

Review

Development and State of the Art of Entrepreneurship Education: A Bibliometric Review

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Abstract: Entrepreneurship education (EE) plays a vital role in fostering an entrepreneurial culture and promoting the growth of the small- and medium-sized business sector in a nation. Research on EE has advanced extremely rapidly in the last two decades. These changes are evident not only in the quantity of published works but also in the evolving methods of academic communication, the rise of emerging nations as prominent contributors to EE research, and the shifting areas of focus in study themes. This current study aims to provide a comprehensive picture of these processes based on a big-data-centred bibliometric analysis of a corpus of 3787 articles that appeared in the Web of Science literature database. The bibliographic metadata was analysed using Biblioshiny, CitNetExplorer, and VOSviewer. To understand the most significant development trends, researchers employed the triangulation method, which included scientific mapping and epistemological analysis in addition to standard tools of bibliometric analysis. This has led to the identification of some study needs. First, improving EE methods in secondary school curricula; second, EE in adult education and the practicality of the findings for andragogy; third, EE in least developed countries and its unique challenges; fourth, combining EE with internet-based, innovative training and education approaches like gamification and simulations; fifth, EE's role and methodological development in societal economic integration; and sixth, women's unique EE requirements. On top of that, this study provides the basis for policymakers and practitioners to consider incorporating entrepreneurial education programmes, which can help to create a prosperous entrepreneurial ecosystem.

Keywords: entrepreneurship education; big data; epistemology; bibliometric analysis; network analysis; science mapping



Citation: Talukder, S.C.; Lakner, Z.; Temesi, Á. Development and State of the Art of Entrepreneurship Education: A Bibliometric Review. *Educ. Sci.* **2024**, *14*, 295. <https://doi.org/10.3390/educsci14030295>

Academic Editors: Jacinto Jardim, Luke Pittaway and Alain Fayolle

Received: 22 January 2024

Revised: 27 February 2024

Accepted: 7 March 2024

Published: 11 March 2024



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1. Introduction

Entrepreneurship is usually seen as an economic activity whose main goal is to meet desires in a profitable way. An enterprise serves as an organizational structure and is called entrepreneurship. It is a well-established fact that entrepreneurial activity drives economic development and is essential to macroeconomic growth and, more generally, a country's overall socioeconomic development, since entrepreneurship generates and maintains employment opportunities, which are crucial for reaching the United Nations' Sustainable Development Goals [1,2].

Educating individuals about entrepreneurship has a twofold effect: it increases their desire to start their own businesses and equips them with the fundamental knowledge, skills, and creative mindsets needed to launch innovative ventures [3,4]. However, entrepreneurial education (EE) is a system that aims to educate, train, and inform individuals interested in developing small-scale business operations. Its goal is to inspire

entrepreneurial consciousness, business creation, and business development. Additionally, EE contributes to the development of an individual's entrepreneurial aptitudes and competencies [5,6].

A number of studies conducted in recent years have shown that individuals can increase their levels of entrepreneurial orientation through secondary and tertiary education [7–9], developing not just the knowledge base but the skills and attitudes that are necessary to be a successful entrepreneur [10]. Because of the multiplicative and accelerative effects of small enterprises on the economy, EE programs help to alleviate poverty by encouraging the formation of new firms. However, EE encompasses more than just expanding one's knowledge; it also involves bringing attention to a problem, encouraging the growth of one's abilities, and fostering a sense of self-efficacy [11,12]. Moreover, the role of EE in the Global South is especially important because in the Global South, small business development can be an engine of general socio-economic progress [13,14].

To create a sustainable EE program, a multidisciplinary approach and active engagement of diverse stakeholders are required [15,16]. Therefore, modern EE should embrace a wide range of innovative methods and streamlined content, integrating the latest results of management sciences, applied psychology, sociology, logistics, and financial management, to just name a few [17,18].

The purpose of this research is to synthesize the existing literature on the topic of EE in order to draw conclusions about its past and present levels of achievement in the field of study. EE needs to adapt to new challenges and differentiate itself based on its complex target audience, considering the rapid changes happening in natural (like climate change), social (like rising tensions between different social groups in many countries; wars), economic (like the ever-increasing prices of energy), and technological (like new forms of communication and the growing role of artificial intelligence) environments. In light of these facts, it is critical to understand the fundamental future directions of EE-related research. To the best of our knowledge, this is the first study to employ bibliometric and science mapping methods in conjunction with ontological and epistemological analysis to uncover the evolution, current status, and projected future direction of entrepreneurship education.

This current paper is divided into five parts. The first part outlines the literature review, the second part describes the methods and workflow of research, the third part summarizes the results of the bibliometric characteristics of publications, and the fourth part identifies the most important ontological and epistemological aspects of EE, as well as its main direction of development. The last section offers a summary of results and suggestions for future research development.

2. Literature Review of Entrepreneurship Education

Over time, publications on entrepreneurship education (EE) have proliferated, and literature reviews addressing diverse EE-related topics have evolved. Table 1 provides a summary of the relevant literature.

Table 1. Summary of prior research in the field of entrepreneurship education and our own research.

Sources	Scope of the Review	Sample Articles	Time Period	Types of Study
[19]	The focus of this review is to identify methodological flaws in existing studies of the impact of entrepreneurship education and to provide recommendations for future research.	39	No time limit–2013	Systematic literature review
[20]	This study presents a thorough literature review and critical analysis of empirical studies on entrepreneurship education (EE) in higher education. This study seeks to discover if EE helps start enterprises.	12	1997–2011	Systematic literature review

Table 1. Cont.

Sources	Scope of the Review	Sample Articles	Time Period	Types of Study
[21]	This study reviews the literature extensively to investigate widespread effective methods of teaching entrepreneurship at the university level. Curriculum and instructional practices are evaluated in light of recommendations from studies on entrepreneurial education.	97	2005–2014	Systematic literature review
[22]	The scope of this study is to organize and integrate the previous literature in the field of entrepreneurship education and training focussing on regional development.	383	1973–2016	Comprehensive review
[23]	This review examines 1134 CSSCI articles on Chinese entrepreneurship education from the past to the present.	1134	1990–2017	Bibliometric analysis
[24]	The focus of this study is to examine and classify EE research literature in order to provide a taxonomical scheme for use in future studies.	1773	1975–2014	Bibliometric analysis
[25]	This study reviews engineering student entrepreneurship education.	324	2001–2017	Comprehensive review
[26]	This literature review analyses 325 scholarly articles on entrepreneurship education (EE). The paper examines how EE research changed from an economic growth strategy to an academic pursuit. It highlights the shift from teachers to students in education.	325	1987–2017	Bibliometric review
[27]	The goal of this paper is to provide light on the development of pedagogy in studies of entrepreneurial education over the past few decades.	395	1980–2018	Systematic literature review
[28]	This review focusses on entrepreneurship education in higher education.	581	201–2020	Bibliometric analysis
[29]	The focus of this study is on entrepreneurship education and entrepreneurship intention. One potential strategy for encouraging this entrepreneurial mindset is participation in an entrepreneurial education program.	298	2010–2020	Bibliometric analysis
[30]	The purpose of this study is to shed light on the development and current state of research in the discipline and to point the way towards promising new avenues of research.	615	2012–2021	Bibliometric analysis
[31]	The scope of the review in this study is to investigate the decision-making processes associated with the implementation of education for entrepreneurship (EE) programs in schools and the integration of this topic into the policy-making process.	19	No time limit–2022	Systematic literature review
[32]	The scope of this study is to organize and integrate the previous literature in the field of entrepreneurship education (EE). The researchers aim to address the broad, complex, and fragmented nature of the research field by conducting co-citation analysis.	680	1977–2021	Bibliometric analysis
[33]	The purpose of this research is to determine which factors in higher education contribute to individuals developing an interest in and plan to pursue a career in entrepreneurship.	2185	2002–2022	Bibliometric analysis
Our paper	Focussing on entrepreneurial education (EE), this study uses bibliometric analysis, science mapping, and ontological and epistemological inquiry to unravel its historical development and predict its future directions.	3787	1983–2022	Comprehensive bibliometric review

Lorz et al. conducted a systematic literature review of 39 articles investigating the effects of entrepreneurship education [19]. Those findings call into serious doubt the widely accepted benefits of entrepreneurship education by revealing substantial methodological shortcomings. Rideout and Gray also investigated entrepreneurial training, and their research was narrowed to programs offered at higher educational institutions [20]. Over the past few decades, they discovered that both interest in and access to entrepreneurship education at the university level have exploded. To better understand what is being taught and how, Sirelkhatim and Gangi conducted a systematic literature review (SLR) on entrepreneurship education at the university level [21]. The review findings show that curriculum content and teaching techniques differ from one program to another, with some trying to raise students' general awareness of entrepreneurship and others aiming to turn out graduates who are ready to launch their own businesses.

In their analysis of the relationship between entrepreneurial education and regional development, Galvo et al. conducted a review of 383 separate studies. Their findings show that training and entrepreneurship education are powerful strategic tools for regional entrepreneurship development, and institutions like universities, governments, and businesses must work together towards a common goal if society is to develop its entrepreneurial spirit [22]. Using a bibliometric analysis of 1134 articles from the Chinese Social Science Citation Index (CSSCI) database, the authors illustrate how the most popular areas of study in the field of Chinese entrepreneurial education have progressed from the "exploratory stage" to the "comprehensive advance stage" over the past two decades. During this time, both the number of published papers and the number of funded papers have increased considerably [23].

Using a bibliometric analysis, Fellnhöfer categorized the literature on entrepreneurship education and determined which sources best support current thinking in the field [24]. To grasp the state of the art in EE research, it is necessary to isolate and synthesize the most significant intellectual connections between all aspects of the field. Moreover, Reis et al. reviewed 324 papers to create a comprehensive overview of the state of entrepreneurship education for engineering students [25]. Three main clusters of literature were identified, including entrepreneurial behaviour and entrepreneurial intention; entrepreneurship education; and entrepreneurship education challenges, outcomes, and best practices. Aparicio et al. reviewed 325 scholarly articles about entrepreneurship education, using a bibliometric approach. Researchers discovered that the focus on EE has shifted from EE as a tool for economic development to EE as a field of study [26]. Furthermore, research topics revealed that students, rather than teachers, have emerged as the main drivers of education. To better understand the current state of entrepreneurship education, Håg and Gabriëlsson undertook a systematic literature review [27]. Their results provide evidence that the scholarly discourse on pedagogy in the field of entrepreneurial education research has shifted from instructor-led models of education to more constructivist ones over time. According to the results of a bibliometric analysis conducted by Wan and Lv, the concepts of entrepreneurial intent (EI) and self-efficacy have been studied extensively to identify the efficacy of EE courses, and the authors of this study suggest that drawing on additional psychological theories could strengthen this field of research [28].

Individuals are encouraged to engage in entrepreneurial endeavours with self-assurance and creativity when they participate in EE programs that teach them the necessary attitudes and skills that are required to run a new venture [29]. Although there has been some success in incorporating entrepreneurship education into the school curriculum, Kiyomi and others decided that there is still room for improvement [30]. Three main suggestions emerged from the comprehensive literature assessment conducted by Banha et al., which included 19 papers on entrepreneurial education and policy making [31]. First, the importance of entrepreneurship to economic growth and development was affirmed. Second, studies have shown that teaching young people about entrepreneurship can help them develop an entrepreneurial mindset. Finally, political willingness and strong execution powers were considered essential to the successful implementation of policy recommendations.

According to a bibliometric study of 680 papers on the topic of entrepreneurship education undertaken by Tiberius and Weyland, two distinct research clusters have emerged: one concentrating on psychological dimensions related to EE and the other on entrepreneurial behaviour and the formation of new ventures [32]. Reviewing the literature on entrepreneurship education over the past two decades, Sreenivasan and Suresh identified three overarching themes: the role of entrepreneurship education in fostering an entrepreneurial mindset among students in higher education, teaching entrepreneurship, and integrating innovation into the educational setting [33].

3. Materials and Methods

Utilizing the big data principle of analysing massive amounts of data, bibliometric analysis is a methodical strategy for studying and evaluating academic publications through quantitative methodologies [34]. Although this sort of bibliometric research may be conducted using a wide range of databases (Web of Science, Scopus, PubMed, Google Scholar), the coverage in PubMed was particularly irrelevant in this case, and the data quality in Scopus and Google Scholar is fairly poor [35]. Moreover, Google Scholar is the most extensive database [36], and it mostly includes sources from developing nations and grey literature; however, the database of Google Scholar is confusing and has poorly defined criteria for publications to be entered; thus, its utility for bibliometric research is severely questioned [37]. Hence, the Web of Science was chosen. Scientific literature mapping was conducted using the Web of Science database because, in comparison to Scopus, it allowed researchers to focus on carefully chosen, high-quality papers published in English [38,39]. All documents were retrieved up to December 2022. The search flowchart is depicted in Figure 1. The researchers experimented with several combinations of keywords to find the best combination of them to cover all the relevant aspects of the problem but not to lose themselves in the jungle of irrelevant-for-our-research pieces of information. The most efficient combination of keywords was as follows: TS = (((“entrepre*” OR “enterpre*”) AND (“educat*” OR “social*” OR “teach*” OR “skill*” OR “attit*” OR “aptit*” OR “competen*”)) AND (“univ*” OR “higher educ*” OR “college*”).

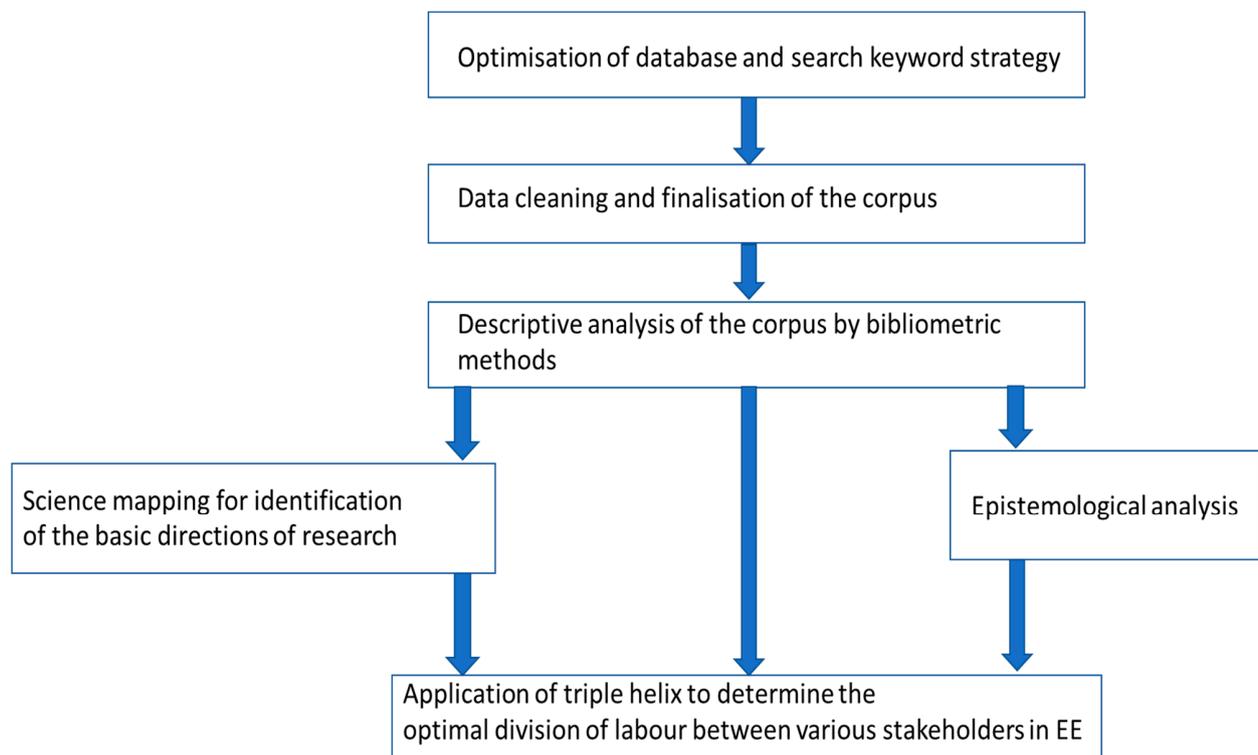


Figure 1. Flowchart of research.

The application of this query returned 6335 items. After removing duplicates and documents written in languages other than English, as well as narrative literature review articles, books, book reviews, conference papers, and letters to the editor, there remained 3787 documents. To obtain a comprehensive picture on the rather complex problem of EE, researchers applied a specific combination of different approaches, which served as torches, lighting the target (in this case EE) from different angles and perspectives. This method of triangulation has been proven as an efficient way to enhance the interpretability and reliability of research.

In the first step, the downloaded bibliometric data (3787 bibliographic information units to each publication) were exported into a plain text file. The analysis was carried out using the “bibliometrix” R-package [40]. This package can be a very efficient workhorse for bibliometric analysis. In the next step, researchers analysed the knowledge background and main direction of research by CitNetExplorer [41] and VOSviewer [42,43], as well as by the CoPalRed software [44].

The researchers discovered characteristic trends and trend changes in the number of yearly publications on EE. That is why the researchers divided the original dataset into three parts (sub-periods). Each of these sub-periods can be characterized by a relatively homogenous trend in the number of yearly publications on EE topics. The base of determination of points of trend changes was elaborated using the mcp R-package [45]. The first segment covers 1983–2009, the second spans 2010–2016, and the final segment covers 2017–2022.

4. Results and Discussion

4.1. General Characteristic Features of EE Related Literature

In first phase of the research, the researchers applied a descriptive statistical analysis to obtain a general picture of the most important characteristic features of the literature published on EE. The most important results of this phase of research are summarised in Table 2. Obviously, the corpus is an extremely rich one, created by 8778 authors, consisting of 3787 documents. There is a dynamic development in the number of publications; this is well reflected by the fact that the average yearly growth rate is more than 17%, and the average age of the documents is as low as 4.11 years. EE typically demands a multidisciplinary approach. This statement is well supported by the fact that the share of single-authored documents is just 666, less than 20% of the total documents in the corpus.

Table 2. The main features of the database.

Description	Results
Timespan	1983:2022
Sources (journals, books, etc.)	1154
Documents	3787
Annual Growth Rate %	17.26
Document average age	4.11
Average citations per doc	13.56
References	125,184
Keywords Plus (ID)	2897
Author’s keywords (DE)	8106
Authors	8778
Authors of single-authored docs	622
Single-authored docs	666
Co-Authors per Doc	2.89
International co-authorships %	26.06

Figure 2 shows the increase in published works from 1983 to 2022. This period of investigation can be divided into three sub-periods on the basis of dynamics and trend of yearly number of publications. The first period begun in 1983, when the first publication on EE topics appeared in the database, and ended in 2009, when the number of yearly publications was 38. Moreover, this phase can be characterised by a nearly decade-long “lull” period in the number of relevant publications. In the era of rapid development of the global economy, the level of interest increased rather slowly from the beginning of the nineties up to the threshold of the global economic crisis in 2008. The global crisis highlighted the fragility of the former economic system, based largely on ill-founded financial constructions, and this even enhanced the level of interest towards small- and medium-sized enterprises. The second period begun in 2010 and ended in 2016. This period can be characterized by an increasing number of publications on the topic of EE. In 2013, the European Economic and Social Committee decided to make an Entrepreneurship 2020 Action Plan for developing entrepreneurial education and training to support growth and business creation in Europe [46]. The first year of the third period was 2017. There are four main features of this period: (1) EE acquired increasing importance in the curriculums of leading Anglo-Saxon and European universities; (2) the results of EE research in China, India, and Southeastern Asia were integrated at an increasing rate into the international academic interest and knowledge base; (3) it became obvious that the entrepreneurship can play an important role in solving the problems of the “Global South”; and (4) new publishers appeared, which were capable to rapidly publish high-quality academic papers on EE. The drop in the last year of the period can be explained by the effects of the COVID-19 crisis.

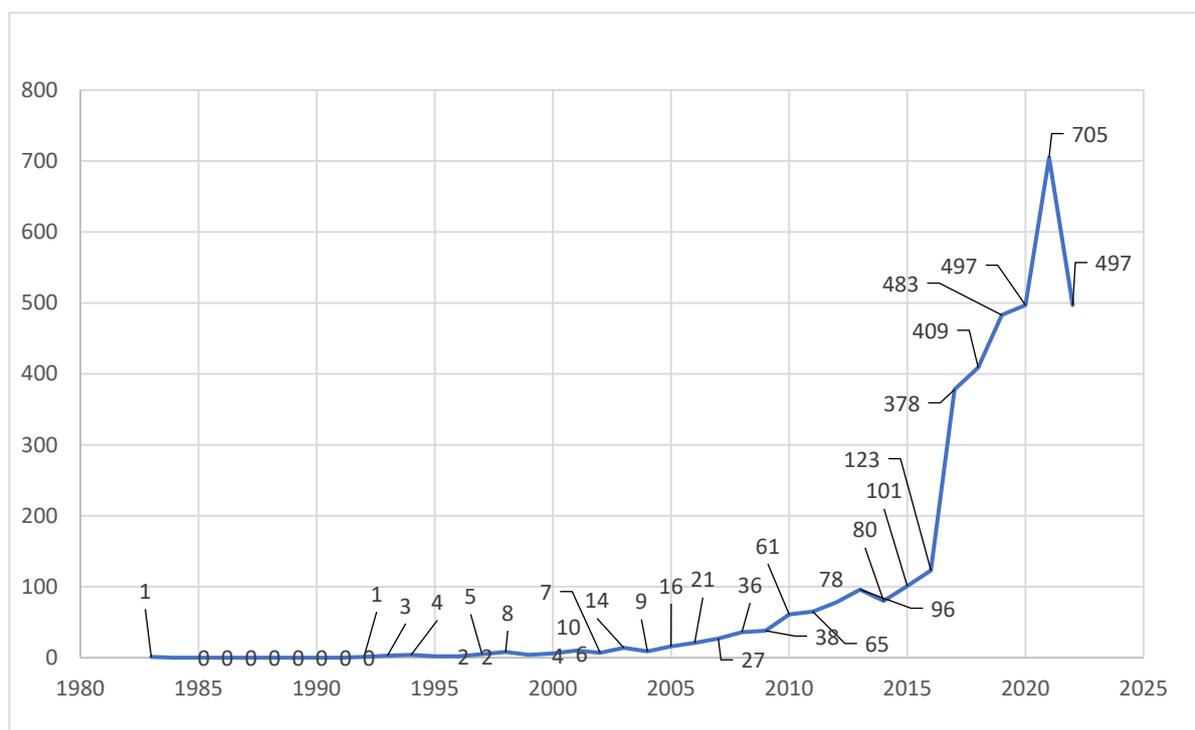


Figure 2. Annual scientific production.

If we analyse the distribution of authors according to the number of papers published by them, we can see a high level of concentration: most of the authors published no more than one paper (Figure 3). The uneven characteristics of the authorship of papers in a given field of study is a general phenomenon [47]. In bibliometrics, this is called Lotka’s Law [48], the “inverse square law of scientific productivity” [49]. The actual and theoretic values, according to Lotka’s Law, is depicted in Figure 3. Obviously, the concentration of authors is higher than would be expected on the basis of the theoretical equation. One possible

explanation of this fact could be the relative novelty of the problem. Another possible explanation is the interdisciplinary character of the research field: some specialists write one article on topics on EE, but the most important part of their academic activity sees itself attached to another subjects. A third explanation could be the relatively low level of long-range programs and projects on EE. As opposed to most of the other disciplines, EE includes relatively few strategic research projects; this is why it does not seem to be a well-founded, feasible strategy to build a long-range academic career on EE research.

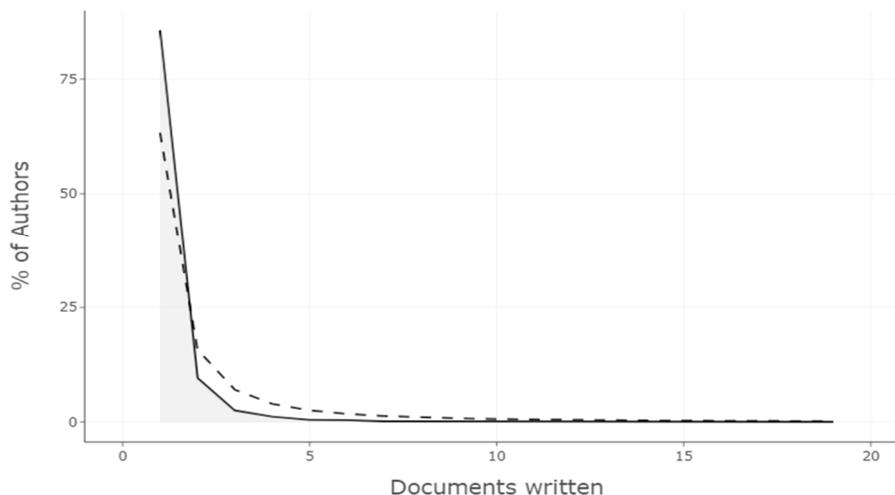


Figure 3. Lotka’s Law curve.

4.2. Sources

The increasing importance of EE and its emancipation, as well as structural changes in academic journals, are well reflected in the changes of the most important journals, where the EE-related publications appear. The most important journals are summarised in Table 3. When analysing the structure of publication in different periods, we can determine that the first period can be characterized by a preponderance of journals, focussing on education (e.g., Higher Education, International Journal of Engineering Education), and the second period is dominated by enterprise management journals. This fact highlights the emancipation of EE as a part of management science. The third period witnesses the increasing importance of new publishers (e.g., Frontiers and MDPI). A considerable number of articles have been published in these journals on how EE is provided in emerging and developing countries.

Table 3. The most important journals on EE in various periods.

1983–2009		2010–2016		2017–2022	
Name of Journal	Articles	Name of Journal	Articles	Name of Journal	Articles
Higher Education	14	Journal of Technology Transfer	28	Frontiers in Psychology	157
Technovation	12	International Journal of Engineering Education	20	Sustainability	147
International Journal of Engineering Education	10	Journal of Small Business Management	15	Education and Training	113
Journal of Business Venturing	8	International Entrepreneurship and Management Journal	13	Industry and Higher Education	67

Table 3. Cont.

1983–2009		2010–2016		2017–2022	
Name of Journal	Articles	Name of Journal	Articles	Name of Journal	Articles
Research Policy	7	International journal of Entrepreneurial Behavior & Research	13	International Journal of Management Education	56
Entrepreneurship and Regional Development	6	Research Policy	13	Studies in Higher education	49
African Journal of Business Management	4	Small Business Economics	13	Journal of Technology transfer	44
Transformations in Business & Economics	4	Entrepreneurship and Regional Development	12	International Journal of Entrepreneurial Behavior & Research	42
Journal of Higher Education	3	African Journal of Business Management	11	Entrepreneurship and Sustainability Issues	28
Journal of Technology Transfer	3	Studies in Higher Education	10	Higher Education Skills and Work-based Learning	28

The distribution of journals, according to the number of publishers, shows a high level of concentration too. If we rank the journals by the number of relevant publications (Table 4), it is obvious that in the first 28 journals, there are as many papers published there as have been published in the 190 another journals. After widening the circle of relevant publications, more than 900 journals appeared in the third zone of the relevant journals. This fact supports the so-called Bradford's Law on the relevance of a journal in different fields [50].

Table 4. Ratios generated using the Bradford method between different journals (1983–2022).

Zone	Number of Journals	Ratio of Number of Journals to the Core Journals
1st	28	1
2nd	218	7.8
3rd	1154	41.2

4.3. Geographic Structure of the Research

In the early phase of the research, EE research was concentrated on the Anglo-Saxon countries. At that time, ten countries produced more than 70% of the total relevant publications (Table 5). In the second period, the relative share of China slightly increased, but this domain was mainly researched in the most developed countries, which had already had rich traditions in this field, and contributed to promoting entrepreneurial activities at universities, as opposed to the traditional, research and (theoretic) development-centred model. The third period can be characterized by the increasing presence of researchers from emerging and developing economies, such as China, Malaysia, and the South African Republic. Parallel to structural changes in the relative order of the most productive nations, a de-concentration of the countries can be detected too. In the third period, the share of the first ten nations by the affiliation of the corresponding authors shrunk to 60%. This fact highlights the increasing level of interest towards EE.

Table 5. Share of various countries according to the nationality of the corresponding author (%).

First Period (1983–2009)		Second Period (2010–2016)		Third Period (2017–2022)	
Country	Share of Papers	Country	Share of Papers	Country	Share of Papers
US	32.4	US	24	CN	13.5
UK	17.4	UK	11.4	US	9.6
CA	4.2	ES	8.1	UK	7.1
AU	3.3	DE	3.6	ES	6.7
DE	2.8	AU	3.5	IT	4.3
CH	2.3	CA	3.1	DE	2.9
ES	2.3	CN	3.1	MY	2.7
IL	1.9	IT	3.1	PT	2.4
IT	1.9	SW	3	ZA	2.4
PO	1.9	NL	2.8	AU	2.3

Note: US—United States, UK—United Kingdom, CA—Canada, AU—Australia, DE—Germany, CH—Switzerland, ES—Spain, IL—Israel, IT—Italy, PO—Poland, SW—Sweden, NL—Netherlands, ZA—South Africa, PT—Portugal, CN—China, MY—Malaysia.

4.4. Epistemological Analysis of the Knowledge Base Development of EE

In total, there have been 40,589 connections among the publications (items) in the corpus on the basis of references. Based on the similarities of the references of different publications, nine clusters could be identified via CitNetExplorer algorithm. This clustering reflects the structure of the knowledge base, which has served as an intellectual cornerstone of the research. In the search for the most characteristic patterns of publications, the researchers applied 10 iterations, and the minimal number of the cluster size of publications was 10. Clusters of publications, consisting of the publications below the minimal cluster size, were merged with the clusters nearest to them.

The largest group of publications consists of 3126 papers. The intellectual base of this cluster is the classic paper by Ajzen (1991) on the theory of planned behaviour [51]. This model has been widely applied in research on motivational bases of entrepreneurship. Another key publication in this cluster is the seminal work of Krueger (2017) on entrepreneurial potential and potential entrepreneurs [52]. This work is based on a concept of the model of Shapero and Sokol (1982) who coined the term “entrepreneurial event” [53]. This concept is a multidimensional one, consisting of initiative taking, concentration of resources and their management, as well as factors linked to the personality traits of the entrepreneur, like relative autonomy and risk-acceptance. In this cluster, Kruger’s concept of entrepreneurial potential can be considered an important intellectual pillar. Kruger defined the entrepreneurial potential as an outcome of perceived desirability and feasibility. The work of Shane and Venkataraman (2000) is a third pillar of this cluster [54]. These authors were among the first to highlight the importance and academic potential of researching entrepreneurship. In summary, it can be stated that this cluster focusses on the psychosocial and social-psychological aspects of entrepreneurial research. It focusses on the drivers and conditions necessary to be an entrepreneur.

The second cluster, consisting of 345 papers, focusses on the academia–government–enterprise triangle. A cornerstone paper in this cluster is an article by Etkowitz and Leyersdorf on the university–industry–government triple helix [55]. The paper by Etkowitz et al. focus on the role of university-related, science-based enterprises. The majority of the articles in this cluster highlight the importance of enterprises as a means through which research findings and knowledge are disseminated to the general public. These units are important not just as carers of knowledge, but they can serve as a model for future generations as a pattern of the realisation of entrepreneurial ambitions.

The third cluster includes 234 articles that discuss the impact of education on society and the economy, with a focus on globalization and the use of cutting-edge communication and information technology. The methods and applications of contemporary communication channels in EE are the primary emphasis of this cluster.

The fourth (surprisingly small) cluster, consisting of just 103 articles, analyses entrepreneur-related efforts in higher education, the problems of curriculum development, and the harmonisation between the world of science and the world of learning. Interestingly, the most cited source in this cluster is a collection of philosophical essays: *The birth of biopolitics*, edited by one of the founders of post-modernist philosophy: Michael Foucault [56]. In this book, some outstanding economists analysed the development of liberal or neo-liberal thinking in the Western world. This fact highlights the idea that entrepreneurial education in higher education is tightly connected to the idea of liberalism and self-care. This means a radical paradigm change compared to previous decades, when society (and, within it, the key actors of higher education) supposed that the state and the state-regulated market economy would be able to solve all the problems of the labour market and the economy in general.

The fifth cluster (53 papers) focusses on the current situation of educational research but not in a normative/prescriptive way, rather on the base of situation analysis, focussing on the in-depth analysis of actual situations and problems mainly via case studies and qualitative analysis—in some cases, applying quantitative methods. Not surprisingly, the most cited works in this cluster are publications, which deal with application of qualitative research methods. The publications emphasise the increasing importance of entrepreneurship education, and here the joining of these educational efforts with the “greening” of universities appears.

The sixth cluster consists of just 31 publications, 85% of which have been written in the last decade. These publications deal with the problems of entrepreneurship at different institutions of higher educations. The entrepreneurship concept focusses on possibilities to be an entrepreneur within an existing organisation. This concept is often analysed from point of view of competitiveness, based on Porter’s concept, and innovations.

The seventh cluster (25 papers) analysis this problem on the basis of institutional economics, investigating the possibilities of the applicability of institutional economics to EE and entrepreneurship.

The eighth cluster, which is a small part of the articles (18 papers), analyses the problems of social entrepreneurship, while the ninth clusters highlight the intersection between enterprise and university life (8 papers).

In summary, it can be stated that university-related entrepreneurial activities well reflect the diversity of the topics; at the same time, there is a further need to better understand the situation in the case of non-university level EE education.

4.5. Conceptual Structure of EE Research

4.5.1. Application of the Conceptual Structure Map Method

The simplest way to analyse and visualise the topics of EE research is the two-dimensional scaling of research topics by the method of the conceptual structure map (MCA). The results of this approach are depicted in Figure 4. Two main topic clusters can clearly be separated: the largest cluster focusses on educational aspects, and the smaller one focusses on the technology transfer aspects of EE.

4.5.2. Application of Science Mapping in EE Research

On the basis of the co-occurrence of words in the title, abstract, and keywords of a document, there is a possibility to make a cluster analysis. Before the clustering, we cleaned the corpus to filter out relatively irrelevant words and terms that were not suitable for the classification of different concepts. As a result of the analysis, five robust clusters could be separated. These are presented in Figure 5, where the words, attached to different clusters, are depicted by circles with various colours. The relative frequency of words is proportional

to the area of the circles. On the basis of the similarity/co-occurrence of various words, the relative position of words to each other is depicted in a two-dimensional coordinate system, on the basis of the multidimensional scaling method.

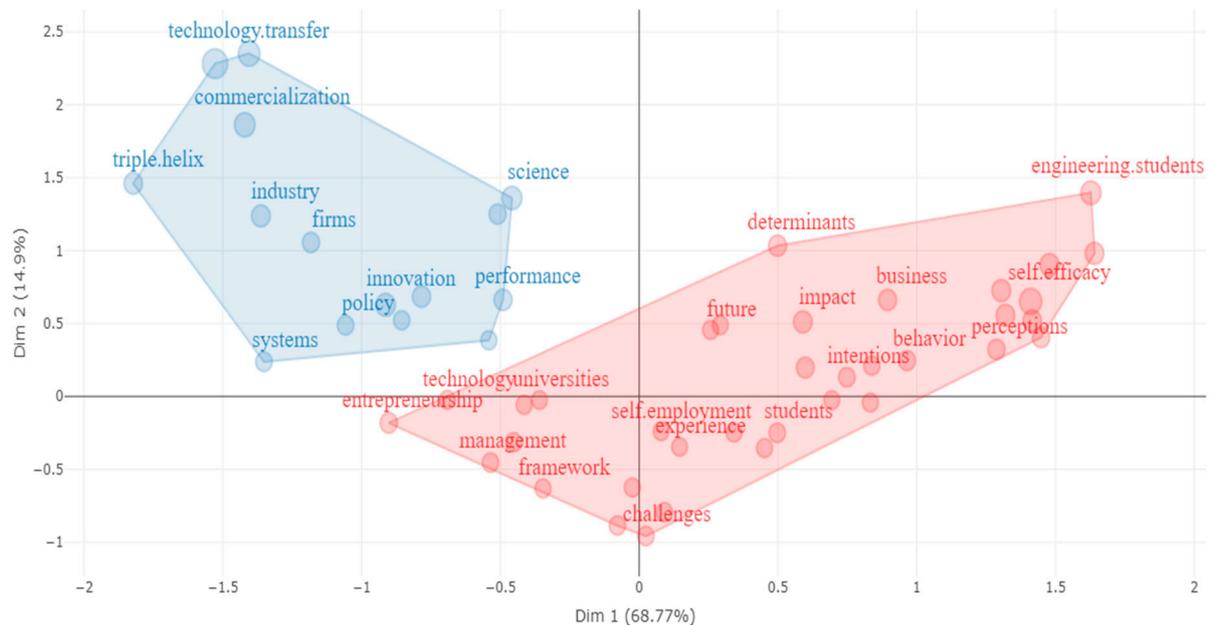


Figure 4. Conceptual structure map (MCA) of the topics of EE research.

The first cluster (depicted in green) mainly focussed on EE in the higher education system. Most of the articles in this cluster focus on students, different EE programs and curriculum development, as well as problems of tackling various challenges in EE programs. The second large cluster (differentiated by red) considers EE as a specific form of innovation, analysing the performance of this approach and its contribution to the development of the performance of various economic entities and to technology transfer. The third large cluster (indicated by blue) focusses on the psychosocial aspects of EE and the path of becoming an entrepreneur. The fourth cluster is a much smaller and a rather diffuse one, situated between the topological space of innovation-oriented and psychosocial-oriented concepts. Moreover, the central focus of this cluster of topics is the entrepreneurial orientation of students and their motivation in the direction of entrepreneurship. The fifth cluster is a rather small one that embraces experience and is accumulated in the process of management and evaluation of various EE projects.

On the basis of applying the clustering concept to the co-occurrence of the words, there is a possibility of clustering different research topics and then classifying the topics on the basis of their connection to other topics and the intensity of the co-occurrence of various keywords within the topics. The connection of a topic with another topic is called centrality. Furthermore, centrality express the degree to which one theme is connected to another theme in a given domain, whereas density quantifies the degree to which keywords within a cluster are connected [57]. Geometrically, the size of a given cluster can be depicted by circles, where the circle is proportional to the total frequency of keywords in the cluster. The relative position of the clusters can be visualised in a coordinate system, spanned by centrality and density axes. At the upper right quarter of the coordinate system are the so-called hot topics or motor themes. This theme has a high level of centrality and density. This means that these topics are in the centre of attention in the given domain and, at the same time, can be characterised by intense discussion. However, the basic themes are situated in the lower right quarter of the coordinate system. These topics are important for other researchers, but—at least in the given domain—there is a relatively low level of discussion within these topics. The upper left quarter contains the topics within which

there is intense debate (this is expressed by the high level of density), but the results of these research activities are not integrated yet into the totality of the domain. The lower left part of the surface can be characterised by low centrality and density. Topics in this part of the coordinate system are not in mainstream research in any sense. This fact can be explained by the novelty of the topics or by the fact that a given topic is not yet important in the domain.

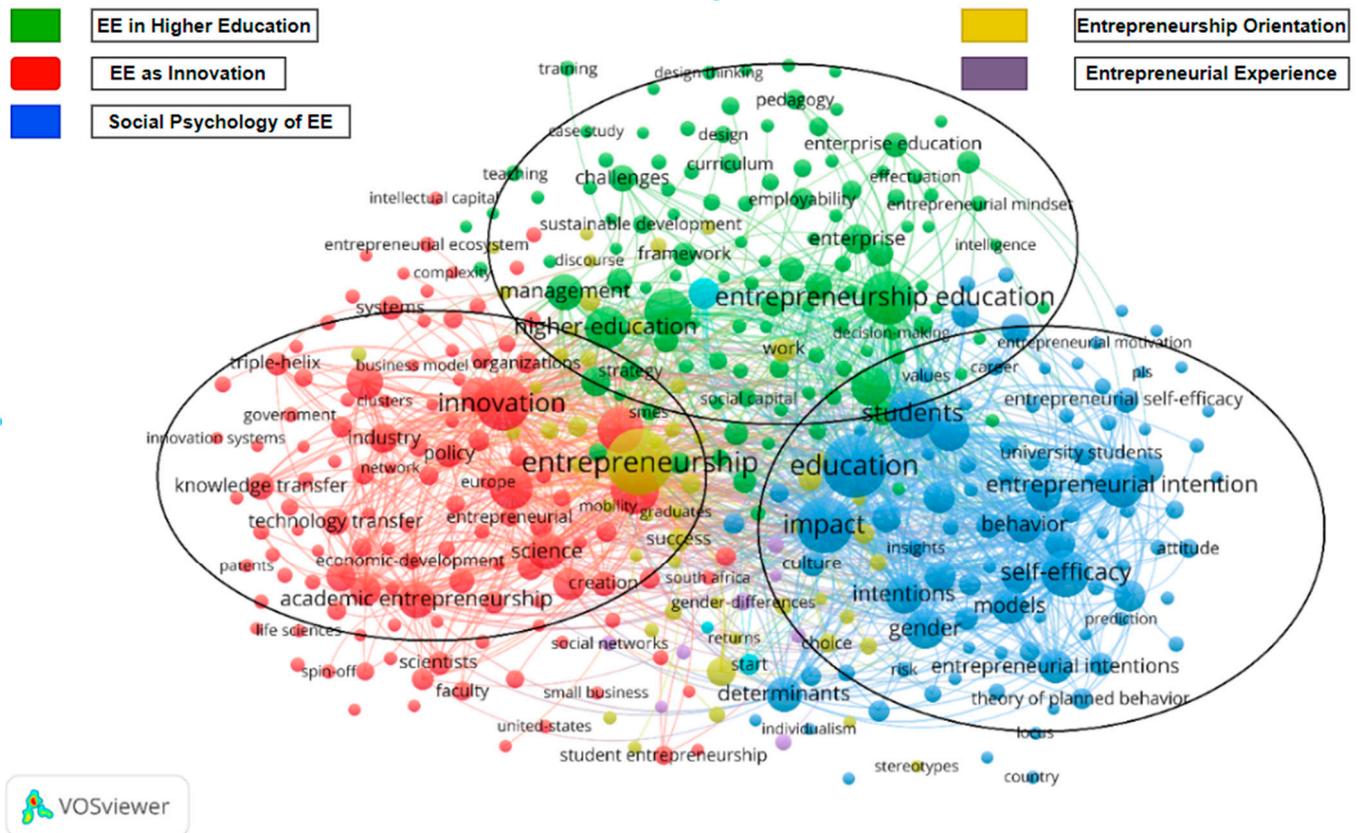


Figure 5. Results of the analysis of keyword co-occurrence.

In the first period of EE research (Figure 6), the topic generating the most debate was the role of academia in the rapidly changing world. Drastic socio-economic development (the increasing importance of knowledge as a production factor, the success of spin-off companies, the golden age of the Silicon Valley) as well as the problems of finance of public higher education institutes motivated the transformation of the educational institutes “from ivory towers to light towers”, in the words of a typical, over-used expression formulated from this time. The well-known triple helix paradigm changes in the industrial policy of the EU were important questions, but the real debates on these topics were located in other domains. This fact is reflected in the low centrality value of this problem.

The foundation of EE research was the literature on marketing and commercialisation as well as the general model—the changing of universities. In this period, the shock-resistance of the newly formatted enterprises and HR problems had a relatively lower importance. The gender-related issues of EE were marginal too.

In the second period, the management of EE courses, curriculum development in higher education, and the analysis of the performance of newly formed enterprises were in the focus of research (Figure 7). The foundations for research supplied the increasing knowledge base on SMEs and higher education policies. Gender-related issues and the role of EE in local development saw relatively intense debate within the topics, but they were not integrated into the domain. In this period, the application of theory of planned behaviour (TPB) was a relatively new, emerging topic in EE research.

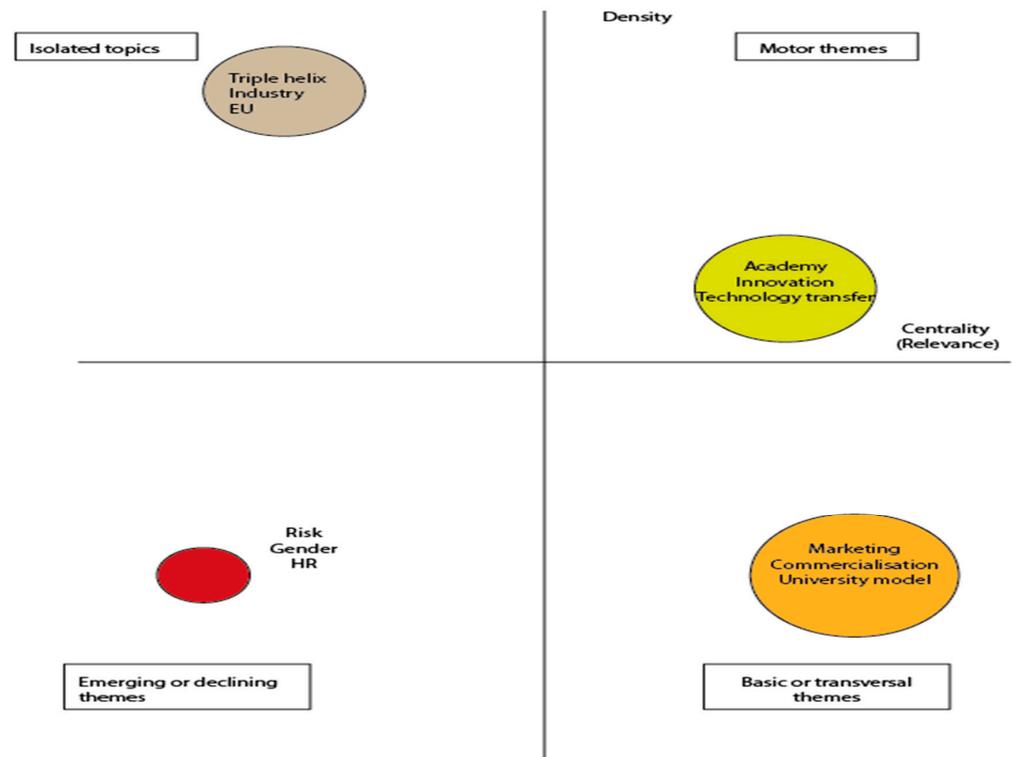


Figure 6. Results of science mapping in the first period (1983–2009) of EE research.

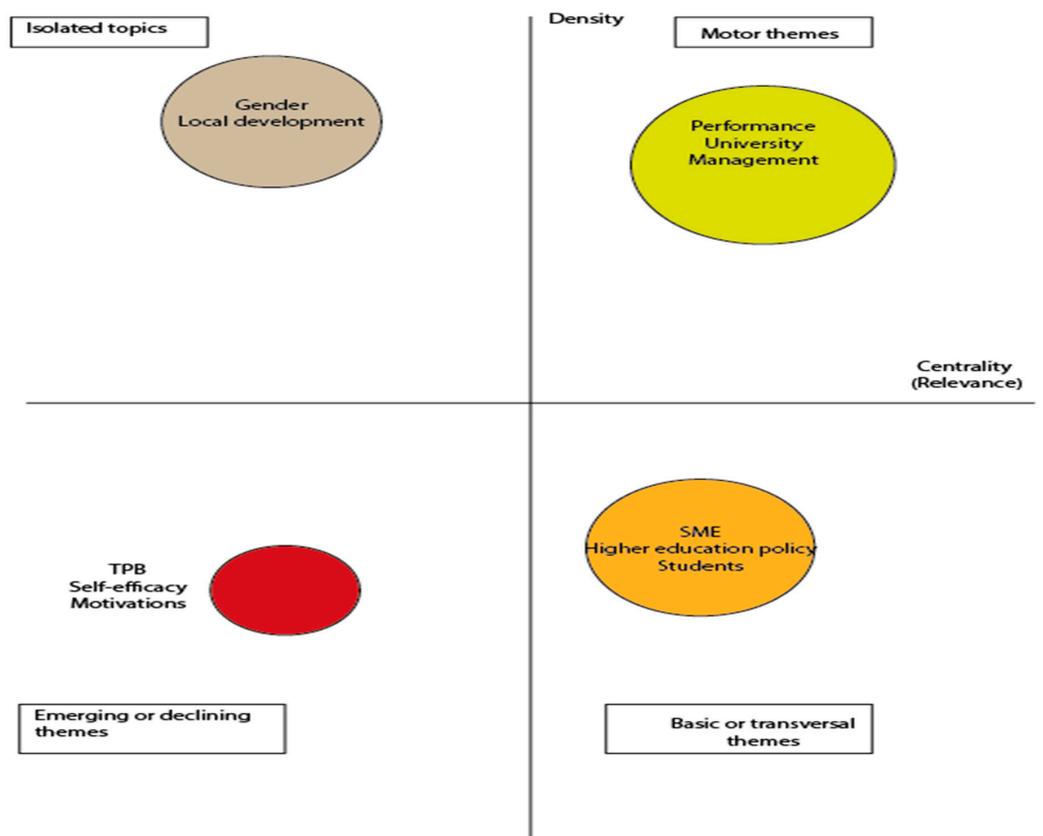


Figure 7. Results of science mapping in the second period (2010–2016) of EE research.

The third period (Figure 8) can be characterised by the increasing importance of socio-logical and social-psychological approaches. This tendency was fuelled by the proliferation of modern methods of structural equation modelling (SEM), especially by partial least squares (PLS) methods, which are suitable to test TPB models. Gender-related issues gained high importance, along with the problems of EE in emerging economies—first in China and then India. This fact demonstrates the changes in the global landscape in EE research. At the same time, there were some relatively novel topics, the importance of which was highlighted by the COVID-19 crisis and by the rapid development of artificial intelligence (AI), as well as new innovative methods of teaching, integrating distance learning, internet-based education, and the enhancement of learners' involvement via gamification.

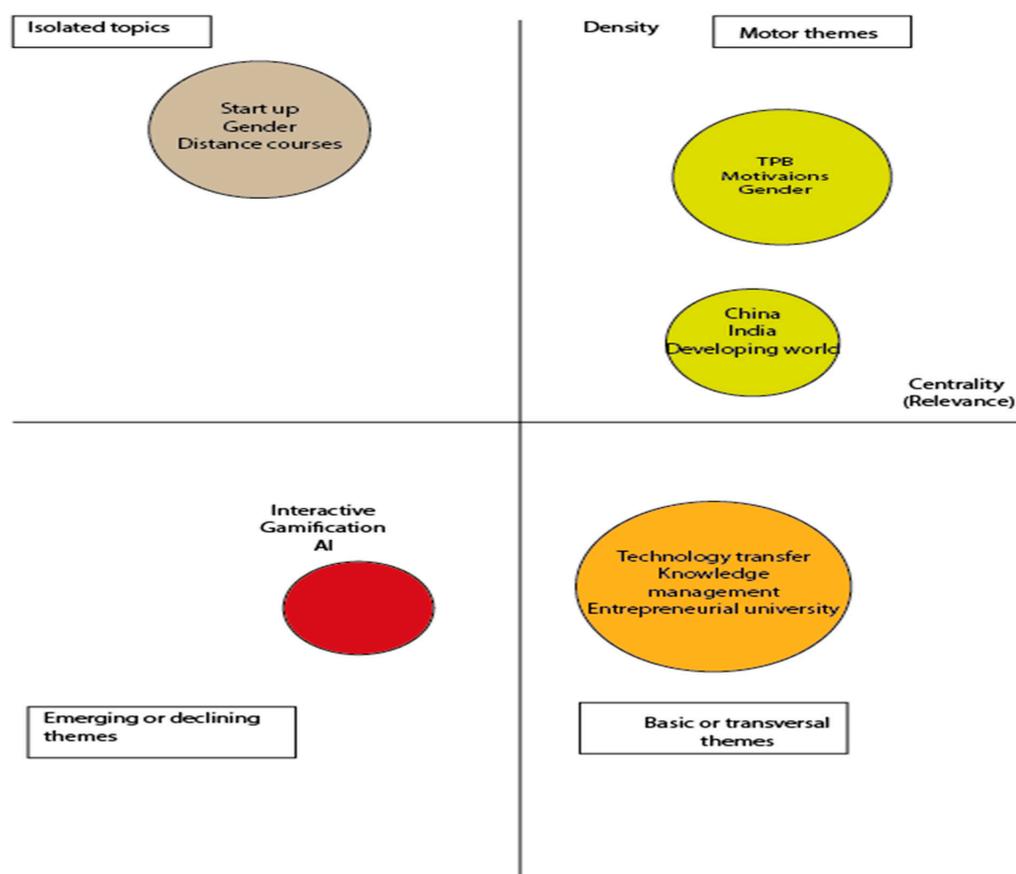


Figure 8. Results of science mapping in the third period (2017–2022) of EE research.

5. Conclusions, Implications, and Limitations

Entrepreneurship education (EE) is a highly complex system that has a relatively short chronological history but a rather rapid development. In this developing process, we see some characteristic, rather positive tendencies. The most important of these are as follows:

1. A rapid development can be seen in number of EE-related publications.
2. There is a high level of diversity in the topics of publications applying a diverse methodological base (e.g., sociology, social psychology, organizational sciences, etc.)
3. There is extending international collaboration between different countries.
4. The academic level research of EE becomes increasingly democratic because new countries have appeared on the list as the most productive.
5. EE was considered a relatively new direction of research, and this explains the application of innovation theory and the triple helix model in the first segment of the research.

6. Meanwhile, the COVID-19 crisis and the rapid development of AI and new innovative methods of teaching, integrating distance learning, internet-based education, and enhancing learners' involvement via gamification have brought to light the significance of some relatively novel topics. Researchers might consider concentrating their attention in the future on such emerging themes in EE research.

At the same time, we face new problems and challenges. The most important of them are as follows:

1. Most of the publications focus on the sphere of higher education. However, EE would be highly important in the case of elementary, vocational, and secondary schools, because in the developing world, a considerable number of these schools prepare for such types of profession, where entrepreneurship is a very important component of daily activity (e.g., in the service sector).
2. To evaluate the possibilities of further development, the researchers applied the triple helix method (Figure 9). According to this approach, the possible limit of academy–business and society cooperation are determined by an A-B-C triangle, but some parts of this triangle are interesting for just two and not three parties. The best, trilateral possibilities of cooperation are in the E-F-G triangle. In this sphere, a win-win situation can be achieved for all parties; this is why the promotion of such types of cooperation and collaboration is highly desirable. Shane and Venkataraman noted that the possibilities of the creation of innovative products [54] that are interesting for the industry are shown in the E-G-F triangular area.

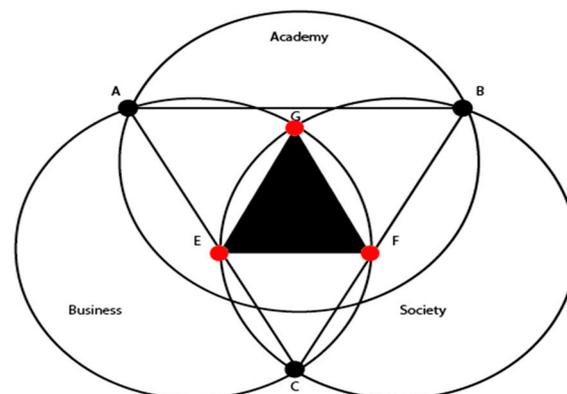


Figure 9. Adaptation of the triple helix model to EE.

This article's information and its connections will guide how academia, business, and industry in the field of entrepreneurial education go forward. Specifically, the views of government and organizational policy and the overall entrepreneurial ecosystem are crucial to the introduction and proper execution of entrepreneurship education in higher institutions. This current study is helpful for researchers and professionals considering exploring this field, and they would benefit from a summary of the relevant research. Researchers and academicians can use the findings of this study and the suggested future research directions to solve the problems related to EE. At the same time, policymakers and practitioners could discover a valuable baseline to support the growth of entrepreneurial education and evaluate its technical, managerial, and organizational consequences for the sustainable development of the entrepreneurial ecosystem and the overall development of the economy.

Entrepreneurship education is critical for attaining the Sustainable Development Goals (SDGs) by providing individuals with the knowledge, skills, and attitude to launch new firms that directly solve critical societal and environmental problems. Moreover, it promotes economic empowerment (SDG 1, 8), gender equality (SDG 5), sustainable practices (SDG 12), and technological advancement (SDG 9) through entrepreneurship, while also supporting lifelong learning (SDG 4) and creating partnerships (SDG 17) among various stakeholders.

Entrepreneurship education considerably contributes to the worldwide effort to achieve specific SDGs by cultivating an entrepreneurial culture and ecosystem, ultimately boosting sustainable development and eliminating inequities.

This research does not go beyond its limits. Data was gathered solely from the Web of Science Database. The results and research direction may change if two or more databases are employed. Further constraints of this study came from constantly increasing the production of scientific output on the database. In the future, researchers may combine multiple databases into a larger one for their studies. Despite these drawbacks, this study is helpful since it establishes a baseline for future research in entrepreneurship education and its future orientation to the current body of knowledge for academics and policymakers.

Author Contributions: Conceptualization, S.C.T. and Z.L.; methodology, S.C.T. and Z.L.; software, S.C.T. and Z.L.; validation, S.C.T. and Z.L.; formal analysis, S.C.T. and Z.L.; investigation, S.C.T., Z.L. and Á.T.; resources, Z.L. and Á.T.; data curation, S.C.T.; writing—original draft preparation, S.C.T. and Z.L.; writing—review and editing, S.C.T. and Z.L.; visualization, S.C.T., Z.L. and Á.T.; supervision, Z.L. and Á.T.; project administration, S.C.T., Á.T. and Z.L.; funding acquisition, Z.L. and Á.T. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The corresponding author will provide the datasets used in research upon valid request.

Acknowledgments: We thank the Hungarian University of Agriculture and Life Sciences and the Doctoral School of Economic and Regional Sciences for their support to this research. We also thank the academic editors and the anonymous reviewers for their insightful and constructive comments.

Conflicts of Interest: The authors declare no conflict of interest.

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