THE ROLE OF ARTIFICIAL INTELLIGENCE IN BUSINESS AND MANAGEMENT DECISION-MAKING: A BIBLIOMETRIC ANALYSIS TO MAP THE SCIENTIFIC DISCOURSE

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Abstract

The role of artificial intelligence (AI) in business and management decision-making has become one of the most intensively studied areas in recent years. The present study conducts a bibliometric analysis based on 4,165 publications in the Web of Science database in order to map the main structural and thematic characteristics of the scientific discourse. It is possible to identify three dominant scientific clusters based on the co-occurrence of keywords, co-citation networks, and scientific collaborations between countries. The following three approaches have been identified: firstly, technology- and algorithm-focused approaches; secondly, organisational and human-centred interpretations; and thirdly, research based on business decision support and information management. The objective of the present study is to emphasise that AI is not merely a technological innovation, but rather an interdisciplinary phenomenon that fundamentally transforms the organisational, ethical and strategic frameworks of decision-making. The results obtained contribute to a more accurate understanding of research trends in the field and provide a basis for further analysis.

Keywords: *artificial intelligence, business decision-making, bibliometric analysis, scientific networks*
JEL: *• D83, M15, O33*

Introduction

In order to scientifically map the relationship between artificial intelligence and business decision-making, a bibliometric analysis was conducted using the Web of Science Core Collection database. The search was conducted on October 15, 2024, using the following search terms:

The search strategy, abbreviated as TS, encompasses a combination of search terms related to "artificial intelligence" (AI), "leadership," "business," "management," and "decision-making" or "decision making." (Figure 1)

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TS = (("artificial intelligence" OR "AI") AND ("leadership" OR "business" OR "management")
AND ("decision-making" OR "decision making"))
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Figure 1: VOSviewer searching prompt
Source: Source: own work

The query yielded a total of 4,165 scientific publications. The number of publications in this field indicates that the application of artificial intelligence in management and decision-making processes is not only a current but also a rapidly expanding interdisciplinary field of research, which is linked to technology sciences, management, psychology, and ethical and social issues. In the following, an exploration of the research landscape is conducted from five different angles: keywords, temporal trends, authors, citation networks, and international collaboration.

Consequently, the network not only delineates the predominant scientific domains of interest but also elucidates the intricacies of the research field's internal structure. Artificial intelligence, in its multifaceted nature, cannot be regarded as a solitary research trajectory; rather, it is a confluence of numerous thematic clusters that frequently intersect and reinforce one another. This finding serves to reinforce the fundamental assumption that AI is not an isolated technological phenomenon in the domain of management and decision-making; rather, it is a systemic transformative force.

Keyword co-occurrence network

The thematic structures underlying scientific research are revealed by a network of co-occurring keywords. The relationships between the most frequently co-occurring keywords were visualized, thereby revealing the main conceptual blocks around which the topics of artificial intelligence and business and management decision-making are organised.

The most common trivial terms were excluded from the thesaurus (Figure 2):

- artificial intelligence,
- decision making,
- decision-making,
- ai,
- artificial intelligence (ai).

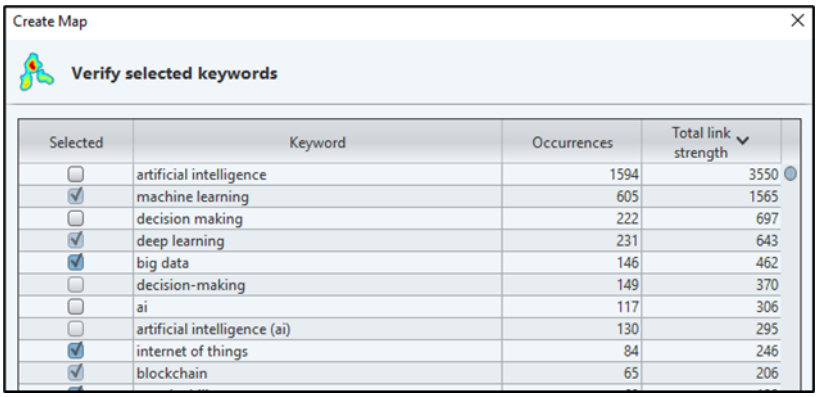

Figure 2: Selected keywords in thesaurus

Source: own work by VOSviewer

At the core of the network is the concept of "machine learning," which itself demonstrates the pivotal role of machine learning methods in this domain. From this centralised nexus, various clusters of research directions bifurcate, thereby forming a multifaceted network of scholarly pursuits. The technology clusters are dominated by keywords such as blockchain, edge computing, digital twin, and reinforcement learning, which provide the background for advanced digital infrastructures and automated decision-making systems. In the management and business-focused cluster, terms such as firm performance, technology adoption, competitive advantage, and data analytics are evident, indicating that a significant proportion of the research is concentrated on the economic impact of AI and its role in creating competitive advantage. (Figure 3)

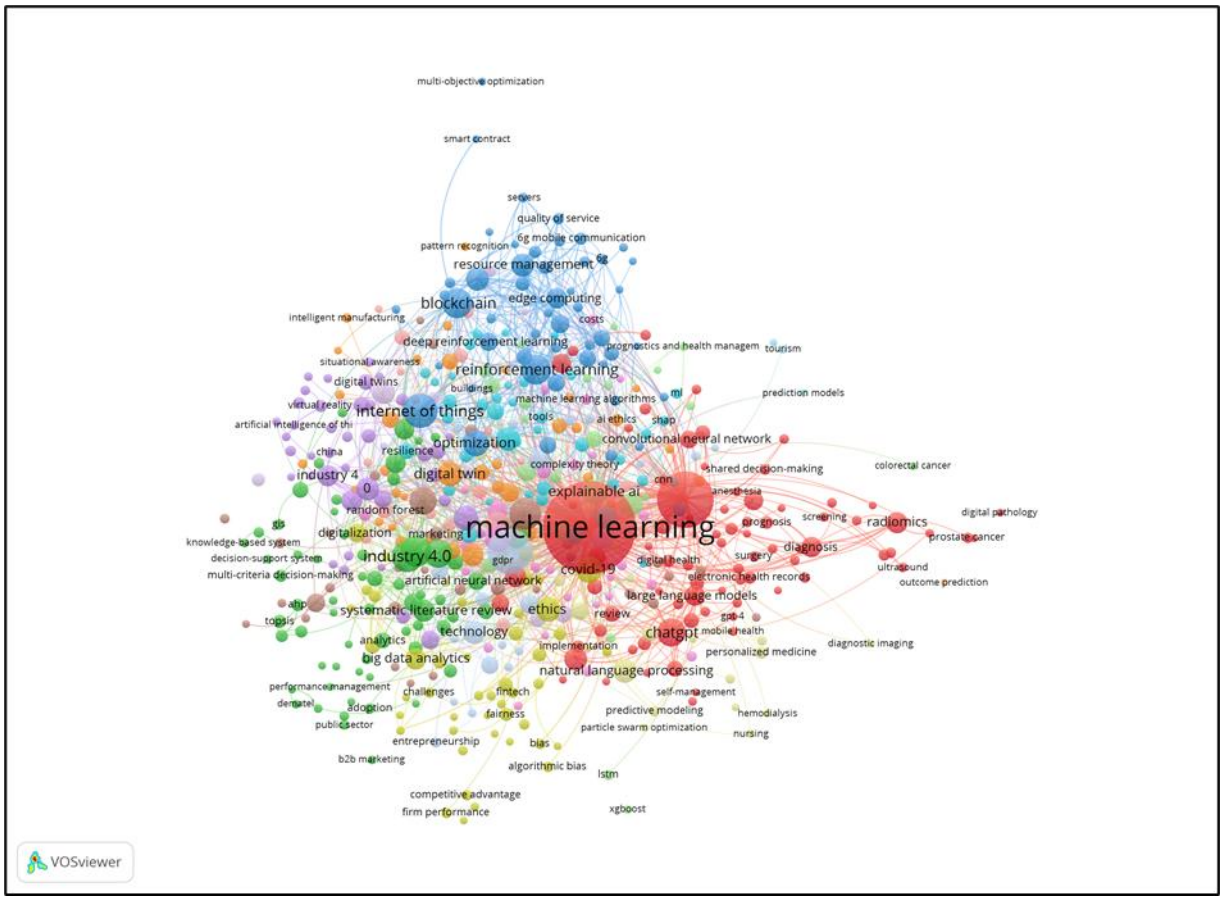

Figure 3: Keyword co-occurrence network

Source: own work by VOSviewer

A clearly delineated cluster pertains to healthcare decision support, encompassing concepts of radiomics, personalised medicine, diagnosis, and electronic health records. This suggests that healthcare is a priority domain for AI-based decision-making. Furthermore, keywords pertaining to ethical and social issues, including explainable AI, algorithmic bias, and ethics, constitute a discrete cluster and are associated with multiple other clusters. This thematic overlap demonstrates that issues of transparency, impartiality, and social acceptance of AI are of paramount importance across all domains of application.

An examination of the temporal trends in the appearance of keywords is warranted

In order to map the development of research directions, a time-based keyword analysis was also performed, in which the keywords used in the publications were coloured according to their average year of appearance. The resulting visualisation enabled the identification of concepts that had been previously identified in preliminary research, as well as those that had only recently become the focus of research. The colour scale ranges from blue (older) to yellow (most recent), with the consequence that newer topics are immediately distinguishable within the network. (Figure 4)

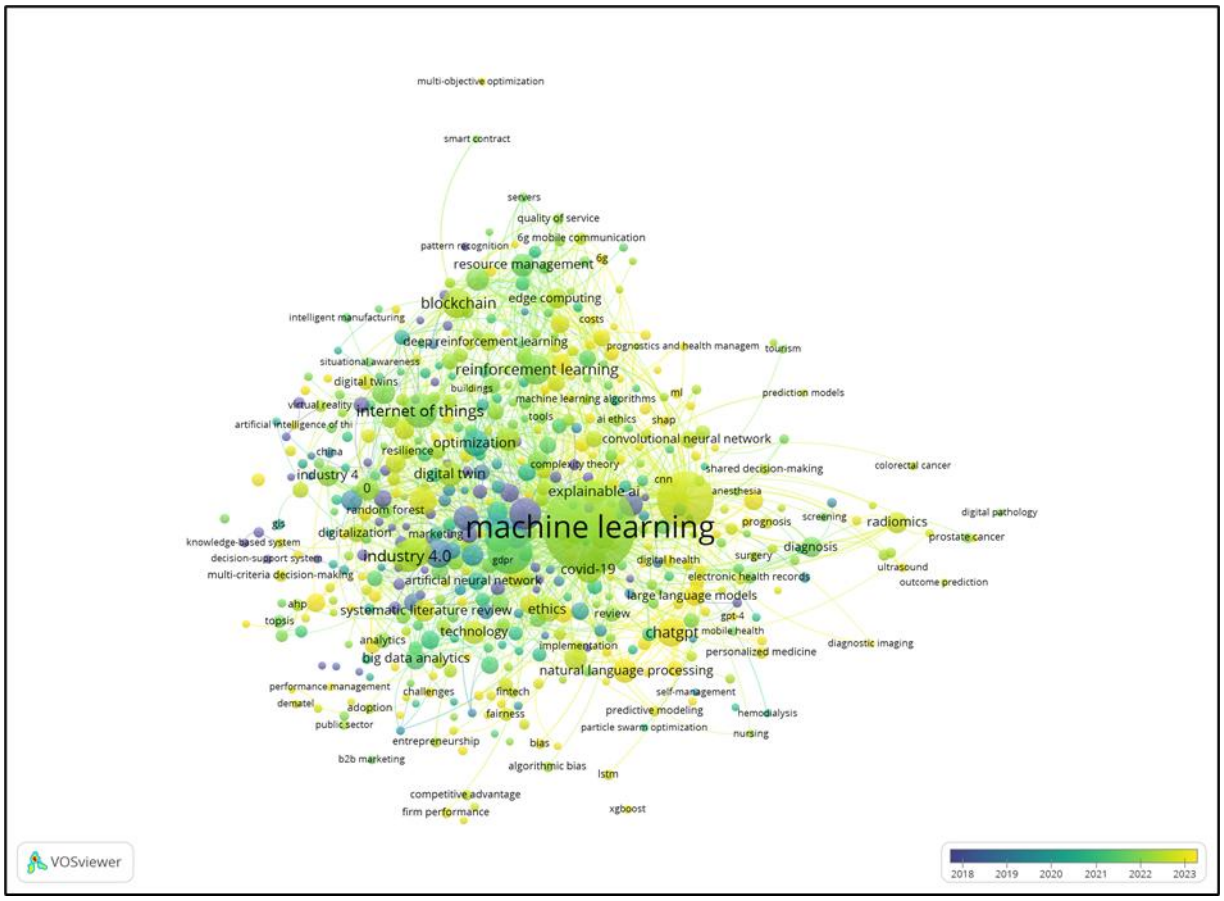

Figure 4: The appearance of keywords

Source: own work by VOSviewer

The prevalence of green hues in the keywords machine learning and neural networks in the network's core suggests that these concepts have been predominant in the field since the early 2010s. Concurrently, novel concepts have emerged in recent years, indicating novel research directions. The nodes of colour yellow indicate, for instance, ChatGPT, large language models, natural language processing and transformers, which have become central research topics in the period following 2022. It is evident that these keywords are indicative of two phenomena: firstly, the rapid pace of technological development, and secondly, the scientific community's rapid response to the emergence of generative artificial intelligence.

In a similar vein, novel yet thematically disparate keywords have been identified, including but not limited to explainable AI, ethics, algorithmic bias, and trust. The aforementioned concepts, which reflect ethical and social considerations, have come to the fore in parallel with the increasingly widespread use of AI, especially in areas where algorithms are replacing processes that are close to human decision-making (e.g., medical diagnosis, financial risk analysis).

Consequently, time-based analysis not only illuminates the subject matter of preceding research, but also signals the emergence of novel scientific priorities that are poised to garner heightened attention in forthcoming years. There is an evident transition from exclusively technological approaches to interdisciplinary, ethical, and human-centred research, which is intimately associated with the primary question of the thesis: the manner in which artificial intelligence is transforming leadership and business decision-making, both technically and in terms of content and responsibility.

The structure of the scientific community, specifically the author cooperation network

By mapping the collaborative network between authors, insights can be gained into the organisational structure of the scientific community, the development of research clusters around collaborations, and the researchers who play a central role in the scientific discourse. Each node in the visualisation generated by the VOSviewer represents an author, with the size of the nodes reflecting the citation weight of the researcher and the lines between them representing joint publications. (Figure 5)

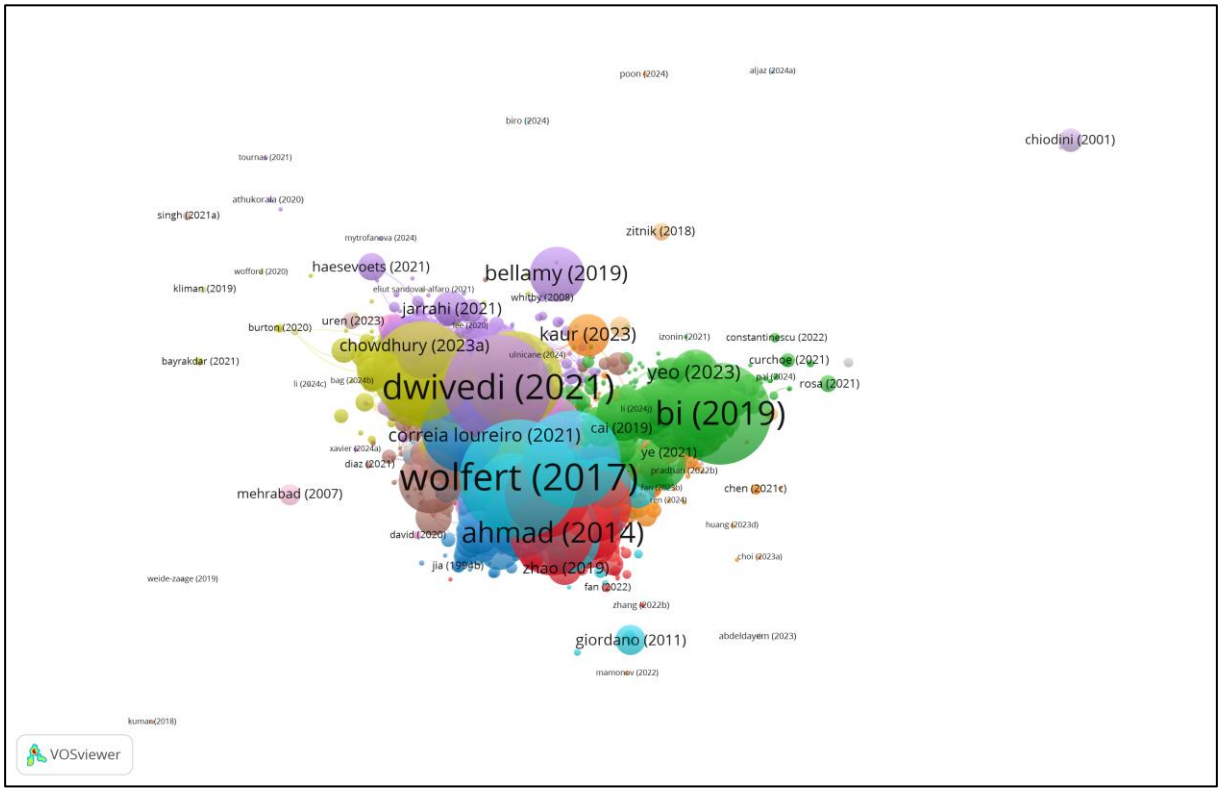

Figure 5: The collaborative network between authors

Source: own work by VOSviewer

One of the largest and densest clusters in the network pertains to business and technology adoption, with prominent authors such as Dwivedi et al. (2021) at the helm. These authors have attained a leading position in the field of digital transformation and technology adoption through their exceptional contributions. This cluster also comprises numerous other active researchers who are engaged in research related to the integration of artificial intelligence in business, enterprise decision support systems, and data-driven competitiveness.

Another distinct cluster focuses on industrial applications and intelligent systems, in which the work of Wolfert et al. (2017), for example, is particularly noteworthy. They have published seminal papers on predictive analytics and data-driven decision making, in particular in the field of agribusiness and supply chain management. The prevailing characteristic of this cluster is a robust technical and application-oriented approach.

The third notable cluster represents ethical and social science approaches. Despite the presence of smaller citation clusters, this field is notable for its focus on the human dimensions of AI, including its explainability and social acceptability. This cluster is characterised by its reduced density, yet it is undergoing a period of growth and increasing interconnectedness. These phenomena are indicative of the topic's growing importance.

The scientific base and schools of thought: the co-institutional network

In order to map the development and theoretical structure of scientific thought, a co-citation analysis was carried out. This network discloses the source works that are frequently cited in the publications under study, thereby indirectly revealing the fundamental works that constitute the intellectual foundation of the research area. The application of the VOSviewer network reveals the presence of distinct thematic clusters, which are indicative of three main scientific "schools". (Figure 6)

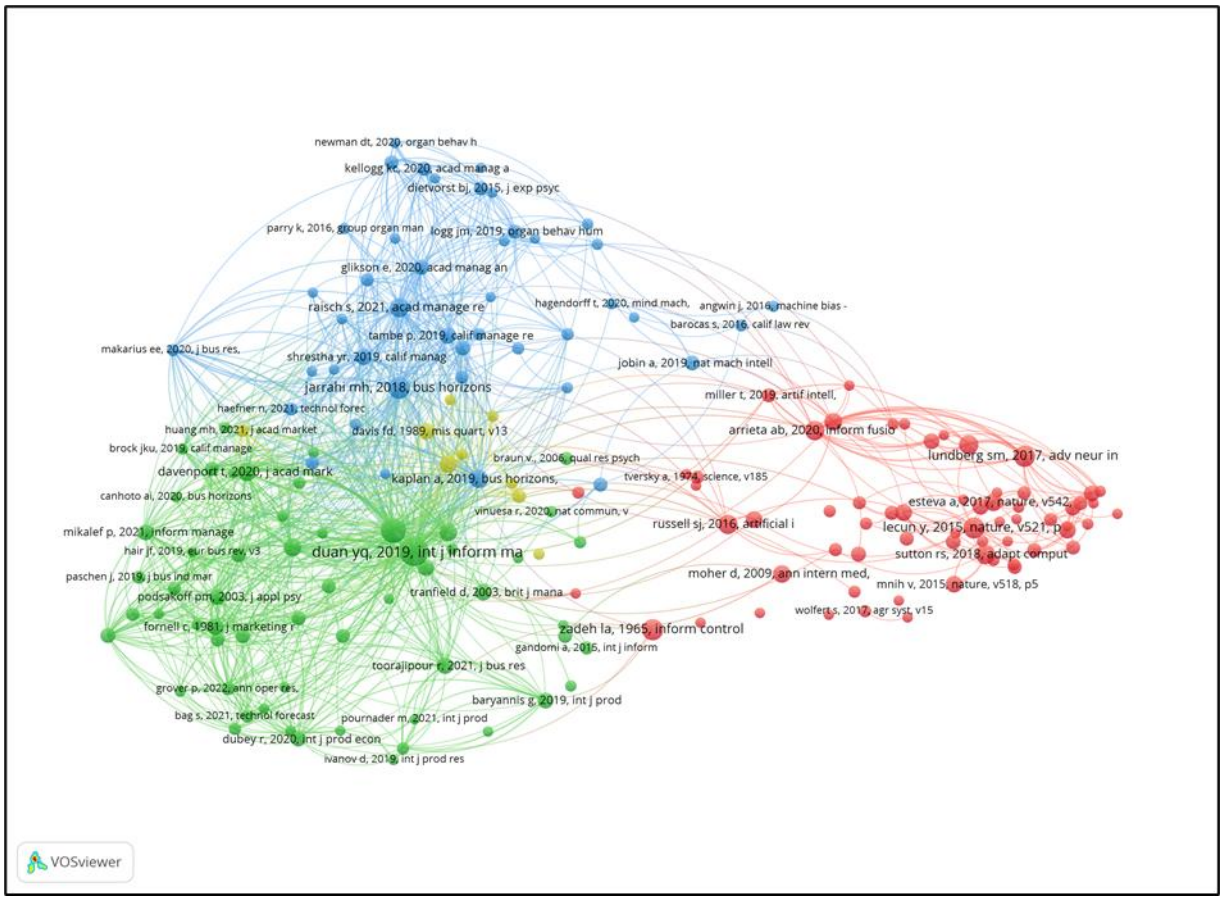

Figure 6: The cocitation network
Source: own work by VOSviewer

The technology-based cluster, indicated by the colour red, encompasses algorithms, models and applications

One of the most prominent clusters in the bibliometric co-citation network pertains to literature focused on algorithms and technology. The "red" cluster is composed predominantly of source works that address the mathematical, IT, and data processing foundations of artificial intelligence. The authors included in this cluster are predominantly theoretical developers of machine learning, deep learning, and predictive modelling. However, there is also a significant number of researchers who study their practical applications, primarily in the context of healthcare or diagnostics.

The following section details the contributions of the primary authors.

Yann LeCun et al. – A seminal figure in the field of deep learning, LeCun's contributions, notably his Nature article entitled "Deep learning" (LeCun–Bengio–Hinton, 2015), represent a foundational source in the central part of the network. That study undertakes a systematic investigation of deep learning architectures and their application in a range of AI tasks.

Sutton and Barto – The seminal work Reinforcement Learning: As Sutton and Barto demonstrate in their seminal work, "An Introduction", the conceptual and technical foundations for an entire field of research are established, namely reinforcement learning. The theoretical framework for machine modelling of decision-making situations, risk management and feedback optimisation is predicated on this work. (Sutton–Barto, 2018)

Alexander G. Esteva – A pioneering figure in the field of artificial intelligence applied to healthcare. In his study on the automation of dermatological diagnosis using artificial neural networks, he demonstrated that machine learning is capable of attaining human-level diagnostic performance. (Esteva et al. 2017)

Scott M. Lundberg – Developer of the SHAP method, which is considered to be one of the cornerstones of "explainable AI" (XAI) research. Lundberg's work examines the transparency and ethical implications of decision models, which represent an intersection between this technology cluster and ethical approaches. (Lundberg–Lee, 2017)

David Moher – Moher's development of the PRISMA protocol has contributed to the standardisation of systematic reviews, providing a methodological framework for validating predictive and AI-based research. (Moher et al. 2009)

Stuart Russell is widely regarded as one of the most prominent thinkers in the field of artificial intelligence, particularly with regard to its philosophical and social ramifications. Russell's oeuvre, including Human Compatible AI, cautions against the ethical and operational challenges inherent in goal setting within a technological framework, yet from a human-centred perspective. (Russell, 2016)

Amir Gandomi – Gandomi's overview article on Big Data is a seminal text for scholars and researchers in the field of artificial intelligence who are interested in practical data science applications. Issues of data quality, data flow, and data interpretation are closely intertwined with technological decision-making. (Gandomi–Haider, 2015)

Volodymyr Mnih (2015) is a co-author of studies that have demonstrated the practical breakthrough of deep reinforcement learning (e.g., AlphaGo, Atari games). Mnih is also closely associated with testing machine decision-making in realistic environments. (Minh et al., 2015)

This cluster is indicative of a robust technological perspective, with artificial intelligence being regarded as a tool that optimises, automates, recognises, and predicts. In this interpretation, the decision-making process is characterised as a data-driven algorithmic process that aims to maximise efficiency, reduce human error, and accelerate the acquisition of information.

Concurrently, it is imperative to acknowledge that the concerns pertaining to explainability and accountability are also evident in this cluster, as exemplified in the research conducted by Lundberg and Russell. This observation underscores the fact that even the most technical approaches cannot circumvent questions concerning the social acceptance and legitimacy of artificial intelligence.

The predominance of this cluster within the network serves to substantiate the assertion that the central axis of the scientific discourse on AI continues to be of a technological nature, encompassing the development of methods, models, and systems. Simultaneously, the "connected edges" of the cluster indicate a multidimensional interpretation. The objective of this article is to establish a connection between technological and organisational-social approaches.

The organisational and management cluster (blue) is concerned with the utilisation of technology in human interaction

The blue cluster of the bibliometric network is evidently distinct from technological approaches: in this context, artificial intelligence is not merely a tool, but a catalyst for organisational, social and psychological processes. The authors examine how leadership, work, decision-making, and the role of humans themselves are changing in AI-supported systems. This perspective has implications for management, as well as the realignment of decision-making responsibility, power, and trust.

The following individuals are considered to be key players in the cluster:

K. C. Kellogg – The author examines the "invisible effects" of AI implementation in organisations, exploring the transformation of work processes when algorithms become an integral component of decision-making processes. The author pays particular attention to the technological tensions that arise between front-line employees and AI-based management. (Kellogg–Valentine–Christin, 2020).

Raisch and Krakowski – This study explores the repercussions of artificial intelligence on leadership roles. The author posits that artificial intelligence is gradually becoming a pivotal "new collaborative actor" in the realm of strategic decision-making. This development, according to the author, is profoundly reshaping the very fabric of responsibility relationships and the identity of leaders themselves. (Raisch–Krakowski, 2021).

Barocas and Selbst – The individual in question is a renowned researcher in the field of discrimination and algorithmic bias. Barocas's work is concerned with the ethical dilemmas that arise when organisational decisions are based on machine biases. (Barocas–Selbst, 2016)

Thomas H. Davenport – He is widely regarded as a pre-eminent figure in the field of interdisciplinary integration, with a particular focus on the convergence of technology and business management. His work highlights how AI can be positioned as a strategic resource and how organisations need to structure themselves for successful implementation. (Davenport, 2018)

Kaplan and Haenlein – This text seeks to examine the problem of defining AI and its social construction. The author posits that the notion of AI is influenced by social actions, which in turn impact the decision-making processes within organisations. (Kaplan–Haenlein, 2019)

M. H. Jarrahi – The individual under discussion is a pioneering researcher in the field of human-machine collaboration. The author posits that AI does not supplant human labour; rather, it engenders novel modes of collaboration, a notion of particular pertinence in contexts characterised by creativity, complexity and absence of structure in decision-making processes. (Jarrahi, 2018)

The focal point of this cluster is the relationship between AI and humans; it interrogates not only the capabilities of technology, but also its influence on human functioning, organisational

culture, trust systems, and governance. The pivotal concerns in this regard encompass the acceptance of machine decisions, the question of delegated responsibility, and the norm-setting influence of AI.

Whilst the technology cluster focuses on the capabilities of AI, this group explores its impact on human beings. This is of critical importance for leaders, for the introduction of AI represents not only a technological innovation, but also a social innovation. It necessitates a new division of labour, new trust structures, and new types of decision-making logic.

This cluster lends support to the view that AI cannot be understood solely as a technical object; its cultural and structural impacts are at least as significant. The authors' arguments provide an opportunity for the article to promote dialogue between different schools of thought, with questions of technological performance being complemented by perspectives on organisational reality and social embeddedness.

The decision support and information management cluster (green) is predicated on a strategy from data

The green cluster brings together researchers and fundamental works that examine issues of artificial intelligence applied in a business and management context, with a particular focus on decision support, big data, data analysis, and information systems. The authors of these texts do not develop algorithms or focus primarily on ethical aspects. Instead, they investigate how AI can be used to optimize organizational operations. This approach is characterised by its strong emphasis on the application-oriented nature of the subject matter, whilst simultaneously acknowledging the interdisciplinary nature of the field, as it employs technical possibilities to serve strategic goals.

The following authors are considered to be among the most prominent in their field.

Duan et al. – In his review article, Duan methodically categorises the business applications of AI, identifies the primary technologies, and emphasises the critical factors for successful implementation. This initial analysis provides a foundation upon which subsequent analyses are built. (Duan–Edwards–Dwivedi, 2019)

Tranfield et al. – The author team under discussion is one of the developers of the methodology of systematic literature reviews. Their work plays a pivotal role in facilitating the evaluation of literature on AI in a structured and transparent manner within the domain of management research. (Tranfield–Denyer–Smart, 2003)

Podsakoff et al.(2003) – It draws attention to measurement problems in organisational behaviour research, particularly the distorting effects of questionnaire-based and empirical data collection. This knowledge is of particular importance when examining AI applications at the organisational level.

Fornell and Larcker – The couple of authors under discussion is considered to be one of the pioneers of the use of structural equation modeling (SEM) in business and consumer research. The contributions of this scholar have resulted in the extensive utilisation of quantitative modelling analysis in the domains of AI and big data research. (Fornell–Larcker, 1981)

Ransbotham et al. – His team's research focuses on the organisational conditions that facilitate digital transformation and the integration of artificial intelligence (AI) within organisational frameworks. It is emphasised that the effective integration of AI necessitates not only technological modifications but also cultural and structural transformations. (Ransbotham et al. 2017)

The following paper was published in 2018 by the author Grover, V. – The author's focus is on the strategic use of information systems. In the context of his AI research, he undertakes analyses

of the potential of data-driven competitive advantage and the relationship between digital competencies and managerial decisions.

This cluster underscores the significance of AI in business rationalization and performance enhancement. The authors of the studies do not call into question the usefulness of AI; rather, they investigate the conditions under which it can be successfully implemented. The methodological rigor exhibited in their studies is notable, with a significant proportion of these studies being founded upon quantitative, statistical modelling or meta-analysis. This methodological rigor enables the drawing of reliable conclusions.

Global collaborations: transnational scientific networks

Research on the role of AI in business and management decision-making is highly international in nature. The network of transnational collaborations provides a valuable opportunity to ascertain the extent to which different national research systems are interconnected, and to determine their position within the global scientific field. The nodes in the network represent individual countries, with the size of the nodes indicating publication activity. The connecting lines show joint publications between researchers from different countries. (Figure 7)

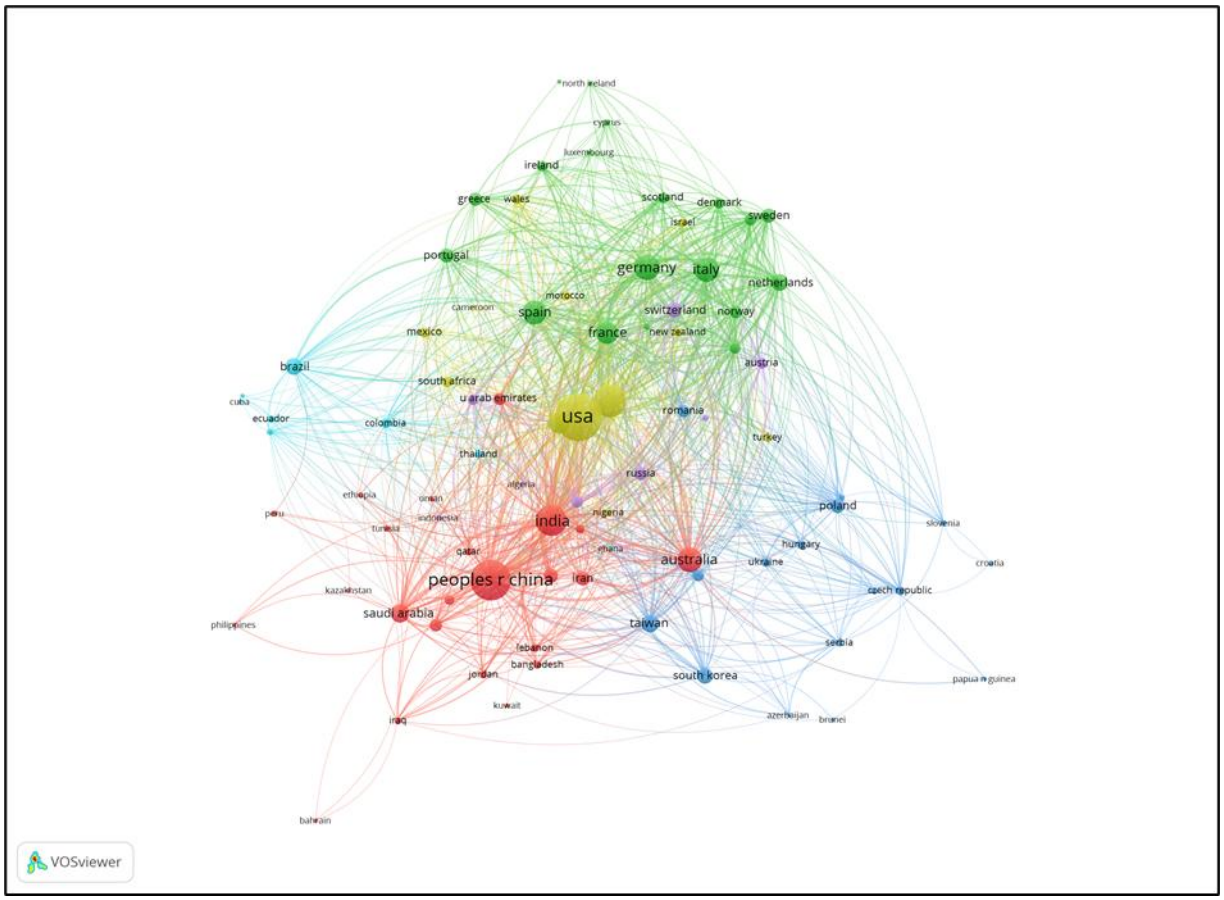

Figure 7: The transnational scientific network (own work by VOSviewer)

Source: own work by VOSviewer

The United States occupies a central position within the network, a fact that is manifest in two principal ways. Firstly, the country is distinguished by its high publication volume. Secondly, it is notable for the considerable number of contacts it maintains. The United States has established close collaborative relationships with researchers in both Europe and Asia, thereby serving as a unifying conduit between scientific communities in disparate regions. This central position is indicative not only of scientific dominance, but also of the coordinating role of US research institutions and universities in global AI research.

China also emerges as a significant hub, characterised by robust internal activity and expanding international connections. While some of these collaborative endeavours are with the US and Australia, it is noteworthy that a distinct and dense network of links has also developed between China, India and Saudi Arabia. This finding indicates that the scientific collaboration between Asia and the Middle East is becoming increasingly prominent, with a distinct research focus emerging in areas such as industrial applications, technological adaptation, and e-governance systems.

With regard to Europe, the network is characterised by its density, yet it is also marked by a fragmentation at the regional level. Germany, France, Italy, the Netherlands and the UK are active participants in research, cooperating mainly with each other and with the US. European countries cooperate closely, and this cooperation frequently focuses on the ethical, regulatory and societal aspects of the use of AI. This approach aligns with the principles of the EU Digital Agenda, which emphasises the concept of "responsible AI".

At the periphery of the network, there are some small but active countries such as Brazil, South Korea, Malaysia or Poland, which are part of the global discourse but have fewer international connections. This phenomenon may be attributable to an increased emphasis on regional research programmes or diminished participation in English-language publications.

The network of cross-country collaborations demonstrates a highly globalised scientific ecosystem, albeit with uneven distribution. The relationships between central and semi-peripheral actors are indicative of both structural power relations and divergent thematic priorities. It is evident that this heterogeneity serves to reinforce the primary thesis of the present study. AI represents a multifaceted phenomenon, encompassing both technological innovation and strategic considerations. Its interpretation and application vary globally, with different cultural interpretations influencing its significance in leadership and decision-making processes.

Synopsis

The role of artificial intelligence (AI) in business and management decision-making has been one of the most dynamically developing areas of research in recent years. The objective of this study is to delineate the organizational framework of this multifaceted scientific discourse by conducting a thorough analysis of pertinent scientific publications. A comprehensive analysis of over 4,000 international articles has yielded three predominant approaches:

- The technological and algorithmic focus is centered on the development, functioning, and technical applications of artificial intelligence (AI).
- Organizational and human-centered interpretations are employed to examine the social and ethical aspects of decision-making.
- Decision support and information management are fields in which artificial intelligence (AI) is utilized as a tool to enhance organizational efficiency and implement data-driven strategies.

The findings indicate that artificial intelligence is not merely a technological innovation; rather, it is a comprehensive, interdisciplinary phenomenon that is transforming the structural, moral, and strategic frameworks of decision-making. The research not only provides a comprehensive mapping of the existing scientific directions in this field but also highlights several emerging trends, including generative artificial intelligence, transparency, and human-machine collaboration. An examination of international cooperation suggests that, although the United States and China play a leading role, there are also active and ethically sensitive research networks in Europe.

The study makes a contribution to the field by offering a more nuanced understanding of the business and management applications of artificial intelligence. Furthermore, it establishes a foundation for future research, providing a valuable reference point for ongoing studies in this area.

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