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The Application of Artificial Intelligence in Businesses: A Bibliometric Review

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A B S T R A C T

The rapid advancement of Artificial Intelligence (AI) technologies has revolutionized various aspects of business operations. This study aims to define the scope of AI applications in businesses through a comprehensive literature review and bibliometric analysis. Using a structured search protocol for data collection, a comprehensive search was conducted across key academic databases to identify relevant literature on AI in business. The gathered data were then analyzed using VOSviewer and Bibliometrix tools to identify key themes, trends, and author groupings within the research field. Results indicate a diverse range of AI applications, including process optimization, customer relationship management, and predictive analytics, showcasing AI's transformative potential in business contexts. The bibliometric analysis further reveals the evolution of research focus over time, highlighting emerging themes and gaps in the literature. This review proposes a structured framework for future research in AI applications in businesses, advocating for a more integrated and strategic approach to AI deployment to maximize its benefits. By identifying the current state of research and future directions, this study provides a valuable roadmap for researchers and practitioners seeking to leverage AI for business innovation and efficiency.

1. Introduction

Once regarded as a distant vision, Artificial Intelligence (AI) has quickly become a fundamental part of business strategy. Over the past decade, firms across a broad array of sectors have adopted AI tools to rethink their operations, stimulate innovation and sharpen their competitive edge (Russell & Norvig, 2020). Techniques such as machine learning, natural language processing and computer vision allow organisations to interrogate massive datasets and extract insights that would have been unattainable using traditional methods (Jordan & Mitchell, 2015). Kaplan and Haenlein (2019) classify AI into mechanical, thinking and feeling systems, each category influencing how companies design their AI capabilities and shape customer perceptions. As adoption spreads, these technologies are powering digital transformation by automating routine tasks, improving customer interactions and optimising complex processes. This momentum echoes Schwab's description of the Fourth Industrial Revolution, where AI acts as a bridge between the digital, physical and biological worlds. Evidence suggests that AI deployments can elevate customer satisfaction, reduce costs and grow revenue (McKinsey & Company, 2020), yet, as Brynjolfsson and McAfee (2017) point out, AI should augment rather than replace human expertise, and expectations must be realistic.

A prominent area of AI deployment is customer relationship management (CRM). Contemporary CRM platforms use AI to examine purchasing histories, preferences and behavioural patterns to tailor

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communications and design more personalised marketing strategies (Lemon & Verhoef, 2016). Firms increasingly rely on chatbots and virtual assistants to answer queries, provide support and engage with users in real time; research shows such tools can enhance satisfaction and loyalty (Sharma et al., 2020). Nevertheless, Younan (2020) emphasises the need for robust metrics to measure the actual impact of AI-based services on customer experience. Predictive analytics, another branch of AI, also enables companies to anticipate customer behaviour, spot market trends and forecast demand, thus supporting data-driven decisions. In retail, for example, AI algorithms analyse purchasing patterns to estimate future demand, align inventory and deliver personalised product recommendations, thereby improving operational efficiency and engagement (Davenport et al., 2020).

AI is also reshaping operational processes. In supply chains, AI systems forecast demand, flag potential disruptions and suggest logistical adjustments by processing historical records alongside external factors like weather and geopolitical conditions (Ivanov & Dolgui, 2020). These models help organisations identify bottlenecks and plan proactive responses. Financial institutions use AI for tasks such as fraud detection, risk assessment, and portfolio management, deriving insights that inform strategic decisions. In human resources, AI-driven tools streamline recruitment by screening candidates, predicting turnover, and improving workforce planning through predictive analytics (Bauer et al., 2021).

The widespread adoption of AI brings significant challenges. Ethical issues, including privacy, algorithmic bias and opaque decision-making, pose serious concerns for businesses and regulators (Boddington, 2017). Implementing AI also demands considerable investment in infrastructure and skilled personnel, which can be prohibitive for small and medium-sized enterprises (Bughin et al., 2018). Similar patterns have been observed in other advanced ICT fields: a study of Hungarian SMEs in the agrifood sector found low adoption of advanced technologies because of financial and skills constraints (Botos et al., 2017). Moreover, a shortage of workers able to develop, deploy, and oversee AI systems contributes to a global talent gap (Lee, 2018). Therefore, understanding AI's role in business requires a balanced view of both its opportunities and its limitations.

Because AI permeates so many facets of business, a broad synthesis of existing studies is essential to integrate disparate findings, chart research trajectories, and highlight unresolved questions. Earlier reviews have tended to concentrate on single domains, such as marketing (Chaffey & Smith, 2017), finance or supply chain management (Min, 2010), which leaves the wider landscape understudied. To address this, we conduct an expansive search of the literature combined with a bibliometric analysis covering the full range of AI applications in business. This approach seeks to elucidate how AI is reshaping business practices, the obstacles to adoption, and the emerging trends guiding its future.

In addition, we use bibliometric tools, including VOSviewer and Bibliometrix to analyse patterns within the field. Bibliometric methods visualise co-authorship networks, track keyword co-occurrence and map thematic clusters, thereby revealing how research on AI in business has evolved. These analyses pinpoint influential topics, key researchers, collaborative networks and methodological preferences, while also exposing gaps that can direct future investigations.

This review is structured around the following questions:

- What are the primary applications of AI in businesses, as identified in the academic literature?
- How have research trends in AI and business evolved, and what are the key themes and areas of focus within this field?
- What collaborative networks and research dynamics are present in the literature on AI applications in business?
- What are the existing gaps and opportunities for future research in the application of AI within the business context?

By exploring these issues, the present review seeks to build a coherent framework for understanding AI's application in business. Such a framework helps researchers and practitioners navigate the complexities of integrating AI into operations, offering guidance on leveraging AI to achieve strategic objectives, enhance competitive advantage and address ethical and workforce challenges. Ultimately, this review consolidates current knowledge while establishing a foundation for future research aimed at ensuring AI is adopted responsibly and effectively across the business landscape.

2. Materials and Methods

This section outlines the research methods employed to investigate the application of Artificial Intelligence in business contexts. To build a comprehensive and unbiased corpus of studies, we first conducted a systematic search of leading academic databases (e.g., Web of Science, Scopus, IEEE Xplore, Google Scholar) using targeted keywords related to AI and business applications. The resulting dataset of relevant articles was then subjected to bibliometric analysis with the help of tools such as VOSviewer and Bibliometrix. These tools enabled us to map publication trends, identify key themes and influential authors, and explore collaboration networks within the field. By combining a systematic literature search with bibliometric techniques, we were able to obtain a structured overview of existing knowledge and research directions on AI in business.

2.1. Bibliometric Analysis

To complement the literature search, a bibliometric analysis was performed using VOSviewer (Van Eck & Waltman, 2010) and Bibliometrix (Aria & Cuccurullo, 2017). This analysis aimed to uncover patterns, trends, and research networks within the literature on AI in business. Bibliometric analysis is an effective method for mapping the intellectual structure of a research field, identifying key research themes, influential authors, and collaborative networks.

Data Extraction: Metadata, including authors, titles, abstracts, keywords, publication sources, and references, were extracted from the selected articles. VOSviewer was used to create visualizations of keyword co-occurrence networks, allowing the identification of key themes and research hotspots within the AI-business domain. Bibliometrix, an R package, was employed to conduct a more in-depth analysis of publication trends, authorship patterns, and citation networks.

Network Analysis: The network analysis included the examination of co-authorship, keyword co-occurrence, and citation networks. Co-authorship analysis identified the most collaborative authors and institutions, while keyword co-occurrence analysis revealed the major topics and themes within the field. Citation network analysis helped identify seminal works and influential authors contributing to the development of AI applications in business (Ding et al., 2001). Although co-authorship and citation networks were examined to understand collaboration patterns and influential publications, only the keyword co-occurrence network is presented as a figure in this paper

2.2. Data Synthesis and Analysis

The findings from the literature search and the bibliometric analysis were synthesized to provide a comprehensive overview of the current state of AI applications in business. The study focused on identifying the primary areas of AI deployment, the evolution of research trends, and gaps in the literature that warrant further investigation. Quantitative data from the bibliometric analysis were integrated with qualitative insights from the literature search to offer a holistic understanding of the field (Davenport & Ronanki, 2018).

2.3. Data Source and Descriptive Statistics

After retrieving the corpus of articles described above, we generated a set of descriptive statistics to summarise the dataset's scope and composition. The final dataset consists of all peer-reviewed journal articles and conference papers on AI in business published between [start year] and [end year] and indexed in Web of Science, Scopus, IEEE Xplore, and Google Scholar. For each record, we extracted authorship, publication source, year, keywords, and citation counts. Figure 1 provides an overview of the number of documents, the distribution of authors, the total citations, and other basic bibliometric metrics, thereby offering transparency about the breadth of the corpus used in this study.

Figure 1 summarises the key descriptive indicators of the dataset. It shows the total number of documents included in the analysis, the distribution of authors, the number of references, and other fundamental bibliometric metrics. This information highlights the richness of the dataset and supports the reliability of the subsequent trend and thematic analyses.



Figure 1. Descriptive statistics of the dataset

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

2.4. Limitations

Although the literature search and bibliometric analysis were designed to be as comprehensive as possible, the search was limited to English-language articles indexed in a select set of databases (Web of Science, Scopus, IEEE Xplore, and Google Scholar). As a result, studies published in other languages or in unindexed sources may not have been captured. In addition, our reliance on bibliographic metadata means that we did not analyse full-text content, which could provide deeper insights. These limitations should be considered when interpreting the findings and may guide directions for future research.

3. Results

3.1. Publication trends and research growth

In recent decades, the application of artificial intelligence (AI) in business has garnered significant attention from both researchers and practitioners. As AI technologies have advanced and become more accessible, their potential to revolutionize business processes, enhance decision-making, and drive innovation has become increasingly apparent. This growing interest is reflected in the academic literature, as demonstrated by the annual scientific production trends in AI business applications.

3.1.1. Annual Scientific Production Analysis

This trend analysis highlights the evolving landscape of AI research in business, underscoring the field's maturation and the expanding role of AI in shaping future business strategies. Figure 2 displays the annual scientific production of research articles on AI applications in business from 1984 to 2023.

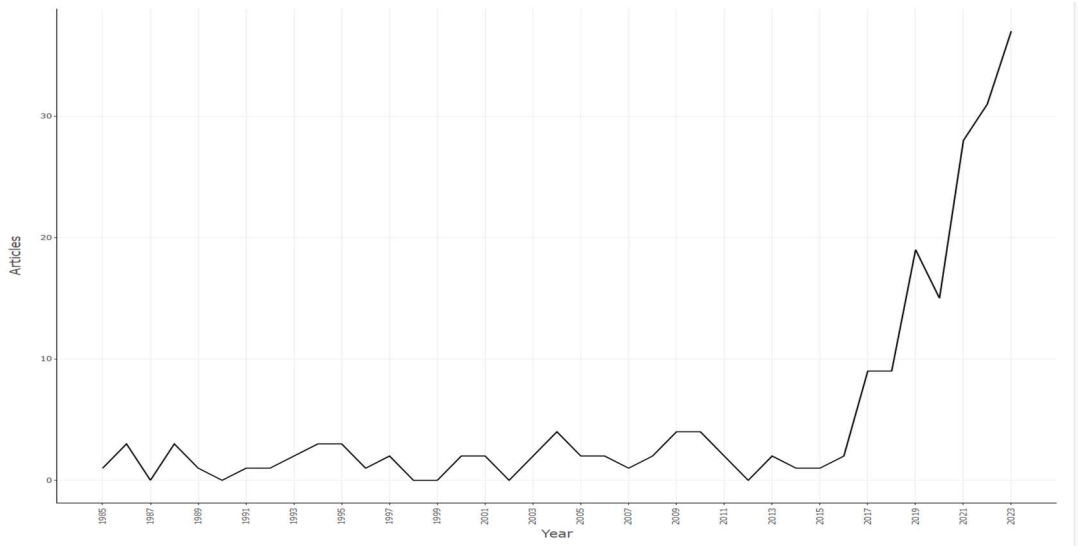


Figure 2. Annual scientific production

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

The graph reveals significant trends in how interest in this field has evolved:

- Initial period (1984–2008): During this period, the number of publications was relatively low and remained fairly constant, with fewer than five articles published per year. This suggests that AI applications in business were in a nascent stage, with limited academic and practical exploration.
- Gradual Increase (2008–2017): There was a slow but noticeable increase in the number of publications starting around 2008, indicating a growing interest in integrating AI technologies within business contexts. However, the growth remained modest, reflecting early experimentation and foundational research in the field.
- Rapid Growth (2017–2023): A significant surge in scientific production is observed from 2017 onwards, reaching over 40 articles in 2023. This dramatic rise demonstrates that AI applications in business have become a highly active research area. The exponential growth during this period reflects advancements in AI technologies, increased accessibility of machine learning tools, and a growing recognition of AI's potential to transform business processes and decision-making.

The rapid growth in recent years indicates that AI applications in business have moved from an emerging topic to a mainstream area of interest, both academically and in practice. This surge aligns with technological advancements, increased computational power, and the proliferation of big data, making AI more applicable and essential for businesses across industries. This trend analysis highlights the evolving landscape of AI research in business, underscoring the field's maturation and the expanding role of AI in shaping future business strategies.

3.1.2. Analysis of Trend Topics

This analysis provides valuable insights into how AI applications in business have developed and diversified, highlighting the transition from early AI methods to modern machine learning-driven solutions.

Figure 3 illustrates the evolution of key terms related to AI applications in business from 1984 to 2023, demonstrating how different research themes have emerged, grown, and evolved over time. The size of the bubbles represents the frequency of each term, with larger bubbles indicating a higher occurrence.

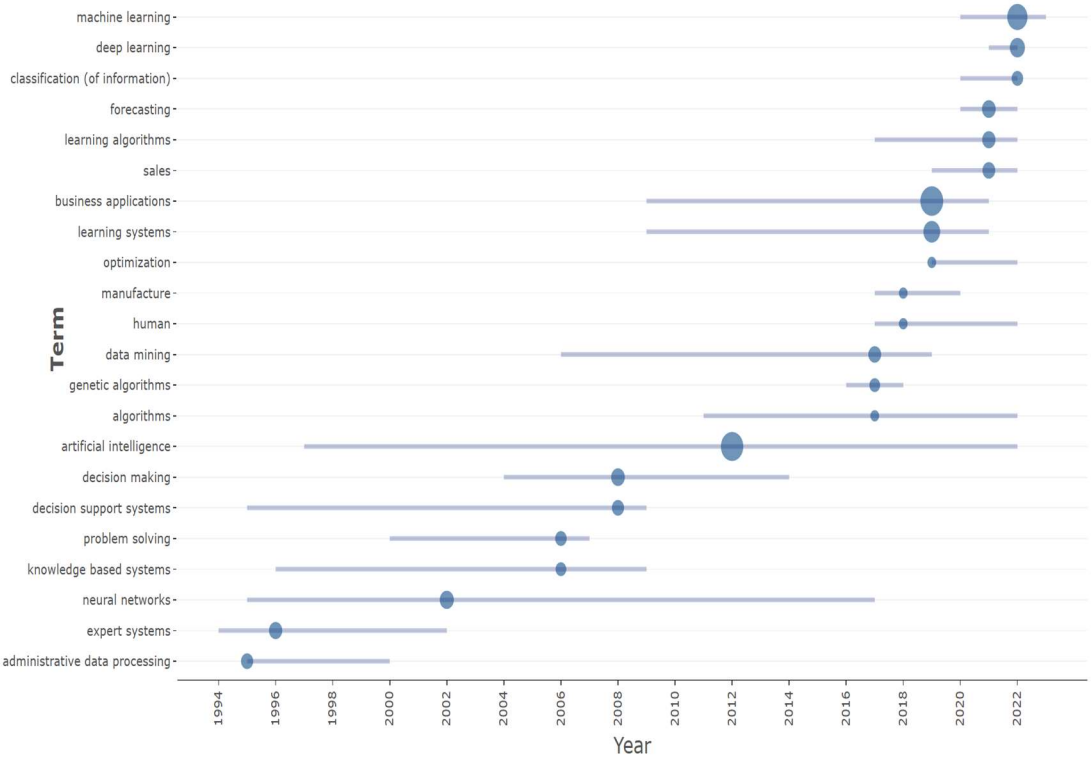


Figure 3. Trend topics

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

Early Research Focus (1984–2000):

During this period, terms such as "expert systems", "administrative data processing", "problem solving" and "decision support systems" were more prominent. This suggests that early AI applications in business were centered mainly around using expert systems and rule-based approaches to improve decision-making and administrative tasks. These topics were foundational in establishing AI's role in supporting business operations.

Shifting Interest to Machine Learning (2000–2015):

Around the mid-2000s, terms like "neural networks", "knowledge-based systems", "data mining", and "genetic algorithms" began gaining traction, reflecting a shift towards more sophisticated AI techniques. This period marked the integration of machine learning models and data analytics into business applications, indicating a transition from rule-based systems to data-driven approaches. The increased attention to "artificial intelligence" during this time suggests a broader interest in how AI technologies could be applied beyond traditional expert systems, paving the way for more advanced AI applications in business.

Recent Trends and Advancements (2015–2023):

The most recent period shows a surge in terms such as "machine learning", "deep learning", "forecasting", "classification" and "big data". These topics have become dominant, reflecting the widespread adoption of machine learning and deep learning techniques in various business contexts, from predictive analytics to automation and optimization. Other terms like "business applications", "sales" and "learning algorithms" indicate that AI research has expanded to cover more diverse applications in real-world business scenarios, demonstrating the growing maturity and practical relevance of AI in business settings.

The evolution of research topics over time reveals the dynamic nature of AI applications in business. There is a clear progression from foundational expert systems to more advanced machine learning and deep learning techniques, showcasing how the field has evolved in response to technological advancements and the increasing availability of data. The rise in topics like "forecasting", "classification" and "optimization" in recent years underscores AI's growing importance in decision-making, strategy, and operational efficiency within business environments.

3.2. Thematic Structure and Research Impact

3.2.1. Thematic Analysis of AI Applications in Business

This map effectively illustrates the maturity and relevance of different themes, highlighting where the research focus currently lies and identifying areas that may become more significant in the future.

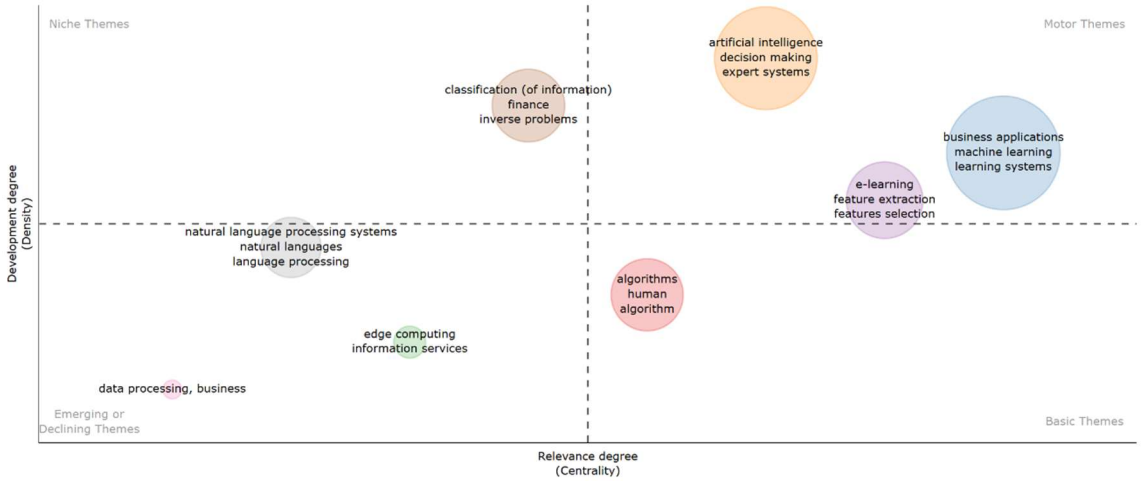


Figure 4. Thematic Map

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

Figure 4 displays the thematic map of research on AI applications in business, using the dimensions of Relevance Degree (Centrality) and Development Degree (Density) to categorize themes into four quadrants:

Motor Themes (High Centrality, High Density):

This quadrant contains themes such as "artificial intelligence", "decision making", "expert systems", "business applications", "machine learning", and "learning systems". These themes are both highly relevant and well-developed, indicating that they are driving the current research in AI applications for business. Their position suggests that they are foundational to the field and form the core topics that are widely studied and applied in business contexts.

Basic Themes (High Centrality, Low Density):

"e-learning", "feature extraction" and "feature selection" appear in this quadrant, indicating that they are fundamental to the domain but still in an emerging or developing stage. These themes are central to the research field but may not have been as extensively developed or explored in business applications as the motor themes.

Niche Themes (Low Centrality, High Density):

The themes "classification (of information)", "finance", and "inverse problems" are located in this quadrant. These topics are well-developed but are not as broadly relevant to the entire field of AI applications in business. They represent specialized areas of research, possibly indicating their importance in particular business sub-domains or specific applications.

Emerging or Declining Themes (Low Centrality, Low Density):

This quadrant includes themes such as "data processing", "business", "natural language processing systems", "language processing" and "information services". These are either emerging areas of research or older themes that have declined in relevance. For example, "data processing" may represent a more traditional approach to AI applications. In contrast, "natural language processing" could indicate an emerging interest that has yet to be fully integrated into mainstream business applications.

The thematic map provides a comprehensive overview of the research landscape for AI applications in business. It shows that while foundational themes like "artificial intelligence" and "business applications" are well-established, there are emerging topics like "feature selection" and "e-learning" that hold potential for future exploration. At the same time, specialized niche areas like "finance" and "inverse problems" indicate the diverse and interdisciplinary nature of the research in this field.

3.2.2. Conceptual Structure Analysis

Figure 5 presents the conceptual structure of the field of AI applications in business, generated using Multiple Correspondence Analysis (MCA). The map positions various terms according to their co-occurrence patterns in research articles, highlighting how closely related they are and revealing distinct thematic clusters.

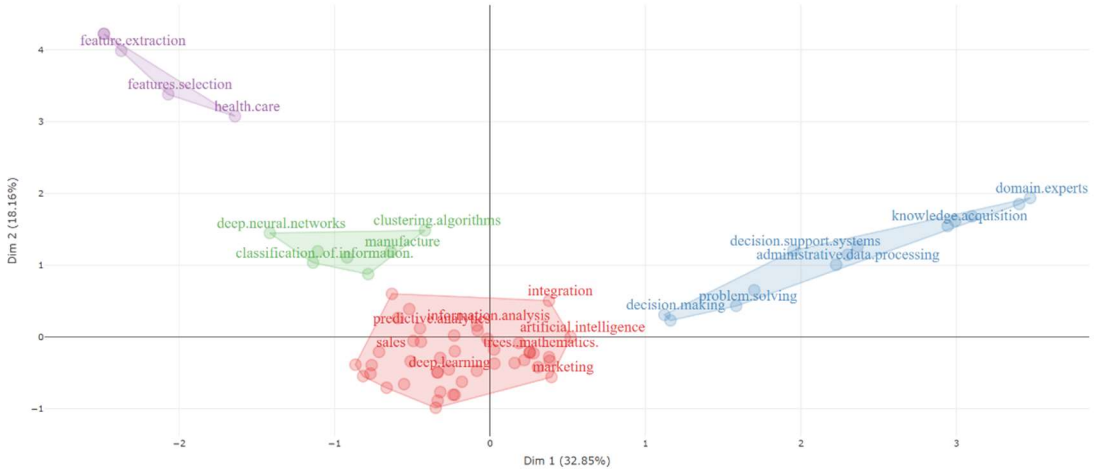


Figure 5. Conceptual structure map (MCA)

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

Cluster 1 (Red - AI Techniques and Business Integration):

The terms "artificial intelligence", "machine learning", "optimization", "integration" and "prediction" are concentrated in this cluster, indicating a strong association between AI techniques and their integration into business practices. This suggests that a significant body of research focuses on applying AI methods to enhance predictive analytics, optimization processes, and overall business operations.

Cluster 2 (Green - Advanced Algorithms and Data Analysis):

Keywords such as "deep neural networks", "clustering algorithms" and "classification algorithms" are found in this cluster. This indicates a research emphasis on advanced algorithmic techniques, showcasing the importance of deep learning and machine learning models in analyzing complex data sets within business applications.

Cluster 3 (Purple - Feature Engineering and Specific Applications):

This smaller cluster includes terms like "feature extraction", "feature selection" and "healthcare". The presence of "healthcare" suggests that feature engineering is a critical aspect of AI applications in specific industries, such as healthcare, where accurate data representation and analysis are essential for effective AI implementation.

Cluster 4 (Blue - Decision Support and Knowledge Management):

Terms such as "decision support systems", "knowledge acquisition", "information processing" and "domain experts" form this cluster. It reflects a focus on using AI to support decision-making processes, enhance knowledge management, and facilitate collaboration between AI systems and human experts in business settings.

Insights: The conceptual structure map provides valuable insights into how different research themes are interconnected in the field of AI applications in business. The centrality of clusters related to AI techniques, business integration, and advanced algorithms highlights their pivotal role in current research efforts. Additionally, the presence of clusters focused on feature engineering and decision support suggests that these areas are critical for translating AI capabilities into practical business applications. This map reveals that while there is a strong focus on integrating AI techniques into business practices, there are also specialized areas of research exploring how AI can be tailored to specific domains, such as healthcare, and how it can enhance decision-making and knowledge management.

3.2.3. Keywords Co-occurrence Network Analysis

Figure 6 displays the keywords co-occurrence network for AI applications in business, illustrating how frequently different keywords appear together in the literature. The size of the nodes represents the importance or frequency of each keyword, while the thickness of the connecting lines indicates the strength of their co-occurrence relationships.

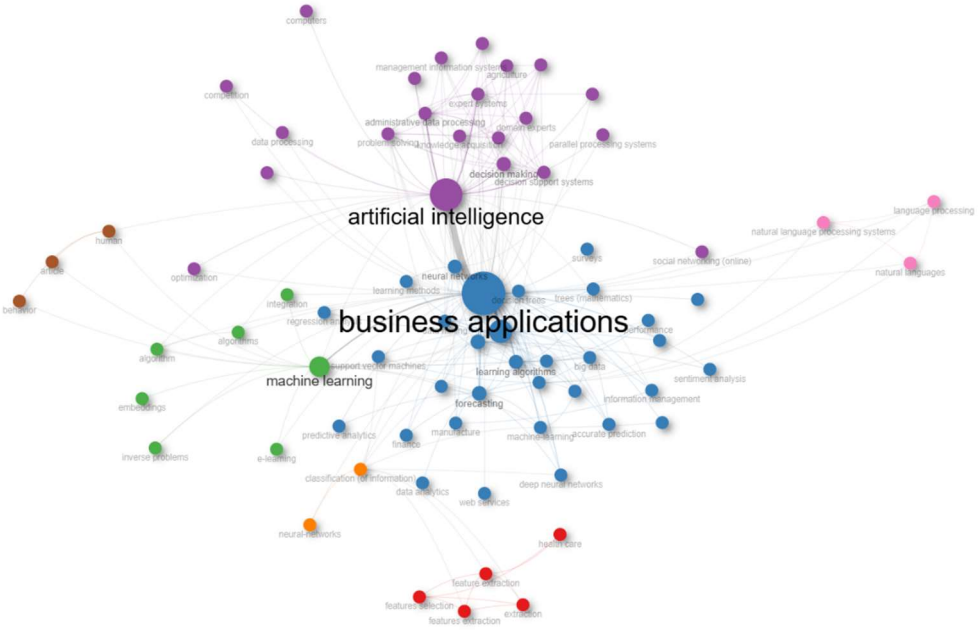


Figure 6. Keywords co-occurrence network

Source: Authors' own editing, using VOSviewer (Van Eck & Waltman, 2010)

The two most central and largest nodes are "business applications" and "artificial intelligence", indicating that these are the most frequently occurring and interconnected concepts in the research field. Their central position suggests that these topics are the core themes around which other research terms revolve.

The network is divided into multiple clusters, each representing a different sub-theme or area of research within AI business applications:

- Blue Cluster (Business Application and Implementation): This cluster contains terms like "forecasting", "machine learning", "decision making" and "classification", showing that much of the research focuses on applying AI techniques to improve business operations, forecasting, and decision-making processes.
- Purple Cluster (AI Techniques and Systems): Contains keywords such as "neural networks", "learning systems", "decision trees" and "expert systems" indicating a research focus on different AI techniques and systems used in business applications.
- Green Cluster (Machine Learning Focus): Keywords like "machine learning", "prediction" and "algorithms" form a cluster, signifying the significance of machine learning techniques in business applications.
- Red Cluster (Data Processing and Knowledge Management): Includes terms like "data mining", "information management" and "knowledge-based systems" emphasizing research on data processing and knowledge management within business settings.
- Pink Cluster (Natural Language Processing): Contains terms like "natural language processing", "language learning systems" and "text analysis" suggesting a growing interest in integrating NLP techniques within business applications.

Smaller nodes like "COVID-19", "social media" and "marketing" suggest emerging research areas where AI is being applied in business contexts, indicating the adaptability of AI applications to contemporary challenges and trends.

The Keywords co-occurrence network provides a comprehensive overview of the thematic structure of AI applications in business. It highlights the dominant research themes (e.g., machine learning, data mining, and decision-making) and shows how different AI techniques are being integrated into business processes. The presence of clusters indicates that research in this field is multifaceted, covering a wide range of topics from AI methodologies to application domains.

3.3. Geographic and collaborative insights

3.3.1. International Collaboration Analysis

The Country Collaboration Map (Fig. 7) illustrates the connections between countries that are actively involved in collaborative research on AI applications in business. The intensity of the blue shading represents the volume of publications from each country, while the lines connecting countries indicate international research collaborations, with thicker lines representing stronger collaborative relationships.

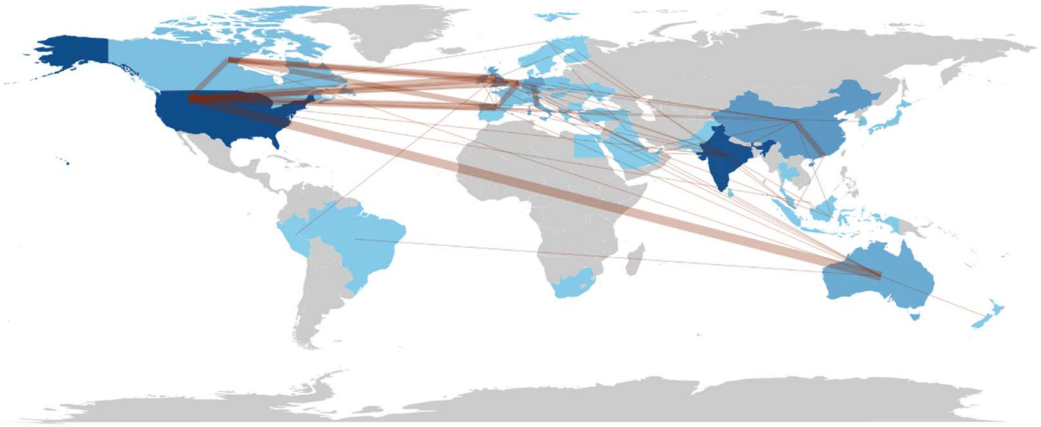


Figure 7. Country collaboration map

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

The United States emerges as the most prominent and active contributor, with numerous collaborative links extending to Europe, Asia, and Australia. This suggests that the US plays a central role in driving research on AI applications in business and frequently partners with other countries, indicating its influence and leadership in the field. India, China, the United Kingdom, and Australia also appear as significant collaborators, showing strong research connections with both neighboring countries and those from different continents. These countries are likely hubs of AI research activity, fostering international partnerships to advance AI applications in business.

Europe displays a dense network of collaborations, particularly among countries like the United Kingdom, Germany, France, and Italy. This indicates a high level of regional cooperation, which shared research interests, funding opportunities, or participation in European Union research initiatives may drive. Asia, particularly China and India, has established strong collaborative ties not only within the region but also with Western countries, reflecting the growing importance and investment in AI research in these countries. North America has a high degree of collaboration, primarily driven by the United States, which collaborates extensively with European and Asian countries. Canada also shows some collaborative ties, although to a lesser extent.

The map indicates that AI applications in business are a globally significant research area with extensive international collaboration. The presence of strong ties between countries from different continents suggests that researchers are actively sharing knowledge, resources, and expertise to advance the field. The United States stands out as a central player. Still, the active involvement of countries like China, India, and the United Kingdom underscores the global nature and interdisciplinary interest in AI's role in business.

This analysis demonstrates that collaboration across borders is a crucial factor in driving AI research forward, enabling researchers to tackle complex challenges and develop innovative solutions in the application of AI to business.

3.3.2. Corresponding Author's Countries Analysis

This analysis underscores the different roles that countries play in advancing AI research in business, highlighting both the importance of national research initiatives and the value of international collaboration in driving the field forward. Figure 8 displays the contributions from corresponding authors by country in AI applications in business research. It differentiates between Single Country Publications (SCP), where all authors are from the same country, and Multiple Country Publications (MCP), indicating international collaborations.

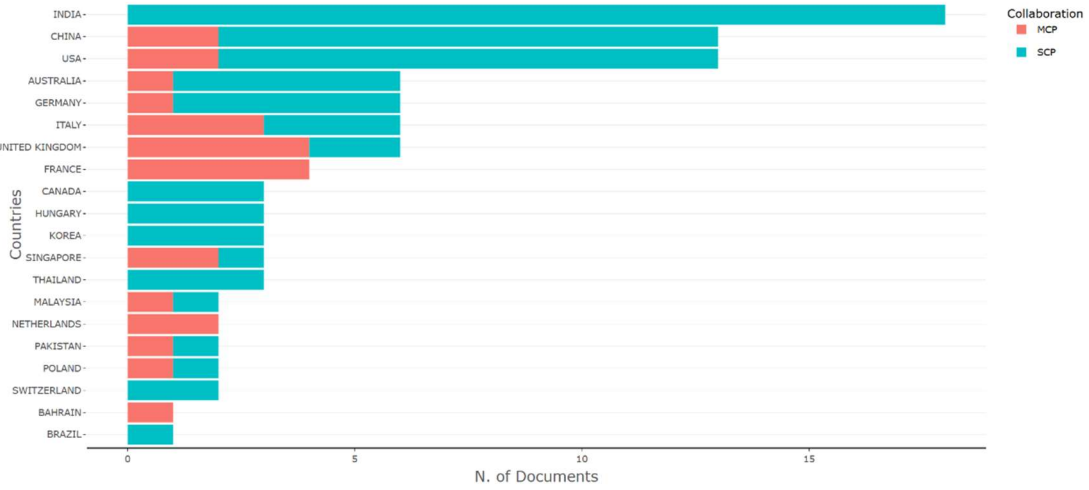


Figure 8. Corresponding author's countries

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

Leading Countries:

India is the most prominent contributor, with a high number of documents (predominantly SCPs), indicating that much of India's AI research in business is conducted domestically, with less reliance on international collaboration. China follows closely and also has a significant number of SCPs, suggesting a strong national focus on AI research for business applications. However, China shows a higher proportion of MCPs compared to India, indicating more international collaboration. The USA has a balanced distribution of SCPs and MCPs, reflecting its role as a major contributor to AI research both independently and in cooperation with other countries.

Countries with High International Collaboration:

The United Kingdom, Germany, and Australia have a notable presence of MCPs, showing that these countries are highly engaged in international AI research partnerships. This indicates an open and collaborative research culture, which is likely contributing to the advancement of AI applications in business on a global scale.

Other Contributing Countries:

France, Canada, Singapore, and Malaysia also show a mix of SCPs and MCPs, but with fewer total publications compared to the leading countries. These countries are steadily contributing to the field, with a noticeable level of international collaboration.

Smaller Contributors:

Countries like Bahrain, Brazil, and Poland have a minimal number of documents, indicating that AI research in business applications is less developed or less prioritized in these regions.

The chart reveals that AI applications in business are researched across diverse geographic regions, with varying degrees of international collaboration. Countries like India and China are leading in total output but tend to have more independent research activities. In contrast, the USA, the UK, and Australia demonstrate a stronger tendency toward international collaboration, which might be indicative of more diverse, innovative, and globally informed research.

3.4. Most Cited Documents in AI Business Applications

Figure 9 displays the most globally cited documents in AI business applications research. The citation count indicates the influence and impact of these papers within the academic community.

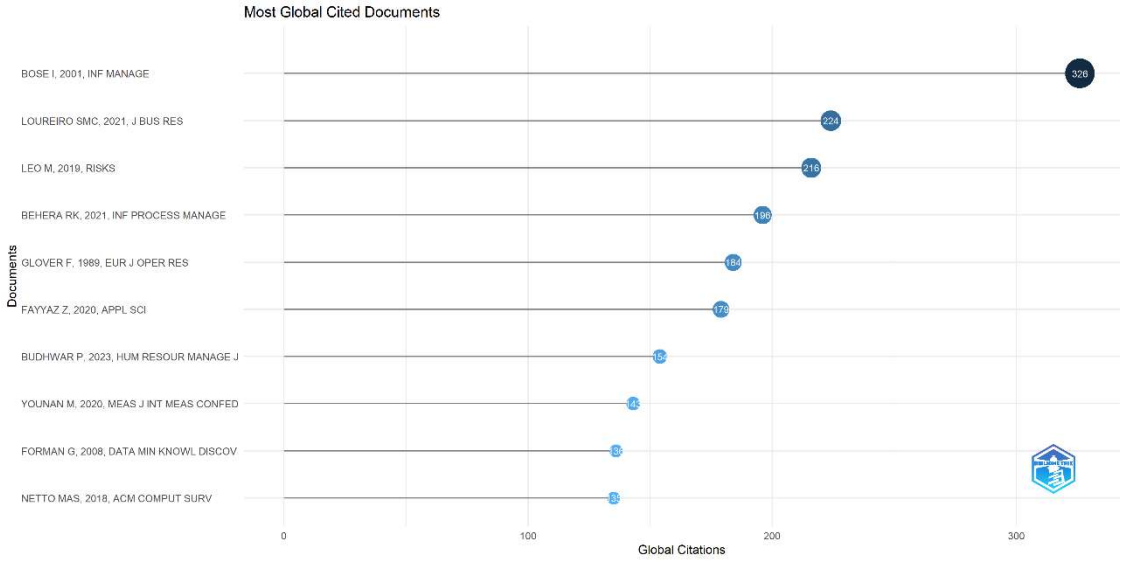


Figure 9. Most cited documents in AI business application research

Source: Authors' own editing, using Bibliometrix (Aria & Cuccurullo, 2017)

The most cited document is by Bose (2001), published in the *Information Management* journal, with a total of 326 citations. This paper's high citation count suggests that it has significantly contributed to foundational knowledge or methodologies in applying AI within business contexts. Following this, the article by Loureiro et al. (2021) in the *Journal of Business Research* has received 224 citations, indicating its relevance and impact on contemporary AI applications in business research. Other notable highly cited works include Leo (2019) in *Risks*, Behera, Bala & Rana (2021) in *Information Processing & Management* and Glover (1989) in *European Journal of Operational Research* with citation counts of 216, 196, and 179, respectively. These papers likely offer substantial insights into AI's role in various aspects of business, such as risk management, decision-making processes, and operational efficiency.

The prominence of these papers underscores their contribution to the development and application of AI technologies in business practices, serving as essential references for researchers exploring this field. This citation analysis reveals the key academic works driving the discourse on AI in business applications. It highlights the importance of engaging with these influential studies to advance the field further.

4. Discussion

4.1 Overview of Findings

The bibliometric analysis provides a comprehensive view of how AI applications in business have evolved, as well as the thematic trends, influential contributors, and international collaborations. This section discusses these findings in the context of existing literature, highlighting the progress, gaps, and future potential in this research field.

The annual scientific production analysis revealed a substantial increase in research output since 2017, with a peak in 2023. This rapid growth aligns with the increased accessibility and advancements in AI technologies, particularly machine learning and deep learning techniques. The observed trend confirms the findings of Loureiro et al. (2021), who noted that AI's growing popularity in business is driven by the technology's potential to optimize decision-making processes, enhance operational efficiency, and provide valuable insights from large datasets. Similarly, Fayyaz et al. (2020) emphasized the importance of machine learning techniques in automating and improving various aspects of business operations.

The thematic analysis identified key research areas, with business applications, artificial intelligence, machine learning, and decision-making emerging as the most central themes. This confirms earlier observations by Bose (2001), who highlighted that AI, particularly expert systems, has been central to decision support in businesses. However, the increased prominence of terms like “deep learning”, “big data” and “forecasting” in recent years indicates a shift toward more data-driven and advanced AI techniques, expanding beyond traditional expert systems.

The keywords co-occurrence analysis further supports these findings, showing that research has evolved from foundational AI methods to integrating sophisticated machine learning models in various domains such as marketing, finance, and operations. This evolution is consistent with recent studies like Behera, Bala & Rana (2021), which emphasized the role of deep learning in enhancing predictive analytics in marketing.

The bibliometric analysis identified several influential contributors to AI research in business. For instance, Bose (2001) and Loureiro et al. (2021) have significantly shaped the direction of research, with high citation counts indicating their impact on the field. Journals like *Expert Systems with Applications* and *Information & Management* emerged as core sources, confirming their role as key outlets for disseminating AI research in business. This aligns with the findings of Forman (2008), who acknowledged the journal's contributions to AI applications across multiple disciplines.

The geographic analysis showed that the United States, China, and India are leading in AI research for business applications, with the US demonstrating a higher degree of international collaboration. This finding is consistent with Budhwar (2023), who emphasized the collaborative nature of AI research, particularly in North America and Europe. The strong collaboration links between countries like the UK, Australia, and Germany highlight the global interest in AI's business applications and suggest that international partnerships are crucial for driving innovation and knowledge exchange in this domain.

China and India’s significant contributions, primarily through single-country publications, indicate robust national research initiatives. Still, there is room for more international engagement, which could foster more diversified research insights. This aspect is crucial for integrating culturally and contextually diverse perspectives, which is often highlighted as a gap in AI research for business, as noted by Behera, Bala & Ray (2021).

4.2. Implications and Future Research Directions

The findings highlight that AI research in business is at a transformative stage, shifting from traditional expert systems to more advanced machine learning and deep learning applications. Future research could explore how AI can address emerging challenges in business, such as sustainability, ethical decision-making, and personalized customer experiences. Bálint et al. (2025) highlight that combining data analytics with targeted employee upskilling programmes is essential for SMEs to achieve digital maturity and adopt sustainable business practices when implementing AI solutions. Work in other sectors further underscores AI’s transformational potential: Topol (2019) describes ‘high-performance medicine’, in which artificial intelligence augments clinicians’ expertise to improve diagnostic accuracy and operational efficiency. Such cross-industry examples highlight how lessons from healthcare can inform the development of AI-enabled business applications. Similarly, Szilágyi et al. (2017) demonstrate how gamification can be harnessed in higher education via a farm-simulation application; such gamified simulation tools could be adapted to support employee training and upskilling in AI-driven business contexts. Additionally, fostering more international collaborations, particularly

involving emerging economies, could lead to more innovative and contextually diverse applications of AI in business.

Research could also focus on underexplored themes identified in the analysis, such as “feature selection”, “natural language processing” and “knowledge acquisition”, which have shown emerging interest but require further development. This direction aligns with the recommendations by Netto et al. (2018), who suggested that leveraging AI techniques like NLP and deep learning could significantly enhance business intelligence systems.

5. Conclusions

This study presented a comprehensive literature search combined with a bibliometric analysis to explore the applications of Artificial Intelligence (AI) in businesses. The findings highlight the evolution of AI from early expert systems to advanced machine learning and deep learning techniques, with significant contributions to process optimization, customer relationship management, and predictive analytics. The thematic and conceptual structures reveal both established areas, such as decision support and business integration, and emerging themes, including feature engineering and natural language processing.

The geographic and collaborative analyses indicate that research is dominated by countries such as the United States, China, and India. At the same time, international collaborations remain essential for broadening perspectives and fostering innovation. Despite the transformative potential of AI, challenges persist regarding ethical considerations, data privacy, transparency, and accessibility for small and medium-sized enterprises.

Overall, the study provides a comprehensive understanding of AI applications in business, identifies existing gaps, and proposes directions for future research. Addressing issues related to sustainability, ethical AI, and interdisciplinary approaches will be crucial for maximizing the benefits of AI while ensuring its responsible and equitable use in business contexts.

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