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ORIGINAL ARTICLE

Thematic mapping of artificial intelligence in management: A bibliometric approach using co-word analysis (2015-2024)

Jorge Arturo Salgado-García [1], Antonia Terán-Bustamante [1,*], Marisol Velázquez-Salazar [1]

[1] Facultad de Ciencias Económicas y Empresariales, Universidad Panamericana, México.
* Corresponding author
Email: ateran@up.edu.mx. **ORCID:** https://orcid.org/0000-0002-0240-5234.

ABSTRACT

Objective. The objective of this study was twofold: first, to map the main themes in the literature on artificial intelligence in management, and second, to explore the relationships between these themes.

Design/Methodology/Approach. A co-word analysis was performed on 15,835 articles indexed in Scopus (2015-2024), with the author's keywords in the field of administration constituting the unit of analysis. The semantic network under consideration was constructed using the 50 most frequent terms, applying normalization by association and the Walktrap algorithm for cluster detection.

Results/Discussion. The results of the analysis indicated that the extant literature was organized around three thematic groups. The first of these focused on conversational interfaces, the second on digital transformation, and the third adopted a computational approach. The thematic structure identified reflected a field in the process of consolidation, with a predominance of technical approaches and limited functional specialization.

Conclusions. Contemporary research endeavors prioritized methodological development over strategic implementation in particular organizational contexts. These findings underscored the necessity for more comprehensive approaches that articulated technology, management, and governance. Moreover, they called for a future agenda that was oriented toward its adoption from sociotechnical perspectives.

Keywords: bibliometrics; co-word analysis; artificial intelligence; management sciences; business; accounting.

1. INTRODUCTION

The field of artificial intelligence (AI) has emerged as a pivotal subject in the realms of technology, business, and science. Despite the fact that its development has been ongoing for decades, the advent of both the novel Coronavirus Disease 2019 (COVID-19) and the launch of ChatGPT by OpenAI in 2022 marked a significant turning point by enabling mass access to advanced language models. This development led to an unprecedented adoption and renewed

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interest in its applications (Brynjolfsson *et al.,* 2023). The pervasive dissemination of AI has given rise to a plethora of discourses concerning its ramifications across diverse domains, including process automation and the reconceptualization of human-machine interaction. For companies, understanding how to integrate AI into their processes has become a strategic necessity. The impact of AI on decision-making processes has been demonstrated to range from the optimization of operational efficiency to the personalization of services (Mikalef & Gupta, 2021). However, the rapid pace of its evolution and the wide range of its applications give rise to inquiries regarding optimal implementation strategies. In light of these considerations, this study endeavors to identify thematic clusters within the scientific production on AI in the domain of administration, employing a bibliometric approach grounded in co-word analysis. The objective of this study is to provide answers to the following research questions: (1) What are the main topics that have been addressed by the extant literature during the specified study period? and (2) What are the conceptual relationships that have been established between the key terms that have been defined by the authors?

1.1. Bibliometric studies on the use of AI in administration

The resurgence of AI commenced in the 1990s with advancements in machine learning (ML) algorithms and augmented processing capabilities. The advent of Big Data and enhanced processing capabilities has enabled the development of increasingly sophisticated models, such as deep neural networks, driven by access to vast repositories of data and hardware optimization (LeCun *et al.,* 2015). The field of AI, as it is currently conceptualized, emphasizes the development of specialized systems designed to execute particular tasks within a defined domain. This approach is referred to as artificial narrow intelligence (ANI), as its capabilities are designed to address specific problems such as image recognition, natural language processing, or business process optimization (Russell & Norvig, 2021). In the context of technological evolution, recent literature has begun to explore how ANI interacts with different economic and organizational sectors. This articulation occurs not only as an enabling technology but also as a catalyst for structural transformations. A multitude of bibliometric studies have contributed to the delineation of this configuration, ranging from its integration into business process management (BPM) to enhance operational efficiency and strategic innovation (Moreira & Dallavalle, 2024) to its role in the collaborative economy, where it facilitates personalization, sustainability, and algorithmic governance (Uskoković *et al.,* 2024).

In the domain of sustainable development, AI is associated with responsible production and consumption. However, its implementation necessitates the resolution of ethical and regulatory challenges (Di Vaio *et al.,* 2020). In the context of Industry 4.0, the ramifications of this paradigm shift extend to economic performance and organizational sustainability (Valaskova & Nagy, 2024). The efficacy of its implementation is contingent on the convergence of technical competencies and human capabilities, particularly in the domains of collaboration and adaptability (Turcato *et al.,* 2024). AI has played a pivotal role as a tool for digital transformation and strategic management, helping to improve operational efficiency, service personalization, and corporate social responsibility. This observation is supported by a bibliometric study on BPM that analyzed articles indexed in Scopus between 1960 and 2023 (Moreira & Dallavalle, 2024). Despite the proliferation of studies exploring the role of AI in various sectors, there are significant gaps in the systematization of its application in the extensive field of administration and in providing an integrated perspective of its thematic structure.

2. METHODOLOGY

To identify the main topics addressed by the scientific literature and the conceptual relationships established between the key terms defined by their authors, a word co-occurrence analysis was performed using the keywords assigned by the authors as the unit of analysis (Donthu *et al.,* 2021). A map was presented with the emerging thematic clusters, and the most relevant articles were selected manually. In this study, the term "administration" is used

as a broad descriptor to refer to the disciplines included in the category "business, management, and accounting" according to the Scopus subject classification (Elsevier, 2025). This category comprises academic publications pertaining to administrative sciences, business management, accounting, organizational behavior, and associated subdisciplines. In Spanish-speaking contexts, the concept of administration typically encompasses these functional areas (Cortés, 2019). The keyword co-occurrence map was constructed using the Bibliometrix package in R (Aria & Cuccurullo, 2017), based on the keywords assigned by the authors in the retrieved articles. The network was generated from the 50 most frequent terms, applying the association normalization method to adjust the co-occurrence values according to the total weight of the nodes. To detect communities within the semantic network, the Walktrap algorithm was used, which identifies thematic clusters through random trajectories that tend to remain within densely connected substructures (Pons & Latapy, 2005). This procedure enabled the visualization of the conceptual structure of the field through thematic clusters derived from the relational proximity between terms.

As part of the standardization process, keywords were manually cleaned up to unify lexical and spelling variants that refer to the same concept. For instance, terms such as "artificial intelligence," "AI," and "artificial intelligence (AI)" were consolidated into a single entry, akin to other instances of pluralization, such as "decision support system" and "decision support systems." Similarly, to avoid the formation of a dominant cluster comprising the term "artificial intelligence," which would hinder the visualization of the underlying thematic structure, it was decided to exclude it from the co-occurrence map. The network under consideration was constructed with the 50 most frequent terms, using the association normalization method, which adjusts co-occurrence values based on the total weight of the nodes. The application of a minimum frequency threshold for the inclusion of terms was not employed, with the objective being the preservation of both established and emerging concepts in the field of study. The interpretation of the clusters was informed by two factors: the spatial proximity of the terms and the internal composition of each cluster. The groups of words were treated as representations of thematic nuclei within the field. To interpret the content, the keywords with the highest frequency and relational weight within each group were analyzed, as well as their position in the factorial space (Cobo *et al.,* 2011). This structural reading was complemented by a manual review of representative articles to validate the thematic coherence of the grouped terms and reinforce the conceptual interpretation of the networks. The sample was obtained through a search of the Scopus database, limited to articles published between 2015 and 2024 that contain the term "artificial intelligence" and belong to the subject area of administration. The year 2015 was selected as the initial point of observation due to its association with the commencement of operations by OpenAI (OpenAI, 2015). The syntax employed in the query is delineated in Equation (1).

```
TITLE-ABS-KEY (artificial AND
intelligence) AND PUBYEAR > 2014
AND PUBYEAR < 2025 AND                    (1)
(LIMIT-TO (SUBJAREA, "BUSI"))
AND (LIMIT-TO (DOCTYPE, "ar"))
```

The initial search yielded a sample of 19,916 documents; however, the unit of analysis was the keywords assigned by the authors, resulting in a final sample of 15,835 articles, excluding those that did not contain that variable. The authors' selection of keywords was driven by their determination to ensure that the lexical elements directly represented the conceptual categories that they deemed to be pivotal to their academic inquiries (Zupic & Čater, 2015). In contrast to other fields, such as the title or abstract, the author's keywords facilitate a more precise capture of the thematic intentions of the document. These keywords have been particularly beneficial for the construction of co-occurrence networks in bibliometric studies (Aria & Cuccurullo, 2017; Salgado-García *et al.,* 2024). This methodological decision was made in order to preserve the semantic coherence and interpretative quality of the thematic analysis, prioritizing consistency in the coding of the terms used.

3. RESULTS

The results indicate that the extant literature on AI in administration can be organized into three primary clusters. Cluster 1 focuses on conversational interfaces, cluster 2 pertains to digital transformation, and cluster 3 is based on a computational approach. This structure demonstrates a discernible orientation toward the technical foundations of AI and its general applications, as opposed to particular administrative functions. Figure 1 presents the thematic map based on co-occurrence. The initial cluster encompasses terms such as "chatgpt," "chatbot," "trust," "ethics," "generative ai," "education," and "anthropomorphism." A significant concentration of research has been observed around the use of generative models and conversational interfaces, with a focus on issues of trust, ethics, personalization, and their application in educational companies. This finding suggests the potential for further research in the domain of human-machine interaction and the social perception of AI, particularly in light of the widespread adoption of ChatGPT. Research has demonstrated that the integration of chatbots has significantly impacted the customer experience across various sectors, including banking. The effectiveness of this integration, facilitated by the reliability of information systems, has been shown to align technological solutions with consumer expectations (Trivedi, 2019). In the tourism sector, generative AI and conversational assistants have assumed a strategic role in enhancing customer interaction, particularly in the post-pandemic era, as they facilitate personalization, booking, and recommendation processes in hotels and travel agencies (Carvalho and Ivanov, 2024; Dwivedi *et al.,* 2023, 2024).

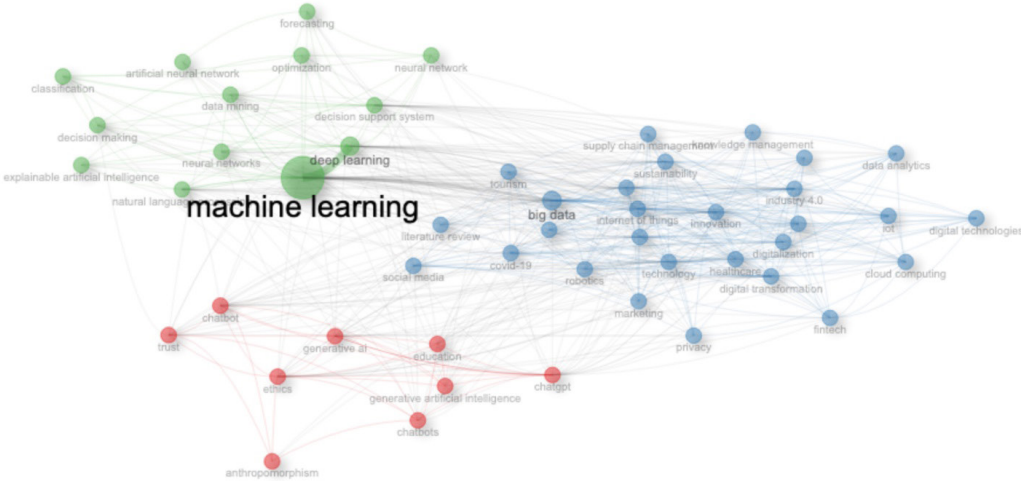

Figure 1. Co-occurrence thematic map. Cluster 1 (red): conversational interfaces, cluster 2 (blue): digital transformation, and cluster 3 (green): computational approach.

In the domain of marketing, AI is presented as a disruptive agent whose implementation necessitates a profound comprehension of the conceptual challenges inherent in digital transformation (Verma *et al.,* 2021). ChatGPT has been demonstrated to enhance consumer engagement, optimize customer service, and generate insights into consumer behavior. However, its utilization also gives rise to inquiries concerning originality, authorship, and reliance on AI (Imran & Almusharraf, 2023). Concerns have been raised regarding potential biases, privacy issues, the dissemination of misinformation, and unethical practices. This has led to a call for regulatory frameworks that ensure transparency and trust in digital interactions (Garvey *et al.,* 2023; Paul *et al.,* 2023). The integration of AI is presented as a catalyst for learning; however, its adoption requires addressing ethical challenges, redefining continuous learning strategies, and ensuring alignment with labor market needs (Abulibdeh *et al.,* 2024). The impact of generative AI and large language models on computer science education has been the subject of detailed analysis. These models have been identified as having a significant impact in

the coming years (Javaid *et al.,* 2023; Prather *et al.,* 2023). Generative AI has been identified as a tool that can enhance productivity. However, its adoption necessitates the implementation of a strategic plan to optimize its benefits while ensuring equitable access to technology (Dwivedi *et al.,* 2023).

The second cluster encompasses terms such as "big data," "industry 4.0," "blockchain," "digital transformation," "internet of things," "automation," "sustainability," "fintech," "healthcare," and "cloud computing." This cluster encompasses research that addresses AI as part of a broader digital transformation environment, with big data being the most developed topic. AI has been integrated into financial and industrial processes in conjunction with other technologies. This field has been well-established for some time, with a wide range of applications spanning various disciplines, including supply chain management and sustainability. In the financial sector, the implementation of AI has seen a marked increase with the objective of enhancing risk management and strategic decision-making. Financial institutions have devised sophisticated credit scoring models that integrate AI with statistical analysis. These models empower financial institutions to enhance lending processes, mitigate losses, and optimize revenue generation (Ala'Raj & Abbod, 2016). Furthermore, the application of metrics to linguistic structures in financial environments has enhanced the analysis of banking information, facilitating a more precise interpretation (Chan & Chong, 2017).

The practice of relationship banking maintains a pivotal function in fostering customer loyalty and in aligning financial services with long-term objectives. However, financial institutions are experiencing mounting pressure to transition toward transaction-centric models. This transition is driven by several factors, including competition from fintech companies and digital platforms, as well as the dynamics of economies of scale. In this context, relationship banking must adapt to the new digital environment to ensure its sustainability (Jakšič & Marinč, 2019). From an organizational perspective, banking institutions must fortify their internal capacities to embrace AI technologies, particularly through management training and proactive engagement with regulators and other actors within the financial ecosystem. Mogaji and Nguyen (2022) propose a conceptual framework that underscores the interaction between customers, financial institutions, and external stakeholders. The authors emphasize that effective AI adoption depends on a clear understanding of business objectives and the resources available to maximize its impact.

In the commercial sphere, the proliferation of digital data and technologies has facilitated the automation and optimization of campaigns, as well as a greater capacity to generate relevant content and qualified leads (Ameen *et al.,* 2022; Kshetri *et al.,* 2024; Quach *et al.,* 2022). The integration of AI within the digital transformation process is driven by its capacity to personalize messages for specific segments, thereby enhancing efficiency in customer acquisition and business relationship management. Supply chain management (SCM) is another topic that is extensively addressed in this cluster. The advent of digital technologies has been instrumental in fostering end-to-end visibility, a pivotal factor in enhancing resilience to disruptions, particularly in crisis contexts such as pandemics (Ivanov, 2024). The utilization of AI in operational decision-making, the adoption of AI by consumers, and the integration of circular economy principles have emerged as pivotal trends in the sector (Dwivedi *et al.,* 2023). The digitization of the supply chain is an extensive process that extends beyond mere operational efficiency, encompassing a wide range of applications, including product design and business model optimization (Rusch *et al.,* 2023). However, these technological advancements must be complemented by improvements in materials handling and their integration with physical processes, as daily operational efficiency continues to depend on the articulation between algorithmic decisions and material execution (Kusiak, 2018; Rolf *et al.,* 2023).

Digitalization has been demonstrated to enhance resilience during periods of crisis (Ivanov, 2024). However, its long-term efficacy is contingent upon the strategic implementation of AI models that are customized to the industrial milieu. Consequently, AI and ML have been employed to advance the sustainable

development goals (SDGs), facilitate the circular economy, and enable enhanced management of the interaction between the environment, the economy, and society. In the contemporary business landscape, various sectors, including but not limited to construction, transportation, manufacturing, healthcare, agriculture, and water management, have adopted AI-based solutions with the objective of enhancing sustainable practices while safeguarding the well-being of future generations (Kar *et al.,* 2022). The third and final cluster encompasses terms such as "machine learning," "deep learning," "decision support system," "data mining," "neural networks," "optimization," and "forecasting." This cluster is characterized by its technical nature, with a focus on the underlying algorithms, models, and computational techniques. In this particular cluster, the focus is on the analysis of AI as a tool that can support various decision-making processes, ML algorithms, classification systems, and prediction models. This cluster is indicative of an algorithmic and analytical orientation, a common feature in quantitative studies applied in management contexts. Table 1 presents the five most frequently occurring keywords in each of the thematic clusters.

Cluster	Keyword	Occurrence
Conversational interfaces	chatgpt	319
	ethics	231
	generative ai	185
	trust	153
	chatbot	149
Digital transformation	big data	547
	industry 4 0	408
	internet of things	349
	digital transformation	323
	sustainability	300
Computational approach	machine learning	1828
	deep learning	588
	decision support system	455
	natural language processing	192
	data mining	167

Table 1. The five most frequently occurring keywords by thematic cluster.

"Machine learning" is the field of study concerned with the ability of systems to learn from data and build analytical models without the use of explicit programming. In contrast, "deep learning (DL)" employs deep neural networks to process unstructured information such as text, images, or audio. In contrast to conventional ML, which necessitates manual feature extraction and operates effectively with structured data, DL automates this process and adapts to complex tasks with large volumes of data (Janiesch *et al.,* 2021; LeCun *et al.,* 2015; Rudin, 2019; Zhang and Ling, 2018). The methodological distinctions underlying these approaches elucidate their complementary nature in organizational contexts, encompassing applications ranging from predictive classification to strategic decision automation. Machine learning techniques have been employed to enhance decision-making processes in critical domains. In dynamic pricing, algorithms adjust prices in real time based on demand patterns and consumer behavior, improving profitability (Chen *et al.,* 2016). In the field of sales, classification models facilitate the prioritization of leads with a higher probability of conversion and the optimization of commercial resources (Kumar *et al.,* 2019). In the field of human resources, the implementation of ML algorithms has been shown to facilitate the prediction of employee turnover, thereby enabling the implementation of preventive measures and enhancing talent retention (Raj *et al.,* 2024). The extant literature acknowledges the persistence of impediments to implementation, including the absence of explicit

regulations and incentives, the high cost of infrastructure necessitated by voluminous data, resistance to change, and a paucity of strategic alignment. It also identifies a shortage of specialized talent in AI and data analysis (Bag & Pretorius, 2022).

4. DISCUSSION

The results of the analysis demonstrate a thematic structure that remains predominantly undiversified, with a mere three substantial clusters aggregating terms associated with conversational interfaces, digital transformation, and computational approaches. This configuration can be interpreted as an indication that the field of study is in an early stage of thematic structuring, in which lines of research have not yet fragmented into specific functional subfields. The presence of a few large clusters is characteristic of emerging or interdisciplinary fields in the process of consolidation, where central themes tend to be organized around general concepts (Zupic & Čater, 2015). Furthermore, cluster density can be utilized as an indicator of thematic specialization; the presence of low differentiation between conceptual nuclei reflects a field that is still seeking cognitive stability (Callon *et al.,* 1991). Consequently, these results suggest the need for more granular analysis in future research, especially focused on specific organizational functions. The thematic structure obtained also reveals a bias toward predominantly technological approaches, with a strong concentration on terms such as machine learning and deep learning. This algorithmic orientation lends further credence to the notion that a significant portion of the extant literature on AI applied to management has been developed from a methodological perspective, with a pronounced focus on computational models rather than the organizational processes they are intended to transform. This phenomenon had already been identified in previous studies, which noted that technology-intensive fields of research tend to prioritize the development of technical tools and frameworks while neglecting the contextual understanding of their applications (Mikalef *et al.,* 2018).

In the context of administration, this discrepancy can result in a divergence between the technical capabilities of AI and its effective implementation in complex organizational environments. While methodological advances are essential, the scarcity of terms associated with specific functions suggests that the integration of AI has not yet been addressed in a differentiated manner from a managerial or strategic perspective. Consequently, research in intelligent systems must evolve from the functional analysis of algorithms to their critical integration into organizational processes, taking into account power dynamics, organizational culture, and decision-making in uncertain environments (Berente *et al.,* 2021). The initial cluster underscores the emergence of a pivotal line of inquiry concerning the ethical, social, and cognitive ramifications of AI, particularly in the context of the pervasive adoption of generative models. In contrast to the other clusters, this group does not prioritize technical or organizational processes. Instead, it focuses on the effects of human-machine interaction. This suggests a shift in the literature toward analyzing the conditions for the appropriate and responsible use of AI. The rapid proliferation of algorithmic systems in sensitive contexts necessitates a systematic evaluation of their ethical implications, including transparency, explainability, privacy, and algorithmic justice (Mittelstadt *et al.,* 2016). Trust in these systems poses a multifaceted challenge, encompassing technical, organizational, and communicative aspects. The sustainable adoption of AI is contingent upon the institutionalization of processes that ensure accountability and govern the algorithms underlying these systems (Rai *et al.,* 2019).

The findings indicate that a shift in research focus is necessary, with a portion of the research effort being redirected toward the development of more integrative frameworks. These frameworks should address the design of intelligent technologies, their contextual insertion into organizational management, their effects on work practices, and the regulatory challenges involved in their adoption. A potential trajectory for future research endeavors could involve the adoption of AI from a sociotechnical vantage point, one that incorporates cultural and organizational structural elements.

5. CONCLUSIONS

A bibliometric analysis of co-words identified three thematic clusters that structure AI research in administration: conversational interfaces, digital transformation, and computational approaches. These results indicate that the field is undergoing a period of consolidation, characterized by a predominant technical orientation and an increasing focus on the ethical and social implications of AI. Despite the notable advancements witnessed in the literature, persistent gaps persist in terms of functional specialization and organizational contextualization. In light of these findings, it is imperative to explore avenues of research that diverge from the computational paradigm. First, it is recommended that the adoption of AI in specific organizational functions be explored through sectoral and comparative studies. Second, it is proposed that an investigation be conducted into the organizational factors that condition the effective adoption of AI in companies. Finally, it is recommended that the ethical and regulatory implications of AI systems be strengthened by analyzing them through the lenses of governance, inclusion, and algorithmic justice. These research lines have the potential to contribute to a more contextualized, multidisciplinary, and sustainable organizational transformation agenda driven by AI.

Conflict of interest

The authors declare that there is no conflict of interest.

Contribution statement

Conceptualization, data curation: Jorge Arturo Salgado-García, Antonia Terán-Bustamante.

Formal analysis, supervision, visualization, original draft writing, revision, and editing: Jorge Arturo Salgado-García, Antonia Terán-Bustamante, Marisol Velázquez-Salazar.

Validation: Antonia Terán-Bustamante, Marisol Velázquez-Salazar.

Statement of data consent

The data generated during the research have been presented in the article. ●

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