



Mapping two decades of entrepreneurship research in higher education: a bibliometric analysis of trends, collaboration, and emerging themes

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Article Info

Article history:

Received Mar 28th 2026

Revised May 15th 2026

Accepted Jun 20th 2026

Keyword:

Entrepreneurship education; higher education; experiential learning; pedagogy; student entrepreneurs

DOI:

<https://doi.org/10.65779/arshaka.v2i1.85>

ABSTRACT

This bibliometric analysis provides comprehensive insights into the development and trends of research on entrepreneurship in higher education from 2004 to 2023. By examining 882 documents sourced from 415 different journals, books, and other publications, the study reveals significant growth in academic interest, with an average annual growth rate of 23.48%. The analysis highlights key contributors, with Maritz A leading in research output, followed by Ahmed U, Fischer BB, Guerrero M, and others. The collaborative nature of this research field is evident, with an average of 2.84 authors per document and 19.5% of publications involving international collaboration. The study also identifies diverse research themes through keyword cluster analysis, emphasizing foundational aspects like entrepreneurial culture and education, as well as emerging areas such as sustainable entrepreneurship and social entrepreneurship. Network visualizations further illustrate the interconnectedness and influence of prominent authors within the research community. This analysis underscores the dynamic and evolving nature of entrepreneurship research in higher education, providing valuable insights for researchers, educators, and policymakers aiming to foster a robust entrepreneurial ecosystem within academic institutions.



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INTRODUCTION

Entrepreneurship has increasingly been recognized as a critical driver of economic growth, innovation, and social development. Higher education institutions (HEIs) play a pivotal role in fostering entrepreneurial mindsets and skills, making the study of entrepreneurship in higher education a vital area of academic inquiry. Over the past two decades, there has been a substantial increase in research focused on understanding how HEIs can cultivate entrepreneurship among students and faculty, thereby contributing to regional and national economic development (Cruz-Sandoval et al., 2023; Reilly, 2023).

Entrepreneurship education aims to equip individuals with the knowledge, skills, and attitudes necessary to create, develop, and sustain new business ventures. By integrating entrepreneurship into higher education, institutions can stimulate innovation, encourage problem-solving, and foster a culture of creativity and initiative. This not only prepares graduates to launch their own enterprises but also enhances their employability and adaptability in a rapidly changing job market (Bahrami et al., 2023; Esquivel et al., 2023; Hegyi, 2023).

Research on entrepreneurship in higher education has grown rapidly over the past two decades. One significant study is on the impact of entrepreneurship education on students' entrepreneurial intentions. This research demonstrates how entrepreneurship education provided in higher education institutions can influence students' intentions to engage in entrepreneurship, as discussed in (Reilly, 2023) study on university-affiliated research centers and entrepreneurial innovation. Additionally, the role of business incubators in higher education in fostering student entrepreneurship is a frequently studied topic. (Romero Sánchez et al., 2023) provide insights into how business incubators can help students develop their business ideas into actual ventures through their analysis of university spin-offs in Colombia.

The effectiveness of entrepreneurship mentorship programs for students is also a focus of research, with (Cruz-Sandoval et al., 2023) examining the impact of mentorship programs on students' readiness to start businesses. Factors influencing the success of student startups in higher education, such as resources, networks, and institutional support, have been thoroughly analyzed by (Poza-Vilches et al., 2023). The perception of students towards entrepreneurship as an alternative career compared to conventional jobs is evaluated in (Valenzuela Ramos et al., 2024) research, which explores how university educational models can influence students' views on entrepreneurship. These studies offer valuable insights into how higher education institutions can play a role in shaping and supporting entrepreneurial spirit among students.

This study aims to conduct a comprehensive bibliometric analysis of research on entrepreneurship in higher education over the past two decades, providing a valuable resource for scholars, educators, and policymakers. The primary objectives of this bibliometric analysis are to examine the growth in the number of publications and citations over time to understand the evolution of research in this field, highlight the most prolific authors, institutions, and countries contributing to the research on entrepreneurship in higher education, visualize collaboration networks among researchers and institutions to identify key hubs and partnerships, and identify frequently occurring keywords and themes to understand current research hotspots and predict future directions.

This bibliometric analysis will provide a comprehensive overview of the research landscape in entrepreneurship in higher education, highlighting significant contributions and identifying gaps in the existing literature. By understanding the trends and patterns in this field, researchers can build on previous work, educators can enhance their teaching methods, and policymakers can develop strategies to support and promote entrepreneurship education. Ultimately, this study aims to contribute to the advancement of entrepreneurship education, fostering a new generation of innovators and entrepreneurs.

METHODS

The screening and selection process of relevant literature in this study followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology (Hutton et al., 2015; Liberati et al., 2009; Moher et al., 2015). The resulting PRISMA flow diagram helps illustrate the article selection process systematically and transparently. Below is the narrative of the PRISMA process based on the data shown in the flow diagram (Figure 1).

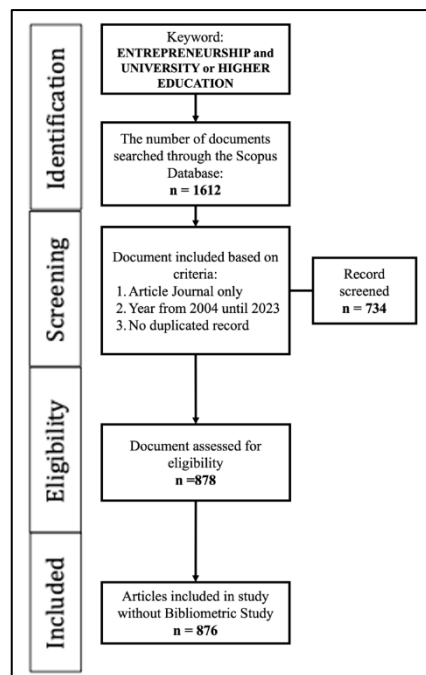


Figure 1. PRISMA Method

The first step in the PRISMA process is the identification of relevant articles. A search was conducted through the Scopus database using the keywords "*entrepreneurship and university or higher education*". This search yielded a total of 1,612 documents that met the initial search criteria.

In the screening phase, the identified documents were further filtered based on specific inclusion criteria: (1) only journal articles were included, (2) articles published between 2004 and 2023, and (3) duplicate records were removed. After applying these criteria, the number of screened documents was 734 articles. These articles were then further evaluated to ensure their relevance to the research topic.

In the eligibility phase, 878 documents were assessed for eligibility. This process involved a full-text review of the articles to ensure that they met stricter eligibility criteria. These criteria included thematic relevance, methodological quality, and significant contributions to the field of entrepreneurship in higher education.

The final phase is inclusion, where articles that met all the eligibility criteria were included in the final analysis. Out of the 878 articles assessed, 876 articles that were not included in bibliometric studies were finally included in the analysis. These selected articles were then analyzed using bibliometric methods to evaluate research trends, author collaborations, and emerging research topics in the field of entrepreneurship in higher education.

This process ensures that the study uses the most relevant and high-quality literature for bibliometric analysis. By using the PRISMA methodology, this research can provide a systematic and comprehensive review of entrepreneurship in higher education, thereby offering valuable contributions to policy and practice development in this field.

RESULTS

Main Information

In Figure 2, bibliometric data were collected and analyzed to provide an in-depth insight into entrepreneurship research in higher education over the period from 2004 to 2023. This analysis covers various aspects such as publication growth, author collaboration, and emerging research topics.



Figure 2. Main information bibliometric

The analysis period spans from 2004 to 2023, encompassing 415 sources including journals, books, and other publications. The total number of documents analyzed in this study is 882, with an average annual growth rate of 23.48%. The average age of the documents is 6.04 years, indicating that most of the research is relatively recent. Each document has an average of 23.32 citations, reflecting the significant impact and relevance of this research in the academic field. The total number of references used in these documents is 38,407, demonstrating the depth of research conducted by the authors.

The keywords used in this research are highly varied, with 945 Keywords Plus (ID) and 2,061 Author Keywords (DE). This indicates the broad range of topics covered in the literature on entrepreneurship in higher education. A total of 2,239 authors contributed to this research, with 149 of them writing single-authored documents. This number shows a high level of collaboration in this field, although there are still significant contributions from single authors.

Documents written by single authors total 154, while the average number of co-authors per document is 2.84. The level of international collaboration is also quite high, with 19.5% of documents involving cross-country cooperation. This indicates that entrepreneurship research in higher education is a highly collaborative and global field. All 882 documents analyzed in this study are articles, showing a strong focus on scholarly publications in journal article form.

Annual Publication Trends

In figure 3, over the past two decades, the field of entrepreneurship in higher education has seen a significant increase in scholarly attention, as evidenced by the annual publication data. The number of articles published each year has generally trended upwards, reflecting growing interest and research activity in this area.

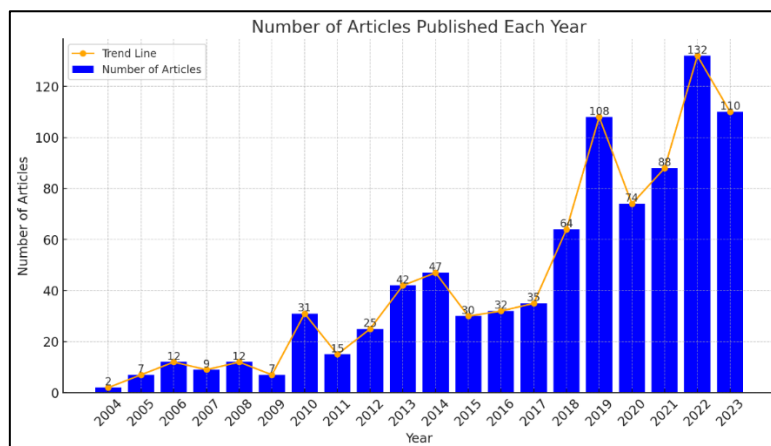


Figure 3. Annual Publication Trends

In 2004, the field was relatively nascent, with only 2 articles published. This initial phase of limited output continued for a few years, with a gradual increase: 7 articles in 2005 and 12 in 2006. The year 2007 saw a slight dip with 9 articles, followed by another steady year in 2008 with 12 publications.

A noticeable spike occurred in 2010, when the number of published articles surged to 31, marking a significant leap from previous years. This momentum continued with 42 articles in 2013 and 47 in 2014. The upward trend became even more pronounced in the latter half of the 2010s. For instance, 2018 saw a substantial rise with 64 articles, and 2019 marked the highest number of publications within the two-decade span, with an impressive 108 articles.

Despite some fluctuations, the number of publications continued to grow in the early 2020s. In 2020, there were 74 articles, increasing to 88 in 2021. The peak year of 2022 witnessed the highest number of articles published in a single year, with 132 publications. Although 2023 saw a slight decrease to 110 articles, it still represented a high level of scholarly activity compared to earlier years.

The year with the fewest publications was 2004, with only 2 articles, while 2022 had the most publications with 132 articles. This dramatic increase highlights the evolving and expanding nature of research on entrepreneurship in higher education, reflecting its growing importance and recognition as a critical area of academic inquiry.

Most Resources Journal

In the exploration of entrepreneurship in higher education, several academic journals have emerged as pivotal sources of scholarly publications. In figure 4, analyzing the distribution of articles across these journals provides insight into the most influential and prolific sources within this research domain.

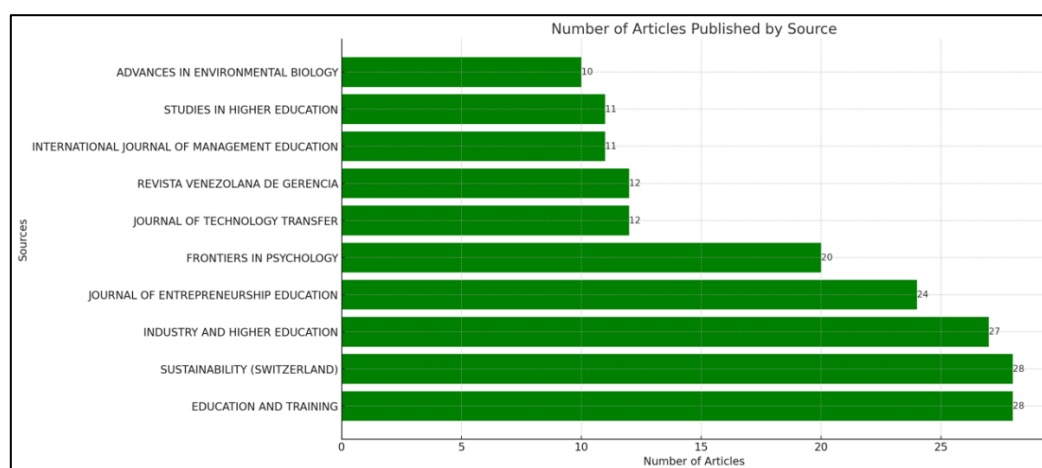


Figure 4. Resources journal

Leading the list are two journals, Education And Training and Sustainability (Switzerland), each with 28 articles. These journals significantly contribute to the field by highlighting innovative educational practices and sustainable development within higher education. Close behind is industry and higher education with 27 articles, serving as a crucial link between academic research and practical applications in industry, emphasizing higher education's role in fostering entrepreneurial skills and knowledge transfer.

The Journal of Entrepreneurship Education, with 24 articles, focuses on the pedagogical aspects of entrepreneurship, providing a forum for integrating entrepreneurship into educational curricula. Frontiers in Psychology has contributed 20 articles, reflected the interdisciplinary nature of entrepreneurship studies and examined the psychological and behavioral dimensions of entrepreneurial education.

With 12 articles each, the Journal of Technology Transfer and Revista Venezolana de Gerencia also play significant roles. The former focuses on transferring technological innovations from academia to industry, while the latter offers perspectives from management studies, particularly in the Latin

American context. The International Journal of Management Education and Studies in Higher Education, each with 11 articles, contribute to understanding how management education and broader higher education studies intersect with entrepreneurial initiatives and policies.

Finally, advances in environmental biology have published 10 articles, highlighting the relevance of environmental considerations in studying entrepreneurship within higher education, particularly sustainable practices and bio-entrepreneurship. Collectively, these journals represent core sources for research on entrepreneurship in higher education, each offering unique perspectives and findings that enrich the academic discourse and practical applications in this evolving field.

Author and Co-Author Contribution

In figure 5, the analysis of authors' production over time in the field of entrepreneurship in higher education reveals significant contributions from several key researchers, highlighting trends in publication frequency and impact.

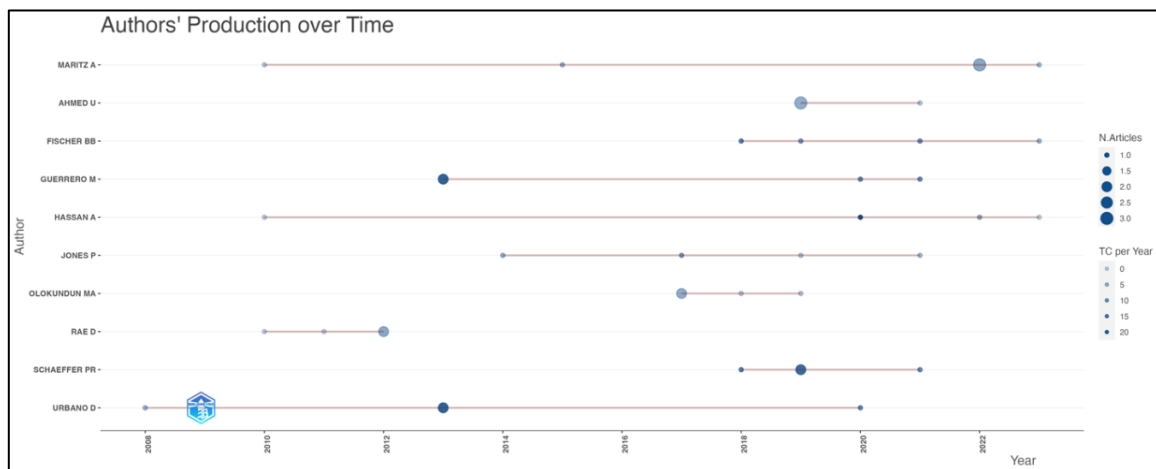


Figure 5. Authors contribution

U. Ahmed (Ahmada et al., 2019; Khalid et al., 2019; Madrid et al., 2018; Yusuf et al., 2021) has been actively contributing since 2018, with a notable frequency of publications that year. Ahmed published two articles in 2019, which have collectively garnered 30 citations, averaging 5 citations per year. Subsequent publications in 2021 reflect a lower citation count, with a single article cited five times, averaging 1.25 citations per year.

B.B. Fischer (Alves et al., 2019; Fischer et al., 2018, 2019; Pinheiro et al., 2023; Schaeffer et al., 2021) has made substantial contributions with consistent high-impact publications. Fischer's work from 2018 has achieved remarkable recognition, with a single article receiving 94 citations, averaging 13.429 citations per year. Publications in 2019, 2021, and 2023 have maintained this high impact, with citation averages of 9.5, 11.25, and 4.5 per year, respectively.

M. Guerrero (Guerrero et al., 2020; Ortiz-Medina et al., 2016; Schaeffer et al., 2021; Urbano & Guerrero, 2013) is another prolific author whose work has significantly influenced the field. Notably, Guerrero's publications in 2013 have accumulated 218 citations, averaging an impressive 18.167 citations per year. Subsequent impactful publications in 2020 and 2021 have continued this trend, with citations averaging 12.2 and 11.25 per year.

A. Hassan (Hassan et al., 2020, 2020, 2022) shows a varied impact over time. Hassan's earlier work in 2010 had a modest citation count, averaging 0.6 citations per year. However, a significant rise is seen in 2020 with an article receiving 111 citations, averaging 22.2 citations per year. Subsequent publications in 2022 and 2023 reflect a moderate to low citation count, averaging 5.667 and zero citations per year, respectively.

P. Jones (Jones et al., 2017, 2021; Jones & Jones, 2014; Wyness & Jones, 2019) has been contributing consistently since 2014. Notable publications include a 2014 article with 52 citations (4.727 citations per year) and a 2017 article with 68 citations (8.5 citations per year). However, more

recent publications in 2019 and 2021 show a decrease in citation impact, with averages of 1.667 and 3 citations per year, respectively.

A. Maritz (De Waal & Maritz, 2022; Maritz, 2010; Maritz et al., 2015, 2022, 2023; Nguyen et al., 2022) has a varied publication record with significant contributions in 2010, 2015, and 2022. The 2010 publication received 20 citations (1.333 citations per year), while the 2015 publication received 47 citations (4.7 citations per year). A notable increase in productivity is seen in 2022 with three articles, collectively receiving 18 citations (6 citations per year).

M.A. Olokundun (Harrison et al., 2022; Ogbari et al., 2019, 2019; Olokundun et al., 2018; Olokundun, Ibidunni, et al., 2017; Olokundun, Moses, et al., 2017; Peter et al., 2019) has shown consistent productivity, particularly in 2017 with two articles receiving a total of 44 citations (5.5 citations per year). Subsequent publications in 2018 and 2019 have lower citation counts, averaging 1 and 1.5 citations per year, respectively.

D. Rae (Rae, 2012; Rae et al., 2012a, 2012b; Rae & Matlay, 2010) has an extended publication record starting from 2010, though with varying impact. Early works in 2010 and 2011 received minimal citations, averaging 0.133 and 0.071 citations per year, respectively. However, Rae's 2012 publications show a higher impact with 77 citations (5.923 citations per year).

P.R. Schaeffer (Alves et al., 2019; Fischer et al., 2018, 2019; Schaeffer et al., 2021) has consistently high-impact publications, particularly in 2018 with 94 citations (13.429 citations per year) and in 2019 with two articles receiving 100 citations collectively (16.667 citations per year). A 2021 publication continues this trend with 45 citations (11.25 citations per year).

D. Urbano (Coduras et al., 2008; Guerrero et al., 2020; Urbano & Guerrero, 2013) has been influential since 2008, with an early publication receiving 79 citations (4.647 citations per year). Significant contributions in 2013 mirror Guerrero's impact, with two articles collectively receiving 218 citations (18.167 citations per year). A 2020 publication maintains high impact with 61 citations (12.2 citations per year).

These authors have significantly contributed to the body of knowledge on entrepreneurship in higher education, with varying degrees of productivity and impact over the years. Their work highlights the dynamic nature of research in this field and underscores the importance of ongoing scholarly contributions.

Authors Country Contribution

In figure 6, the analysis of corresponding authors' countries provides valuable insights into the geographical distribution of research activity in the field of entrepreneurship in higher education. A total of 270 articles were identified, showcasing significant contributions from various countries, with China, Spain, the USA, and the United Kingdom leading in terms of the number of articles.

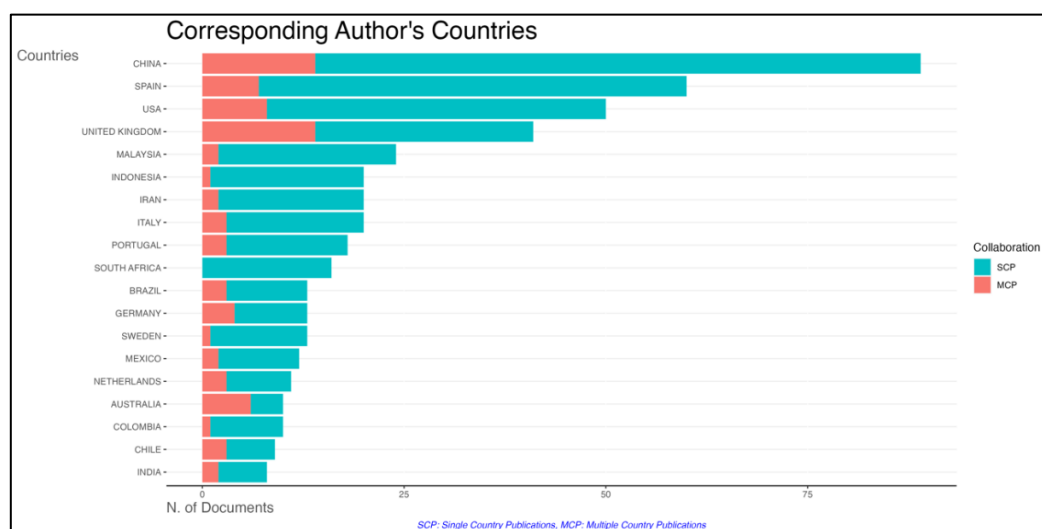


Figure 6. Authors country contribution

China stands out with 89 articles, most of which are single-country publications (SCP) (75), and 14 are multiple-country publications (MCP), resulting in an MCP_Ratio of 0.157. This indicates a moderate level of international collaboration. Similarly, Spain has produced 60 articles, with 53 SCPs and 7 MCPs, yielding an MCP_Ratio of 0.117, reflecting a balanced approach to both domestic and international research collaborations. The USA follows with 50 articles, comprising 42 SCPs and 8 MCPs, and an MCP_Ratio of 0.160, suggesting a significant level of international collaboration, similar to China. The United Kingdom, with 41 articles, shows a high MCP_Ratio of 0.341, with 14 MCPs out of 27 SCPs, indicating a strong emphasis on international collaboration in research.

Countries with moderate contributions include Malaysia, which has 24 articles predominantly SCPs (22), resulting in a low MCP_Ratio of 0.083, suggesting limited international collaboration. Indonesia also contributed 20 articles, with 19 SCPs and 1 MCP, yielding a very low MCP_Ratio of 0.050. Iran's contribution includes 20 articles, 18 SCPs, and 2 MCPs, with an MCP_Ratio of 0.100, indicating minimal international collaboration. Italy, with 20 articles, has an MCP_Ratio of 0.150, demonstrating a balanced approach to both domestic and international collaborations.

Significant international collaborators are highlighted by Germany, which produced 13 articles with a high MCP_Ratio of 0.308, indicating strong international research partnerships. The Netherlands, with 11 articles, shows an MCP_Ratio of 0.273. Australia, with 10 articles, has a notably high MCP_Ratio of 0.600, reflecting a strong tendency towards international collaboration. Chile's 9 articles include an MCP_Ratio of 0.333, highlighting a robust international research network.

Emerging research contributors such as Finland, Nigeria, Saudi Arabia, and Turkey have relatively fewer articles but demonstrate varying levels of international collaboration, as indicated by their MCP_Ratios. Emerging contributors like Ecuador, Japan, and Kazakhstan show high MCP_Ratios (0.750 for Ecuador and Japan), suggesting that their research efforts are highly collaborative on an international scale despite a lower overall number of publications.

Countries with limited data include Argentina, Belgium, Costa Rica, Ghana, and others, each contributing a single article. These countries have MCP_Ratios of either 1.000 or 0.000, reflecting exclusive international collaborations or purely domestic research efforts.

Thematic Map

In figure 7, the thematic map visualizes the main themes in research on entrepreneurship in higher education based on their development degree (density) and relevance degree (centrality). This map helps identify which themes are central and well-developed and which ones are emerging or declining. The map is divided into four quadrants: Niche Themes, Motor Themes, Emerging or Declining Themes, and Basic Themes.

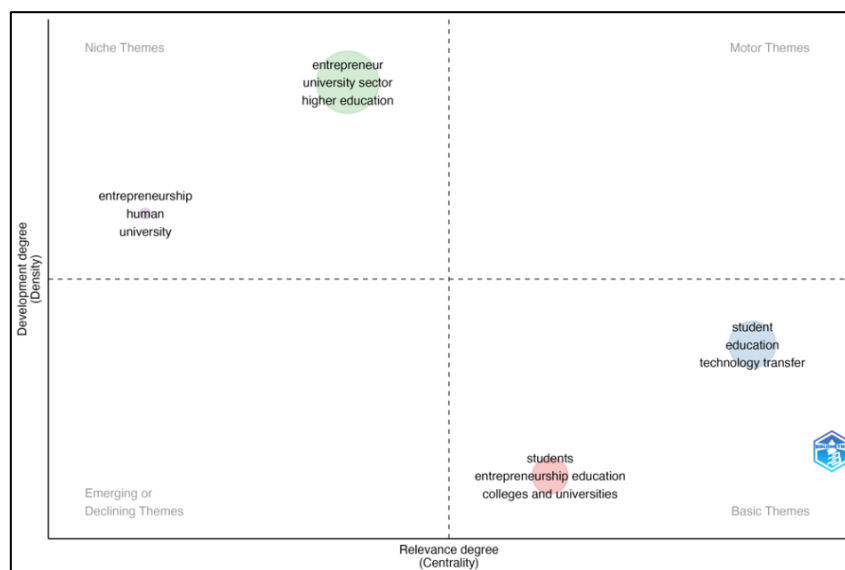


Figure 7. Thematic Map Visualization

The thematic map provides a strategic overview of research themes in entrepreneurship in higher education, categorized into four quadrants. In the Niche Themes quadrant, topics like entrepreneur, university sector, and higher education are well-developed but less connected to other themes, indicating specialized studies that are crucial for specific aspects of entrepreneurship but not widely integrated with other research areas. The Motor Themes quadrant includes student, education, and technology transfer, which are both highly developed and central, driving the field forward and influencing a wide range of other topics. Emerging or Declining Themes such as entrepreneurship, human, and university are less developed and central, suggesting they may be emerging areas of interest or declining in relevance. These themes are currently not well-integrated with other research areas, representing potential new research avenues or areas becoming less relevant. Basic Themes include students, entrepreneurship education, and colleges and universities. These themes are highly central but less developed, forming the foundational topics within the field. They are crucial for understanding the field and well-integrated with other themes but offer room for further development and exploration. In conclusion, Niche Themes are well-developed but not broadly connected, Motor Themes are well-developed and central, Emerging or Declining Themes require further investigation, and Basic Themes form the core foundation of the field. Understanding these themes helps researchers, educators, and policymakers focus on areas needing more development or those pivotal to advancing the field.

Three Field Plot Analysis

In figure 8, the Three-Field Plot visualizes the intricate relationships between authors, their countries, and the dominant research themes or keywords within the field of entrepreneurship in higher education. This bibliometric analysis reveals how authors from various countries contribute to different research themes, providing insights into influential authors, key countries, and prevalent topics.

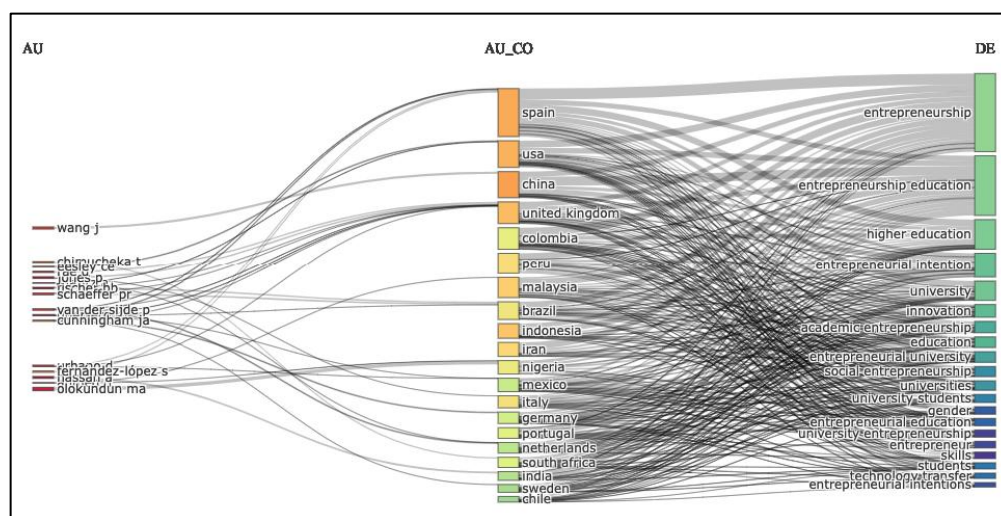


Figure 8. Three-Field map visualization

Wang J emerges as a significant contributor, displaying multiple connections to various countries and research themes, thus indicating an influential role in the field. Other notable authors include Etzkowitz H, Isenberg D, Schaefer PR, and Van Der Sijde P, who also show substantial contributions and collaborations across different countries and themes. Additionally, authors like Olokundun MA, Fernandez-Lopez S, and Gonzalez-Pernia JL exhibit significant output, demonstrating their active engagement in diverse research themes.

From the perspective of countries, Spain stands out with a high number of connections to various research themes and authors, indicating its central role in entrepreneurship research in higher education. The USA and China follow closely, showcasing their strong influence and active participation in the research landscape. These countries exhibit extensive links to key research themes such as entrepreneurship education and higher education. Other countries, including the United Kingdom,

Colombia, Peru, and Malaysia, also show significant involvement, connecting multiple authors to various research themes.

The dominant research themes include entrepreneurship, entrepreneurship education, higher education, entrepreneurial intention, and university, all of which are well-connected to various authors and countries, highlighting their central importance in the field. Themes like innovation, academic entrepreneurship, education, social entrepreneurship, and entrepreneurial university also display strong connections, underscoring their relevance in current research. Emerging themes such as university students, skills, technology transfer, and entrepreneurial intentions reflect evolving focus areas within the field.

In conclusion, the Three-Field Plot offers a comprehensive overview of the collaborative landscape in entrepreneurship in higher education. Influential authors like Wang J, Etzkowitz H, and Schaefer PR demonstrate significant contributions across various themes and countries. Spain, the USA, and China are central hubs, actively engaging in multiple research themes and showcasing their prominent roles in the global research community. Key themes such as entrepreneurship, entrepreneurship education, and higher education drive much of the research activity. This visualization highlights the interconnectedness of authors, countries, and research themes, providing valuable insights for researchers, educators, and policymakers aiming to understand and advance the field of entrepreneurship in higher education.

Keyword Analysis

In figure 10, the keyword analysis visualized through the VOSviewer map provides a detailed overview of the interconnectedness and prominence of various research themes within the field of entrepreneurship in higher education. Each keyword represents a focal point in the scholarly discourse, with the size of the nodes indicating the frequency of occurrences and the thickness of the links representing the strength of co-occurrence relationships between keywords.

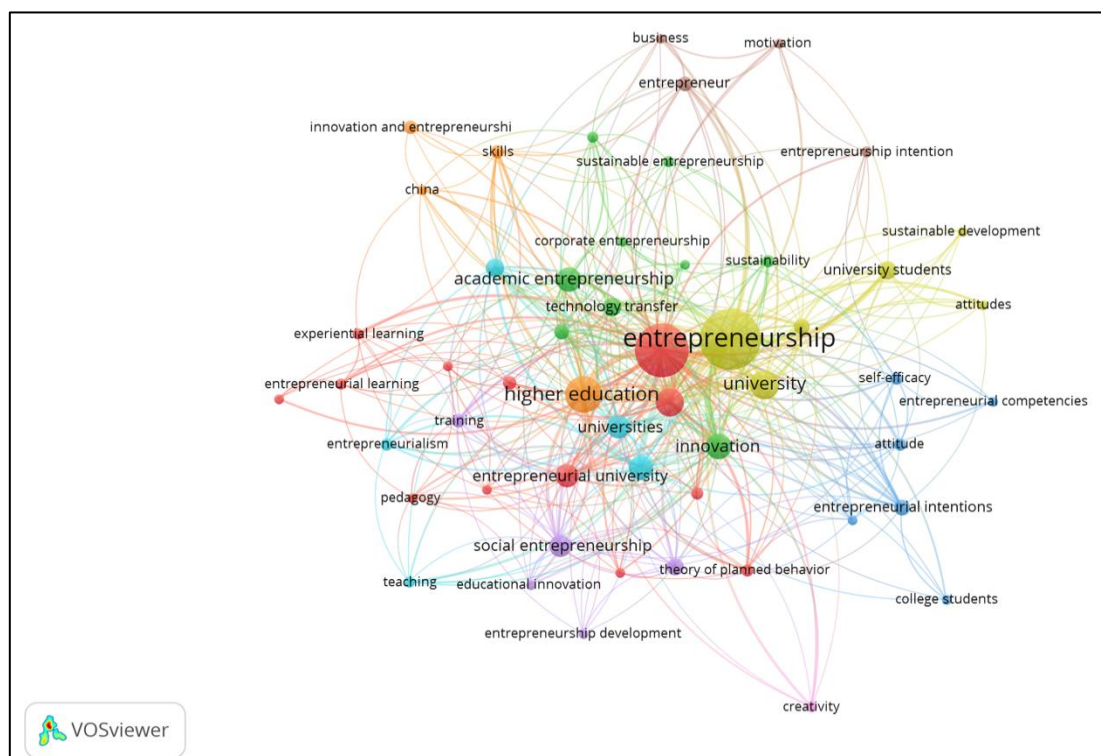


Figure 10. Keyword visualization

At the center of the network, entrepreneurship stands out as the most prominent keyword, indicating its central role in the research landscape. This keyword is highly interconnected with several other significant themes such as higher education, university, innovation, and academic

entrepreneurship. These connections suggest that entrepreneurship is widely studied in various contexts, emphasizing its importance in higher education and institutional settings.

Higher education and university are also major nodes in the network, reflecting their critical roles in the research on entrepreneurship. The strong link between these keywords and others such as innovation, entrepreneurial university, and universities highlights the focus on how higher education institutions foster and support entrepreneurial activities and mindsets.

Keywords like academic entrepreneurship, social entrepreneurship, and corporate entrepreneurship indicate the diversity of entrepreneurial contexts explored in the literature. Academic entrepreneurship shows strong ties with technology transfer and innovation, underscoring the role of universities in promoting innovation and commercialization of research. Social entrepreneurship is linked with themes such as educational innovation and entrepreneurship development, pointing to the growing interest in how entrepreneurial initiatives can address social challenges.

In the table 1, the keyword cluster analysis provides a detailed view of the main themes and sub-themes within the field of entrepreneurship in higher education, revealing the various focal points of research and their interconnections.

Table 1. Keyword Cluster

Cluster 1 (13 items)	Entrepreneurial culture, Entrepreneurial ecosystem, Entrepreneurial intention, Entrepreneurial learning, Entrepreneurial mindset, Entrepreneurial self-efficacy, Entrepreneurial skills, Entrepreneurial university, Entrepreneurship education, Experiential learning, Pedagogy, Student entrepreneurs, Theory of planned behavior
Cluster 2 (9 items)	Academic entrepreneurship, Corporate entrepreneurship, Entrepreneurial university, Higher education institutions, Innovation, Sustainability, Sustainable entrepreneurship, Technology transfer, University entrepreneurship
Cluster 3 (6 items)	Attitude, College students, Entrepreneurial competencies, Entrepreneurial intention, Self-efficacy, University support
Cluster 4 (6 items)	Attitudes, Entrepreneurship, Gender, Sustainable development, University, University students
Cluster 5 (5 items)	Educational innovation, Entrepreneurial education, Entrepreneurship development, Social entrepreneurship, Training
Cluster 6 (5 items)	Education, Entrepreneurialism, Students, Teaching, Universities
Cluster 7 (4 items)	China, Higher education, Innovation and entrepreneurship, Skills
Cluster 8 (4 items)	Business, Entrepreneur, Entrepreneurship intention, Motivation
Cluster 9 (1 item)	Creativity

Cluster 1 focuses on foundational aspects of entrepreneurship education, emphasizing the development of entrepreneurial skills, mindsets, and intentions among students, with a highlight on experiential learning and pedagogical strategies. Cluster 2 underscores the role of higher education institutions in fostering innovation and entrepreneurship, including technology transfer, sustainable practices, and the integration of corporate and academic activities, highlighting institutional dynamics and support systems. Cluster 3 examines individual attributes and support mechanisms that influence entrepreneurial intentions and competencies among students, focusing on attitudes, self-efficacy, and university support systems. Cluster 4 explores socio-cultural and developmental aspects of entrepreneurship within higher education, addressing gender impacts, sustainable development, and student attitudes. Cluster 5 emphasizes innovative educational approaches and training programs, focusing on social entrepreneurship and novel strategies to foster entrepreneurial skills and mindsets. Cluster 6 centers on the educational environment's role in promoting entrepreneurialism, including teaching methods, university support, and the overall educational context. Cluster 7 highlights regional aspects of entrepreneurship education, particularly in China, examining the development of skills and integration of innovation within specific regions. Cluster 8 delves into motivational factors driving

individuals towards entrepreneurship, exploring business intentions, personal motivations, and entrepreneurial aspirations. Cluster 9 underscores the importance of creativity, emphasizing that fostering creativity is essential for entrepreneurial success and innovation.

In conclusion, the keyword and cluster analysis reveals a comprehensive and interconnected landscape of research themes within entrepreneurship in higher education. From foundational aspects and institutional dynamics to student-centric factors and educational innovations, the clusters highlight the field's diverse and multifaceted nature. Understanding these clusters provides valuable insights for researchers, educators, and policymakers to advance the study and practice of entrepreneurship in higher education, ensuring all critical aspects are addressed to foster a robust entrepreneurial ecosystem.

DISCUSSION

This bibliometric analysis provides deep insights into the development of research on entrepreneurship in higher education from 2004 to 2023. The data collected reveals a significant increase in interest and research activity in this field, highlighting the importance of entrepreneurship within the context of higher education.

Annual Publication Growth: The growth in annual publications reflects the rising academic interest in entrepreneurship in higher education. From just 2 articles in 2004, the number of publications has exponentially increased, peaking at 132 articles in 2022. This growth not only indicates an increase in the quantity of research but also an improvement in the quality and impact, as evidenced by the high average number of citations per document.

Author Collaboration: Author collaboration is a notable aspect of this analysis. With an average of 2.84 authors per document and 19.5% of documents involving international collaboration, it is clear that research on entrepreneurship in higher education is highly collaborative. This collaboration enriches the research with diverse perspectives and enhances the quality and innovation of research findings. The significant number of single-author contributions also shows that there is room for in-depth and innovative individual research.

Keywords and Research Topics: The variety of keywords used in the documents shows the wide range of topics being researched. Keywords such as "entrepreneurial culture," "academic entrepreneurship," and "sustainable entrepreneurship" indicate that the research not only focuses on fundamental theories but also on practical applications and the social impact of entrepreneurship. Further keyword cluster analysis reveals that themes like experiential learning, educational innovation, and entrepreneurship development are major focuses in the literature. This indicates a significant effort to integrate entrepreneurship theory with educational practice and student capacity building.

Research Impact and Relevance: Each document has an average of 23.32 citations, reflecting the significant impact and relevance of this research in the academic field. The high number of references used in these documents also indicates that the research in this field is based on a strong and deep theoretical foundation. This suggests that research on entrepreneurship in higher education is growing not only in quantity but also in quality and depth.

CONCLUSION

Overall, this bibliometric analysis shows that research on entrepreneurship in higher education has experienced significant growth over the past two decades. The high level of collaboration, both nationally and internationally, and the wide variety of topics covered indicate that this field continues to develop and attract significant interest from the academic community. This analysis provides a solid foundation for understanding the trends and directions of research in the field of entrepreneurship in higher education and for identifying areas that require further attention and development in the future.

Despite the positive trends, there are still challenges that need to be addressed. One challenge is ensuring that international collaboration continues to increase to integrate global perspectives into the research. Additionally, efforts should be made to encourage more interdisciplinary research that can combine entrepreneurship with other fields such as technology, health, and social sciences.

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