Systematic Review of South African Entrepreneurs and Artificial Intelligence

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Key words
Artificial Intelligence, AI, entrepreneurs and South Africa

Abstract

The integration of Artificial Intelligence (AI) technology into entrepreneurial endeavours has become a global phenomenon, with the potential to revolutionize industries and improve productivity. In the context of South Africa, understanding the relationship between entrepreneurs and AI is particularly relevant given the country's efforts to foster a vibrant entrepreneurial ecosystem and leverage technological advancements. Understanding the interaction between entrepreneurs and AI is important given the country's aim to build a strong entrepreneurial ecosystem while also leveraging technology breakthroughs. Entrepreneurship is an important engine of economic growth and innovation in emerging markets and developing countries, such as South Africa. This paper systematically reviews and analyses the existing literature to expand the knowledge in this area. This review follows the preferred technique. The methodology for this study adheres to the Preferred Reporting Items for Systematic Reviews and Bibliometric Analysis (PRISMA) standards and Vosviewer software. It applies a comprehensive search approach throughout Scopus, including terms such as "South Africa" "entrepreneurs and artificial intelligence." The rigorous application of inclusion and exclusion criteria resulted in a thorough study of 122 chosen studies on entrepreneurs and AI from various countries. The findings show a vibrant entrepreneurial environment with increasing AI usage, despite considerable constraints such as limited access to resources, infrastructure, skills and expertise. The data also show a high prevalence of conceptual study approaches used in previous research, which was frequently confined to certain countries and technology-driven sectors. There is also an inclination towards investigating AI adoption and challenges within larger companies, while Small Medium Enterprises (SMEs) remain relatively unexplored.

Introduction

We stand at the beginning of a new era of the industrial revolution. While the third revolution focused on the introduction of computers in manufacturing, with the new paradigm (i.e., Industry 4.0), technological evolution and futuristic models have created smart and intelligent systems with automation and completely digitalized production methods (Muhuri, Shukla, and Abraham, 2019). Industry 4.0 refers to the shift from a manufacturing paradigm, where machines simply operationalize routines, to digital manufacturing, where machines are capable of communicating with each other, self-monitoring and collaborating autonomously (Oztemel and Gursev, 2018). Artificial Intelligence (AI) is central to all Industry 4.0 technological paradigms. Artificial intelligence (AI) has led to significant new technological breakthroughs worldwide. These developments bring new opportunities and challenges to existing and potential entrepreneurs. Therefore, entrepreneurs need to adapt continuously and keep abreast of new trends and developments. Furthermore, AI solutions are now easily accessible to entrepreneurs at a relatively reasonable cost. Artificial Intelligence (AI) is an example of how radical external changes empower and enable new economic activities (Obschonka and Audretsch, 2020). Moreover, AI has crucial implications for how entrepreneurs develop, design, and scale their businesses during the entrepreneurial process (Chalmers, MacKenzie and Carter, 2021). The democratization of AI enables entrepreneurs to compete even with large companies, thus levelling the technological playing field (Truong, Schneckenberg, Battisti and Jabbouri, 2023). This impact of AI on entrepreneurial activity and processes has also attracted considerable

interest from researchers in the field. However, existing studies are disjointed, making it challenging to generate a comprehensive and systematic overview. Hence, there is a strong need for a systematic literature review that considers evolution and the need for the establishment of theoretical frameworks to provide guidance and generalizability (when applicable) in research on entrepreneurs' growing interest in adopting AI-based technologies. The lack of existing systematic literature reviews about entrepreneurs and AI in South Africa makes the present study valuable.

In the present study, the following research questions were answered:
Research Question 1 (RQ1): "How has the intersection between entrepreneurs and AI evolved?"
RQ2: "How do the main authors relate to each other? And who are they?"
RQ3: "What are the main linked keywords?"
RQ4: "How can semantic analysis be leveraged in a systematic literature review?".

Theoretical Background

Entrepreneurs require continuous adaptation to changes in the environment, and technological tools can function as external enablers in new business activities (Davidsson, Recker, and von Briel, 2018).

Artificial Intelligence (AI)

Artificial Intelligence (AI) is not easy to define, and this review does not provide an exhaustive definition of AI. The term "artificial intelligence" was first coined by John McCarthy in 1956 when he held the first academic conference on the subject (Cordeschi, 2007). In Vannevar Bush's seminal work, "As We May Think" (Bush and Vannevar, 1945), he proposed a system that amplifies people's own knowledge and understanding. Five years later, Alan Turing wrote a paper on the notion of machines being able to simulate human beings and the ability to do intelligent things, such as play chess (Turing, 1950). However, AI has been described differently over time. The different definitions include AI as a branch of Computer Science, computational system.

(a) Artificial Intelligence (AI) as a branch of Computer Science

Artificial Intelligence (AI) is a branch of computer science concerned with the study and creation of computer systems that exhibit some form of "intelligence"; systems that learn new concepts and tasks systems that can reason and draw useful conclusions about the world around us; systems that can understand a natural language or perceive and comprehend a visual scene and systems that perform other types of features that require human types of intelligence" Shubhendu and Vijay, 2013).

(b) Artificial Intelligence (AI) as a computational system

Artificial Intelligence (AI) is the ability of a computational system to imitate intelligent behaviour (Choudhury et al., 2020).

Artificial intelligence (AI) transforms not only the future of entrepreneurs but also the processes of entrepreneurship. Through the help of AI, entrepreneurs were able to for see what the current trend is, what the future demands of people are, and how they can shape the future of people. With AI it is able easy to interpret a big set of data into knowledgeable information that will help entrepreneurs to make the right decisions related to their business operations and the new products and services that help businesses grow (Hosanagar, 2019).

Entrepreneurs

Rapid changes in the market and increasing competition due to globalization have made it essential for entrepreneurs to use advanced technologies to gain a competitive advantage (Darwish, Darwish, and Bunagan, (2020)). Therefore, we also need to better understand the benefits and risks that may arise from their use. Entrepreneurs must constantly adapt to market conditions, customer preferences and emerging technologies. This adaptability enables them to remain competitive in the face of emerging trends and challenges. The latest of these challenges is AI. Entrepreneurs can leverage AI technologies to improve their entrepreneurial operations, automate processes, and collect and analyse data to improve the decision-making process, and create innovative solutions (Obschonka and Audretsch 2020). With the integration of AI, entrepreneurs can develop advanced technologies and solutions with the potential to innovate industries and create new markets. Entrepreneurs incorporate AI in prospecting and refining venture ideas

(e.g., using AI to conduct rapid experiments and search for new technological solutions), design organizations (e.g., automating routine tasks and roles), selling products, leveraging AI for advertising and the analysis of consumer data) and scaling ventures (e.g., growing salesforces through AI sales bots), (Chalmers et al., 2021). Entrepreneurs are increasingly using branches of AI, such as machine learning, natural language processing and artificial neural networks, to automate tasks in their pursuit of opportunities and the creation of new ventures (Lévesque, Obschonka, and Nambisan, 2022). In addition, AI can enable entrepreneurs to identify trends and opportunities, personalize customer experiences, and optimize supply chains (Giuggioli and Pellegrini 2023).

Methodology

On the basis of the growing popularity of bibliometric analysis as a coherent framework for mapping a particular knowledge field. The methodology of this study is based on the Protocol of Preferred Reporting Items for Systematic Reviews (PRISMA) (Page, Moher, Bossuyt, Boutron, Hoffmann, Mulrow and McKenzie, 2020) and bibliometric analysis.

Protocol of Preferred Reporting Items for Systematic Reviews (PRISMA) is generally applied across different disciplines to present the essential steps of conducting a quantitative or a qualitative systematic literature review, such as bibliometric analysis (Page and Moher, 2017). Bibliometric analysis is a popular and rigorous methods for exploring and analysing large amounts of scientific data systematically (Donthu, Kumar, Mukherjee, Pandey and Lim, 2021).). It encapsulates the application of quantitative techniques such as citation analysis on bibliometric data such as units of publication and citation indices. It's techniques mainly involve two categories which are: (1) Performance analysis, which accounts for the contributions of research constituents, and (2) Science mapping, which focuses on the relationships between research constituents.

Search strategy

The search strategy of this study regarding finding relevant and related extant studies utilized the Scopus database. Scopus provides enriched academic data from thousands of reputable sources (Baas, Schotten, Plume, Côté and Karimi, 2020). The search for relevant extant articles was executed by exploring Scopus by title, abstract, and keywords. Search keywords used for the literature search was as follows. Artificial Intelligence or "AI", "Entrepreneurs" and "South Africa,). The result of this search was a drawdown of 241 publication records, which were further reduced to 223 English language conference papers, articles, reviews, notes, and book chapters. In the second stage, the remaining dataset was imported into an Excel spreadsheet, where the screening was conducted to assess duplicates followed by a manual evaluation of titles and abstracts This resulted in a sample of 122 references related to AI, Entrepreneurs and South Africa The inclusion and exclusion criteria used are presented in Table 1, below, and applying these criteria results in 122 eligible articles.

Table 1: Criteria for Inclusion and Exclusion of Related Studies

Inclusion criteria
• Articles that were published between 2020 and 2024, two years before South Africa established the Artificial Intelligence Institute. • Articles that appeared in peer-reviewed journals, and peer-reviewed conference proceedings because of the limited literature. • Articles that were published in English to avoid language translation errors.
Exclusion criteria
• Articles that were published before 2020. • Articles that did not focus specifically on AI, Entrepreneurs in South Africa. • Any grey reports in student dissertations, government reports, lecture notes, book chapters, and company publications that did not guarantee rigorous scientific reviews. • Articles that were published in languages that require translation into English.

The specification of inclusion and exclusion criteria may define the primary studies to include in a systematic review, such as bibliometric analysis (Olugbara Olugbara, Letseka, Ogunsakin and Olugbara, 2021). The criteria were used to identify the relevant studies from which useful data were extracted. The data extraction procedure is based on the identification of potentially relevant articles; screening of relevant

articles; eligibility assessment, and extraction of relevant information. The data extraction process is a critical component of a systematic literature review that should be carefully tailored to align with the set of research questions investigated (Stravinskienė and Serafinas, 2021). In this context, Kitchenham and Charters (2007) have provided valuable insights by suggesting additional pertinent data points that can be captured to enrich the analysis.

Aside from basic information such as authors, publication year, and source, the data extraction procedure of this study included a wide range of elements to guarantee a full comprehension of the research. The following information was meticulously extracted for each of the selected studies: purpose and objectives, country of study, and entrepreneurs, entrepreneurship and AI, sample characteristics, source title, main conclusions, study implications, limitations, and future research agenda. The comprehensive data extraction procedure of the current study is directly linked to the quality assessment phase in a systematic literature review, which is a crucial step in evaluating the reliability and validity of the selected studies. Figure 1, below, illustrates the PRISMA flow diagram for the systematic literature review carried out in this study.

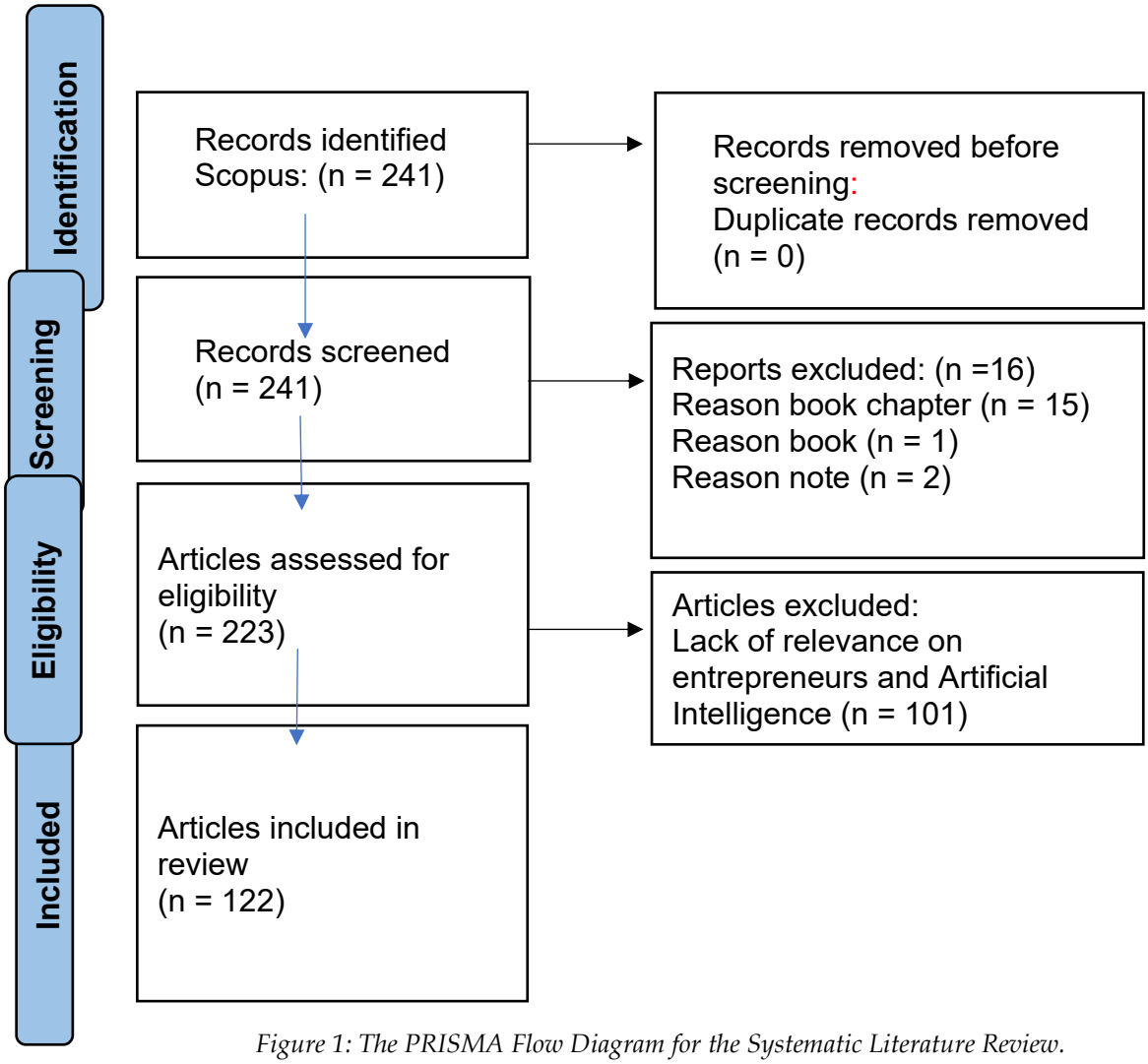

Figure 1: The PRISMA Flow Diagram for the Systematic Literature Review.

Bibliometric analysis

Bibliometric analysis is a quantitative statistical method that is extensively used in research to reveal the emerging trends, interlocuter structure, influence and impact of an article on future probing. Its methodology manifests across performance analysis and science mapping and is enriched by network analysis (Donthu, et al., 2021).

Bibliometric analysis can be divided into two categories: (1) Performance analysis and (2) Science mapping. This study uses performance analysis. Performance analysis is a standard review practice that uses descriptive data analytics to investigate the contributions of research to a given discipline. The performance metrics are conventionally based on publication, citation, and a portmanteau of publication and citation metrics. Performance analysis examines the contributions of research constituents to a given field (Ramos-Rodrígue and Ruíz-Navarro, 2004), whereas science mapping examines the relationships between research constituents (Baker, Kumar, and Pandey, 2021). The analysis pertains to the intellectual interactions and structural connections among research constituents. The techniques for science mapping include: citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis. When combined with network analysis, such techniques are instrumental in presenting the bibliometric structure and the intellectual structure of the research field.

The study further uses network analysis. Network analysis is based on graph theory and uses network metrics, data clustering, and visualization tools to enrich the judgement of bibliometric analysis towards illuminating the relative importance of research constituents that are not necessarily reflected through publications or citations. The commonly used network metrics are centrality measures of degree, betweenness, eigenvector, closeness, and priority measures of PageRank.

Results, Analysis, and Discussion

To conduct the analysis, this study used the Analysis Tool: VOSviewer Software. VOSviewer software was developed by Van and Waltman (Van Eck, and Waltman, 2010). has been commonly used to analyse and visualize bibliometric networks. It was adopted in this study. Distance-based visualizations of bibliometric networks can be provided by VOSviewer, which can show bibliometric visualizing networks and text mining features. The VOSviewer software is a bibliometric analysis tool widely used for constructing and visualizing bibliometric networks of publications and researchers on the basis of the metrics of citation, bibliographic coupling, cocitation, or coauthorship relations. According to Van and Waltman (2010), in the visual map of VOSviewer, each circle represents a term, and the size of the circle and font represent the activity of the term. The larger the circle and font are, the more active the term is in the field, and vice versa. The distance between any two terms in the diagram represents the degree of association between the two terms. The smaller the circle distance between the two terms is, the stronger the correlation between the two terms, and vice versa.

Moreover, it renders text mining functionality for constructing and visualizing co-occurrence networks of important terms extracted from a body of scientific literature with support for a qualitative interpretation of the closely connected clusters in a map (Van Eck and Waltman, 2010). The methodology of this study can therefore be grouped into a systematic review of studies on Entrepreneurs and Artificial Intelligence (EAI) and a bibliometric analysis of the studies.

Documents by year

The distribution of publication outputs is represented in Figure 2, below. The number of articles published on AI in 2024 increased over the previous years.

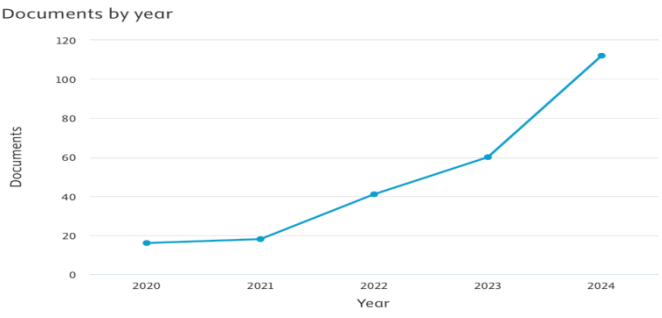

Figure 2: Distribution Of Publication Outputs

Documents by subject area

Figure 3, below, represents the contributing subject area. Social Sciences is the subject with the greatest contribution to the field (17.6%), followed by Computer Science (17.6%), Other (16.0%), Engineering (10.1%), Medicine (9.2%), and Business Management (6.6%).

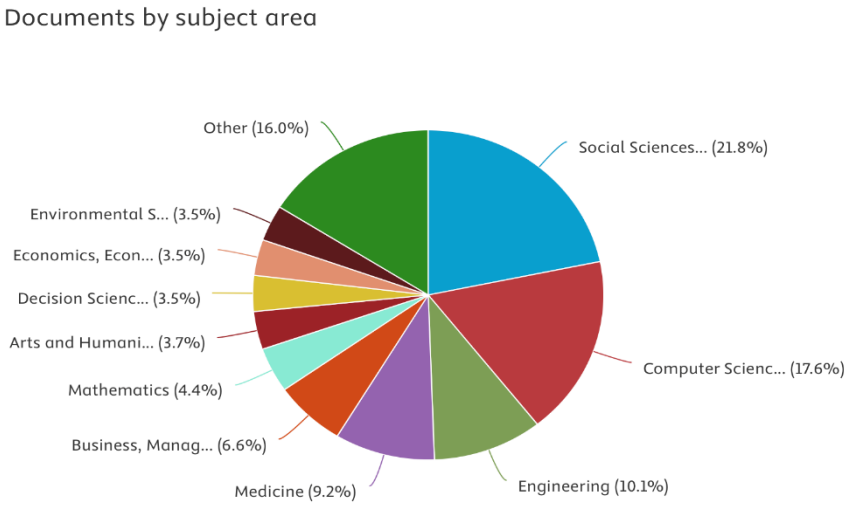

Figure 3: Documents By Subject Area

Network visualization of co-authorship and authors

To conduct the author and co-authorship analysis network, the minimum number of articles was one (1), and the total number of authors was 643. For each of the 643 authors, the total strength of the co-authorship links with other authors was calculated. The authors with the greatest strength were selected. The largest set of connected items consisted of nineteen (19) items. This can be seen in Figure 4, below.

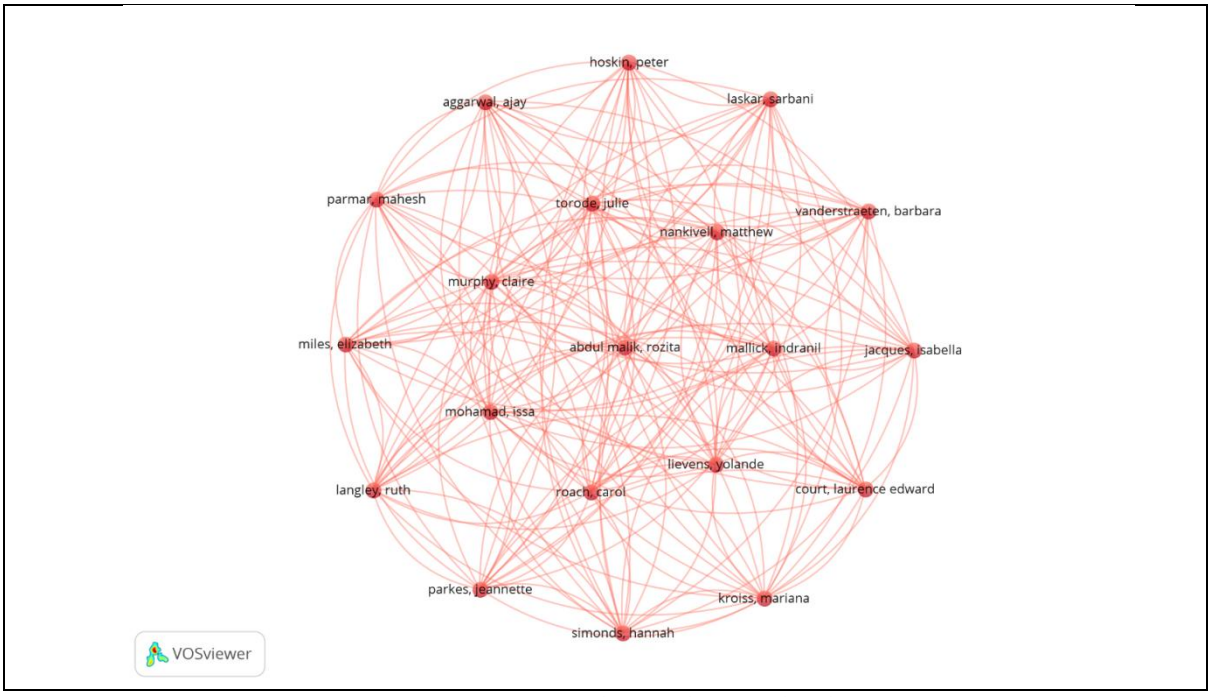

Figure 4: Authors and Co-Authorship

Most prolific authors, documents, citation and total link strength

The most prolific authors. Documents, citation and total link strength are shown in table two below.

Rank	Author	Documents	Citation	Total link strength
1	Abdul Malik, Rozita	1	8	19
2	Aggarwal, Ajay	1	8	19
3	Jacques, Isabella	1	8	19
4	Krosis, Mariana	1	8	19
5	Langley, Ruth	1	8	19
6	Laskar, Sarbani	1	8	19
7	Lievens, Yolande	1	8	19
8	Mallick, Indranil	1	8	19
9	Miles, Elizabeth	1	8	19
10	Murphy, Claire	1	8	19
11	Nankivell, Matthew	1	8	19
12	Parkes, Jeanette	1	8	19
13	Parmar, Mahesh	1	8	19
14	Roach, Carol	1	8	19
15	Simonds, Hannah	1	8	19
16	Torode, Julie	1	8	19
17	Vanderstraeten, Barbara	1	8	19
18	Balooch, Guive	1	8	19
19	Mohamad, Issa	1	8	19

Table 2: Most prolific authors, documents, citation and total link strength

Co-occurrence and all key words

The minimum number of co-occurrences of keywords was two (2), and there were one thousand seven hundred and four (1704) keywords, 255 of which met the threshold. For each of the two hundred and fifty-five (255) keywords, the total strength of the co-occurrence was calculated. The keywords with the greatest total links were selected. The greatest set of connected items consists of 684 items. The ten (10) main keywords based on co-occurrence are shown in Table 3, below.

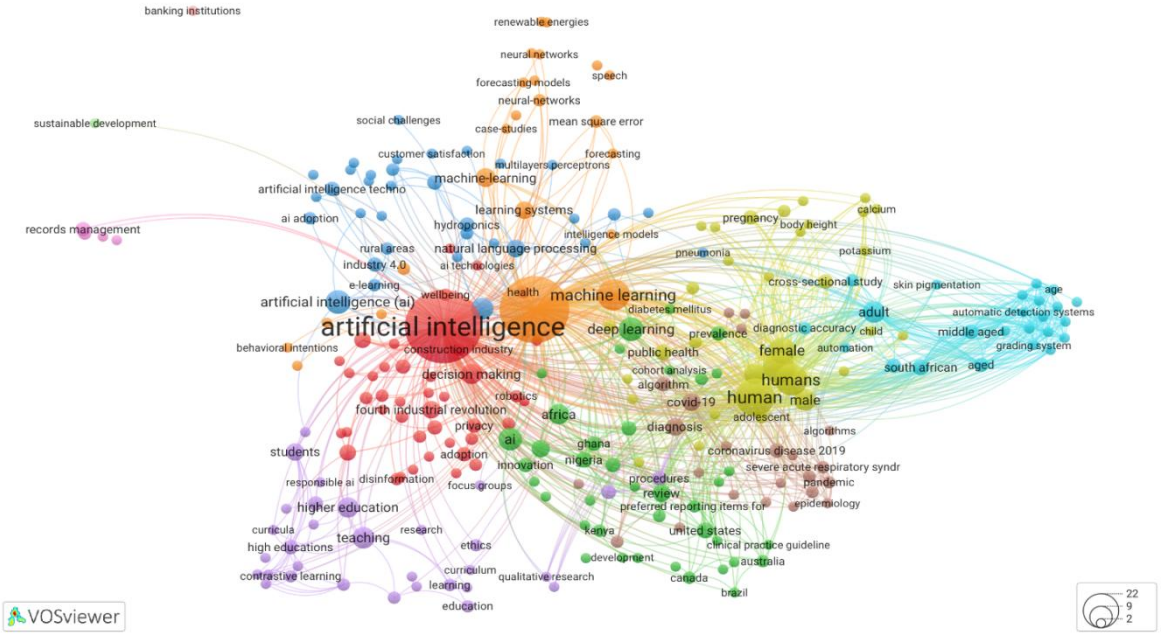

Figure 5: Co-Occurrence and All Keywords

Table 3:

Rank	Keyword	Occurrences	Total link strength
1	South Africa	87	684
2	Artificial Intelligence	105	594
3	Human	27	424
4	Humans	19	319
5	Article	18	302
6	Female	13	226
7	Adult	9	187
8	Machine learning	19	185
9	Controlled study	8	150
10	Male	9	145

Limitations of the study and future research

The limitations of this analysis can be the starting point for future research. One example is that while the Scopus database was used, others, such as Google Scholar or Web of Science, could have been included. Another is that all non-English language documents were excluded. Further semantic studies could be carried out that consider and analyse the representative topics in each language.

Additionally, AI-related topics, including their links with entrepreneurs, are evolving rapidly. The fact that the analysis of the literature was carried out up to 2024 makes interesting comparisons possible after this date. In turn, analysing the moderating role of some variables linked to the digitalization of entrepreneurs' businesses will allow for an in-depth investigation of the causal relationship. In addition, it would be worthwhile to explore in depth the benefits of elements such as machine learning, big data and the Internet of Things on entrepreneurial development. Analogously, a quantitative cross-country analysis of similar economic environments will add further value to this research.

Conclusion

This paper presents a comprehensive review of the literature on South African entrepreneurs and AI. Entrepreneurs and AI constitute a relatively nascent field of research. The paper accepts that AI developments in South Africa have a deeper history, with academic and governmental initiatives in automation, intelligent systems, and early machine learning applications dating back to the 1980s, including work at universities like Stellenbosch and Pretoria on expert systems and neural networks tailored to sectors such as mining, agriculture, and healthcare. However, the study was aimed at reflecting on a key institutional milestone aimed at coordinating national AI efforts, research, and innovation building on recommendations from the Presidential Commission on the Fourth Industrial Revolution (PC4IR) report in 2020. Hence the included studies are between 2020 and 2025 publicans on AI and entrepreneurs in South Africa. The potential exclusion of relevant research, the limited existing literature on AI and entrepreneurs, and the possible influence of diverse methodologies and contexts of previous studies on the generalizability of the findings.

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