

Artificial Intelligence and Entrepreneurship: A Comprehensive Bibliometric and Text Mining Analysis of Global Research Trends

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Abstract:

This study provides an in-depth bibliometric and text mining analysis of the evolving intersection between Artificial Intelligence (AI) and entrepreneurship from 2002 to 2024. Utilizing the SPAR-4-SLR protocol and PRISMA framework, 313 relevant publications were systematically analyzed to uncover scientific production trends, influential countries, key authors, and thematic developments. Results reveal an exponential growth in research, particularly from 2019 onward, with significant contributions from China, India, and the United States. Emerging themes such as machine learning, digital entrepreneurship, and sustainability underscore the transformative role of AI in entrepreneurial processes. The study highlights critical research gaps, especially regarding practical applications in developing economies and the integration of AI in entrepreneurship education. This analysis provides valuable insights for academics, policymakers, and practitioners aiming to navigate and shape the future of AI-driven entrepreneurship

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Jel Classification Codes : O33, L26, Q55

Introduction

Artificial Intelligence (AI) has emerged as a transformative force in the contemporary business landscape, driving innovation and reshaping economic growth and entrepreneurship (Blanco-González-Tejero et al., 2023; Giuggioli et al., 2024) . As AI technologies continue to evolve rapidly, they have the potential to revolutionize various sectors by automating processes, enhancing decision-making, and fostering the development of new products and services.

On the other hand, Entrepreneurship has been a topic of discussion for decades. Its importance and contribution to economic growth and development have been emphasized in numerous studies (Maliki & Benghalem, 2019; Parker & Parker, 2012; Simba et al., 2025; Urbano et al., 2019). The value generated through entrepreneurial efforts has formed the basis for a variety of economic initiatives (Milow et al., 2024). Entrepreneurs are often regarded as innovative creators who utilize adaptability and creative destruction to unlock new opportunities and possibilities (Rathee et al., 2025).

Benghalem et al., (2022), along with other researchers, assert that the effectiveness of entrepreneurship in driving economic development is not merely tied to the number of self-employed individuals. Instead, it hinges on the innovative and imitative entry of existing businesses into new markets. This perspective underscores the importance of AI in facilitating such market entries by enabling businesses to innovate and adapt more effectively. Thus, tools like Artificial Intelligence (AI) are particularly important for the digital transformation of organizations, as entrepreneurs must constantly adapt and stay updated with the latest advancements (Gerlich et al., 2025).

The integration of AI into entrepreneurial activities has sparked significant interest among researchers, who seek to understand its impact on the creation and growth of new ventures. This interest highlights the crucial role AI plays in enabling businesses to innovate, adapt, and thrive in dynamic markets (Jain et al., 2025).

Despite the growing body of literature on AI and entrepreneurship, there remains a notable gap in the methodological and theoretical focus of existing studies. Previous research has often concentrated on specific aspects of AI's influence on entrepreneurship without providing a holistic analysis. This study seeks to bridge the existing gap by utilizing a comprehensive approach that integrates bibliometric analysis, systematic review, and text mining techniques. The research aims to explore several key questions :

1. How has the intersection of artificial intelligence (AI) and entrepreneurship evolved over time?
2. What is the scientific landscape surrounding this topic, particularly in terms of patterns among countries, journals, articles, and authors?
3. In what ways has entrepreneurship been transformed through the integration of AI?
4. What potential avenues for future research exist at the intersection of AI and entrepreneurship?

To effectively address the research questions, this article is structured into several key sections. In Section 2, we provide a detailed description of the methods and search techniques used to gather relevant material on AI and entrepreneurship. The results are presented in Section 3, while Section 4 discusses the implications of these findings and identifies potential themes that warrant further investigation. Finally, Section 5 concludes the article and suggests possible avenues for future research on AI and entrepreneurship.

1. Methods and search techniques

This study employs a combined bibliometric analysis and text mining approach to investigate the intersection of artificial intelligence (AI) and entrepreneurship. The methodology integrates the SPAR-4-SLR² protocol (Paul et al., 2021) for systematic literature reviews and the PRISMA³ framework for transparent reporting. It is structured into three main phases: Gathering, Organizing, and Evaluating.

1.1 Gathering (SPAR-4-SLR)

Relevant literature was identified using a comprehensive search strategy based on the SPAR-4-SLR protocol. The search terms included variations of "artificial intelligence" ("Artificial Intelligence" OR "AI") and "entrepreneurship" ("Entrepreneurship" OR "Entrepreneur"). The Scopus database, accessed through the Portal SNDL (the National System of Online Documentation in Algeria), served as the primary source. The search covered the period from 2002 to 2024 and was limited to English-language documents. Document types included articles, books, book chapters, conference papers, conference reviews, and reviews.

1.2 Organizing (SPAR-4-SLR & PRISMA)

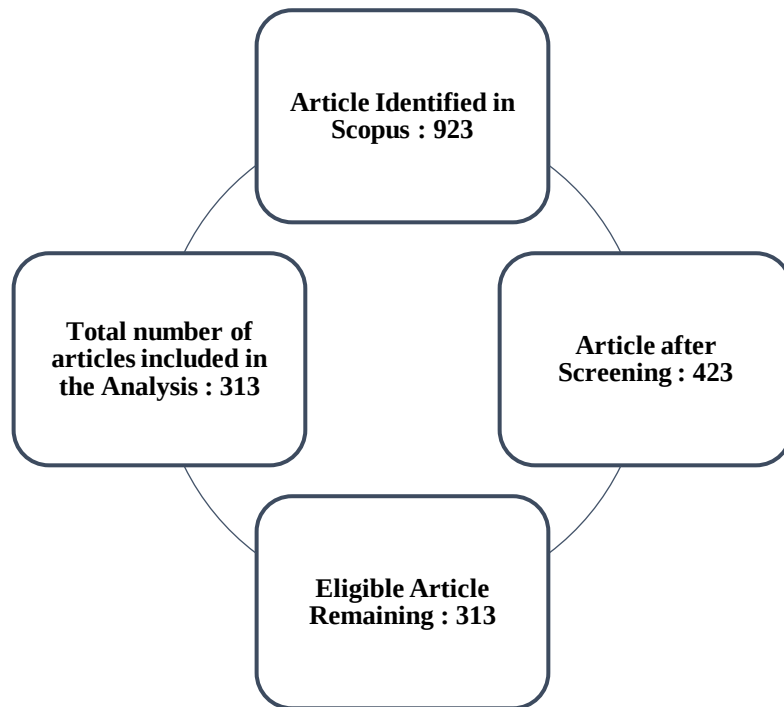
The initial search yielded a large number of publications. To refine the dataset, several filtering steps were applied following the SPAR-4-SLR protocol and reported using the PRISMA framework :

- **Duplicate Removal:** All duplicate records were eliminated.
- **Invalid DOI Removal:** Documents with invalid DOIs were excluded.
- **Relevance Screening (PRISMA):** Using the PRISMA flow diagram (Figure 1), 610 irrelevant papers were removed, resulting in a final selection of 313 documents.

² Scientific Procedures and Rationales for Systematic Literature Reviews

³ Preferred Reporting Items for Systematic Reviews and Meta-Analyses

Figure 1: Flowchart illustrating the PRISMA methodology for data selection and screening.



Source: Author's construction based on the prevalent literature review

1.3 Evaluating (SPAR-4-SLR)

The present analysis encompasses several dimensions vital to understanding the research landscape in this field. First, a comprehensive evaluation of leading countries highlights their local impacts and historical production trends. Second, the analysis identifies prominent authors and examines their influence on the field through publication trends. Furthermore, a detailed content analysis is conducted, focusing on cited references and recurring keywords, employing methodologies such as word clouds, treemaps, and trending topics. The exploration of the conceptual structure is supported by co-occurrence networks and thematic maps that illustrate thematic evolution. Finally, the social structure is examined through an analysis of international collaborations, visualized via a world map that delineates country partnerships.

Table 1 : Methodology Overview

Gathering (SPAR-4-SLR)	Organizing (SPAR-4-SLR & PRISMA)	Evaluating (SPAR-4-SLR)
Search Terms "Artificial Intelligence" OR "AI" AND "Entrepreneurship" OR "Entrepreneur" Database: Scopus (via Portal SNDL)	Filtering Removal of duplicates and invalid DOIs, relevance screening (PRISMA) Document Types	Country Analysis Relevance, impact, production trends Source and Author Analysis: Relevance, impact, publication trends

Timespan: 2002-2024	Articles, Books, Book Chapters, Conference Papers, Reviews Language English-only documents	Content Analysis: Keywords, word clouds, trending topics Conceptual Structure: Co-occurrence networks, thematic evolution Social Structure: International collaboration networks
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Source: Author's construction

We initiated the bibliometric study after extracting and filtering the relevant publications. A CSV file containing 313 pertinent bibliographic records was exported from Scopus. The analysis was conducted using Biblioshiny, an open-source bibliometric software available in RStudio (Aria & Cuccurullo, 2017). Biblioshiny distinguishes itself from other bibliometric tools through its extensive array of statistical methods and graphical capabilities.

2. Results

2.1 Main Information

Our analysis indicates that, as of November 2024, a total of 313 documents were authored by 843 researchers. These include 237 journal articles published between 2002 and October 2024. The publications utilized 858 unique keywords. This dataset provides a valuable foundation for exploring emerging trends and contributions in the field.

Figure 2: Overview of the dataset



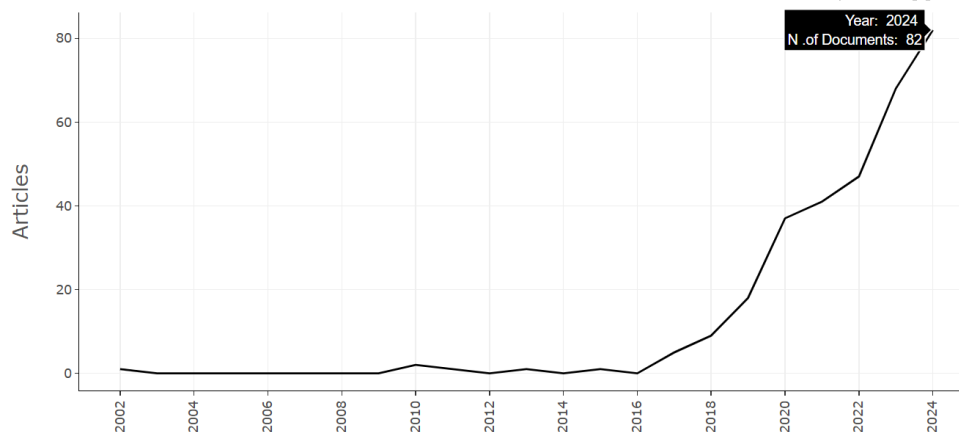
Source: Author's construction based on SCOPUS database

2.2 Scientific production

The temporal evolution analysis of publications related to entrepreneurship and artificial intelligence, as illustrated in Figure 3, reveals four distinct periods. The first phase, Initial Stagnation (2002-2015), saw the number of articles remain nearly at zero from 2002 until around 2015. This was followed by the Early Growth Phase (2016-2018), during which a significant increase in scientific output became evident around 2016. The subsequent period, Rapid Acceleration (2019-2022), experienced

a dramatic surge in the rate of scientific production. Currently, we are witnessing what can be described as Explosive Growth (2023-2024), with the last two years showcasing an even more remarkable rise in scientific output. This exponential growth highlights the transformative impact of AI on entrepreneurial activities and underscores the considerable potential for further advancements in this dynamic field (Giuggioli & Pellegrini, 2023)

Figure 3: Trajectory of yearly publications on AI and Entrepreneurship



Source: Author's construction based on SCOPUS database

2.3 Country Analysis

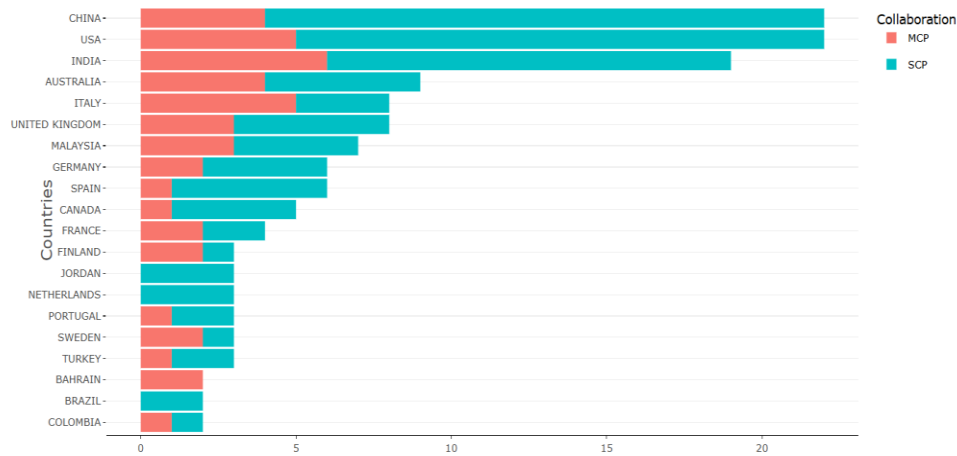
An analysis of the global distribution of research output on artificial intelligence and entrepreneurship reveals distinct patterns in international collaboration. Figure 4 illustrates the difference between Single Country Publications (SCP) and Multiple Country Publications (MCP), highlighting the dynamics of both national and international research efforts.

The country analysis indicates that China, India, and the United States lead in SCP, reflecting strong internal research capacities and significant national investments in AI and entrepreneurship. These countries prioritize domestic research development, demonstrating their ability to produce substantial academic output independently (Boateng et al., 2024).

In contrast, countries such as the United Kingdom, Germany, and Australia show a more balanced distribution between SCP and MCP. This balance indicates a strong commitment to international collaboration, which fosters knowledge exchange and cross-border innovation. European nations, in particular, display a higher tendency to engage in collaborative research, enhancing the diversity and impact of scientific outputs.

Emerging economies such as Malaysia, Jordan, and Bahrain enhance the field primarily through collaborative research efforts, as indicated by their higher MC ratios. This trend suggests that international partnerships are essential for expanding research capacities in these regions.

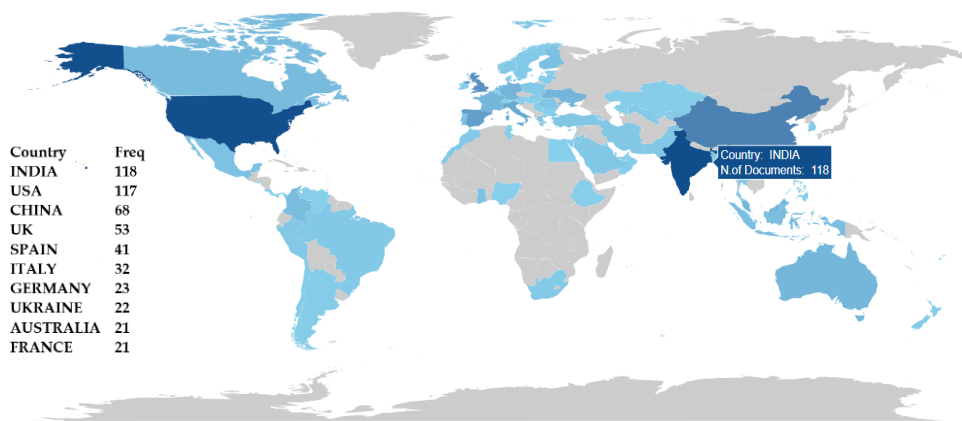
Figure 4: The 20 Leading Countries in Research Publications on AI and Entrepreneurship



Source: Author's construction based on SCOPUS database

The Global Contributions Map, specifically Figure 5, illustrates the geographic distribution of research contributions. Darker areas indicate higher publication counts, with India leading at 118 publications. This map emphasizes the global nature of this field and highlights key contributors such as the USA, China, and the UK.

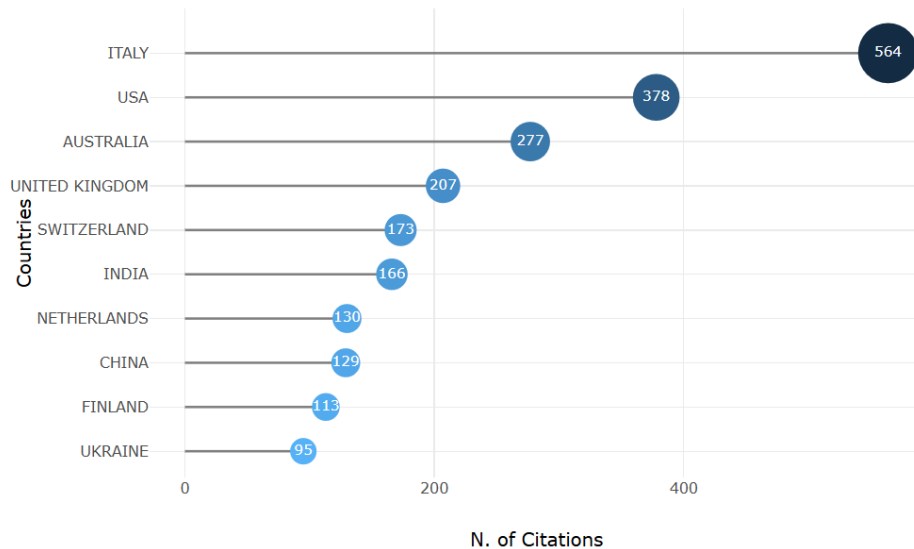
Figure 5: Global Contributions Map



When it comes to the most cited countries, Figure 6 illustrates the number of citations per country, highlighting the scientific impact of research outputs. Italy leads with 564 citations, followed by the USA with 378 citations and Australia with 277. This data demonstrates the strong influence these countries have in the field. The United Kingdom and Switzerland also show significant academic impact, with 207 and 173 citations, respectively. Countries such as India, the Netherlands, and China contribute meaningfully but have comparatively lower citation counts. This distribution reflects the varying degrees of research visibility and influence among

nations, emphasizing the dominance of developed countries in citation performance. The data underscores not just the quantity but also the quality and impact of research from these countries.

Figure 6 : most cited countries



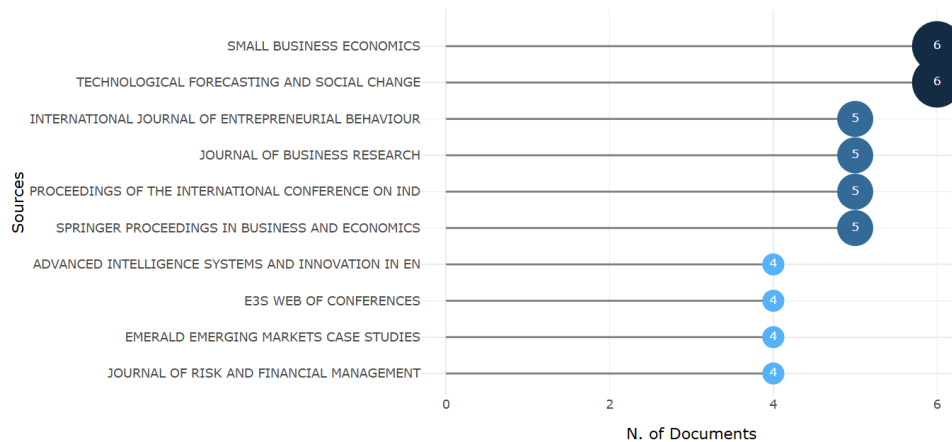
Source: Author's construction based on SCOPUS database

2.4 Source and Author Analysis

In examining the most influential sources of publications in AI entrepreneurship research, Figure 7 reveals a clear leader tier, comprising Small Business Economics and Technological Forecasting and Social Change, each with six published documents.

Other notable sources include the International Journal of Entrepreneurial Behavior, Journal of Business Research, and the Proceedings of the International Conference on Industrial Engineering and Operations Management, each contributing five publications. Additionally, sources such as Springer Proceedings in Business and Economics, Advanced Intelligent Systems, Innovation in Engineering, E3S Web of Conferences, Emerald Emerging Markets Case Studies, and the Journal of Risk and Financial Management each add four documents to the overall body of research. This distribution underscores the interdisciplinary nature of the field, bridging economics, entrepreneurship, business, and technological innovation.

Figure 7: Most relevant source

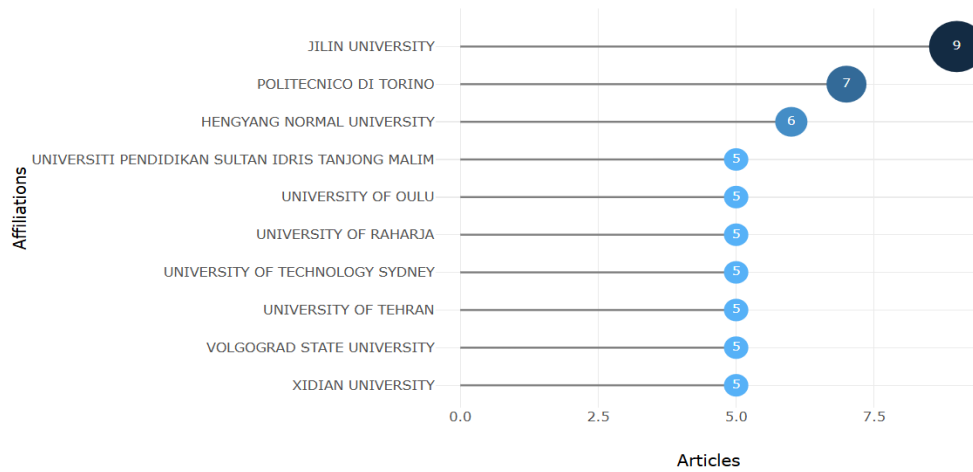


Source: Author's construction based on SCOPUS database

Figures 8 and 9 together highlight the key contributors in the field of AI and entrepreneurship, showcasing the individual authors along with their institutional affiliations. Figure 8 shows that Nijkamp P is the most prolific author in this area, having published a total of 4 documents. He is followed closely by Abadi S, Carayannis EG, Grigoroudis E, Gupta BB, Gupta V, and Al-Shiboul MA, each of whom has contributed 3 documents. This indicates that a select group of scholars is making a concentrated effort to advance research at the intersection of AI and entrepreneurship.

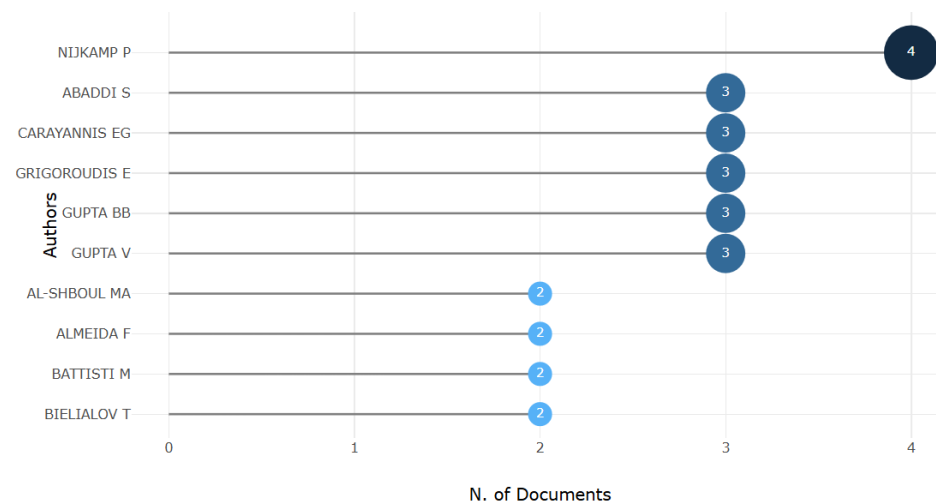
In parallel, Figure 9 identifies Jilin University as the leading institution, with 7 articles published, followed by Politecnico di Torino and Hengyang Normal University, which have 6 and 5 articles, respectively. This alignment of authorship and institutional output underscores the collaborative and interdisciplinary nature of research in this evolving field, pointing to key players that may drive future advancements and knowledge dissemination.

Figure 8 :Most Relevant Affiliations



Source: Author's construction based on SCOPUS database

Figure 9: Most Relevant Authors

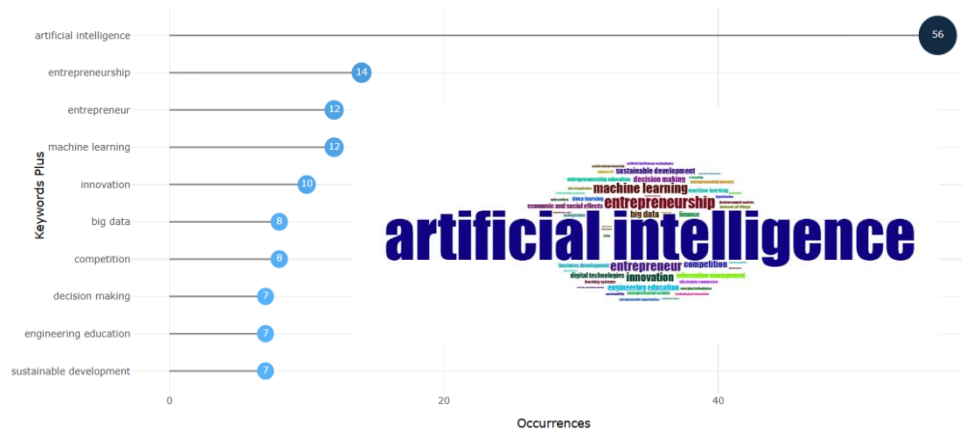


Source: Author's construction based on SCOPUS database

2.5 Content Analysis

The content analysis highlights the most frequently mentioned themes. It reveals that artificial intelligence (AI) is a transformative force that is reshaping industries and societal structures. Entrepreneurship focuses on the importance of innovation and adaptability in utilizing AI effectively. Emerging technologies such as machine learning and big data underscore the technical foundations that drive this field. Additionally, terms like "sustainable development" and "education" reflect a broader societal relevance. This emphasizes a commitment to creating technologies that promote sustainability, workforce education, and equitable growth.

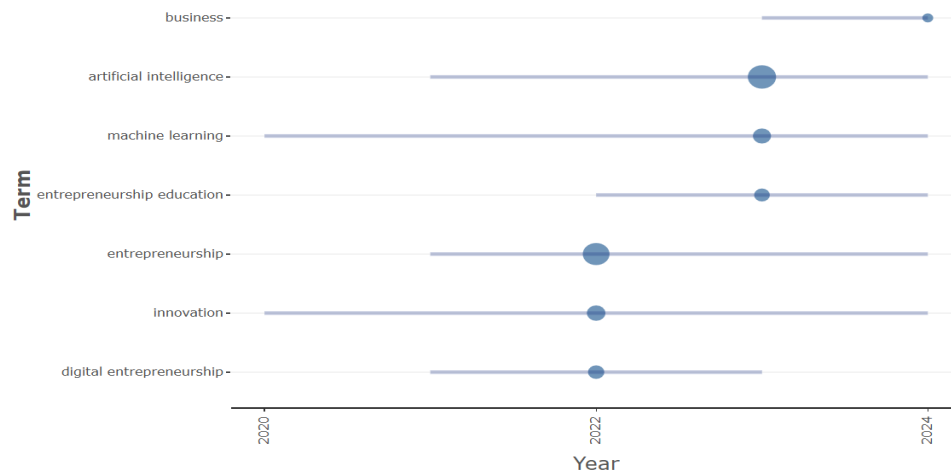
Figure 10 : Most frequent words



Source: Author's construction based on SCOPUS database

Figure 11 illustrates how key terms such as "digital entrepreneurship" and "innovation" gained prominence with significant peaks in publications observed in 2022 and 2024, while more technical concepts like "machine learning" and "artificial intelligence" have become increasingly significant in recent years. The emphasis on business and entrepreneurship education reflects a shift toward practical applications and instructional methods. This evolving focus signals a dynamic intersection between AI and entrepreneurship, highlighting opportunities for further exploration of innovation-driven business models and educational frameworks in the digital

Figure 11 : Trend Topics in the last two years



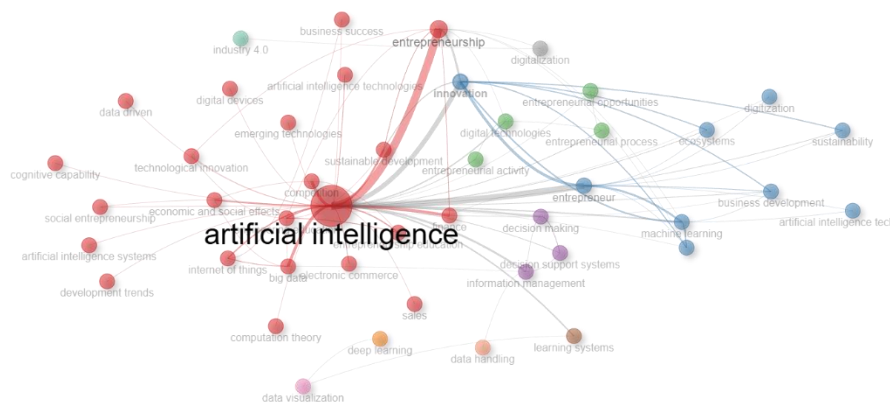
Source: Author's construction based on SCOPUS database

2.6 Conceptual Structure

Figure 12 presents a network visualization of co-occurring keywords in AI and entrepreneurship research. Nodes represent keywords, while edges indicate their connections in the bibliometric dataset. Larger nodes like "innovation" and "artificial intelligence" highlight central themes with strong connections to other terms. Color-

coded clusters show thematic groupings, with the red cluster focusing on "innovation" and the blue and green clusters addressing "machine learning" and "entrepreneurship education." This structure emphasizes the multidisciplinary aspect of AI-driven entrepreneurship studies and illustrates how emerging technologies influence innovation and educational practices. The results are similar to those found by Meyer et al., (2023) who identified entrepreneurship education as the most impactful theme based on their research. This theme emerged in 2014 and saw significant usage in 2017. The authors among others Farhangmehr et al., 2016) agree that promoting entrepreneurship education among youth can help develop competent individuals equipped with essential entrepreneurial skills and knowledge.

Figure 12: Co-occurrence Network



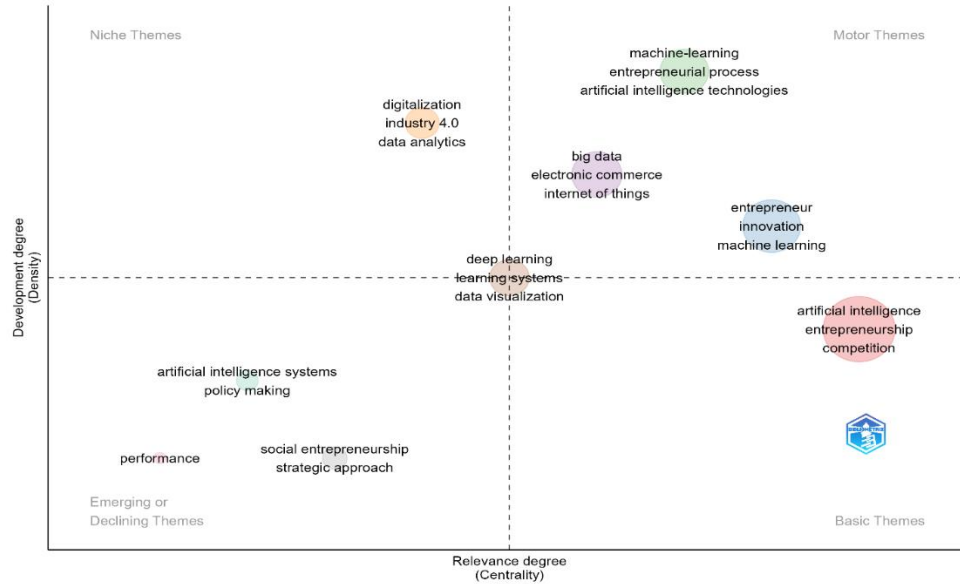
Source: Author's construction based on SCOPUS database

The thematic map presented in Figure 13 reveals the intellectual structure and research dynamics in the field of artificial intelligence and entrepreneurship. The analysis demonstrates four distinct thematic clusters based on centrality (relevance degree) and density (development).

Motor themes, positioned in the upper-right quadrant, encompass highly developed and central research topics including machine-learning, entrepreneurial process, and artificial intelligence technologies, suggesting these themes are fundamental to the field's development. The upper-left quadrant identifies niche themes such as digitalization, industry 4.0, and data analytics, representing specialized research areas with high development but lower centrality.

Basic themes in the lower-right quadrant, including artificial intelligence, entrepreneurship, and competition, indicate areas that are central to the field but require further theoretical development. The lower-left quadrant reveals emerging or declining themes, notably artificial intelligence systems, policy making, and social entrepreneurship, which may represent either nascent research directions or diminishing scholarly interest. Notably, concepts such as deep learning, learning systems, and data visualization occupy central positions, potentially serving as bridges between different research streams and suggesting their role in integrating various aspects of the field.

Figure 13: Keywords thematic Map for Articles



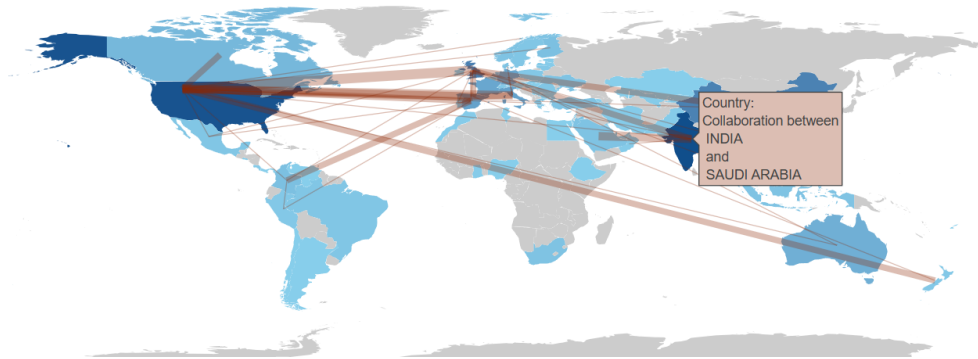
Source: Author's construction based on SCOPUS database

2.7 Social Structure

The collaboration world map depicted in Figure 14 illustrates the global research collaboration patterns in artificial intelligence and entrepreneurship studies. The visualization notably highlights significant international research partnerships, with particularly strong collaborative links between India and Saudi Arabia, as indicated by the connecting lines. This could be attributed to several factors. India has a strong talent pool in artificial intelligence and entrepreneurship, while Saudi Arabia is making significant investments in innovation and technology as part of its Vision 2030 initiative (Asem et al., 2024).

This geographical distribution of research collaborations demonstrates the global nature of AI and entrepreneurship scholarship, while also revealing potential opportunities for strengthening research partnerships in currently less-connected regions, particularly in Africa and parts of South America.

Figure 14: Collaboration World Map



Source: Author's construction based on SCOPUS database

3. Implications

The bibliometric and text mining analysis of artificial intelligence and entrepreneurship research reveals several significant implications for theory, practice, and future research directions as illustrated in Figure 15. This visual representation highlights four key interconnected dimensions emerging from our analysis.

First, the exponential growth in publications, particularly during the 2022-2024 period, indicates a rapidly maturing field that demands increased attention from both scholars and practitioners. This surge in academic interest suggests that AI is not merely a technological tool but a transformative force reshaping entrepreneurial processes and opportunities (Thottoli et al., 2024)

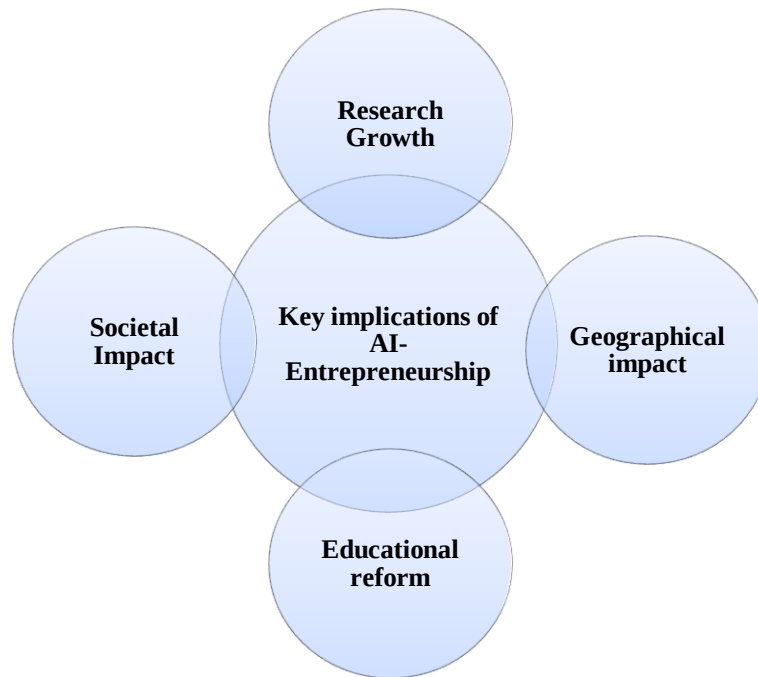
The geographical distribution of research output, represented in the right segment of Figure 15, shows strong contributions from countries like India, China, and the United States, highlights the global nature of AI-driven entrepreneurship while also revealing significant disparities in research capacity and focus. The dominance of certain countries in citation impact, particularly Italy and the United States, suggests a need for more inclusive international collaboration to ensure diverse perspectives in theory development and practical applications.

The thematic analysis reveals several critical implications for entrepreneurship education and practice. The emergence of machine learning and data analytics as motor themes indicates that future entrepreneurs will need to develop technical competencies alongside traditional business skills. This finding suggests that entrepreneurship education programs should be redesigned to incorporate AI-related knowledge and skills more systematically. As illustrated in Figures 12 and 13 of this review, there has been a noticeable shift in scholarly focus towards entrepreneurship education, competencies, and skill sets (Alkhalil et al., 2021; Alqahtani, 2023; Bell & Bell, 2023; Berglund et al., 2020; Bogoviz et al., 2019; Chen et al., 2024). This trend underscores the significance of exploring the relationship between artificial intelligence and entrepreneurship further.

The strong presence of sustainability and social entrepreneurship themes in the literature suggests that AI-driven entrepreneurship is increasingly aligned with broader societal goals. This alignment presents opportunities for developing AI-enabled solutions that address social and environmental challenges while creating

economic value. Furthermore, the prominence of digital entrepreneurship in recent publications indicates a shift toward technology-enabled business models that may require new theoretical frameworks and practical approaches.

Figure 15: Key Implications of AI and Entrepreneurship Research



Source: Author's Conclusion

The central node of the diagram emphasizes how these four dimensions are fundamentally interconnected, suggesting that future developments in AI-driven entrepreneurship will require integrated approaches that consider all these aspects simultaneously.

Conclusion

This study has provided a comprehensive bibliometric analysis of research at the intersection of artificial intelligence and entrepreneurship from 2002 to 2024. Through systematic analysis of 313 documents authored by 843 researchers, our research reveals several key insights about the evolution and current state of this field.

The temporal analysis demonstrates a clear transformation from initial stagnation (2002-2015) to explosive growth (2023-2024), marking a paradigm shift in how researchers approach the integration of AI and entrepreneurship. This evolution reflects broader technological advancements and their increasing relevance to entrepreneurial activities.

Our findings highlight significant gaps and opportunities in the current research landscape. While technical aspects of AI in entrepreneurship are well-documented, there remains a notable shortage of studies examining implementation challenges, particularly in developing economies. Additionally, the concentration of research

output in specific geographical regions suggests an opportunity for more diverse perspectives and collaborative research initiatives.

Looking ahead, several promising research directions emerge from this analysis:

1. The need for empirical studies examining real-world implementation of AI in entrepreneurial ventures across different cultural contexts
2. Development of comprehensive theoretical frameworks that bridge the technical-social divide in AI-enabled entrepreneurship
3. Investigation of AI's role in promoting sustainable and inclusive entrepreneurship models
4. Exploration of how AI can enhance entrepreneurial education and skill development

These research directions are not merely academic pursuits but are crucial for understanding and shaping the future of entrepreneurship in an AI-driven world. As we move forward, the challenge lies not just in developing more sophisticated AI technologies, but in ensuring their meaningful integration into entrepreneurial practices that create both economic and social value.

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