerators a viable part of the overall innovation strategy (Kohler, 2016). Del Sarto et al. (2020) conclude that factors affecting the survival of accelerated enterprises differ from incubated firms. Corporate accelerators meet the following criteria for success: transparent and aligned goals, an independent staff of start-up advocates, a substantial and dedicated external network, top-management support, long-term ambitions, and performance indicators (Kupp et al., 2017). The findings show that incubation groups, spin-offs, in-formal and formal networks, physical infrastructure, and regional culture are all uniquely related and interact to establish a system conducive to dense entrepreneurial activity (Neck et al., 2004). Weiblen and Chesbrough (2015) propose a typology of corporate engagement mechanisms with start-ups that balance speed and agility against control and strategic direction.

Cluster 3 focuses on business incubators and economic development. The various conceptual approaches around regional knowledge networks underpin distributed innovation (Collinson & Gregson, 2003). Business incubators can improve young firms to survive and grow during their start-up years and can play a crucial role in the economic development of a community or region (Al-Mubaraki & Busler, 2010). The association between incubation and the investments raised by early-stage start-ups is a performance metric. Høvig et al. (2017) demonstrate that many incubators, tacitly or explicitly, recruit startups using a causal approach, picking candidates with a thorough and planned business plan. However, Lukosiute et al. (2019) found some adverse outcomes entrepreneurs can experience when engaging with incubators or accelerators.

Cluster 4 is concerned with human capital, business networks, and venture survival. Based on human capital and signaling theory, the influence of founder traits on attracting external investment and boosting the survival of new high-technology experiences is investigated by Gimmon & and Levie (2010). It is still being determined whether start-up enterprises improved by publicly funded incubator efforts have higher survival rates than comparable start-up firms that did not receive such support (Schwartz, 2013).

Empirical research shows that entrepreneurs who have obtained significant support for establishing businesses or support networks are satisfied with business incubator assistance than those who have not (Tötterman & Sten, 2005). Vanderstraeten et al. (2016) investigate the relationship between an incubator's industry segmentation efforts and its customization strategy, along with the impact on incubated survival and growth.

Cluster 5 focuses on the classification and role of incubators, along with the service characteristics of incubators. The types of functions of incubators have been of interest to researchers for more than three decades. As most high-tech entrepreneurs do not relocate and are tied closely to their incubator organization, geographical location limits start-up possibilities (Cooper, 1985). Von Zedtwitz (2003) defines five categories of incubators: university incubators, independent commercial incubators, regional business incubators, and company-internal and virtual incubators. Conflicts between competitive scope (industry, region, and segment (focus) and strategic purposes (profit) have an impact on the nature, quality, and implementation of incubation services, as well as how they are managed (Zedtwitz & Grimaldi, 2006). Thierstein and Wilhelm (2001) outline the theoretical and methodological underpinnings of a survey of Incubation, Technology, and Innovation (ITI) centers. Based on the literature and essential theoretical components, a conceptual framework of start-up formation and graduation includes pre-incubation, incubation, and post-incubation stages (Mungila Hillemane et al., 2019).

Cluster 6 outlines the techniques for identifying metrics to analyze start-ups' success and business incubators' operation. Saura et al. (2019) apply text mining and analyze comments made on social networks such as Twitter to assist the understanding of start-up ecosystems and the success factors for start-up development of University Transfer Technology Offices (UTTOs) play a crucial role in the diffusion of innovation and the development of new technology infrastructure (Siegel et al., 2008). Somsuk and Laosirihongthong (2014) aim to identify the enabling variables influencing the success of university business incubators (UBIs) in terms of specific internal resources while also investigating the priority of these aspects.

Academic entrepreneurship, spin-off, and technology transfer are all part of *Cluster 7*. Fernández-Alles et al. (2014) seek to identify the resources and skills necessary for Academic Spin-off (ASO) development should be identified theoretically and empirically, along with the market and educational players who provide them at two stages of development (early development and consolidation). Creating an incubator structure for spin-offs appear to be a learning process in which slight decision-making power can be wielded over senior management's social network in the financial and business community to provide science-based entrepreneurial businesses with the necessary human, financial, and technological resources (Moray & Clarysse, 2005). The context of university spin-off firms is investigated, focusing on the interaction with science park incubators and their significance as brand identities (Salvador, 2011). Robust connectivity and effective filtration characterize thriving university entrepreneurial ecosystems with a solid local and interregional character (Prokop, 2021).

Global citation score analysis

The GCS analysis can be used to identify groundbreaking papers. The GCS represents the total number of citations a publication receives across the whole database, regardless

of whether it is part of a network of connected nodes (Knoke & Yang, 2011). Thus, the normalized GCS classifies works based on the ratio of their average yearly citations to their total yearly existence in Scopus (through 2022). This normalized GCS analysis identifies the top ten papers currently of interest to the scientific community. Furthermore, since its initial appearance, promising new articles in that field can be identified (Strozzi et al., 2017).

Only four of the ten publications with the highest normalized GCS are related to the first two most significant clusters revealed by evaluating the CNA, according to Table 2. It indicates that relevant research can be included in primary citation coexistence networks. However, there are articles with higher normalized GCS values with higher GCS (Pauwels et al., 2016), and vice versa with lower normalized GCS values with lower GCS (Chan & Lau, 2005).

Pauwels et al. (2016) stand out because, although published in 2016, they have received a substantial number of citations. In the years right after their publication, papers frequently get more citations. This scenario could imply that these articles are innovative studies outlining future study directions. While any program providing mentorship, networking opportunities, and funding access to start-ups is an accelerator, the challenge is understanding their distinct characteristics and profiles geared to assist start-ups.

Business Innovation Centers (BICs), University Business Incubators (UBIs), independent private incubators (IPIs), and corporate and private incubators (CPIs) are the four categories into which Grimaldi and Grandi (2005) map business incubators. However, they argue that the diversity of incubation organizations is driven by how business requirements and expectations vary over time, motivating incubators to differentiate the range of services they provide. Chan and Lau (2005) designed an assessment framework for technology incubators in the science park. Benefits include resource sharing, advisory services, improved public perception, networking, cluster effects, geographical proximity, cost subsidies, and funding support.

Burst detection analysis

Finding the research areas and advancement patterns of a field over time using burst detection analysis is a beneficial tool for revealing the dynamics of academic articles (Zhou et al., 2019). Burst detection, which expands the keyword network, aims at understanding the variables that lead to the accumulation of citations by shedding light on the developments and frontiers in each research field (Yan & Zhang, 2022). A BDA of citations is a valuable tool for indicating the impact of publications and determining research topics and development trends over time (Amjad et al., 2022).

As a result, future research directions can be easily identified. Figure 4 displays the top 20 outcomes of Kleinberg's Burst Detection algorithm that the Citespace application utilized (Kleinberg, 2003). As part of the normalization process, we converted all word marks to lowercase, excluded end words, removed the plural, periods, and hyphens from abbreviations and initials.

BDA detected the keywords characterized by bursts of activity from 1972 to 2023. The burst of biotechnology in 1989 and its strength confirm the particular interest of research in, e.g., technology transfer, education, industry, societies, and institutions. It is crucial to highlight that between 2014 and 2018, specific keywords, such as "university

Table 2 Top 10 most cited articles ranked by normalized GCS

Rank	Title	Authors	Publication Year	Journal	Appearance in CNA	GCS	Normalized GCS*
1	Understanding a new generation incubation model: The accelerator	Pauwels et al., (2016)	2016	Technovation	Yes	238	11.29
2	Engaging with start-ups to enhance corporate innovation	(Weiblen & Chesbrough, 2015)	2015	California Management Review	Yes	179	6.88
3	Business incubators and new venture creation: An assessment of incubating models	(Grimaldi & Grandi, 2005)	2005	Technovation	No	186	2.67
4	Complements or substitutes? the role of universities and local context in supporting the creation of academic spin-offs	(Fini et al., 2011)	2011	Research Policy	No	112	2.42
5	High-tech start-ups in University Science Park incubators: The relationship between the start-up's lifecycle progression and use of the incubator's resources	(McAdam & McAdam, 2008)	2008	Technovation	No	108	2.33
6	An Entrepreneurial System View of New Venture Creation	(Neck et al., 2004)	2004	Journal of Small Business Management	Yes	142	1.95
7	Spinning out new ventures: A typology of incubation strategies from European research institutions	(Clarysse et al., 2005)	2005	Journal of Business Venturing	Yes	126	1.67
8	Research and technology commercialization	(Markman et al., 2008)	2008	Journal of Management Studies	Yes	106	1.60
9	Incubators: Tool for entrepreneurship?	(Aernoudt, 2004)	2004	Small Business Economics	No	112	1.58
10	Assessing technology incubator programs in the science park: The good, the bad and the ugly	(Chan & Lau, 2005)	2005	Technovation	No	95	1.22

* Citation in 2022/years since the adoption

spin-off" and "commercialization" in start-up incubation views, were prevalent. Accelerator (strength: 5.7) and entrepreneurial ecosystem (4.08) are tied to the main bursts in recent years (2020–2023). The claimed rise in interest is consistent with the citation network (Cluster 1 and 2) and GCS findings of emerging topics.

Co-occurrence network of keywords

Finding study trends to improve the CNA and BDA results can be accomplished with the support of CONK. The primary drawback of CNA is that it excludes essential works that must be referenced, especially for new studies.

The keyword network analysis is necessary with the BDA data to support CNA analysis.

A co-occurrence (or co-word) network was used to analyze the selected terms. The links show how frequently the words appear together across various publications, while the nodes in this network represent the authors' chosen keywords (Callon et al., 1991). It may be relevant to the research topic and show patterns and trends in that discipline if a word or phrase is used frequently (Ding et al., 2001).

Performing a co-occurrence analysis in VOSviewer is possible by following the procedures listed below. VOSviewer employs three methods to produce a map showing the keyword network. Following the screening of abstracts in the Scopus database, 1116 publications were picked, and their keywords were extracted within title, abstract, and authors' keywords. The data were then "cleaned" by combining synonyms, abbreviations, and whole phrases and was then used as a batch file. A keyword to be examined and added to the network must appear in at least 5 papers (Khitous et al., 2020).

Forty-one nodes were produced by VOSviewer, and organized into 5 clusters (Fig. 5). Since there were no overlaps between the groupings of nodes, a given keyword could

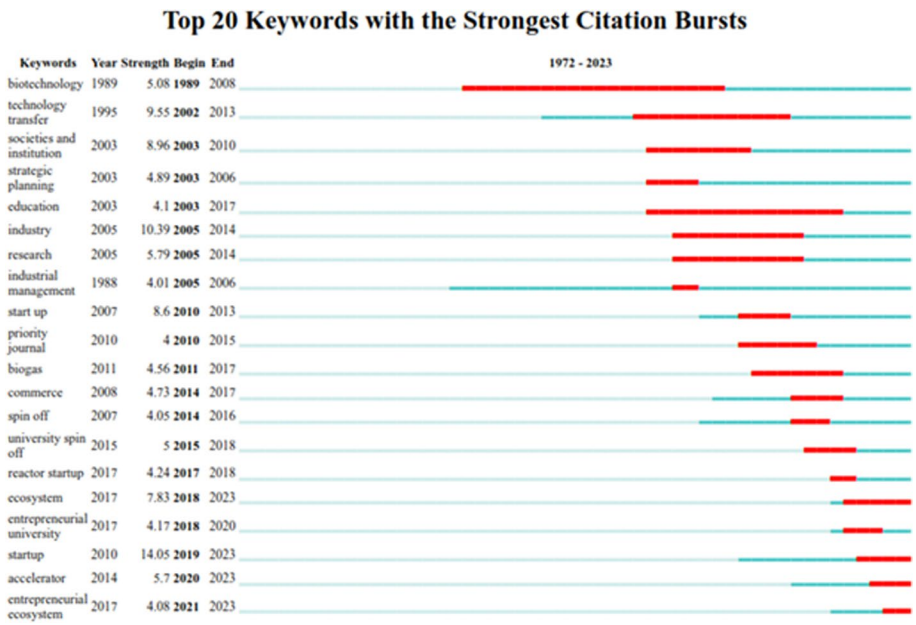

Fig. 4 Results of keyword burst detection from 1972 to 2023

only belong to one cluster. 478 linkages comprised the co-occurrence network, which had a 1521 total link strength. The greater the number, the more essential the keyword is to the network, and the more frequently it appears in combinations with other phrases. A keyword appears more frequently in the studied set, the larger and more transparent a node is (Ejsmont et al., 2020). The more yellow the nodes and linkages are, the more they indicate their timeliness and relevance to the ecosystem, accelerator, and entrepreneur ecosystem.

Table 3 contains a detailed information on keywords and clusters. The clusters reflect five distinct study themes. The co-occurrence of the keywords in the dataset then determines the order of the study themes.

Cluster 1 focuses on business incubator support services, technological transfer, and creating sustainable development. Grimaldi and Grandi (2005) distinguish four types of incubators (i.e., business, university, independent and corporate) and two incubation models. Markman et al. (2005) investigated the relationships between the structure and methods of UTTOs and the business of new ventures and incubation. Knowledge gaps can exist at several levels of aggregation, including PRIs, spin-offs, teams, individuals, incubators, and at various stages of spin-off development (Lockett et al., 2005). Technology Business Incubators (TBIs) elements are discussed, emphasizing their growing importance in the geographical context. They serve as the foundation and engine of local entrepreneurial ecosystems (Lamine et al., 2018). Surana et al. (2020) proposed that Science, Technology, and Innovation (STI) achieve long-term development goals. Van Rijnsoever et al. (2017) analyzed how entrepreneurial support organizations might integrate limited sustainable development start-ups (SDSs) into entrepreneurial ecosystems. Meanwhile, business incubators support services are generally related to entrepreneurs' long-term impacts (Karahan et al., 2022). Almansour (2022) examined how utilizing technical advancements like digital marketing and aligning with pertinent SDGs may improve.

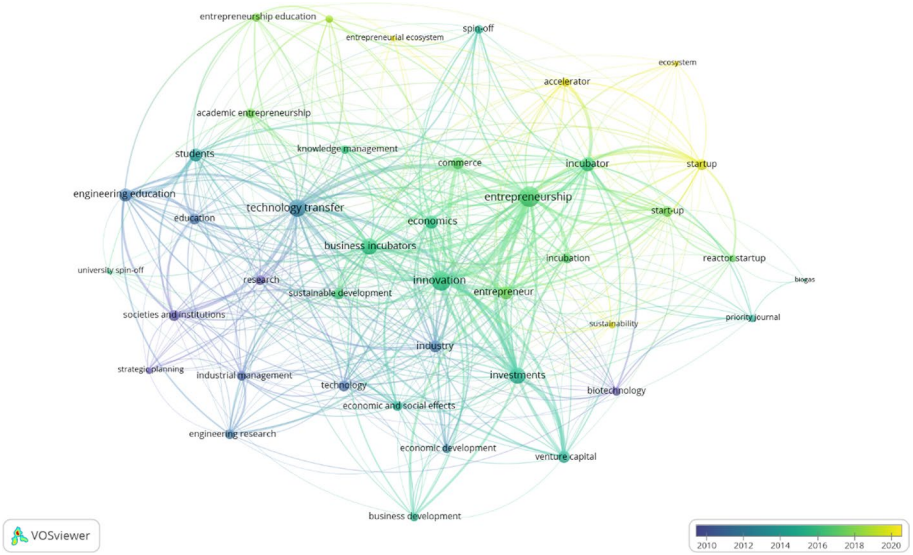

Fig. 5 Co-occurrence of Keywords Network Map

Table 3 Main research topics based on CONK

Cluster	Keywords	Total link strength	Occurrences*	Main research topics
1	Business incubators	155	98	Incubator services and technology transfer
	Technology transfer	188	94	
	Students	99	41	
	Technology	75	37	
	Engineering education	98	35	
	Societies and institutions	73	28	
	Sustainable development	66	25	
	Education	76	24	
	Industrial management	56	23	
	Engineering research	54	22	
	Research	56	19	
	Strategic planning	25	13	
	University spin-off	12	5	
2	Incubator	131	57	Start-up incubation/development
	Start-up	69	47	
	Biotechnology	40	18	
	Priority journal	28	17	
	Accelerator	47	16	
	Biogas	5	14	
	Reactor start-up	34	12	
	Ecosystem	16	8	
3	Entrepreneurship	279	172	Entrepreneurship and innovation
	Innovation	233	131	
	Entrepreneur	95	42	
	Economics	102	39	
	Incubation	55	34	
	Business development	45	26	
	Economic development	45	21	
	Economic and social effects	55	20	
	Sustainability	20	14	
4	Entrepreneurship education	38	23	The role of Universities in entrepreneurship
	Knowledge management	45	22	
	Academic entrepreneurship	51	20	
	Entrepreneurial university	36	18	
	Spin-off	39	16	
5	Investments	161	161	The role of investments and finance
	Commerce	83	83	
	Venture capital	81	81	
	Industry	92	92	

* Ranking order, min = 5

Corporate sustainability (CS) aims to accomplish the "triple bottom line" (Kuckertz & Wagner, 2010) by balancing economic achievement, social fairness, and environmental resilience and transforming sustainability orientation into a substantive enterprise. The economy, environment, and society gains must be achieved through sustainable entrepreneurship while preserving businesses, local communities, and incubator ecosystems (Johnson & Schaltegger, 2019). Though the link between CS and start-ups has

been investigated (Bojnec & Tomšič, 2020), there is still a significant research gap when considering the driving forces and barriers between start-ups' business performance and incubators' association with sustainable development.

Cluster 2 depicts the primary topic of start-up development and the involvement of the entrepreneurial ecosystem. Chan and Lau (2005) present the effectiveness of incubators from the standpoint of the venture creation and development process. Elfring and Hulsink (2007) explored the network progress of founding entrepreneurs. Brito (2018) sought to explore how universities might serve as leaders and integrators of innovation ecosystems. Meanwhile, Tripathi and Oivo (2020) discussed the concerns of incubators, accelerators, co-working spaces, mentors, and events in the firm development process. Furthermore, the factors influencing start-up creation and the entrepreneurial ecosystem (Zaidi et al., 2023) and the enhancement of the innovation ecosystem are highlighted by Felizola et al. (2019).

Cluster 3 is concerned with incubation models, network incubators, and the concept of sustainability-profiled business incubators. Grimaldi and Grandi (2005) completed a classification of business incubators and an evaluation of incubation models. A networked incubator is a fundamentally new and long-lasting organizational paradigm that is ideally adapted to the growth of firms in the Internet economy (Hansen et al., 2000). Weiblen and Chesbrough (2015) suggested a typology of corporate processes to elucidate how businesses might bridge the gap between themselves and the start-up environment. Furthermore, by focusing more on social media, business incubators can assist entrepreneurs in creating networks to benefit their own companies (Tötterman & Sten, 2005).

Sustainability-profiled business incubators are specialized incubators that develop and promote start-ups and organizations with a strong focus on sustainability and environmental responsibility. These incubators provide resources, mentorship, and a supportive ecosystem to enterprises committed to sustainable practices, eco-friendly products, and reducing environmental impact (Bank & Kanda, 2016). Saura et al. (2019) identified crucial factors in User Generated Content (UGC) on the Twitter social network for the creation of successful start-ups, and factors for sustainable start-ups and business models, tenant recruitment, and processes to support sustainability-profiled incubators. Seven factors were proposed for the framework of sustainability-profiled incubators, e.g., green building and facilities, green screening process, environmental education and awareness, energy and water management, promotion of green management and green proactive tenants (Fonseca & Chiappetta Jabbour, 2012). Bank et al. (2017) show that regional and interregional cooperation and a well-designed, structured pre-incubation process are necessary to attract tenants to sustainable incubators.

Cluster 4 raises the issue of universities' role in fostering the formation of academic spin-offs. Existing literature reveals two opposing trends in beginning entrepreneurs' networks (Elfring & Hulsink, 2007). One evolves from an identity-based network with a high concentration of strong ties to a network with weak ties. The second scenario is the inverse, with weak relationships predominating during the emergence phase and some evolving into solid ties, as is typical of the early growth phase. Fini et al. (2011) discussed the role of universities and the local context in fostering academic spin-offs. The discussion focused on firms' technological investments during the incubation stage of an

industry between a technological breakthrough and the first instance of its commercialization (Moeen & Agarwal, 2017). Lamine et al. (2018) emphasized the rising importance that technology business incubators (TBIs) play in the spatial context, where they act as the foundation and engine of local entrepreneurial ecosystems and covered a variety of TBIs' features.

Cluster 5 investigates the relationship between incubation and the number of investments raised by early-stage start-ups as a performance indicator. Grimaldi and Grandi (2005) defined human capital and signaling theory. The effect of founder characteristics on attracting external investment and enhancing the survival of new high-technology ventures is investigated (Gimmon & Levie, 2010). Cumming et al. (2019) presented two opposing arguments to steer entrepreneurial start-ups away from liquidation and toward acquisition outcomes. On the one hand, acquisitions can be made through the control route and with the help of outside financiers such as (VCs). VCs exert control over start-ups through board seats and other contractual rights, causing the necessary changes to attract a strategic acquirer (Morgan, 2014).

Discussion and implications

The main objective of this study was to examine the success of small enterprises on the innovation processes, to shed light on novel research perspectives on business incubation. A bibliometric analysis was used to analyze societal impacts of start-ups while also considering sustainability. The article offers a comprehensive overview of the various perspectives and trends of start-up incubation research, since the 1980s. The systematic review methodology used in this study ensured that all relevant literature were identified and synthesized. The primary novelty of the paper is the complexity of the research methods, in addition to identifying and comprehensively understand and visualize different research perspectives on how start-ups are incubated. At the same time, the visualization analysis provided a unique perspective on the interconnectedness and trends of ideas in the field.

The study implied that several key factors contribute to the success of start-up incubation programs, including mentorship, networking opportunities, access to funding, and a supportive community. The visualization analysis revealed many interconnections between these factors, all essential components of a successful incubation program. The advantage of the Network Analysis and Visualization used in this bibliometric review is that it provides a systematic and integrated overview of the research field of business incubators. By conducting a bibliometric analysis, the study organizes and integrates the scholarly knowledge base relating to incubators, allowing for a more objective understanding of business incubation. By conducting performance analyses and science mappings, the study reveals the most productive and impactful articles, authors, journals, disciplines, and countries in the field. The research identifies previous predominant research themes and provides a framework for future research opportunities. In contrast to previous approaches (Deyanova et al., 2022), the research identifies past dominant research themes, tendencies and provides a framework for future research opportunities in business incubations. The results can guide policymakers in planning and providing incubation initiatives for innovation improvement or regional development.

Theoretically, this research will build on prior findings from at least two research streams. The first is the role of the entrepreneurial ecosystem (Autio et al., 2014) and sustainability development (Isenberg, 2016). Regarding the latter, the extant literature needs to provide more knowledge on what context, what kind, and how much support is likely to result in creating new start-ups with a positive impact on social, economic, and environmental progress. However, the incubation needs of different start-ups may be very distinct (Rasmussen et al., 2014), and spin-offs typically have many liabilities and require more support, e.g., financial resources, networking and business/entrepreneurial competencies, and probably longer incubation times before they gain sustainable returns.

An important theoretical contribution of our approach is nuancing the understanding of highlighting the role of the environment (local context or ecosystem) in the creation of start-ups. Incubation has mainly been studied in relation to incubators (Mian et al., 2016). However, incubators are only one of the several organizations within an ecosystem that contribute to the process of incubating start-ups. Start-ups can obtain support from several ecosystem actors, including universities, technology transfer offices, accelerators, investors, government agencies, and large firms (Novotny et al., 2020).

The findings of this study have several implications for practitioners and researchers in the field of start-up incubation. For example, the study highlights the importance of mentorship in supporting the development of new ventures and suggests that incubators should focus on providing high-quality mentorship programs for their members. In addition, the study suggests that incubators should prioritize building strong networks of support and services for their members, as this can facilitate access to funding and other critical resources. First, the review identifies the key factors contributing to the success of start-up incubators. This information can be valuable for entrepreneurs considering joining an incubator or policymakers looking to establish new ones. For instance, the analysis reveals that effective incubators frequently feature seasoned mentors and offer networking possibilities, which can influence the design of upcoming incubator programs (Leitão et al., 2022). Second, the visualization analysis helps to identify gaps in the existing literature and highlight areas for future research. For example, the analysis may demonstrate that certain subjects, such as the role of government policies in incubation programs, still need to be thoroughly researched (Pattanasak et al., 2022). Third, the success of start-up incubation programs can depend on the characteristics of the local ecosystem, including human (labor/knowledge), financial (money) and informational (technical, legal, financial, and procedural advice) resources, and the degree of interactions among these diverse elements (Sardeshmukh et al., 2019). Policymakers should consider the unique needs of their region when designing and implementing incubation programs. For example, incubators with a robust entrepreneurial culture may require different types of assistance than those without such a culture (Bărbulescu et al., 2021). Fourth, the review highlights the importance of evaluating the outcomes of incubation programs. This information can be used to improve future programs and inform policy decisions. For example, one study discovered that the ability of start-ups in incubation programs to attract follow-on funding could be used to measure their success (Donbesuur et al., 2020).

Overall, the bibliometric review and visualization analysis provide valuable insights for entrepreneurs, policymakers, and researchers interested in start-up incubation. By identifying critical success factors, highlighting gaps in the literature, emphasizing the importance of the local ecosystem, and promoting program evaluation, this research can help to improve the effectiveness of start-up incubation programs and support the growth of new businesses.

Conclusions

The incubator model dates to the late 1950s with the foundation of the first incubators in the start-up ecosystem. This bibliometric review and visualization analysis aimed to shed light on the progress and current state of start-up incubation research. Through a search and analysis of relevant literature, we have identified five key themes and trends of start-up incubation research, such as incubator services and technology transfer, start-up incubation and development, entrepreneurship and innovation, the role of universities in entrepreneurship, and the role of investors and finance. In addition, the visualization analysis provided a unique perspective on the relationships between different concepts in the literature and highlighted areas for further research. The field initially focused on biotechnology with a particular interest in technology transfer. Later, the relationship of education, research, and industry, as well as university spin-offs were prevalent. In recent years, accelerators and (entrepreneurial) ecosystems have been the main research interest. Start-up incubation has received attention from all continents but has been dominated by scholars from only a few countries, such as the United States, the United Kingdom, and Italy. Accordingly, there is a strong need for more research, especially in emerging economies to enhance our understanding of the role of the institutional context in start-up incubation.

Start-up incubation literature connects several subfields, including management, business, engineering, energy, and medicine, rather than concentrating on one subdiscipline. Based on the bibliometric and visualization analyses of start-up incubation perspectives, it is advisable to take a more careful approach to supporting start-ups and start-up development organizations. This approach should consider broader societal impacts of start-up firms and their products, including social, cultural, environmental, and economic returns in addition to sales and profit, both the economic and social dimensions of sustainability as well as the specific needs and challenges different start-ups face (Fini et al., 2018).

Some incubators (social incubators) focus on start-ups that pursue both economic and social objectives, hence indicators measuring technological, economic, and social performance should be developed according to the type of incubator (Sansone et al., 2020). The diversity of start-ups is also reflected by their specific liabilities, such as newness, smallness, and outsiders (Guercini & Milanesi, 2016). Not every start-up develops in the same way and speed or needs the same type and amount of external support to establish itself on the market, e.g., academic spin-offs typically have many liabilities and require more support and longer incubation times than scalable software start-ups (Novotny et al., 2020).

We identified several key factors that contribute to the success of start-up incubation programs, including access to funding, mentorship and coaching, networking

opportunities, and infrastructure and human capital. In addition, it was found that including sustainability practices and principles can enhance the success and impact of start-ups and contribute to broader social goals. However, there are also challenges and limitations associated with start-up incubation programs, including the need for ongoing support beyond the initial incubation period, the risk of dependence on incubators, and the potential for negative impacts on social and environmental sustainability.

Based on the proposed framework, multiple research agendas and recommendations occurred. The first allows for establishing legislation, administrative processes, and intellectual property frameworks that encourage the development of start-up organizations. Second, implement extensive mentoring, business advisory services, networking opportunities, and workshops for start-up incubators. These programs should include access to networks and industry-specific knowledge. Third, investigate how ecosystem elements, such as the local start-up culture, institutions, and resource accessibility affect the incubation of start-ups. Fourth, develop tactics to overcome obstacles and encourage sustainability, inclusion, equity, and diversity inside incubator ecosystems.

The findings also emphasize the importance of a collaborative and integrated approach to start-up incubation, which includes the active participation and engagement of a diverse range of stakeholders such as the government, industry, academia, start-up development organizations, and civil society. Such an approach can help start-ups address complex challenges while also contributing to achieving larger sustainability or broader societal goals. However, further research is needed to fully understand how different actors and factors collaborate to foster start-up success and to identify additional strategies and technologies to improve incubation outcomes in various start-up ecosystems.

Machine learning can provide start-ups with valuable insights and tools to help them grow and succeed in a competitive market (Zhang et al., 2022). In addition, there is a need for more research into the specific needs and challenges faced by start-ups in different industries, networks and stages of big data-driven development (Nagy et al., 2023). Artificial intelligence-based decision-making algorithms can analyze large amounts of data to identify patterns and predict future outcomes. Start-ups can use this technology to predict customer behavior, market trends, and other business factors, e.g., fraudulent activity. For instance, examine the effects of various ecosystem attributes on incubators' operational effectiveness by automating repetitive tasks, and sustainability by reducing waste, conserving resources, and reducing the environmental impact of operations (Lăzăroiu et al., 2022).

The study has a few limitations. First, the research is based solely on Scopus imports of bibliographic data. The findings of bibliometric analysis may be impacted using a particular database (Mongeon & Paul-Hus, 2016). As a result, depending on the database chosen, the results may differ. Second, the restricted access to the documents left out certain crucial writings. It may be considered by future researchers studying the subject.

Abbreviations

SUPIE	Start-up incubation ecosystem
SLNA	Systematic Literature Network Analysis
BNAV	Bibliographic Network Analysis and Visualization
CAN	Citation network analysis
GCS	Global citation score

BDA	Burst detection analysis
CONK	Co-occurrence networks of keywords
VOS	Visualization of similarities
GCSA	Global citation score analysis
CNM	Citation Network Map
PRIs	Public Research Institutions
UTTOs	University Transfer Technology Offices
ASO	Academic spin-off
BICs	Business Innovation Centers
UBIs	University Business Incubators
IPIs	Independent private incubators
CPIs	Corporate and private incubators
TBIs	Technology business incubators
STI	Science, technology, and innovation
CS	Corporate sustainability
UGC	User generated content

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Code availability
Not applicable.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
All authors have fully agreed to this submission and agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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References

Aernoudt, R. (2004). Incubators: Tool for entrepreneurship? *Small Business Economics, 23*, 127–135. https://doi.org/10.1023/B:SBEJ.0000027665.54173.23
Almansour, M. (2022). Business incubators and entrepreneurial training: leveraging technological innovations and digital marketing. *IEEE Transactions on Engineering Management*. https://doi.org/10.1109/TEM.2022.3180212
Al-Mubaraki, H. M., & Busler, M. (2010). Business incubators: Findings from a worldwide survey, and guidance for the GCC states. *Global Business Review, 11*, 1–20. https://doi.org/10.1177/097215090901100101
Amjad, T., Shahid, N., Daud, A., & Khatoon, A. (2022). Citation burst prediction in a bibliometric network. *Scientometrics, 127*, 2773–2790. https://doi.org/10.1007/S11192-022-04344-3/TABLES/10
Åstebro, T., Bazzazian, N., & Braguinsky, S. (2012). Startups by recent university graduates and their faculty: Implications for university entrepreneurship policy. *Research Policy, 41*, 663–677. https://doi.org/10.1016/j.respol.2012.01.004
Audretsch, D., Colombelli, A., Grilli, L., Minola, T., & Rasmussen, E. (2020). Innovative start-ups and policy initiatives. *Research Policy, 49*, 104027. https://doi.org/10.1016/J.RESPOL.2020.104027
Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy, 43*, 1097–1108. https://doi.org/10.1016/j.respol.2014.01.015
Bank, N., Fichter, K., & Klofsten, M. (2017). Sustainability-profiled incubators and securing the inflow of tenants—The case of Green Garage Berlin. *Journal of Cleaner Production, 157*, 76–83. https://doi.org/10.1016/j.jclepro.2017.04.123

Bank, N., & Kanda, W. (2016). Tenant recruitment and support processes in sustainability-profiled business incubators. *Industry and Higher Education, 30*, 267–277. https://doi.org/10.1177/0950422216659567
Barbero, J. L., Casillas, J. C., Wright, M., & Ramos Garcia, A. (2014). Do different types of incubators produce different types of innovations? *The Journal of Technology Transfer, 39*, 151–168. https://doi.org/10.1007/S10961-013-9308-9
Bărbulescu, O., Tecău, A. S., Munteanu, D., & Constantin, C. P. (2021). Innovation of startups, the key to unlocking post-crisis sustainable growth in Romanian entrepreneurial ecosystem. *Sustainability, 13*, 671. https://doi.org/10.3390/SU13020671
Belitski, M., & Heron, K. (2017). Expanding entrepreneurship education ecosystems. *Journal of Management Development, 36*, 163–177. https://doi.org/10.1108/JMD-06-2016-0121
Bojnec, Š, & Tomšič, N. (2020). Corporate sustainability and enterprise performance. *International Journal of Productivity and Performance Management, 70*, 21–39. https://doi.org/10.1108/IJPPM-05-2019-0226
Breznitz, S. M., & Feldman, M. P. (2012). The engaged university. *Journal of Technology Transfer, 37*, 139–157. https://doi.org/10.1007/s10961-010-9183-6
Brito, C. (2018). Promoting the creation of innovation ecosystems: The case of the University of Porto. *Journal of Innovation Management, 6*, 8–16. https://doi.org/10.24840/2183-0606_006-003_0002
Bruneel, J., Ratinho, T., Clarysse, B., & Groen, A. (2012). The Evolution of Business Incubators: Comparing demand and supply of business incubation services across different incubator generations. *Technovation, 32*, 110–121. https://doi.org/10.1016/j.technovation.2011.11.003
Callon, M., Courtial, J. P., & Laville, F. (1991). Co-word analysis as a tool for describing the network of interactions between basic and technological research: The case of polymer chemistry. *Scientometrics, 22*, 155–205. https://doi.org/10.1007/BF02019280
Chan, K. F., & Lau, T. (2005). Assessing technology incubator programs in the science park: The good, the bad and the ugly. *Technovation, 25*, 1215–1228. https://doi.org/10.1016/j.technovation.2004.03.010
Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology, 57*, 359–377. https://doi.org/10.1002/asi.20317
Chen, C., Ibekwe-SanJuan, F., & Hou, J. (2010). The structure and dynamics of cocitation clusters: A multiple-perspective cocitation analysis. *Journal of the American Society for Information Science and Technology, 61*, 1386–1409. https://doi.org/10.1002/asi.21309
Clark, L. (2010). Book review: The SAGE handbook of organizational research methods. *Management Learning, 41*, 355–358. https://doi.org/10.1177/1350507610041003060 4
Clarysse, B., Wright, M., Lockett, A., Van de Velde, E., & Vohora, A. (2005). Spinning out new ventures: A typology of incubation strategies from European research institutions. *Journal of Business Venturing, 20*, 183–216. https://doi.org/10.1016/j.jbusvent.2003.12.004
Cohen, S., Fehder, D. C., Hochberg, Y. V., & Murray, F. (2019). The design of startup accelerators. *Research Policy, 48*, 1781–1797. https://doi.org/10.1016/j.respol.2019.04.003
Collinson, S., & Gregson, G. (2003). Knowledge networks for new technology-based firms: An international comparison of local entrepreneurship promotion. *R and D Management, 33*, 189–208. https://doi.org/10.1111/1467-9310.00292
Cooper, A. C. (1985). The role of incubator organizations in the founding of growth-oriented firms. *Journal of Business Venturing, 1*, 75–86. https://doi.org/10.1016/0883-9026(85)90008-4
Corsi, C., & Prencipe, A. (2016). Improving innovation in University Spin-offs. The fostering role of university and region. *Journal of Technology Management and Innovation, 11*, 13–21. https://doi.org/10.4067/S0718-27242016000200002
Cumming, D., Werth, J. C., & Zhang, Y. (2019). Governance in entrepreneurial ecosystems: Venture capitalists vs. technology parks. *Small Business Economics, 52*, 455–484. https://doi.org/10.1007/s11187-017-9955-6
Del Sarto, N., Isabelle, D. A., & Di Minin, A. (2020). The role of accelerators in firm survival: An fsQCA analysis of Italian startups. *Technovation*. https://doi.org/10.1016/j.technovation.2019.102102
Deyanova, K., Brehmer, N., Lapidus, A., Tiberius, V., & Walsh, S. (2022). Hatching start-ups for sustainable growth: a bibliometric review on business incubators. *Review of Managerial Science, 16*, 2083–2109. https://doi.org/10.1007/s11846-022-00525-9
Ding, Y., Chowdhury, G. G., & Foo, S. (2001). Bibliometric cartography of information retrieval research by using co-word analysis. *Information Processing and Management, 37*, 817–842. https://doi.org/10.1016/S0306-4573(00)00051-0
Donbesuur, F., Boso, N., & Hultman, M. (2020). The effect of entrepreneurial orientation on new venture performance: Contingency roles of entrepreneurial actions. *Journal of Business Research, 118*, 150–161. https://doi.org/10.1016/j.jbusres.2020.06.042
Eesley, C. E., & Lee, Y. S. (2021). Do university entrepreneurship programs promote entrepreneurship? *Strategic Management Journal, 42*, 833–861. https://doi.org/10.1002/smj.3246
Ejsmont, K., Gladysz, B., & Kluczek, A. (2020). Impact of industry 4.0 on sustainability—bibliometric literature review. *Sustainability, 12*, 5650. https://doi.org/10.3390/su12145650
Elfring, T., & Hulsink, W. (2007). Networking by entrepreneurs: Patterns of tie-formation in emerging organizations. *Organization Studies, 28*, 1849–1872. https://doi.org/10.1177/0170840607078719
Eveleens, C. P., van Rijnsoever, F. J., & Niesten, E. M. M. I. (2017). How network-based incubation helps start-up performance: A systematic review against the background of management theories. *The Journal of Technology Transfer, 42*, 676–713. https://doi.org/10.1007/s10961-016-9510-7
Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. *International Journal of Production Economics, 162*, 101–114. https://doi.org/10.1016/j.ijpe.2015.01.003
Falagas, M. E., Pitsouni, E. I., Malietzis, G. A., & Pappas, G. (2008). Comparison of Pubmed, Scopus, web of science, and Google scholar: Strengths and weaknesses. *The FASEB Journal, 22*, 338–342. https://doi.org/10.1096/fj.07-9492LSF
Felizola, M. P. M., De Aragão Gomes, I. M., & Prata De Almeida, M. B. F. (2019). Innovation ecosystem in Sergipe state: The difficulties faced by startups. *International Journal of Innovation and Technology Management*. https://doi.org/10.1142/S0219877019500354

Fernández-Alles, M., Camelo-Ordaz, C., & Franco-Leal, N. (2014). Key resources and actors for the evolution of academic spin-offs. *Journal of Technology Transfer, 40*, 976–1002. https://doi.org/10.1007/s10961-014-9387-2
Fini, R., Grimaldi, R., Santoni, S., & Sobrero, M. (2011). Complements or substitutes? The role of universities and local context in supporting the creation of academic spin-offs. *Research Policy, 40*, 1113–1127. https://doi.org/10.1016/j.respol.2011.05.013
Fini, R., Rasmussen, E., Siegel, D., & Wiklund, J. (2018). Rethinking the commercialization of public science: From entrepreneurial outcomes to societal impacts. *Academy of Management Perspectives, 32*, 4–20. https://doi.org/10.5465/amp.2017.0206
Fonseca, S. A., & Chiappetta Jabbour, C. J. (2012). Assessment of business incubators' green performance: A framework and its application to Brazilian cases. *Technovation, 32*, 122–132. https://doi.org/10.1016/j.technovation.2011.10.006
Gimmon, E., & Levie, J. (2010). Founder's human capital, external investment, and the survival of new high-technology ventures. *Research Policy, 39*, 1214–1226. https://doi.org/10.1016/j.respol.2010.05.017
Gnyawali, D. R., & Fogel, D. S. (1994). Environments for entrepreneurship development: Key dimensions and research implications. *Entrepreneurship Theory and Practice, 18*, 43–62. https://doi.org/10.1177/104225879401800403
Grimaldi, R., & Grandi, A. (2005). Business incubators and new venture creation: An assessment of incubating models. *Technovation, 25*, 111–121. https://doi.org/10.1016/S0166-4972(03)00076-2
Guckenbiehl, P., Corral de Zubielqui, G., & Lindsay, N. (2021). Knowledge and innovation in start-up ventures: A systematic literature review and research agenda. *Technological Forecasting and Social Change, 172*, 121026. https://doi.org/10.1016/j.techfore.2021.121026
Guercini, S., & Milanesi, M. (2016). Interaction approach and liabilities: A case analysis of start-up firms. *Journal of Business-to-Business Marketing, 23*, 293–309. https://doi.org/10.1080/1051712X.2016.1250595
Hackett, S. M., & Dilts, D. M. (2004). A systematic review of business incubation research. *The Journal of Technology Transfer, 29*(1), 55–82. https://doi.org/10.1023/B:JOTT.0000011181.11952.0F
Hansen, M. T., Chesbrough, H. W., Nohria, N., & Sull, D. N. (2000). Networked incubators: Hothouses of the new economy. *Harvard Business Review, 78*, 74–84199.
Horne, J., & Fichter, K. (2022). Growing for sustainability: Enablers for the growth of impact startups—a conceptual framework, taxonomy, and systematic literature review. *Journal of Cleaner Production, 349*, 131163. https://doi.org/10.1016/j.jclepro.2022.131163
Høvig, O., Pettersen, I. B., & Aarstad, J. (2017). Entrepreneurial causation vs. effectuation in a business incubation context: Implications for recruiting policy and management. *Entrepreneurship Research Journal*. https://doi.org/10.1515/erj-2017-0065
Hummon, N. P., & Dereian, P. (1989). Connectivity in a citation network: The development of DNA theory. *Social Networks, 11*, 39–63. https://doi.org/10.1016/0378-8733(89)90017-8
Iscaro, V., Castaldi, L., & Buccino, G. (2021). Networked business incubators: A systematic literature review. *Global Business and Economics Review, 25*, 331–354. https://doi.org/10.1504/GBER.2021.118708
Isenberg, D. J. (2016). Applying the ecosystem metaphor to entrepreneurship: Uses and abuses. *Antitrust Bulletin, 61*, 564–573. https://doi.org/10.1177/0003603X16676162
Johnson, M. P., & Schaltegger, S. (2019). Entrepreneurship for sustainable development: A review and multilevel causal mechanism framework. *Entrepreneurship Theory and Practice, 44*, 1141–1173. https://doi.org/10.1177/1042258719885368
Karahan, M., Rashid, L., & Kratzer, J. (2022). Gearing-up for purpose: The relationship between entrepreneurs' usage of incubation support services and sustainable impacts. *Journal of Cleaner Production*. https://doi.org/10.1016/j.jclepro.2022.134315
Khitous, F., Strozzi, F., Urbinati, A., & Alberti, F. (2020). A systematic literature network analysis of existing themes and emerging research trends in circular economy. *Sustainability, 12*, 1633. https://doi.org/10.3390/su12041633
Kleinberg, J. (2003). Bursty and hierarchical structure in streams. *Data Mining and Knowledge Discovery, 7*, 373–397. https://doi.org/10.1023/A:1024940629314/METRICS
Kohler, T. (2016). Corporate accelerators: Building bridges between corporations and startups. *Business Horizons, 59*, 347–357. https://doi.org/10.1016/j.bushor.2016.01.008
Kraus, S., Breier, M., Lim, W. M., Dabić, M., Kumar, S., Kanbach, D., Mukherjee, D., Corvello, V., Piñeiro-Chousa, J., Liguori, E., & Palacios-Marqués, D. (2022). Literature reviews as independent studies: guidelines for academic practice. *Review of Managerial Science, 16*, 2577–2595. https://doi.org/10.1007/S11846-022-00588-8/FIGURES/3
Kuckertz, A., & Wagner, M. (2010). The influence of sustainability orientation on entrepreneurial intentions—Investigating the role of business experience. *Journal of Business Venturing, 25*(5), 524–539. https://doi.org/10.1016/j.jbusvent.2009.09.001
Kupp, M., Marval, M., & Borchers, P. (2017). Corporate accelerators: Fostering innovation while bringing together startups and large firms. *Journal of Business Strategy, 38*, 47–53. https://doi.org/10.1108/JBS-12-2016-0145
Lamine, W., Mian, S., Fayolle, A., Wright, M., Klofsten, M., & Etzkowitz, H. (2018). Technology business incubation mechanisms and sustainable regional development. *Journal of Technology Transfer, 43*, 1121–1141. https://doi.org/10.1007/s10961-016-9537-9
Lăzăroiu, G., Androniceanu, A., Grecu, I., Grecu, G., & Neguriță, O. (2022). Artificial intelligence-based decision-making algorithms, internet of things sensing networks, and sustainable cyber-physical management systems in big data-driven cognitive manufacturing. *Oeconomia Copernicana, 13*, 1047–1080. https://doi.org/10.24136/OC.2022.030
Leitão, J., Pereira, D., & Gonçalves, Â. (2022). Business incubators, accelerators, and performance of technology-based ventures: A systematic literature review. *Journal of Open Innovation: Technology, Market, and Complexity, 8*, 46. https://doi.org/10.3390/JOITMC8010046
Lockett, A., Siegel, D., Wright, M., & Ensley, M. D. (2005). The creation of spin-off firms at public research institutions: Managerial and policy implications. *Research Policy, 34*, 981–993. https://doi.org/10.1016/j.respol.2005.05.010
Lukosiute, K., Jensen, S., & Tanev, S. (2019). Is joining a business incubator or accelerator always a good thing? *Technology Innovation Management Review, 7*, 5–15. https://doi.org/10.22215/TIMREVIEW/1251

Markman, G. D., Phan, P. H., Balkin, D. B., & Gianiodis, P. T. (2005). Entrepreneurship and university-based technology transfer. *Journal of Business Venturing, 20*, 241–263. https://doi.org/10.1016/j.jbusvent.2003.12.003
Markman, G. D., Siegel, D. S., & Wright, M. (2008). Research and technology commercialization. *Journal of Management Studies, 45*, 1401–1423. https://doi.org/10.1111/j.1467-6486.2008.00803.x
Mascarenhas, C., Marques, C. S., Galvão, A. R., & Santos, G. (2017). Entrepreneurial university: Towards a better understanding of past trends and future directions. *Journal of Enterprising Communities, 11*, 316–338. https://doi.org/10.1108/JEC-02-2017-0019
McAdam, M., & McAdam, R. (2008). High tech start-ups in University Science Park incubators: The relationship between the start-up's lifecycle progression and use of the incubator's resources. *Technovation, 28*, 277–290. https://doi.org/10.1016/j.technovation.2007.07.012
McIver-Harris, K., & Tatum, A. (2020). Measuring incubator success during a global pandemic: A rapid evidence assessment. *SSRN Electronic Journal*. https://doi.org/10.2139/SSRN.3687712
Mian, S., Lamine, W., & Fayolle, A. (2016). Technology business incubation: An overview of the state of knowledge. *Technovation, 50–51*, 1–12. https://doi.org/10.1016/j.technovation.2016.02.005
Miller, D. J., & Acs, Z. J. (2017). The campus as entrepreneurial ecosystem: The University of Chicago. *Small Business Economics, 49*, 75–95. https://doi.org/10.1007/s11187-017-9868-4
Moeen, M., & Agarwal, R. (2017). Incubation of an industry: Heterogeneous knowledge bases and modes of value capture. *Strategic Management Journal, 38*, 566–587. https://doi.org/10.1002/smj.2511
Mongeon, P., & Paul-Hus, A. (2016). The journal coverage of Web of Science and Scopus: A comparative analysis. *Scientometrics, 106*, 213–228. https://doi.org/10.1007/S11192-015-1765-5/METRICS
Moray, N., & Clarysse, B. (2005). Institutional change and resource endowments to science-based entrepreneurial firms. *Research Policy, 34*, 1010–1027. https://doi.org/10.1016/j.respol.2005.05.016
Morgan, H. (2014). Venture capital firms and incubators: Corporations can work with venture capitalists to leverage the strengths of both worlds. *Research Technology Management, 57*, 40–45. https://doi.org/10.5437/08956308X5706014
Mungila Hillemane, B. S., Satyanarayana, K., & Chandrashekar, D. (2019). Technology business incubation for start-up generation: A literature review toward a conceptual framework. *International Journal of Entrepreneurial Behaviour and Research, 25*, 1471–1493. https://doi.org/10.1108/IJEBR-02-2019-0087
Nagy, M., Lăzăroiu, G., & Valaskova, K. (2023). Machine intelligence and autonomous robotic technologies in the corporate context of SMEs: Deep learning and virtual simulation algorithms, cyber-physical production networks, and industry 4.0-based manufacturing systems. *Applied Sciences, 13*, 1681. https://doi.org/10.3390/APP13031681
Neck, H. M., Meyer, G. D., Cohen, B., & Corbett, A. C. (2004). An entrepreneurial system view of new venture creation. *Journal of Small Business Management, 42*, 190–208. https://doi.org/10.1111/j.1540-627x.2004.00105.x
Novotny, A. (2020). Bridging or isolating? The role of the university technology transfer office in the start-up incubation ecosystem. *Research handbook on start-up incubation ecosystems* (pp. 299–318). Edward Elgar Publishing Ltd.
Novotny, Á., Rasmussen, E., Clausen, T. H., & Johan, W. (2020). Helping birds to fly: Introducing start-up incubation ecosystems. In A. Novotny, E. Rasmussen, T. H. Clausen, & W. Johan (Eds.), *Research handbook on start-up incubation ecosystems* (pp. 1–17). Edward Elgar Publishing.
Pattanasak, P., Anantana, T., Paphawasit, B., & Wudhikarn, R. (2022). Critical factors and performance measurement of business incubators: A systematic literature review. *Sustainability, 14*, 4610. https://doi.org/10.3390/su14084610
Pauwels, C., Clarysse, B., Wright, M., & Van Hove, J. (2016). Understanding a new generation incubation model: The accelerator. *Technovation, 50–51*, 13–24. https://doi.org/10.1016/j.technovation.2015.09.003
Powell, K. R., & Peterson, S. R. (2017). Coverage and quality: A comparison of web of science and scopus databases for reporting faculty nursing publication metrics. *Nursing Outlook, 65*, 572–578. https://doi.org/10.1016/j.outlook.2017.03.004
Pranckutė, R. (2021). Web of science (WoS) and scopus: The titans of bibliographic information in today's academic world. *Publications, 9*, 1–12. https://doi.org/10.3390/PUBLICATIONS9010012
Prokop, D. (2021). University entrepreneurial ecosystems and spinoff companies: Configurations, developments and outcomes. *Technovation, 107*, 102286. https://doi.org/10.1016/j.technovation.2021.102286
Rasmussen, E., Mosey, S., & Wright, M. (2014). The influence of university departments on the evolution of entrepreneurial competencies in spin-off ventures. *Research Policy, 43*, 92–106. https://doi.org/10.1016/j.respol.2013.06.007
Salvador, E. (2011). Are science parks and incubators good "brand names" for spin-offs? The case study of Turin. *Journal of Technology Transfer, 36*, 203–232. https://doi.org/10.1007/s10961-010-9152-0
Sansone, G., Andreotti, P., Colombelli, A., & Landoni, P. (2020). Are social incubators different from other incubators? Evidence from Italy. *Technological Forecasting and Social Change, 158*, 120132. https://doi.org/10.1016/j.techfore.2020.120132
Sardeshmukh, S., O'Connor, A., & Smith, R. M. (2019). Resources in entrepreneurial ecosystems—a multi-level perspective. *Academy of Management Proceedings, 2019*, 13828. https://doi.org/10.5465/AMBPP.2019.13828abstract
Saura, J. R., Palos-Sanchez, P., & Grilo, A. (2019). detecting indicators for startup business success: sentiment analysis using text data mining. *Sustainability, 11*, 917. https://doi.org/10.3390/su11030917
Schmutzler, C., & Presse, A. (2021). Do startups benefit from incubation? An analysis of startups' absorptive capacity. In D. Mietzner & C. Schultz (Eds.), *FGF studies in small business and entrepreneurship* (pp. 31–49). Springer.
Schwartz, M. (2013). A control group study of incubators' impact to promote firm survival. *Journal of Technology Transfer, 38*, 302–331. https://doi.org/10.1007/s10961-012-9254-y

Siegel, D., Wright, M., Chapple, W., & Lockett, A. (2008). Assessing the relative performance of university technology transfer in the US and UK: A stochastic distance function approach. *Economics of Innovation and New Technology, 17*, 717–729. https://doi.org/10.1080/10438590701785769
Soetanto, D., & Jack, S. (2016). The impact of university-based incubation support on the innovation strategy of academic spin-offs. *Technovation, 50–51*, 25–40. https://doi.org/10.1016/j.technovation.2015.11.001
Somsuk, N., & Laosirihongthong, T. (2014). A fuzzy AHP to prioritize enabling factors for strategic management of university business incubators: Resource-based view. *Technological Forecasting and Social Change, 85*, 198–210. https://doi.org/10.1016/j.techfore.2013.08.007
Sonne, L. (2012). Innovative initiatives supporting inclusive innovation in India: Social business incubation and micro venture capital. *Technological Forecasting and Social Change, 79*, 638–647. https://doi.org/10.1016/j.techfore.2011.06.008
Spigel, B., & Harrison, R. (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal, 12*, 151–168. https://doi.org/10.1002/sej.1268
Stokan, E., Thompson, L., & Mahu, R. J. (2015). Testing the differential effect of business incubators on firm growth. *Economic Development Quarterly, 29*, 317–327. https://doi.org/10.1177/0891242415597065
Strozzi, F., Colicchia, C., Creazza, A., & Noè, C. (2017). Literature review on the 'Smart Factory' concept using bibliometric tools. *International Journal of Production Research, 55*, 6572–6591. https://doi.org/10.1080/00207543.2017.1326643
Surana, K., Singh, A., & Sagar, A. D. (2020). Strengthening science, technology, and innovation-based incubators to help achieve sustainable development goals: Lessons from India. *Technological Forecasting and Social Change, 157*, 120057. https://doi.org/10.1016/j.techfore.2020.120057
Theodorakopoulos, N., Kakabadse, N. K., & McGowan, C. (2014). What matters in business incubation? A literature review and a suggestion for situated theorising. *Journal of Small Business and Enterprise Development, 21*, 602–622. https://doi.org/10.1108/JSBED-09-2014-0152/FULL/XML
Thierstein, A., & Wilhelm, B. (2001). Incubator, technology, and innovation centres in Switzerland: Features and policy implications. *Entrepreneurship and Regional Development, 13*, 315–331. https://doi.org/10.1080/08985620110074469
Tötterman, H., & Sten, J. (2005). Start-ups: Business incubation and social capital. *International Small Business Journal, 23*, 487–511. https://doi.org/10.1177/0266242605055909
Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management, 14*, 207–222. https://doi.org/10.1111/1467-8551.00375
van Rijnsoever, F. J. (2020). Meeting, mating, and intermediating: How incubators can overcome weak network problems in entrepreneurial ecosystems. *Research Policy, 49*, 103884. https://doi.org/10.1016/j.respol.2019.103884
van Rijnsoever, F. J., & Eveleens, C. P. (2021). Money don't matter? How incubation experience affects start-up entrepreneurs' resource valuation. *Technovation, 106*, 102294. https://doi.org/10.1016/j.technovation.2021.102294
Van Rijnsoever, F. J., Van Weele, M. A., & Eveleens, C. P. (2017). Network brokers or hit makers? Analyzing the influence of incubation on start-up investments. *International Entrepreneurship and Management Journal, 13*, 605–629. https://doi.org/10.1007/s11365-016-0416-5
Vanderstraeten, J., van Witteloostuijn, A., Matthyssens, P., & Andreassi, T. (2016). Being flexible through customization—the impact of incubator focus and customization strategies on incubatee survival and growth. *Journal of Engineering and Technology Management-JET-M, 41*, 45–64. https://doi.org/10.1016/j.jengtecman.2016.06.003
Vincent, V. Z., & Zakkariya, K. A. (2021). Entrepreneurial orientation and startup performance in technology business incubation: mediating role of absorptive capacity. *Journal of Small Business Strategy, 31*, 100–116. https://doi.org/10.53703/001C.29837
von Zedtwitz, M. (2003). Classification and management of incubators: Aligning strategic objectives and competitive scope for new business facilitation. *International Journal of Entrepreneurship and Innovation Management, 3*, 176–196. https://doi.org/10.1504/ijeim.2003.002227
Waaijer, C. J. F., van Bochove, C. A., & van Eck, N. J. (2011). On the map: Nature and science editorials. *Scientometrics, 86*, 99–112. https://doi.org/10.1007/S11192-010-0205-9/FIGURES/4
Wang, J. (2022). The exploration and practices of TusPark in promoting business incubation and industrial development. *Journal of Evolutionary Studies in Business, 7*, 298–320. https://doi.org/10.1344/jesb2022.2.j114
Weiblen, T., & Chesbrough, H. W. (2015). Engaging with startups to enhance corporate innovation. *California Management Review, 57*, 66–90. https://doi.org/10.1525/cmr.2015.57.2.66
Wright, M., Siegel, D. S., & Mustar, P. (2017). An emerging ecosystem for student start-ups. *Journal of Technology Transfer, 42*, 909–922. https://doi.org/10.1007/s10961-017-9558-z
Yan, B., & Zhang, X. (2022). What research has been conducted on procrastination? Evidence from a systematical bibliometric analysis. *Frontiers in Psychology, 13*, 120. https://doi.org/10.3389/FPSYG.2022.809044/BIBTEX
Yetisen, A. K., Volpatti, L. R., Coskun, A. F., Cho, S., Kamrani, E., Butt, H., Khademhosseini, A., & Yun, S. H. (2015). Entrepreneurship. *Lab on a Chip, 15*, 3638–3660. https://doi.org/10.1039/c5lc00577a
Zaidi, R. A., Khan, M. M., Khan, R. A., & Mujtaba, B. G. (2023). Do entrepreneurship ecosystem and managerial skills contribute to startup development? *South Asian Journal of Business Studies, 12*, 25–53. https://doi.org/10.1108/SAJBS-07-2020-0233
Zedtwitz, M., & Grimaldi, R. (2006). Are service profiles incubator-specific? Results from an empirical investigation in Italy. *Journal of Technology Transfer, 31*, 459–468. https://doi.org/10.1007/s10961-006-0007-7
Zhang, L., Fu, Y., Wei, Y., Chen, H., Xia, C., & Cai, Z. (2022). Predicting entrepreneurial intention of students: Kernel extreme learning machine with boosted crow search algorithm. *Applied Sciences, 12*, 6907. https://doi.org/10.3390/app12146907

Zhou, W., Chen, J., & Huang, Y. (2019). Co-citation analysis and burst detection on financial bubbles with scientometrics approach. *Economic Research-Ekonomska Istraživanja, 32*, 2310–2328. https://doi.org/10.1080/1331677X.2019.1645716

Knoke, D., Yang, S. (2011). Introduction to social network analysis-basic methods for analyzing networks. In: *Social Network Analysis* (pp. 46–92)

Schumpeter, J, A. (1934). *The theory of economic development: An inquiry into profits, capital, credits, interest and the business cycle*. Harvard Economic Studies

Tripathi, N., Oivo, M. (2020). The roles of incubators, accelerators, co-working spaces, mentors, and events in the startup development process. In: *Fundamentals of software startups: Essential engineering and business aspects* (pp. 147–159). Springer International Publishing, M3S Research Unit, University of Oulu

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