

Exploring the linkage between business incubation and entrepreneurship: understanding trends, themes and future research agenda

Business
incubation

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Abstract

Purpose – This article aims to conduct a bibliometric study using structural and relational approaches amongst the extracted documents and investigates the connections between business incubation and entrepreneurship-related papers to describe the field comprehensively.

Design/methodology/approach – A total of 259 articles have been retrieved from Scopus database in order to conduct the bibliometric analysis. Performance analysis and science mapping techniques of bibliometrics have been used along with data visualisation software, i.e. VOSviewer and RStudio. The network collaboration and intellectual structures, i.e. bibliographic coupling, co-occurrence analysis, word cloud and trending topics, have been presented to identify the field's latest trends, themes and development.

Findings – The findings highlight annual publication trends, including the most frequently cited articles, the most productive authors, countries and highly influential journals that contribute the most to the said field. The intellectual structures have been developed to identify research themes and trends by running co-occurrence analysis and bibliographic coupling. The findings of this study emphasize the value of technology transfer, mentorship programmes, entrepreneurship education and an emphasis on innovation and creativity through entrepreneurial universities and academia. These findings provide policymakers and administrative officials with crucial guidance for fortifying the pillars of entrepreneurship and education for the comprehensive development of the economy. Further, this article attempts to identify the most influential and relevant publications as well as the newest trends in the area of business incubation in combination with entrepreneurship.

Research limitations/implications – The article contributes not only to broaden the scope of knowledge on the said research discipline but also to comprehend how the field has evolved over a period of time. This study also attracts the interest of scholars/academicians, leading to the significant production of scholarly documents in business incubation and entrepreneurship.

Practical implications – The field of entrepreneurship and business incubation is one of the important pillars for the growth and development of the economy. This piece contributes to this arena by focusing on the areas that must be taken care of by developing the entrepreneurial ecosystem and fostering the progress of startups. The fundamentals of this research highlight the importance of mentorship programs, entrepreneurship education, technology transfer and a focus on innovation and creativity through entrepreneurial education and efforts by universities/academia, giving an important direction to the policymakers and administration for strengthening the pillar of entrepreneurship and education for the holistic development of the economy.

Originality/value – Business incubation is an emerging field of academic research connected to startups, venture formation and entrepreneurship ecosystems, making it a potential scholarly discipline. This study presents a thorough bibliometric analysis over the last three decades, offering comprehensive details on the



most significant developments in the field of business incubation. Moreover, the various analytical methods applied to this study make it more attractive.

Keywords Business incubation, Entrepreneurship, Startups, Innovation, Incubator, Bibliometric analysis, Intellectual structure, Incubation

Paper type Literature review

Introduction

Over the last three decades, a new wave of startups or new business ventures has emerged and is immensely growing, especially in the post-COVID period. This has led further to the increase in the interest of various stakeholders like academicians, government, industry, researchers and scholars willing to research in the area of business incubation, startups and new venture creation. Considerable changes are occurring in the development, execution and implementation of entrepreneurial policies and entrepreneurial initiatives (Lewis, Harper-Anderson, & Molnar, 2011). In these specific situations, most studies found that “business incubators” are the utmost beneficial tools/drivers to nurture a startup’s growth and foster entrepreneurship in the business ecosystem (McAdam & Marlow, 2007; Dee, Livesey, Gill, & Minshall, 2011). In recent trends, understanding the nature of business incubators and the various aspects of serving their tenants, as a formal technique for encouraging entrepreneurial activity is growing significantly (Bøllingtoft & Ulhøi, 2005; Samaemofrad, Van Den Herik, & Verborg, 2016). Consequently, a business incubation system in the entrepreneurial environment becomes necessary as it promotes innovation, startups and entrepreneurship. Also, they can provide a promising, conducive and positive environment to support business ventures (Ayatse, Kwahar, & Iyortsuun, 2017) that facilitates startups with the necessary skills and resources to help them survive, sustain and grow. Business incubators play the role of change agents in a country’s economy, delivering the lowest-cost, best-possible solutions to business ventures (Campbell, 1989) and promoting innovation in the startup ecosystem. The business incubation process is about assisting entrepreneurs, developing startups and achieving various business gains from business incubators’ innovative business activities. They also add value to the business ventures by providing various services that help grow and blossom tenant firms (Mian, 1996; Sansone, Andreotti, Colombelli, & Landoni, 2020). Business incubator services are essential for new venture creation (Lai & Lin, 2015) and are expected to come up with rewarding benefits for their tenants.

Phan, Siegel, and Wright (2005) say that the literature on business incubation/incubators is widely incongruent and isolated, and the theories of business incubation need to be more cohesive (Albort-Morant & Ribeiro-Soriano, 2016). Thereby, a need arises to review, revisit, and reconsider the works already done in this area to find future directions in the field of the study. Therefore, with the help of the Scopus database, the authors have attempted to provide a general description of the various studies done by multiple authors in different countries that have been published in the said area in several journals. This description is provided to help the readers know about the field’s top articles, authors, journals, countries and major themes. Based on the bibliometric information extracted from the Scopus database, the current study aims to examine/scrutinize the productivity of the annual publications trend, the top ten most cited publications, the most productive authors, the most contributing countries and the best leading journals publishing in the field/area of business incubation in combination with entrepreneurship (because business incubation and entrepreneurship go hand in hand with each other). This investigation has been done for the last three decades with the help of bibliometric analysis and data visualisation software, i.e. VOSviewer and RStudio, to provide a general overview of the said discipline. Cadavid Higuaita, Awad, and Franco Cardona (2012) state that whilst doing bibliometric analysis, one should identify three

types of bibliometrics indicators: quantity, quality and structural. Quantity measures productivity, quality measures the publication impact with the help of the number of citations received by a publication and structural indicators measure the relationship between the articles/publications. The present study has used all three indicators.

Based on bibliometric indicators, the authors have conducted a bibliometric analysis to answer these three research questions:

- RQ1.* What is the frequency of annual publications, the most prolific authors, the most productive countries and the most influential journals in the field?
- RQ2.* Which are the top ten most cited articles in the area of business incubation and entrepreneurship?
- RQ3.* What are the main themes and trends of research contributed by researchers in the said area?

The performance analysis technique of bibliometrix has been applied to answer the first two research questions ([RQ1](#), [RQ2](#)). The following analysis includes studying documents (publications), their h-index and citation patterns. Number of publications act as proxies of a particular field's productivity (quantity). At the same time, citations and h-index metrics measure an author's publications' productivity impact (quality). The authors have used science mapping analysis to investigate the third research question. This analysis includes the structural indicators performed using bibliographic coupling, co-occurrence analysis, trending topics and word cloud.

The present study has been organized as follows: [Section 2](#) present a review of related literature along with a historical background and different definitions mentioned in the literature by various authors. [Section 3](#) discusses the bibliometric analysis methodology. [Section 4](#) analyses the performance analysis results using tables and network visualisations used to present the co-occurrence analysis and bibliographic coupling. [Section 5](#) summarises the findings and conclusions, followed by implications and future research agenda.

Review of literature

The concept of business incubators/incubation evolved in the early 1980s, and research on this concept started in 1984 ([Hackett & Dilts, 2004](#)). Temali and Campbell did the first major survey on the USA incubators, and the very first academic publication in the field of incubation/incubators was acknowledged and published in the year 1984 ([Hackett & Dilts, 2004](#)). Right after this publication, a series of publications ([Allen & Rahman, 1985](#); [Plosila & Allen, 1985](#); [Campbell & Allen, 1987](#)) came, to assess and understand the emergence of the incubation industry throughout the nations.

While looking at the historical background of business incubators from the previous literature, it is evident that the very first business incubator was set up in 1959, named Stanford Research Park in Batavia Industrial Centre (New York) in the USA ([Lewis, 2002](#); [Aerts, Matthyssens, & Vandembemt, 2007](#)). Along with this, the first business incubation wave emerged in the late 1970s and before 1980s, and the business incubation programs have been propagated all over the world since then ([Albert & Gaynor, 2000](#)). There were mainly two important reasons for the diffusion of the business incubation concept throughout the world. The 1st – linking the business incubators to the university research ([OECD, 1997](#)) and the 2nd – global expansion of the high-quality internet ([Grimaldi & Grandi, 2005](#)); the incubators that emerged in the 1st wave were generally operating in the northeast region of the USA. The value proposition of these incubators is to achieve the economics of scale and economic development in the nation. In the 2nd wave, a new business incubation model emerged in the 1990s, i.e. virtual incubators ([Carvalho & Galina, 2015](#)) focused on

information, maintaining communication and more oriented towards technology-based firms (Torun, Peconick, Sobreiro, Kimura, & Pique, 2018). After that, the industry of business incubators met with another business incubation model in the 3rd wave, known as the International Business Incubators or the International Enterprise Centre (Carvalho & Galina, 2015). These incubators were directed towards the growth of knowledge-intensive firms by offering the tenants a full range of services. The key feature of these incubators is to provide network support (Bruneel *et al.*, 2012; Mian *et al.*, 2016) and to connect different countries and regions to build an entrepreneurial ecosystem.

The literature has identified that the evolution of business incubators mainly occurred in the three waves or phases; each wave came up with a generation of business incubators. Every generation has a business incubator model, its value proposition, core service and respecting offerings. Considering previous literature, the historical background of business incubators has been summed up in Table 1.

Business incubator/incubation has been understood and defined by various authors in various ways. Some of the definitions given by well-renowned researchers/authors and sources in the field of business incubation were presented in Table 2, along with the respective authors, who have defined the business incubators/incubation as follows:

Whilst doing the literature review, it was found that authors/scholars have mainly focused on the evolution of business incubators (Schwartz & Göthner, 2009; Bruneel *et al.*, 2012; Shepard, 2017; Pellegrini & Johnson-Sheehan, 2021). Many studies also highlight the role of business incubators in “venture creation” (Aerts *et al.*, 2007; Masutha & Rogerson, 2014; Li, Ahmed, Qalati, Khan, & Naz, 2020; Saraireh, 2021) and the process they have adopted for nurturing a venture (Meru & Struwig, 2015; Bank & Kanda, 2016; Iyortsuun, 2017). Whilst others talk about business incubator support services (Rice, 2002; Chandra & Medrano Silva, 2012; Lai & Lin, 2015; Xiao & North, 2017). Certain prominent studies stressed on providing an “effective support mechanism” for new entrepreneurial firms, provision of innovative services for nurturing a “conducive entrepreneurship development environment” and analysing business incubators as drivers for entrepreneurial growth (McAdam & Marlow, 2007; Fernández Fernández *et al.*, 2015; Lukeš, Longo, & Zouhar, 2019; Hughes, Hughes, Morgan, Hodgkinson, & Lee, 2021). Digital startups are another type of entrepreneurial endeavours mentioned in the literature (Yao & Li, 2023; Zhao, Liu, & Zhang, 2023) that focus on creating customer-centric businesses and building unique value propositions through innovative business activities for addressing customers’ demands (Guo, Guo, & Ma, 2022). At the same time, some authors have mentioned the various types of business incubators in the market in their research (Hansen, Chesbrough, Nohria, & Sull, 2000; Bøllingtoft & Ulhøi, 2005; Bøllingtoft, 2012).

Business incubators help in creating an impactful business and act as the main pillar supporting innovation (Gerlach & Brem, 2015) and promoting entrepreneurship. They also assist in building competence among entrepreneurs through business incubation training programs that support entrepreneurial activities (Sudana, Apriyani, Suprptono, & Kamis, 2019). The act of entrepreneurship and actors’ entrepreneurs stimulate regional, industrial and economic growth (Arora & Sharma, 2021) by identifying niche markets, attracting funding, promoting sustainability and creating jobs regionally (Arora, Dhiman, & Sharma, 2023). Entrepreneurial involvement creates opportunities for collaboration and network building among big corporate and small startup units for knowledge exchange and business development (Corvello, Felicetti, Steiber, & Alänge, 2023), which ultimately gives birth to an innovative ecosystem and generates critical values for creating innovative ventures (Metallo, Agrifoglio, Briganti, Mercurio, & Ferrara, 2021). As new ventures learn a lot from entrepreneurial practices, they serve as a key to innovation and creativity (Wu *et al.*, 2023) and help translate the innovative idea into the actual business outcome (Huang, Li, Wang, & Li, 2022).

Waves of BI	Generation	BI model	Value proposition	Core services	Offering	References
1st before 1980s	1st Generation	Science/Research parks	Economies of scale	Infrastructure support	Affordable space and shared resources	Bruneel <i>et al.</i> (2012), Carvalho and Galina (2015), Mian <i>et al.</i> (2016), Torun <i>et al.</i> (2018)
2nd 1980–1990s	2nd Generation	Virtual incubator	Accelerating knowledge-based services	Business support/ services	Value-adding services, i.e. coaching and training	Bruneel <i>et al.</i> (2012), Carvalho and Galina (2015), Mian <i>et al.</i> (2016), Torun <i>et al.</i> (2018)
3rd after 2000	3rd Generation	International business incubators	Access to knowledge, legitimacy and external resources	Network support	Specialised resources, expertise and professional services	Bruneel <i>et al.</i> (2012), Carvalho and Galina (2015), Mian <i>et al.</i> (2016), Torun <i>et al.</i> (2018)
Note(s): BI referred to as business incubation						
Source(s): Authors' compilation from the review of literature						

Table 1.
Evolution of business
incubators

Authors	Page no.	Definition
Allen and Rahman (1985)	p. 12	"A facility that aids the early-stage growth of companies by providing rental space, shared office services and business consulting assistance"
Lalkaka (2002)	p. 169	"Have the purpose of assisting the new venture creation process and provide affordable workspace as well as shared facilities, counselling, training, information and access to external networks for entrepreneurial groups"
Cornelius and Bhabra-Remedios (2003)	p. 3	"A dynamic process where young firms are nurtured to help them to survive and grow during periods of uncertainty, particularly during the startup phase"
Hackett and Dilts (2004)	p. 57	"A shared office space facility that seeks to provide its incubatees with a strategic, value-adding intervention system (i.e. business incubation) of monitoring and business assistance"
Peters, Rice, and Sundararajan (2004)	p. 83	"Provide a supportive environment for startup and fledgling companies"
Tötterman and Sten (2005)	p. 488	"Support new potential companies in their development process by not only giving them credibility but also by helping them to build promising support and business networks"
Carayannis and Von Zedtwitz (2005)	p. 103	"Facilitating entrepreneurs and early-stage startup companies and compete with consulting firms, real-estate agents and other companies for the most interesting and valuable startups"
Schwartz and Hornych (2012)	p. 178	"Provide favourable locations and beneficial business contexts via the spatial concentration of a variety of support elements, such as rental space, infrastructure and facilities and consulting services"
Al-Mubarak and Busler (2013)	p. 19	"An economic and social program which provides intensive support to startup companies, coach them to start and accelerate their development and success through business assistance program"
Mian <i>et al.</i> (2016)	p. 1	"Promising policy tools that support innovation and technology-oriented entrepreneurial growth"
NBIA (2021)	p. 1	"Facilities that provide shared resources for young businesses, such as office space, consultants and personnel. They may also provide access to financing and technical support"
Source(s): Authors' compilation from the review of literature		

Table 2.
Different definitions by
different authors

Entrepreneurship promotion is necessary for taking policy actions (Kim, Lee, & Ames, 2005), and incubators have the capacity and experience to provide policy solutions to younger firms. Business incubators create value by combining resources and generating entrepreneurial spirit for startups (Li *et al.*, 2020). They function as building blocks that bridge the knowledge gap and help to increase accessibility, awareness and affordability of social, financial and human capital, which are vital resources for entrepreneurial success (Carayannis & Von Zedtwitz, 2005). Almost every author, including Mian (2011), concludes that business incubation is indispensable for entrepreneurial growth and development. Since business incubators play a central role in creating and developing an entrepreneurial ecosystem; therefore, it is important to understand, synthesise and analyse the previous research contributions on “business incubation in combination with entrepreneurship”.

Research methodology

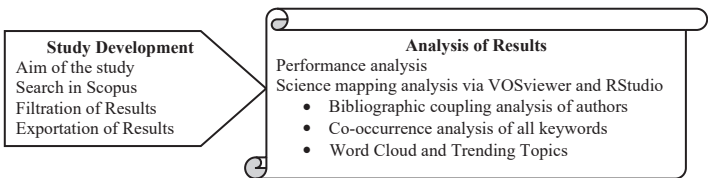
Bibliometrics has been regarded as a helpful tool that can assess the overall production of the research work and observe the overall state of knowledge in a particular field (Okubo, 1997; Koseoglu, Yick, King, & Arici, 2022). Bibliometric methodology suggests that by linking the published articles, one could scientifically analyse the structure of a knowledge domain (Arici

et al., 2022a, b). Here, Figure 1 presents the overall research methodology approach for this paper.

Bibliometric data collection technique

For conducting a scientific review study, the choice of a database is crucial as it directly impacts the quality of the results. Various bibliometric sources, like Scopus, ScienceDirect, Web of Science, Google Scholar, EBSCO and many more, are available for data retrieval. Nevertheless, when it comes to specific study disciplines, the coverage of various databases varies, which influences the search results. Due to Scopus’s scientific quality and comprehensiveness, the current study has chosen it as a primary database for extracting bibliographic information. Table 3 presents a brief summary of extracted data from SCOPUS. Figure 2 illustrates a stepwise process of data extraction and Figure 3 shows the science mapping techniques of bibliometric analysis, used to identify the main trends and themes of the research.

Firstly, a search string was created to summarise the terms associated with the “business incubation” concept. The dataset considered for conducting the study was collected from Scopus on 5th April 2022. The keywords of the search string were “Business Incubators” OR “Business Incubation” OR “Technology Business Incubators” OR “Business Incubation Center”. By using Boolean AND these keywords were then combined with “Entrepreneurship”. Thus, the following search key TITLE-ABS-KEY (“Business Incubators” OR “Business Incubation” OR “Technology Business Incubators” OR “Business Incubation Center” AND “Entrepreneurship”) AND (LIMIT-TO (PUBSTAGE, “final”)) AND (LIMIT-TO (DOCTYPE, “ar”)) AND (LIMIT-TO (SUBJAREA, “BUSI”) OR LIMIT-TO (SUBJAREA, “SOCI”)) AND (LIMIT-TO (SRCTYPE, “j”)), AND LIMIT-TO (LANGUAGE, “English”)) used to retrieve the data.



Source(s): Created by authors

Figure 1.
Overall research
methodology approach

Main information about the data Description	Results
Timespan	1993:2022
Source (journals)	150
Documents (article)	259
Authors	612
Keywords plus	327
Author’s keywords	762
Single-authored docs	51
Co-authors per doc	2.65
References	12,964

Note(s): Data extracted from Scopus and analysed in RStudio

Table 3.
Summary of
extracted data

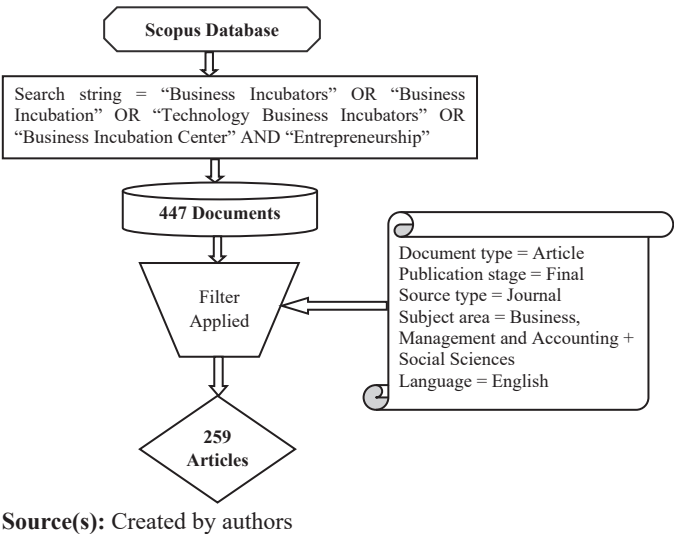


Figure 2.
Data extraction
process

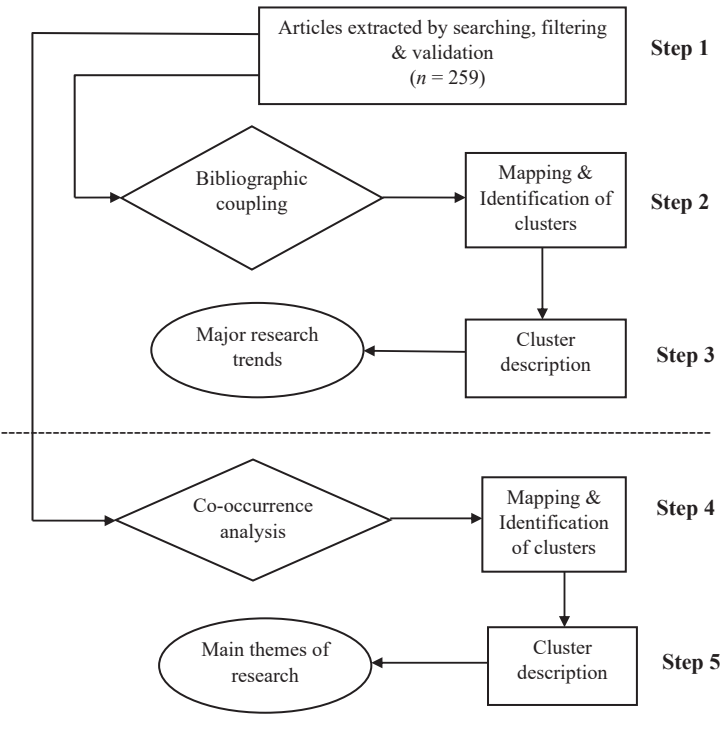
In the second stage, the keywords mentioned above were searched; a total of 447 documents appeared in the Scopus database. In the third stage, certain filters were applied to narrow down the search. These filters are applied in the database to extract the narrowed-down research objective pertaining to a specific area or a discipline of study. The document type was selected to be “article”, at the “final” publication stage in the source “journal”. Only two subject areas were selected, i.e. “business management and accounting” and “social sciences”, as they cover the largest share of publications on business incubators, i.e. 63%. Articles written in languages other than English were excluded. So, out of 447 documents, only journal articles published or are at the final stage of publication in the English language in the field of “business management & accounting and social sciences” were extracted, narrowing the articles to only 259. Finally, a dataset of 259 articles has been retrieved through the Scopus database for further analysis and interpretation.

Bibliometric analysis techniques

The first technique used to conduct the analysis was performance analysis, which examines the overall research contribution in the given area or field (Cobo, López-Herrera, Herrera-Viedma, & Herrera, 2011; Ramos-Rodríguez & Ruiz-Navarro, 2004). To cover the number of prolific authors, countries, influential journals and articles, the authors have attempted to investigate the trend of publications year by year, highly productive authors, countries, most influential journals and top ten most cited articles of the field. The results of performance analysis were shown in various tables in the later section of this article.

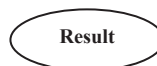
The second analysis technique was science mapping presented in Figure 3, which measures the relationships between the research constituents (Baker, Kumar, & Pandey, 2021; Cobo et al., 2011; Arici et al., 2022a, b). In the present study, the authors have performed bibliographic coupling, co-occurrence analysis, word cloud and trending topics for analysing the collaboration patterns and intellectual structures amongst the research constituents. Results were presented with the help of a bibliographic analysis enrichment technique called network analysis (Köseoglu, Sehitoglu, & Craft, 2015). Two visualisation softwares were used to present the retrieved data: VOSviewer and RStudio.

Bibliometric Analysis Techniques



Note(s):

Activity



Source(s): Adopted from Galvagno and Giaccone (2019) and Arici, Köseoglu and Arici's (2022) study, Created by authors

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Figure 3.
Science mapping
techniques to identify
the main trends and
themes of the research

Results

Performance analysis

This technique examines various research constituents' performance or overall contribution (Baker *et al.*, 2021). This analysis follows a standard practice that is used to perform reviews and represent the performance indices of individual research constituents like countries, journals and authors.

Annual publications

To provide an overall summary of the annual output of the publications in the field of business incubation along with entrepreneurship; here, Figure 4 highlights the three stages of the publication trends. The first stage was considered between 1993 and 2002, wherein the research on business incubators/incubation was nascent. In the second stage, research in the field developed moderately from the years 2003 to 2013. Finally, after the 3rd stage, i.e. from

Documents by year

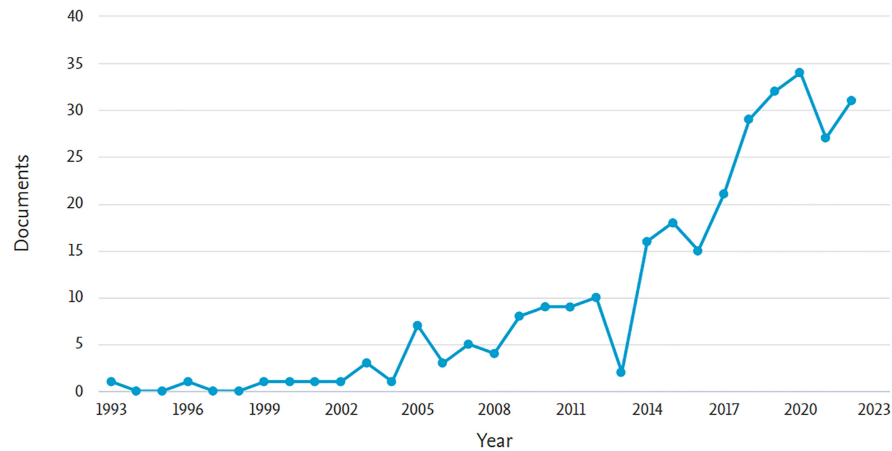


Figure 4.
Frequency of annual publication by years

Source(s): Extracted from Scopus database

2014 onwards, the publications count grew considerably. Further, it was found that most of the publications were published in the last decade, i.e. from 2014 to 2022.

Most prolific authors

In the field of business incubators/incubation, a lot of authors/researchers have significantly contributed to the development of the said field. As per the data extracted from Scopus regarding the high number of publications, some of the most contributing researchers are highlighted. However, the present study’s major shortcoming remains that the results may not have included many other well-known researchers who have contributed to the area due to focus on certain key terms, keywords and other restricted search parameters available only in one database.

Table 4 presents the list of authors who have conducted research on business incubation in combination with entrepreneurship. It is evident from Table 4 that no particular author appears more productive than the rest of the authors in terms of the number of paper publications. The reason is that all the authors have published almost the same number of documents, and very little fluctuation in the frequency of publishing the articles can be seen.

Table 4.
List of top ten prolific authors

Rank	Author	Documents	h-index	Citations
1	Lose, T.	5	2	6
2	Anholon, R.	4	2	12
3	KhanM.S.	4	3	64
4	Li, C.	4	3	23
5	Schwartz, M.	3	3	48
6	Teixeira, A.A.C.	3	2	21
7	Aarstad, J.	2	1	11
8	Ahmed, N.	2	2	17
9	Allahar, H.	2	1	5
10	Bandera, C.	2	2	49

Source(s): Authors’ compilation from the Scopus database

The authors who have published a high number of articles in the field are “Lose” with five documents, and “Anholon”, “Khan”, “Li” and “Schwartz” have published four papers each.

Most productive countries

In Table 5, the countries are ranked in descending order, and the rank of the country is given on the basis of number of documents published in a particular country. Along with ranks, citations received and the h-index of the publications has been tabulated. Between the time periods 1993–2022, the researchers of the United States of America produced the highest number of documents, i.e. 57 with 2,483 total citations along with an h-index of 23, placing at the first rank. Next in the line, the most productive nations are the UK and Spain, with 27 and 22 documents, each with 973 and 306 citations and an h-index of 12 and 8, respectively, holding second and third positions in the ranking. After Spain are South Africa, Germany, France, Indonesia, Brazil, China and India, the top ten publishers of articles in the field. Out of the top ten countries, half of the contribution in the field comes from emerging economies (South Africa, Indonesia, Brazil, China and India). These emerging economies are competing with developed countries by contributing to paper production.

Most influential journals

Table 6 presents an overview of influential journals that have contributed immensely to the area of business incubation along with entrepreneurship. The influence of a journal is

Rank	Country	Documents	Citations	h-index
1	United States of America	57	2,483	23
2	UK	27	973	12
3	Spain	22	306	8
4	South Africa	14	74	5
5	Germany	13	235	9
6	France	12	250	8
7	Indonesia	11	23	3
8	Brazil	10	114	6
9	China	10	69	4
10	India	10	89	2

Source(s): Authors' compilation from the Scopus database

Table 5.
List of top ten
productive countries

Rank	Journal	Citations	CiteScore	Documents	h-index
1	<i>“Journal of Business Venturing”</i>	758	14.6	4	4
2	<i>“Technovation”</i>	299	10.8	7	6
3	<i>“Journal of Technology Transfer”</i>	266	9.2	4	4
4	<i>“Journal of Business Research”</i>	223	11.2	3	3
5	<i>“International Journal of Entrepreneurial Behaviour and Research”</i>	87	8.0	4	3
6	<i>“Management Decisions”</i>	70	7.9	3	3
7	<i>“Journal of Small Business and Enterprise Development”</i>	66	5.4	5	5
8	<i>“Education and Training”</i>	46	4.8	3	3
9	<i>“Entrepreneurship and Regional Development”</i>	20	8.0	3	3
10	<i>“Sustainability Switzerland”</i>	20	5.0	6	2

Source(s): Authors' compilation from the Scopus database

Table 6.
List of top ten
influential journals

measured through the number of citations. The journal that receives a higher number of citations is considered a highly influential journal.

It is evident from Table 6 that “*Journal of Business Venturing*” is the top most influential journal in the said field as per the extracted Scopus database. It also has the highest CiteScore amongst all the journals, i.e. 14.6. After this, “*Technovation*”, “*Journal of Technology Transfer*” and “*Journal of Business Research*” have received the highest citations and placed in second, third and fourth position in this category. All three journals have received 220+ citations and have high CiteScore, i.e. 10.8, 9.2 and 11.2, respectively.

Most cited publications

The information and data found from Scopus can be categorized in various ways. One of the ways is to classify the articles and set an order for the articles that received the highest number of citations. Thus, the authors have identified the articles most acknowledged by the research community. Table 7 presents a list of top ten highly cited articles of all the time, published in the discipline/field of business incubators/incubations along with the publications in the area of entrepreneurship. An attempt has been made to rank the articles based on receiving the highest number of citations. For each article, Table 7 presents the article's titles, authors' names, publication year, journal's name and the total number of citations received by an article. The most cited and influential article found on business incubators was published by “Bøllingtoft & Ulhøi” in 2005 in the “*Journal of Business Venturing*”, which has received 352 citations. Next, three articles have 250+ citations and the next five articles have received over 150+ citations.

Here, Table 8 briefly summarises the article title and authors, the research problems, methodology used, the sampling and the corresponding findings of the articles mentioned in Table 7.

Science mapping

This technique uses network visualization to analyse the relationships between various research constituents (Baker *et al.*, 2021; Koseoglu *et al.*, 2022). This analysis examines the structural connections & intellectual interactions among the given research constituents, which include the authorship analysis, citation & co-citation analysis, bibliographic coupling and co-occurrence analysis. Here, the authors have analysed the bibliographic coupling and co-occurrence analysis.

Bibliographic coupling

When two articles cite the same third article, then it is said that bibliographic coupling has been done. “Bibliographic coupling” helps to identify the major themes in the study area. This analysis assumes that references of two articles share the same origin of the content and have been cited by both (Baker *et al.*, 2021), and based on the publication citing pattern, the thematic clusters are formed (Donthu, Kumar, Mukherjee, Pandey, & Lim, 2021). Figure 5 presents the network visualization of bibliographic coupling (type of analysis-bibliographic coupling, unit of analysis-authors). Whilst doing the analysis, the minimum number of documents of an author is set at a minimum of two, along with a minimum citation of 1. Out of 611 authors, only 61 met the threshold, meaning only 61 authors have done bibliographic coupling out of 611. The network contains 61 items (coupled authors) along with 11 clusters. Each node and circle represents an author and their academic relationship in terms of citations.

The red cluster contains a larger set of 17 coupled authors where the research mainly focused on the “role of business incubators in small enterprise development”, the

Rank	Article title	Author	Source	Year	Cited by
1	"The networked business incubator – leveraging entrepreneurial agency?"	Bøllingtoft, A., Ulhøi, J.P.	<i>Journal of Business Venturing</i>	2005	352
2	"Entrepreneurship and university-based technology transfer"	Markman, G.D., Phan, P.H., Balkin, D.B., Gianiodisi, P.T.	<i>Journal of Business Venturing</i>	2005	350
3	"The evolution of business incubators: comparing demand and supply of business incubation services across different incubator generations"	Bruneel, J., Ratinho, T., Clarysse, B., Groen, A.	<i>Technovation</i>	2012	278
4	"Networked incubators: hothouses of the new economy"	Hansen, M.T., Chesbrough, H.W., Nohria, N., Sull, D.N.	<i>Harvard business review</i>	2000	274
5	"Critical role and screening practices of European business incubators"	Aerts, K., Matthyssens, P., Vandenbempt, K.	<i>Technovation</i>	2007	235
6	"Startups: business incubation and social capital"	Tötterman, H., Sten, J.	<i>International Small Business Journal</i>	2005	179
7	"Complements or substitutes? The role of universities and local context in supporting the creation of academic spin-offs"	Fini, R., Grimaldi, R., Santoni, S., Sobrero, M.	<i>Research Policy</i>	2011	177
8	"Architecting gloCal (global-local), real-virtual incubator networks (G-RVNs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: lessons learned and best practices from current development and business incubation"	Carayannis, E.C., Von Zedtwitz, M.	<i>Technovation</i>	2005	168
9	"Corporate accelerators: building bridges between corporations and startups"	Kohler, T.	<i>Business Horizons</i>	2016	144
10	"Analysing the influence of gender upon high-technology venturing within the context of business incubation"	Marlow, S., Mcadam, M.	<i>Entrepreneurship: Theory and Practice</i>	2012	140
Source(s): Authors' compilation from the Scopus database					

Table 7.
List of most cited
articles

Table 8.
Summary of the top ten
influential articles

Authors & article title	Research problem	Methodology	Sampling	Findings
(1) Bollingtoft and Ulhøi (2005) “The networked business incubator – leveraging entrepreneurial agency?”	What kind of factors facilitating or hindering the networking within a networked incubator?	Ethnographic	One incubator	Findings showed that there were basically two categories that can be used to categorize the mechanisms that were facilitating or hindering networking in incubator. First, mechanisms related to individuals and their relationships with one another. Second, mechanisms involved in the incubator’s construction
(2) Markman, Phan, Balkin, and Gianiodis (2005) “Entrepreneurship and university-based technology transfer”	(a) What kind of licensing strategies and structures of UTTO are most conducive for startup formation? (b) And how these licensing strategies and structures of UTTO are correlated with one another?	Grounded theory & correlation	128 UTTO (University technology transfer offices) directors	Findings demonstrated that for-profit UTTO structures were positively correlated to startup formation whereas traditional university and non-profit UTTO structures reflected correlation only when there was a presence of university based incubators. Licensing-for-equity strategy was positively correlated while sponsored research licensing strategy is negatively correlated to startup formation. Strategy of licensing-for-cash is highly recognized transfer strategy
(3) Bruneel et al. (2012) “The evolution of Business incubators: comparing demand and supply of business incubation services across different incubator generations”	How business incubation models have evolved and to gain insights about value proposition of business incubators?	Case study, semi-structure interview & structured questionnaire	Seven business incubators & 71 tenants	Findings revealed that business incubators of all generations offer almost same support services. The tenants of older generation incubators rendering less service from the service offering of an incubator. Authors suggested this was due to weak selection criteria to select the tenants and lack of explicit exit policies. Incubator of older generation should update their service portfolio
(4) Hansen et al. (2000) “Networked incubators: hothouses of the new economy”	To analyse the state of leading-edge incubators marketplace	Telephone interview	169 incubators	Finding depicted that almost all the incubators offers basic services pulse coaching, funding and office space. Only 26 % of incubators were able to provide organized networking facility. Authors argued that networked incubators are indispensable to foster the entrepreneurial spirit and to offer economics of scale to the startups. Feature of networked incubator is to give access to a network of potential partners and build business alliance

(continued)

Table 8.

Authors & article title	Research problem	Methodology	Sampling	Findings
(5) Aerts <i>et al.</i> (2007) "Critical role and screening practices of European business incubators"	Description of business incubator's screening practices in the European context	Self-administered online questionnaire	97 business incubators	Findings showed that a large section of business incubators focus either on the characteristics of tenant's market or those of tenant's management team instead of screening potential incubatees based on a balanced set of criteria. It was also noted that survival rate of an incubatees has a significant positive relation with a more balanced screening profile
(6) Tötterman & Sten (2005) "Startups: business incubation and social capital"	How business incubators are supporting tenants/entrepreneurs?	Survey interview and case study	Three business incubators	According to findings, business owners who have received significant support for starting their companies or developing their support networks were satisfied with the services provided by business incubators than those who have not
(7) Fini, Grimaldi, Santoni, and Sobrero (2011) "Complements or substitutes? The role of universities and the local context in supporting the creation of academic spin-offs"	To what extent universities' and local context support, complement or substitute each other to create academic spinoff and fosters entrepreneurship	Empirical analysis	64 STEM Universities	Finding showed that ULSMs (University-level support mechanisms) have a substitution effect in terms of regional; financial development, social capital, in presence of business incubator, public R&D expenditures and the extent of innovative performance in the region and they complement the legislative support provided to high-tech entrepreneurship
(8) Carayannis and Von Zedtwitz (2005) "Architecting gloCal (global-local), real-virtual incubator networks (G-RVNs) as catalysts and accelerators of entrepreneurship in transitioning and developing economies: Lessons learned and best practices from current development and business incubation"	To describe an overarching incubator model that combines components and best practices derived from five incubator archetypes	Survey interview	XX research interviews with incubators in different countries	The paper offers an architectural framework for developing a gloCal, real and virtual network of incubators (G-RVIN) as a knowledge and innovation infrastructure and infrastructure technology that would connect entrepreneurs and micro-enterprise owners with local, regional and global networks of clients, suppliers, and complementors and thereby, assist in bridging and leveraging the various divides (digital, knowledge, cultural, socio-political, etc.)

(continued)

Table 8.

Authors & article title	Research problem	Methodology	Sampling	Findings
(9) Kohler (2016) “Corporate accelerators: building bridges between corporations and startups”	What strategies and techniques being used by accelerator to facilitate an interplay between the corporation and startups?	Semi-structured interview	40 corporate accelerators	As per the paper, corporate accelerators have enormous discrepancies in work practices, significant cultural variations and many organisational clocks that generate obstacles despite their potential. So, corporate accelerators must be effectively designed in terms of proposition, process, people and place to benefit both startups and the company to create innovation
(10) Marlow and McAdam (2012) “Analysing the influence of gender upon high-technology venturing within the context of business incubation”	How gender roles are understood, expressed and articulated, within a context of business incubation?	Case study (Single-case approach)	One incubator tenant	The tenant’s narrative revealed four main themes: the first one concerned to early education, family influences, career and entrepreneurial spirit. Second, difficulty in dealing with domestic responsibilities (being mother, wife) and being entrepreneur. Third, tried to deal with her experiences as a woman and a high-tech entrepreneur. Finally, her perceptions of how she “fit” into business incubator
Source(s): Authors’ own elaboration				

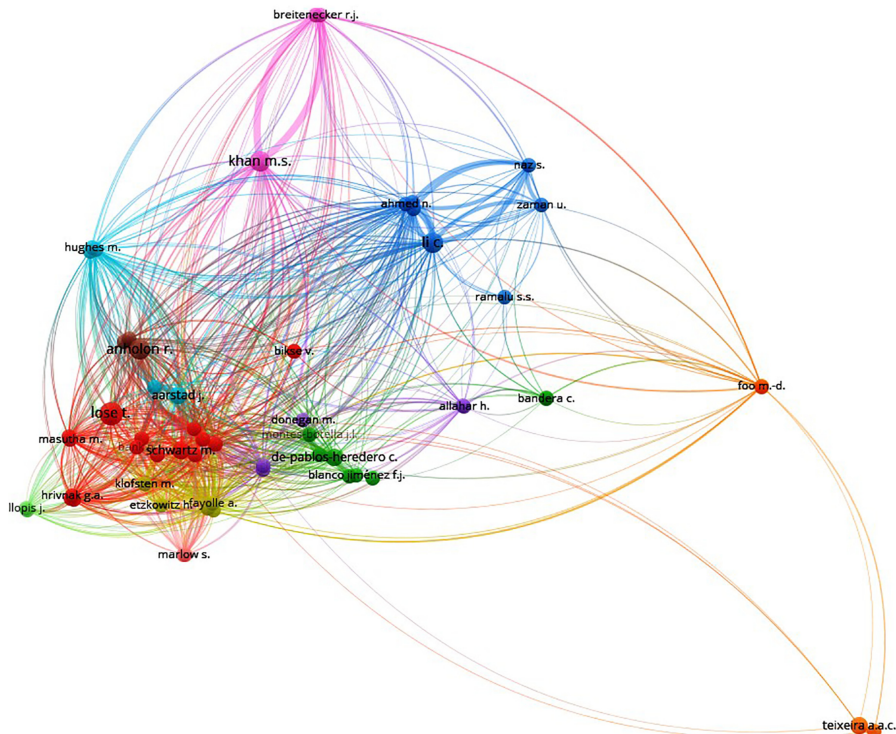


Figure 5.
Bibliographic coupling
of authors

Source(s): Extracted from VOSviewer using Scopus database

“effectiveness of business incubators”, innovative startups and sustainable incubators, challenges of business incubators, incubator’s performance and synergising entrepreneurship through incubated business. Another large cluster is anchored by green and blue. The green cluster consists of those authors who tend to do research on business incubator services, virtual incubators and value creation as a function of business incubation. Blue cluster coupled those authors who tend to do research on analyzing the impact of business incubators and where incubation proves to be an instrument of entrepreneurship development. Another purple cluster coupled the authors “Allahar”, “Donegan”, “Sookram”, working on university-centred business incubation research topics.

Co-occurrence analysis

“Co-occurrence” conveys that two or more keywords in the same article occurred together. The keywords that frequently occur together possess a thematic relationship (Dhiman & Arora, 2023) and are known as the “co-occurrence of keywords”, greater the frequency of keyword occurrence, stronger the relationship between the main keywords.

Figure 6 shows the visual network of “co-occurrence analysis”. The “type of analysis” is “co-occurrence”, and the “unit of analysis” is “all keywords”. By selecting the full counting method, the dataset of 979 keywords was limited to a minimum number of five occurrences of keywords, where only 39 items met the threshold. Whilst running this analysis in VOSviewer, the weights were assigned to each keyword. The higher the weight of the keyword, greater

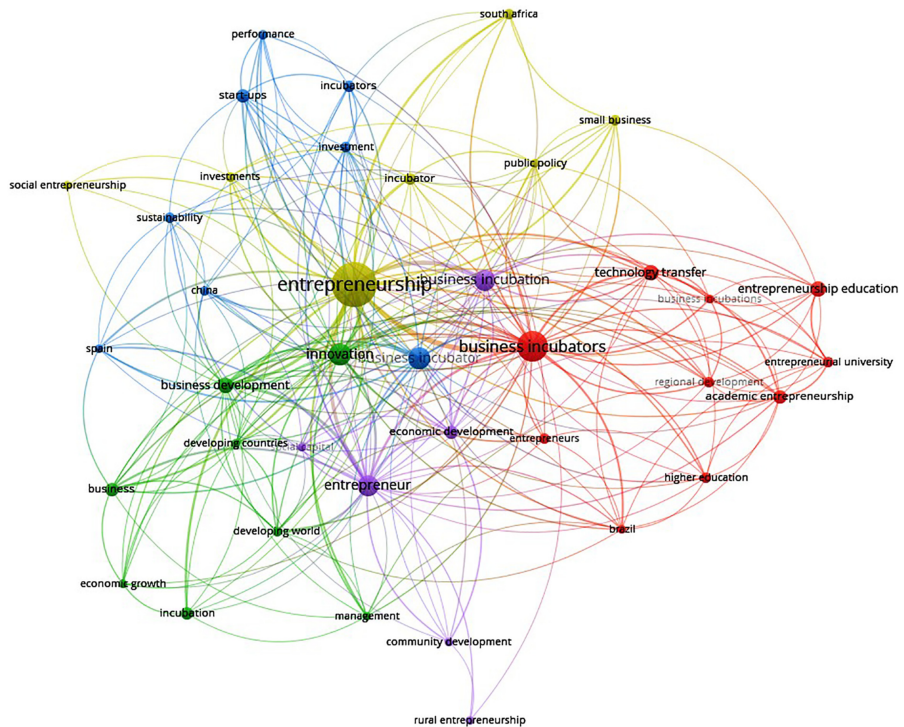


Figure 6.
Co-occurrence of all
keywords

Source(s): Extracted from VOSviewer using Scopus database

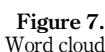
the size of the bubble and label of the keyword and the lower the keyword's weight smaller the keyword's bubble (Van Eck & Waltman, 2014). There were five clusters with 39 items having 277 links. To relate the cluster's items, the authors have given an example of the most cited and influential articles listed in the Scopus database downloaded file. The clusters are described as follows:

Cluster 1 (Red): (*Business Incubators and Technology Transfers*) consists of ten items. The most frequent word in the cluster was "Business Incubators", with 56 times occurrence, also positioned at the centre and almost every other keyword is connected with it in the visualisation. The other keywords of interest were "Technology Transfer" (15), "Entrepreneur" (27), "Regional Development" (7) and "Business Incubations" (5). The Research of (Markman *et al.*, 2005) is an example of this cluster. They have mentioned in their paper that technology transfer from labs to startup companies decides the success of university-based business incubators. Also, an established university-based technology transfer structure determines the formation of new ventures and the successful implementation of business incubation.

Cluster 2 (Green): (*Innovation and Business Development*); the keywords "Innovation" and "Business Development" have the most frequency of occurrence in this cluster, i.e. 29 and 15 times, respectively. Other related keywords in the cluster were "incubation" (10), "Business" (11), "Economic Growth" (5) and "Developing Countries" (5). The research of Lalkaka (2002) stated that innovation is one of the key drivers for economic development, and the measure of innovation is technology business incubator, which nurtures the new firms by providing services like counselling and other facilitating services.

Cluster 4 (Yellow): (*Entrepreneurship, Incubator, and Small Business*); the cluster consists of a total of seven items, but the primarily occurred keyword was “Entrepreneurship” with 120 occurrences, then “Incubator” with a frequency of 9 and “Small Business” with seventimes occurrences. The other related keywords are “Public Policy” and “Investments”, with 5 and 6 occurrences, respectively. [Sofouli and Vonortas \(2007\)](#) stated that the economic contexts of the nation and management quality of S&T parks/incubators are crucial for the success of the incubation program. They have given policy implications that to promote entrepreneurship and innovation, it is not only necessary to create only an incubation program but also focus on other contextual issues that contribute to the successful execution of an incubation program.

Word cloud



Source(s): Extracted from RStudio

evident that these are the main themes in this area because these keywords are highlighted keywords in both, and various studies are being conducted on these themes. A business incubator is one of the core elements of entrepreneurship, and it helps entrepreneurs to develop businesses and promotes innovation with the help of technology transfer. All these are crucial for the developing world’s technological, regional, community and economic; development.

Trending topics

Figure 8 presents information on the most trending topic in the said field according to retrieved results from the Scopus database. Earlier, business incubation was assessed as an economic development tool; now, it is considered a technology transfer mechanism. With the help of technology transfer, it promotes growth and development through technology and innovation. Technology transfer means “licensing of technology from a university to an incubator client firm” (Phillips, 2002). In recent years, entrepreneurship has great relevance in higher education (Adeel, Daniel, & Botelho, 2023); therefore, the concept of academic entrepreneurship and entrepreneurship education is promoted through business incubators. All these concepts are centric towards student startup creation in educational institutes or university setups (Lyu, Shepherd, & Lee, 2023) because most innovative startups are founded only by students (Al-Mamary & Alshallaqi, 2022). Therefore, due to the high practical relevance of business incubators and entrepreneurship in the education system, these terms become trending topics in this field. Nowadays, most universities and institutes focus on business incubation programs because these are fundamental building blocks of startup creation and innovation development.

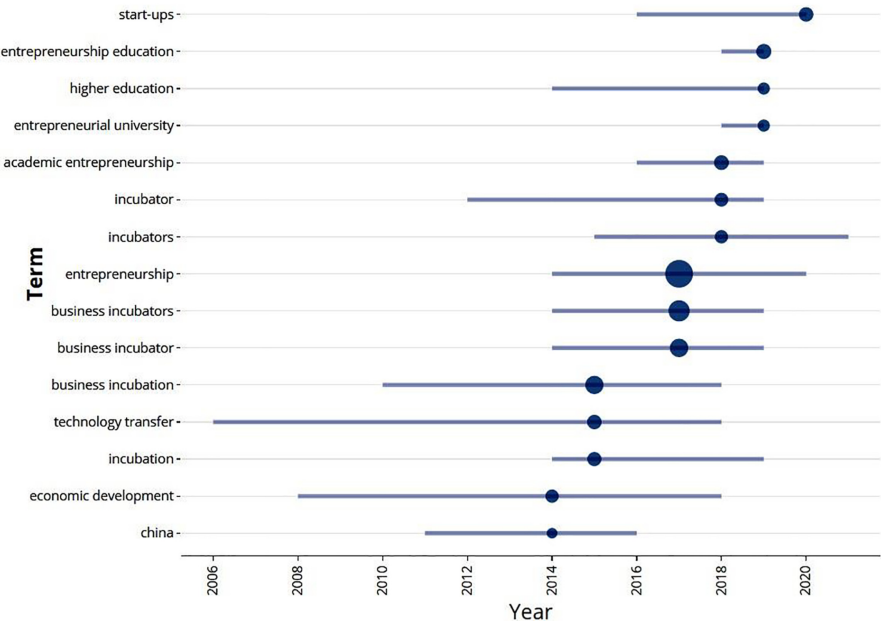


Figure 8.
Most trending topics

Source(s): Extracted from RStudio

Findings and conclusion

This paper has highlighted who amongst the authors, countries and journals have contributed most in the “Business Incubation in connection with Entrepreneurship” field. The study examines the annual trend of publications and finds that after 2014, the research on this topic has grown, and the highest number of publications was recorded in 2020. If we look at the productivity of the authors in a nutshell Lose, Anholon, Khan and Li have the highest number of articles amongst all the authors. The countries with a high number of publications are the United States of America, the UK and Spain. The most influential journal that received higher number of citations is “Journal of Business Venturing” with a highest CiteScore among all the journals, i.e. 14.6 as per the Scopus results extracted. Also, the article titled “The networked business incubator - Leveraging entrepreneurial agency?”, written by Bøllingtoft & Ulhøi, figures out to be the most cited and influential article. By running co-occurrence analysis in VOSviewer and word cloud in RStudio, it confirmed that business incubators, entrepreneurship, technology transfer, innovation, business development, business incubation, startup, small business, economic development, developing word were the key highlighted themes of the said discipline. With the help of most trending topics in the area, it was found that academic entrepreneurship, entrepreneurial universities or institutions and startups in higher education become the trend because all these are promoted through business incubators or business incubation programs in educational universities/institutions.

The results of this bibliometric analysis show that the research publications on business incubation and its connection with entrepreneurship are growing significantly but have a lot of scope for future research and publications. Only 259 results were found in Scopus for this current research. The most probable reason could be that the research on business incubators/incubation was at the initial stages in the past decade and it is growing now. However, there can be many other publications relevant to this field that may have been indexed in other databases or published in other journals which are not indexed in the Scopus database, which can be considered one of the most significant limitations of this research. Moreover, the data has been extracted from only one database, i.e. Scopus, which may limit other well-known journals, authors and articles on “business incubation and entrepreneurship”. Also, the results found by running performance analysis and science mapping are the only trends found in the Scopus database, and these results may not necessarily be the same across all “business incubation-entrepreneurship” related research.

Implications of the study

Business incubation is an emerging field of academic research connected to start-ups, venture formation and entrepreneurship ecosystems, making it a potential scholarly discipline. Contributions to research on business incubation and entrepreneurship have the potential to play a crucial role in developing insights and guidelines for academicians, managers and practitioners, especially in the business arenas. They can understand the dynamics of business incubation by depending on the present academic research. They can also adopt effective business strategies for nurturing startups by focusing on mentorship programs, providing supportive ecosystems, providing training programs and establishing a culture of managing and facing risk in times of uncertainty. Further, this research highlights that managers should spend constructive time on entrepreneurship education and its peculiarities to apprise budding managers about the entrepreneurial ecosystems.

Future research agenda

A significant number of studies on “Business Incubation and Entrepreneurship” reflect that business incubators are one of the favourable driving forces that influence innovation,

startup creation, entrepreneurial growth and foster economic development. The results of the study highlight future research opportunities with a great potential to contribute via research in this area.

Firstly, the majority of studies found in the database are mostly on business incubation's evolution, role, services, technology, startup and entrepreneurial growth. However, some economic rationales (community development, sustainability and public policy) of business incubation schemes are still the dry areas of research, as the frequency of occurrence of keywords like community development, sustainability and public policy with business incubators are very low. So, in the future the scholars can focus on these research areas or the dimensions of "incubation and entrepreneurship". From the results of most trending topic, it is evident that research on academic entrepreneurship, entrepreneurial university that promotes startups and innovation with the help of a business incubation program is in the latest trend, so the scholar can also explore this dimension of research.

Secondly, as seen from the results of annual publications, the research on "business incubation in connection with entrepreneurship" has grown significantly after 2014, implying that many new aspects of business incubation/incubator and entrepreneurs are coming up. A newer dimension of business incubator is emerging, i.e. "accelerator", "corporate accelerator" and "seed accelerator", which is not much explored. Accelerator is a new dimension of business incubator, so the shift is moving towards it in today's time. Therefore, future studies can explore this dimension and provide a new direction in the field of business incubation.

Thirdly, future studies can analyse the collaboration of business incubators and entrepreneurs with other actors such as Venture Capitalists, Business angels, Universities and Corporations. Also, studies can be conducted to understand how business incubators can support entrepreneurs as well as our society to address the grand challenges. Research can also be conducted to examine and understand business incubators' evolution or entrepreneurial growth and differences with other actors, such as business accelerators and startup studios. Scholars can also conduct a study to understand if business incubators are better to support the creation of an "entrepreneurial ecosystem" from scratch or if they are better to support the development of an entrepreneurial ecosystem that is already in place.

Finally, this study has used only one database, i.e. Scopus, for the bibliometric analysis, whereas, in future studies, the researchers can attempt to combine two or more databases like ProQuest, EBSCO, WoS and Google Scholar for conducting the bibliometric studies or SLR's to highlight about emerging research trends and themes. We recommend combining two or more databases because other well-known journals, authors and articles on "business incubation-entrepreneurship" have been indexed in the above databases other than Scopus, which may have been missed under this study. For more understanding of the business incubation field, scholars/researchers can also conduct another type of review study: a meta-analysis and systematic literature review.

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