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Bibliometric Mapping Of The Literature On Ai In Workforce Recruitment: Visualization Of Trends And Scientific Collaborations

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ABSTRACT

This study aims to explore the research landscape of artificial intelligence (AI) in recruitment and selection within human resource management by mapping publication trends, intellectual structures, and emerging themes. Using a bibliometric analysis of 404 Scopus-indexed documents and tools such as Bibliometrix and VOSviewer, the study examines scholarly output, collaboration networks, and thematic clusters from global research. Results show a rapid increase in publications since 2018, with a peak in 2024, driven by key technologies including machine learning, natural language processing, and predictive analytics. Emerging areas such as generative AI (e.g., ChatGPT), blockchain, and virtual reality are gaining traction, while ethical concerns around fairness, transparency, and algorithmic bias are becoming increasingly prominent. The research highlights South Asia, particularly India, as a leading contributor, though the field remains globally diverse. These findings provide a comprehensive overview of the evolving AI in recruitment domain, offering theoretical insights and practical guidance for HR professionals and policymakers. The study underscores the need for multidisciplinary, ethically informed approaches to ensure AI-driven recruitment is both efficient and equitable.

Keywords: *artificial intelligence, recruitment, bibliometric analysis, algorithmic bias, human resource management*

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1. INTRODUCTION

The digital transformation of human resource management (HRM) has accelerated rapidly in recent years, with the adoption of artificial intelligence (AI) emerging as one of its primary drivers. AI is increasingly applied in recruitment and selection processes—ranging from initial screening, résumé analysis, and video interviewing to psychometric assessments—substantially enhancing efficiency, accuracy, and objectivity in decision-making (Upadhyay & Khandelwal, 2018; Tambe et al., 2019). Recent studies also emphasize that AI is reshaping recruitment into a data-driven discipline, enabling organizations to make evidence-based talent decisions at an unprecedented scale (Qin et al., 2023).

Scholarly attention toward AI in HRM has grown significantly. (Hamouche et al. 2023) observed that AI adoption enhances organizational productivity while introducing new managerial and ethical challenges. Similarly, (Benabou & Touhami, 2025), through a PRISMA-based systematic review, found that AI applications in HRM span various stages of the employee lifecycle but remain dominated by technical perspectives. (Kaushal et al. 2023), using bibliometric methods, highlighted that the field is rapidly expanding yet lacks integration across disciplines.

Despite its potential, the use of AI in recruitment raises critical concerns related to ethics, fairness, and transparency. (Raghavan et al. 2020) warned that algorithmic hiring systems may inadvertently reproduce social biases if not properly designed. (Leicht-Deobald et al. 2019) further argued that algorithm-based decision-making challenges personal integrity and organizational legitimacy. (Mujtaba & Mahapatra 2024) emphasized the importance of algorithmic fairness, while Mori et al. (2025) reviewed ethical frameworks for AI-driven recruitment using theories of justice. Moreover, Nosratabadi et al. (2022) underlined the need to consider the entire employee lifecycle rather than limiting AI applications solely to candidate selection.

Although the body of literature is expanding, it remains fragmented and predominantly technical. Social, psychological, and organizational aspects of AI-driven recruitment remain underexplored (Hamouche et al., 2023; Aydin et al., 2024). This highlights the need for a multidisciplinary approach that integrates insights from computer science, psychology, and organizational behavior. Wamba et al. (2022) also stressed that AI adoption in HR entails not only technological innovation but also operational and managerial challenges in practice.

The urgency of this study lies in addressing three dimensions. Academically, most existing research remains conceptual or case-based, with insufficient quantitative mapping; therefore, bibliometric analysis is essential to uncover research trends, dominant themes, and scholarly collaboration. Practically, organizations urgently require an evidence-based overview of the rapidly evolving knowledge landscape to implement AI-driven recruitment strategies that are not only efficient but also ethical, transparent, and effective. Without such mapping, firms risk adopting technologies reactively, overlooking issues of fairness, trust, and legitimacy. Socially, algorithmic bias in recruitment has profound implications for equal employment opportunities and public trust in AI-based selection systems.

Accordingly, this study aims to fill these gaps by conducting a bibliometric analysis of the scientific literature on AI in recruitment. By systematically mapping research trends, collaboration networks, and emerging themes, this research aims to:

1. Identify publication trends and developments in AI topics in recruitment.
2. Explore collaboration networks between authors, institutions, and countries.
3. Uncover dominant keywords and emerging research themes.
4. Develop a scientific visualization map to show the direction of future research..

2. LITERATURE REVIEW

The rapid advancement of artificial intelligence (AI) has significantly transformed human resource management (HRM) practices. AI refers to computational systems capable of performing complex cognitive tasks such as learning, reasoning, and decision-making (Russell & Norvig, 2021). In HRM, AI applications are increasingly visible through machine learning, natural language processing, and algorithmic analytics, which support recruitment, performance evaluation, training, and employee

development (Black & van Esch, 2020a). Particularly in recruitment, AI has improved efficiency via applicant tracking systems (ATS), automated résumé screening, video interviews, and personalized candidate communication (Tambe et al., 2019; Van Esch et al., 2019). These developments provide the basis for hypothesizing that AI adoption enhances recruitment efficiency and candidate experience.

Beyond efficiency, fairness and trust have emerged as central concerns. (Zhou et al. 2021) found that algorithmic fairness strengthens candidates' trust and justice perceptions, while (Strohmeier & Piazza, 2022) demonstrated that algorithm-based decisions are perceived as more consistent than human judgments. Similarly, (Savani et al., 2023) confirmed that fairness perceptions significantly influence candidates' acceptance of AI-driven recruitment. Together, these studies underpin the hypothesis that perceived fairness in algorithmic selection positively influences candidate trust and acceptance.

At the same time, ethical challenges remain. Raghavan et al. (2020) warned that algorithmic hiring systems may perpetuate historical discrimination embedded in training data. Fabris et al. (2023) showed that marginalized applicants often view algorithmic selection as dehumanizing in the absence of transparency, and Köchling & Wehner (2020) emphasized the need for systematic audits of fairness. These findings highlight that bias mitigation and transparency are critical factors shaping candidate perceptions of legitimacy. The human-centered AI perspective of Raisch & Krakowski (2021) further reinforces that AI in HRM must balance efficiency with ethical responsibility and employee well-being.

From the organizational perspective, readiness and strategic integration play decisive roles. Jha & Kumar (2023) identified managerial support, digital literacy, and cultural alignment as critical readiness factors, while Mollah et al. (2024) found that AI-augmented HRM contributes to sustainable performance when embedded in organizational strategy. Meijerink et al. (2021) argued that digital HRM not only improves decision quality but also elevates HR from an administrative to a strategic function. These studies support the hypothesis that organizational readiness positively moderates the effectiveness of AI adoption in HRM.

The scholarly field itself has experienced rapid growth. Bibliometric reviews by (Zupic & Čater, 2015) and (Donthu et al., 2021) stressed the importance of mapping research trends to capture the evolving knowledge structure. More recently, (Bondarouk et al., 2023) observed a shift from technical efficiency toward ethical and sustainability dimensions, consistent with the human-centered HRM paradigm. (Mendling et al., 2020) identified four dominant research clusters—machine learning for HR, AI in recruitment, decision support systems, and AI for training—while (Cuesta-Valiño et al., 2024) highlighted AI's growing role in onboarding and training. These findings indicate that research attention is progressively moving toward integrating AI throughout the HR lifecycle while emphasizing ethics, fairness, and strategic alignment.

In summary, the literature consistently demonstrates that AI adoption enhances efficiency and objectivity in recruitment, but ethical concerns regarding bias, fairness, and transparency remain central. Candidate fairness perceptions and organizational readiness emerge as decisive factors for successful implementation. Thus, the hypotheses guiding this study are grounded in prior evidence that (1) fairness and transparency in AI-based recruitment positively influence candidate trust and acceptance, and (2) organizational readiness enhances the impact of AI adoption on sustainable HR outcomes. This provides a strong theoretical justification for conducting a bibliometric analysis to capture the state of the field, dominant research streams, and existing gaps.

3. RESEARCH METHOD

This research uses a bibliometric approach to analyze the scientific literature related to the application of Artificial Intelligence (AI) in the workforce recruitment process. The bibliometric approach enables quantitative analysis of scientific publications to identify research trends, scientific collaboration, and the intellectual structure of a field of study (Donthu et al., 2021) (Zupic & Čater, 2015).

3.1. Research Design

This study adopts a descriptive-quantitative design employing bibliometric analysis to systematically examine the body of literature on the application of Artificial Intelligence (AI) in workforce recruitment and selection. Bibliometric analysis is widely recognized as a robust method for quantifying and visualizing patterns within scientific publications, allowing researchers to

uncover publication trends, scholarly collaboration networks, and the intellectual structure of a research field (Donthu et al., 2021); Zupic & Čater, 2015). Unlike traditional narrative reviews, bibliometrics provides objective and replicable results based on citation data and metadata from large-scale bibliographic databases. Data visualization in this study was conducted using specialized bibliometric software, which enables the graphical mapping of co-authorship, keyword co-occurrence, and co-citation relationships, thereby offering insights into both historical foundations and emerging frontiers of the field (Aria & Cuccurullo, 2017).

3.2. Data Source

The dataset was obtained from the Scopus database, which was selected due to its comprehensive coverage, multidisciplinary scope, and international credibility. Scopus provides access to standardized metadata, including article title, abstract, keywords, author names, institutional affiliations, references, and citation counts, which are essential for bibliometric research (Mongeon & Paul-Hus, 2016). Compared with other databases such as Web of Science (WoS) or Google Scholar, Scopus offers broader coverage across management, computer science, and social sciences, ensuring a more representative corpus of AI-in-recruitment literature.

3.3. Search Strategy

The literature search was conducted using the following keyword combinations: ("Artificial Intelligence" OR "AI") AND ("Recruitment" OR "Hiring" OR "Talent Acquisition") AND ("Human Resource" OR "HR"). The search was limited to peer-reviewed journal articles, conference proceedings, and book chapters published in English. This deliberate scope ensures high-quality and accessible publications while maintaining focus on AI applications within the HR recruitment domain. To minimize potential bias, the search strategy was iteratively refined by testing keyword variations and examining sample records for relevance.

3.4. Analysis Procedure

The analysis steps were carried out as follows:

3.4.1. Data Extraction

The metadata of all retrieved publications were exported in .CSV and .RIS formats, containing bibliographic information such as authorship, title, keywords, affiliations, abstracts, and references. These files were imported into bibliometric software tools such as VOSviewer for processing and analysis.

3.4.2. Data Cleaning

Before the analysis, the dataset underwent a thorough cleaning process to ensure accuracy and consistency. Author name disambiguation was performed to merge different variations of the same researcher's name, while institutional affiliations were standardized to consolidate records referring to the same organization under different formats. In addition, keyword normalization was conducted to unify synonyms and adjust for variations such as singular and plural forms (e.g., "AI recruitment" and "artificial intelligence in hiring"). These steps were essential to reduce duplication and inconsistency in the data, thereby enhancing the validity of the co-occurrence and co-citation networks (van Eck & Waltman, 2010).

3.4.3. Bibliometric Analysis

After the data were retrieved and cleaned, the bibliometric analysis was carried out using both performance indicators and science mapping techniques. The performance analysis included several dimensions:(1) the annual distribution of publications (year) to illustrate the growth trend of research on AI in recruitment, (2) the sources or journals (source) publishing the most relevant studies, (3) the most productive authors contributing to the field, (4) institutional affiliations (affiliation) to identify leading organizations, (5) territorial distribution (territory) to analyze contributions by countries or regions, (6) document type (type) such as journal articles, conference papers, or book chapters, and (7) subject areas (subject area) to capture the disciplinary orientation of the publications. These indicators provide a comprehensive overview of the productivity, impact, and geographical as well as disciplinary spread of the literature.

Beyond descriptive performance indicators, science mapping was conducted through co-occurrence analysis of keywords, which helps identify dominant themes and conceptual structures in the field. To gain deeper insights, the analysis included three complementary visualizations: the co-occurrence network, which shows the relationships and clustering of keywords; the overlay

visualization, which highlights the temporal evolution of themes by displaying average publication years of keywords; and the density visualization, which emphasizes the frequency and intensity of keyword use across the corpus. Together, these mapping techniques enable the identification of both established research domains and emerging frontiers in the application of AI to workforce recruitment.

4. RESULTS AND DISCUSSION

4. 1 RESULTS

Based on the results of a bibliometric analysis of 404 scientific documents containing the keyword combinations “artificial intelligence” OR “machine learning” AND “recruitment” OR ‘hiring’ OR “talent acquisition” OR “employee selection” AND “human resource management,” obtained from the Scopus database, a number of important patterns were found that reflect the development of research in recent years, including:

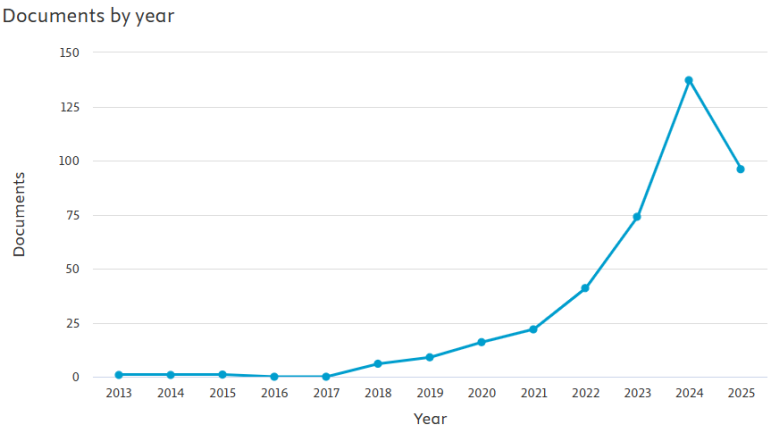

Figure 1. Document Distribution By Year

Sources: Data Processed (2025)

Figure 1 illustrates the annual distribution of scientific publications concerning the application of Artificial Intelligence (AI) in workforce recruitment from 2013 to 2025. For over a decade—from 2013 to 2017—the number of publications remained very low and sporadic, with zero to one document per year. This reflects the nascent stage of AI implementation in recruitment and the limited academic engagement with this topic during that time.

A notable increase begins in 2018, marking the emergence of scholarly interest, with six documents published, followed by nine in 2019. The growth trend continues steadily into 2020 (16 documents) and 2021 (22 documents), indicating a shift toward recognizing the potential of AI technologies in human resource management. The trend becomes more pronounced in 2022 with 41 publications, followed by a sharp rise in 2023 (74 documents).

The peak of publication activity is observed in 2024, with 137 documents published—representing the height of academic engagement with the topic. Although a decrease occurs in 2025 with 96 documents, the number remains significantly higher compared to earlier years, suggesting that AI in recruitment remains a vital and expanding field of research.

This substantial increase in publications in the past five years reflects the convergence of technological advancement, organizational demand for digital transformation, and the growing academic emphasis on exploring the implications of AI-driven recruitment processes. Future research is likely to focus on refining AI applications, addressing ethical considerations, and evaluating the effectiveness of AI systems in diverse recruitment contexts.

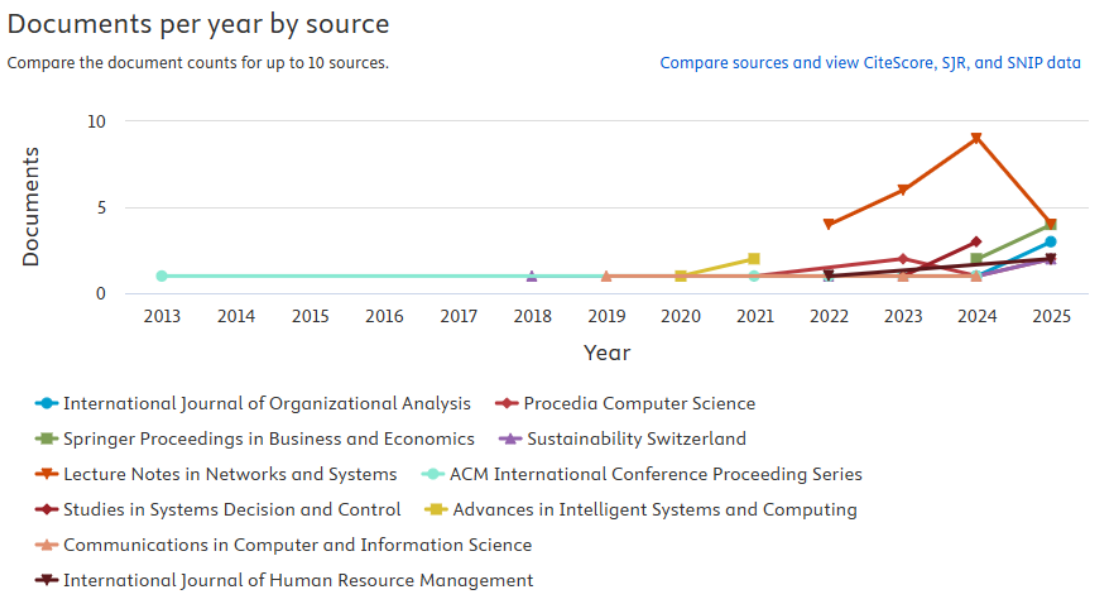

Figure 2. Document Distribution By Source

Sources: Data Processed (2025)

Figure 2 illustrates the annual distribution of documents published from 2013 to 2025 across ten prominent academic sources related to artificial intelligence (AI) in recruitment and human resource management. The data reveals a notable increase in scholarly attention beginning in 2020, with a significant surge observed in 2023 and 2024. *Lecture Notes in Networks and Systems* demonstrates the most substantial growth, peaking in 2024 with the highest number of publications, indicating its prominence as a preferred outlet for research in this domain. Similarly, the *ACM International Conference Proceeding Series* shows consistent publication activity from 2013 through 2025, suggesting a sustained interest in AI applications within computer science conferences. Other sources such as the *International Journal of Organizational Analysis*, *Procedia Computer Science*, *Sustainability Switzerland*, and *International Journal of Human Resource Management* have also contributed increasingly to the literature, particularly after 2021. This trend underscores the growing interdisciplinary engagement and expanding academic discourse surrounding the integration of AI technologies in workforce recruitment and management processes

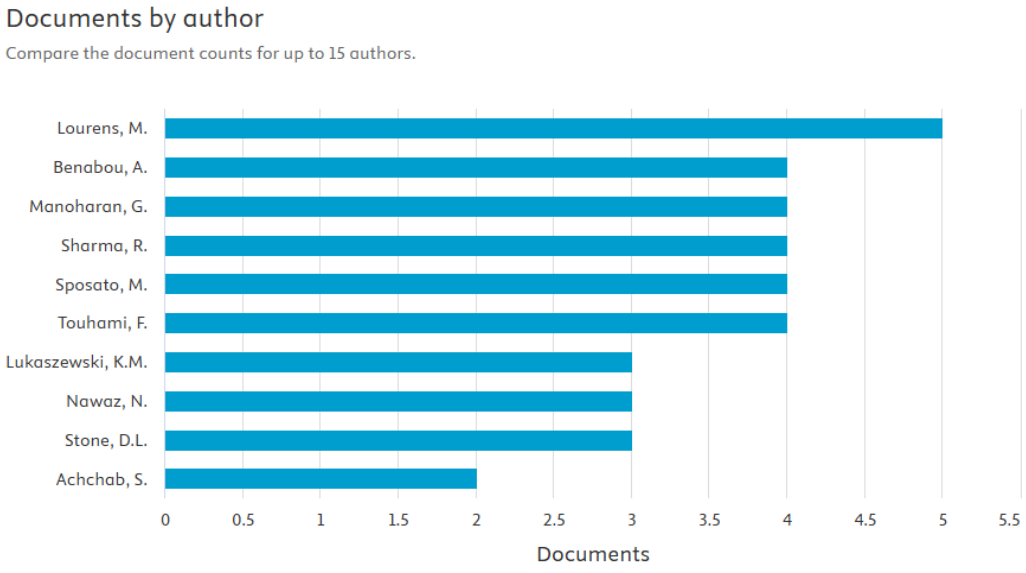

Figure 3. Document Distribution By Author

Sources: Data Processed (2025)

Figure 3 displays the top contributing authors in the field of artificial intelligence (AI) in recruitment, based on the number of documents published. Among the leading scholars, Lourens, M., emerges as the most prolific author with a total of five publications. This is followed by several authors, Benabou, A., Manoharan, G., Sharma, R., Sposato, M., and Touhami, F., each contributing four publications. Additionally, Lukaszewski, K.M., Nawaz, N., and Stone, D.L. each have three publications, while Achchab, S. has authored two documents. This data highlights a diverse group of contributors to the literature, indicating that the topic of AI in recruitment is being explored by a relatively distributed yet growing scholarly community. The consistent output among multiple authors suggests the emergence of influential researchers and potential thought leaders in this evolving research domain.

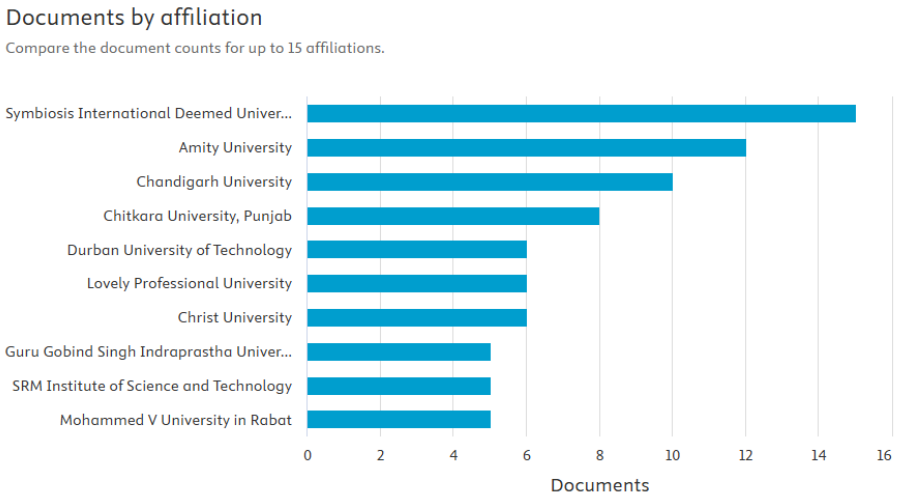

Figure 4. Document Distribution By Affiliation

Sources: Data Processed (2025)

Figure 4 highlights the leading institutional affiliations contributing to the literature on artificial intelligence (AI) in recruitment. Symbiosis International Deemed University stands out as the most active institution with a total of 15 published documents, followed by Amity University and Chandigarh University, each contributing 12 and 10 documents, respectively. Chitkara University, Punjab, Durban University of Technology, Lovely Professional University, and Christ University also show notable engagement with 8 to 6 publications. Meanwhile, institutions such as Guru Gobind Singh Indraprastha University, SRM Institute of Science and Technology, and Mohammed V University in Rabat each contributed five documents. This distribution indicates that research on AI in recruitment is being driven primarily by academic institutions in India and other developing countries, reflecting their increasing investment and interest in digital transformation within human resource practices.

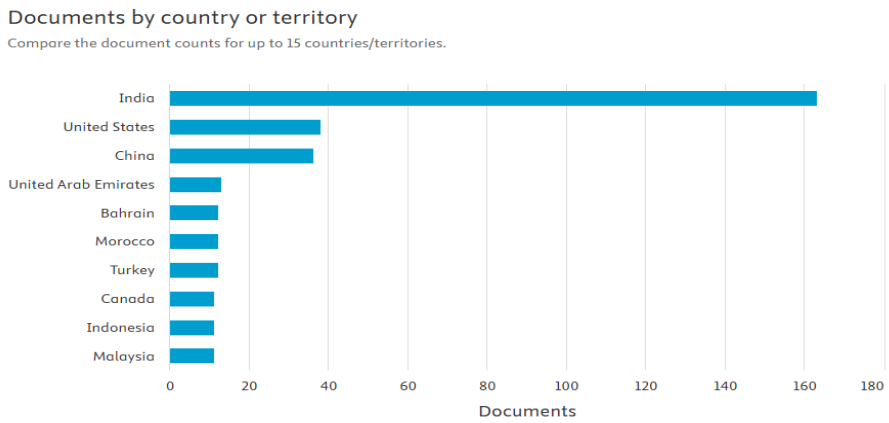

Figure 5. Document Distribution By Territory

Sources: Data Processed (2025)

Figure 5 presents the distribution of documents by country or territory, illustrating the global landscape of research on artificial intelligence (AI) in recruitment. India dominates the field with a significant margin, contributing more than 160 publications—far surpassing all other countries. The United States and China follow distantly with around 40 publications each, indicating moderate levels of research activity. Countries such as the United Arab Emirates, Bahrain, Morocco, Turkey, Canada, Indonesia, and Malaysia contribute fewer than 20 documents each. This data highlights a regional concentration of research activity, particularly in India, reflecting the country's increasing academic engagement and policy interest in AI technologies for talent acquisition and human resource management. The participation from diverse geographical regions also points to a growing global awareness and adoption of AI-driven recruitment practices, albeit with varying intensities.

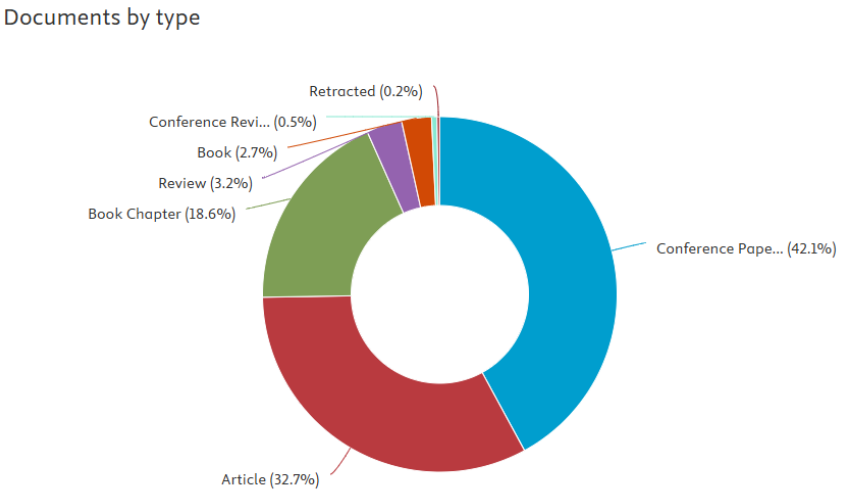

Figure 6. Document Distribution By Type

Sources: Data Processed (2025)

Figure 6 illustrates the distribution of documents by type within the literature on artificial intelligence (AI) in recruitment. The majority of publications are in the form of conference papers (42.1%), indicating the field's dynamic and evolving nature, often discussed in academic and professional gatherings. This is followed by journal articles (32.7%), reflecting peer-reviewed contributions that provide more in-depth and validated insights. Book chapters also represent a significant portion (18.6%), highlighting the inclusion of this topic in broader academic volumes. Other document types include reviews (3.2%), books (2.7%), conference reviews (0.5%), and a very small fraction of retracted documents (0.2%). This composition suggests that while the field is still developing—heavily discussed in conference settings—it is also gaining traction in more stable and scholarly formats like journal articles and academic books.

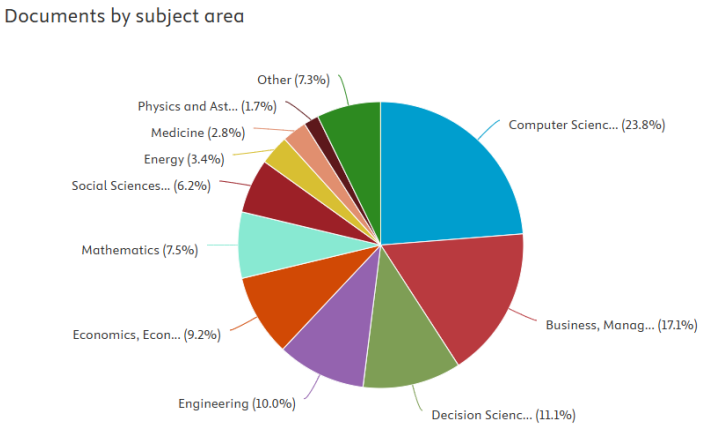

Figure 7. Document Distribution By Subject Area

Sources: Data Processed (2025)

Figure 7 categorizes the documents related to artificial intelligence (AI) in recruitment by subject area, revealing a highly interdisciplinary research landscape. The largest proportion of publications is contributed by the field of computer science (23.8%), emphasizing the technological foundation of AI development and applications. This is followed by Business, Management, and Accounting (17.1%) and Decision Sciences (11.1%), reflecting the managerial and strategic implications of AI integration in recruitment processes. Engineering (10.0%), economics and econometrics (9.2%), and mathematics (7.5%) also represent notable shares, suggesting the involvement of analytical modeling and system design in this domain. Other contributing areas include social sciences (6.2%), energy (3.4%), medicine (2.8%), and physics and astronomy (1.7%), along with a collective 7.3% from other disciplines. This distribution underscores the multifaceted nature of AI in recruitment, which intersects with computational, organizational, social, and economic dimensions.

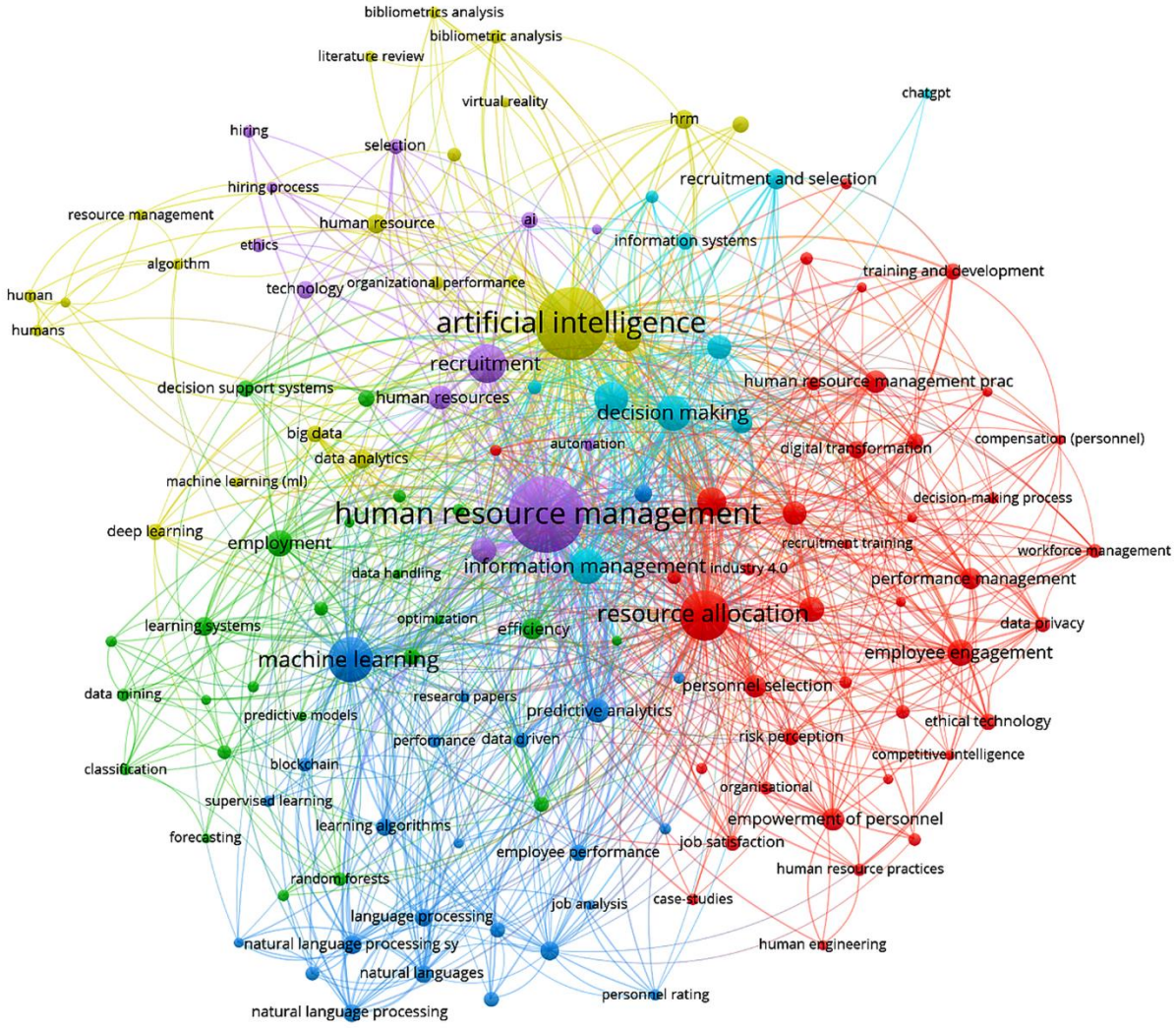

Figure 8. Co-occurence Analysis Network Visualization

Sources: Data Processed (2025)

The co-occurrence network presented in Figure 8 reveals six distinct thematic clusters that structure the current research landscape on artificial intelligence (AI) in recruitment and human resource management. Each cluster represents a different research focus, reflecting the field's interdisciplinary nature and evolving complexity.

The first cluster (red) revolves around strategic human resource management and workforce optimization. Key terms such as resource allocation, employee engagement, performance management, empowerment of personnel, and job satisfaction dominate this cluster, underscoring the strategic integration of AI in enhancing workforce productivity and organizational performance.

The frequent co-occurrence of terms like "decision-making process," "recruitment training," and "workforce management" indicates that AI is being leveraged to support strategic HR decision-making. Moreover, the presence of data privacy, ethical technology, and competitive intelligence signals a growing discourse around the ethical implications of AI deployment in personnel processes. This cluster emphasizes the managerial, operational, and ethical dimensions of AI adoption in human capital management.

The second cluster (blue) is concentrated on the technical and computational underpinnings of AI, with central keywords such as machine learning, natural language processing, predictive models, supervised learning, classification, data mining, and language processing. This cluster reflects a strong research orientation toward the development and application of AI algorithms to automate and optimize recruitment processes. The inclusion of terms such as "forecasting," "blockchain," "learning algorithms," and "employee performance" demonstrates how computational methods are being applied to predict candidate success, detect hiring patterns, and improve decision accuracy. Overall, this cluster indicates a focus on technical innovations aimed at advancing recruitment intelligence.

The third cluster (green) focuses on data-driven employment analytics and decision support systems. Keywords such as employment, data analytics, deep learning, learning systems, big data, and decision support systems are central here. This cluster bridges the gap between algorithmic development and its real-world application in employment contexts. The appearance of optimization, data handling, and efficiency suggests an interest in using advanced analytics to enhance HR processes and employment outcomes. It also reflects the rising use of big data and AI tools to inform evidence-based decision-making in talent acquisition and workforce planning.

The fourth cluster (yellow) engages with the human and ethical dimensions of AI in recruitment. Dominant terms include ethics, humans, hiring, selection, human resources, and technology organization. This cluster addresses the social, ethical, and philosophical concerns arising from AI's involvement in decision-making processes related to people. Topics such as bias, transparency, and fairness in AI systems are implicitly reflected through these keywords. This cluster emphasizes the need for responsible AI that aligns with organizational values and societal norms, particularly in contexts that directly affect individual careers and livelihoods.

The fifth cluster (purple) represents the meta-analytical and methodological layer of the literature. Keywords such as "bibliometric analysis," "bibliometrics," "literature review," and "virtual reality" suggest a body of work focused on mapping the intellectual structure of the field and exploring emerging technologies. The inclusion of HRM and organizational performance indicates that researchers are examining not only the empirical effects of AI but also how the knowledge base itself is evolving. This cluster provides an overview of the field’s maturity, publication trends, and thematic trajectories.

Finally, the sixth cluster (light blue) reflects current and emerging trends, particularly the integration of generative AI tools into recruitment processes. Terms like ChatGPT, recruitment and selection, and information systems point to new directions in AI research. The emergence of generative AI as a topic of interest shows how tools such as ChatGPT are being explored for their potential in candidate interaction, interview simulation, and resume screening. This cluster represents the cutting-edge frontier of research, where novel technologies are actively being tested and evaluated in HR contexts.

In conclusion, the co-occurrence analysis reveals that research on AI in recruitment is multifaceted, spanning technical, managerial, ethical, and methodological dimensions. The interconnectedness among clusters demonstrates the convergence of computational innovation and human-centered concerns, suggesting a maturing field with strong potential for practical implementation and theoretical expansion. As AI technologies continue to evolve, future research is expected to further bridge these domains, addressing not only efficiency and accuracy but also fairness, transparency, and the human impact of AI-driven recruitment systems.

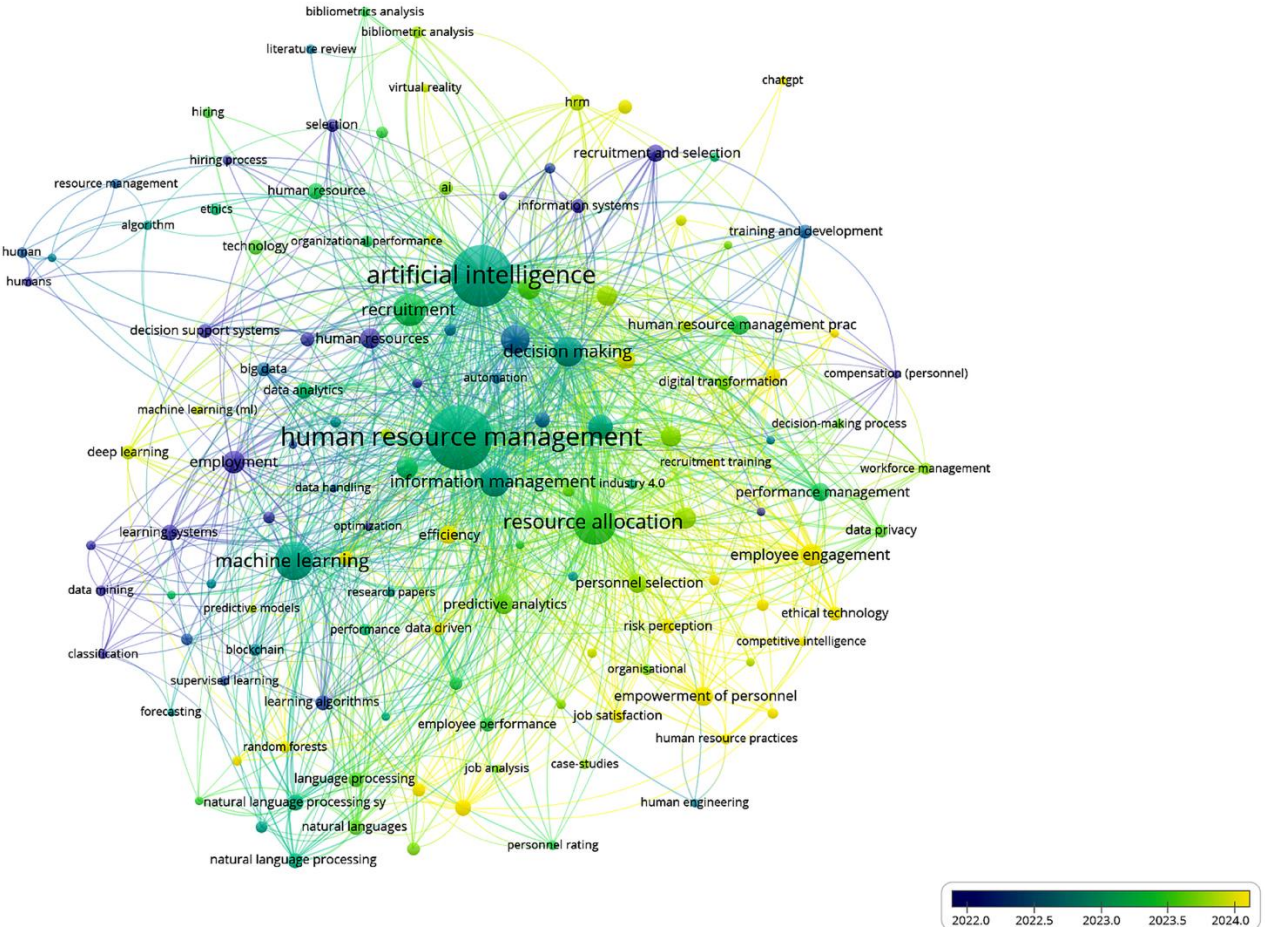

Figure 9. Co-occurence Analysis Overlay Visualization

Sources: Data Processed (2025)

The bibliometric network visualization illustrates the conceptual and thematic landscape of research at the intersection of artificial intelligence (AI) and human resource management (HRM). Developed using VOSviewer, the map presents co-occurrence relationships among keywords derived from a curated body of scholarly literature. Node size reflects the frequency of a keyword's appearance across the dataset, while the proximity between nodes and the thickness of connecting lines signify the strength of their co-occurrence relationships. The overlay colors, transitioning from cooler to warmer tones, represent the recency of keyword usage, signaling emerging versus more established areas of focus.

At the heart of the map lies a dense cluster of interconnected keywords, where “human resource management,” “artificial intelligence,” “machine learning,” and “resource allocation” emerge as dominant hubs. These central concepts underscore a strong and evolving integration of AI technologies into core HR functions. The tight linkage between "artificial intelligence" and "human resource management" indicates that the field is increasingly oriented toward applying AI solutions to improve HR operations, ranging from strategic decision-making to day-to-day personnel processes.

The presence of keywords such as “recruitment,” “employment,” “decision making,” and “information management” signals that a substantial body of research is focused on how AI tools can enhance the efficiency, precision, and effectiveness of HR activities. These terms point toward practical applications such as automated screening, predictive hiring models, and data-driven employee assessments.

The prominence of “machine learning” as a node, closely associated with technical keywords like “predictive analytics,” “data mining,” “supervised learning,” “natural language processing (NLP),” and “classification,” reflects the methodological backbone of AI in HRM research. These associations suggest a strong emphasis on leveraging algorithmic models to extract insights from workforce data, optimize recruitment processes, and inform managerial decisions. Tools such as natural language processing are increasingly being used to analyze employee feedback, resumes, or interview transcripts, highlighting a shift

toward unstructured data analysis within HR contexts.

Emerging concepts—including "ChatGPT," "ethical technology," "data privacy," "digital transformation," and "competitive intelligence"—are located near the edges of the network but are shown in brighter, warmer colors, suggesting their growing significance in current and future research. These topics introduce ethical, legal, and organizational considerations regarding the deployment of AI technologies in people-centric environments. The appearance of conversational AI tools such as ChatGPT points to the rise of automated communication interfaces for tasks like virtual interviews, onboarding support, or employee feedback systems.

Human-centered outcomes are also gaining traction, as evidenced by the presence of terms like "employee engagement," "empowerment of personnel," "job satisfaction," and "performance management." These keywords indicate a parallel research direction focusing not just on operational efficiency but also on how AI influences workplace culture, employee experience, and organizational inclusion. This signals a shift in the discourse from a purely techno-centric view to a more socio-technical and ethical perspective.

Moreover, keywords such as "decision making," "optimization," and "efficiency" show strong connectivity with both technical and strategic management themes, reinforcing the idea that AI is being explored not only as an operational tool but also as a decision-support mechanism that can align workforce planning with organizational goals.

The network also includes methodological keywords like "bibliometric analysis," "literature review," and "case studies," which indicate a meta-analytical effort within the academic community to evaluate and synthesize existing knowledge. This suggests a maturing research field that is beginning to consolidate theoretical frameworks and methodological approaches while identifying new research gaps.

Additionally, peripheral concepts such as "virtual reality," "blockchain," and "automation" point to areas of technological convergence that are beginning to enter the HRM discourse. These adjacent innovations hold potential for reshaping HR practices in terms of immersive training, secure employee records, and robotic process automation.

In conclusion, this bibliometric map reveals a rich and dynamic research ecosystem centered on the application of artificial intelligence in human resource management. It showcases a well-established methodological foundation in data analytics and machine learning, a deepening concern for ethical and human-centered impacts, and a forward-looking orientation toward emerging technologies. The interplay of these themes suggests that the field is undergoing a profound transformation—one that balances algorithmic precision with the complexities of human behavior, organizational dynamics, and technological responsibility. This visual and analytical framework offers valuable insights for researchers, practitioners, and policymakers seeking to navigate the rapidly evolving interface between AI and HRM.

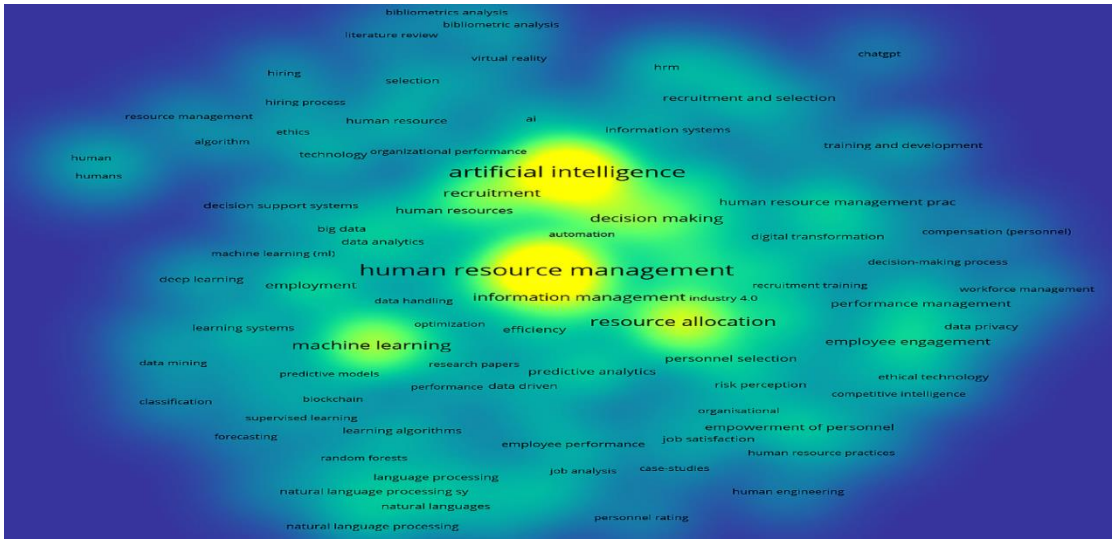

Figure 10. Co-occurence Analysis Density Visualization

Sources: Data Processed (2025)

The heatmap visualization generated via VOSviewer provides a density-based representation of the most frequently co-occurring keywords in the academic literature on the integration of artificial intelligence (AI) within the domain of human resource management (HRM). Unlike the network visualization, which emphasizes relational structure, this heatmap captures the intensity and concentration of research activity, enabling a clearer understanding of focal research themes and their surrounding contexts.

The central area of the heatmap, marked by bright yellow hues, highlights a core research nexus composed of the keywords "human resource management," "artificial intelligence," "machine learning," "resource allocation," "information management," and "decision making." These terms are not only frequently cited but also densely interconnected, reflecting their foundational role in shaping the scholarly discourse in this field. Their central location and high density imply that a substantial body of research consistently addresses how AI and machine learning techniques are being utilized to enhance decision-making processes, optimize human resource functions, and drive strategic workforce management.

Adjacent to this core cluster, terms such as "recruitment," "employment," "employee engagement," "performance management," and "empowerment of personnel" show significant density, indicating that practical HR functions—especially talent acquisition, motivation, and employee development-constitute key areas of AI application. These associations suggest a research emphasis on leveraging intelligent systems to improve employee lifecycle management, from hiring and onboarding to retention and performance evaluation.

From a technical perspective, the dense presence of "predictive analytics," "data analytics," "data mining," "natural language processing," and "deep learning" signals a strong methodological orientation in the literature. These terms underscore the increasing sophistication of analytical tools employed in HRM research, moving beyond traditional statistical methods toward more complex algorithmic models capable of handling large-scale, real-time, and unstructured data. In particular, the prominence of natural language processing suggests a growing interest in automating the analysis of textual information such as resumes, employee feedback, and communication logs.

In the peripheral zones of the map, where the heat intensity is lower and the keywords appear with cooler color tones, emerging or less central topics are identified. These include "ChatGPT," "virtual reality," "blockchain," "ethical technology," and "data privacy." Though less frequent, their presence signifies the rise of interdisciplinary and forward-looking topics. For instance, the emergence of "ChatGPT" hints at the increasing experimentation with large language models in conversational HR tools such as AI-driven interviews, onboarding assistants, and internal support bots. Similarly, terms like "ethical technology" and "data privacy" reflect the growing concern over the responsible deployment of AI, particularly in managing sensitive employee data and ensuring fairness, transparency, and accountability in algorithmic decisions.

Methodologically reflective terms such as "bibliometric analysis," "literature review," and "case studies" are also present in the network, though with moderate density. This indicates that researchers are not only contributing new empirical findings but are also critically evaluating the field's development, thematic structure, and future directions.

Moreover, the visible connection of terms such as "automation," "optimization," "efficiency," and "industry 4.0" to the denser areas reinforces the understanding that AI in HRM is part of a larger digital transformation narrative. It supports the view that organizations are increasingly integrating intelligent technologies not just for routine task automation but also for strategic agility and resilience in workforce planning.

In summary, the heatmap confirms a highly concentrated scholarly focus on the intersection of intelligent technologies and core HRM functions, especially recruitment, decision support, employee performance, and data-driven management. At the same time, it identifies peripheral yet growing areas of innovation and ethical reflection, indicating a field that is simultaneously maturing and expanding. For scholars, practitioners, and policymakers, this visualization offers an invaluable roadmap for understanding both the established centers of gravity and the emerging frontiers in AI-driven human resource management research.

4.2 DISCUSSION

The results of this bibliometric analysis reveal a complex and rapidly evolving intellectual landscape in the study of artificial intelligence (AI) within workforce recruitment. The analysis underscores the growing academic interest in leveraging AI to improve decision-making, efficiency, and fairness in human resource management (HRM). Prior studies confirm that AI-based recruitment enhances both efficiency and objectivity while reducing human bias ((Black & van Esch, 2020; Upadhyay & Khandelwal, 2019). The visualization maps demonstrate not only the density of research activity around certain core themes but also the emergence of new conceptual frontiers that extend the boundaries of conventional HR practices.

Central to the discussion is the identification of AI, human resource management, machine learning, and decision-making as the most prominent and interconnected research themes. These terms do not only dominate the scientific discourse but also serve as bridges between technical innovation and strategic HR applications. This finding resonates with earlier evidence showing that AI-driven analytics support talent acquisition, performance prediction, and employee retention (Leicht-Deobald et al., 2019 ;Vrontis et al., 2022).

A key insight from the analysis is the strong methodological orientation of the field, as evidenced by the frequent appearance of terms like predictive analytics, supervised learning, deep learning, and natural language processing. These terms indicate a consistent scholarly focus on algorithmic techniques and data science methods. In line with this, authors such as Tursunbayeva et al. (2018) and Tambe et al. (2019) highlight how predictive models transform recruitment through advanced text and sentiment analysis.

Simultaneously, the research community is increasingly acknowledging the ethical, psychological, and societal implications of deploying AI in recruitment. The emergence of terms such as ethical technology, data privacy, transparency, and fairness points to an expanding awareness of algorithmic bias and the risks associated with opaque decision-making systems. This reflects a paradigm shift from a purely efficiency-driven perspective to one that values human-centric, trustworthy AI systems, a concern echoed by scholars such as Bogen & Rieke (2018) and Strohmeier & Piazza (2022). Moreover, the presence of keywords such as “empowerment of personnel,” “employee engagement”, and “job satisfaction” suggests that AI applications are being examined not just for their operational capabilities but also for their impact on the employee experience and organizational culture (Zhou et al., 2021).

The bibliometric heatmap further emphasizes the central role of “resource allocation” and “information management,” suggesting that AI is perceived as a strategic asset in optimizing workforce distribution, aligning human capital with business goals, and enhancing data-driven HR planning. Previous studies confirm that data-driven HRM enables organizations to achieve agility and scalability while making evidence-based strategic choices (Bondarouk & Brewster, 2016; Minbaeva, 2018).

An important observation is the emergence of next-generation tools such as generative AI (e.g., ChatGPT), blockchain, and virtual reality, albeit still peripheral in current research. These technologies represent a frontier of innovation where AI is being explored for more interactive and immersive recruitment processes—ranging from automated candidate screening to virtual interviews and onboarding simulations. Their peripheral yet increasing presence suggests that future research will likely explore these areas in more depth, particularly in terms of user acceptance, ethical design, and regulatory challenges (Dwivedi et al., 2023).

From a geographical and institutional perspective, the results show a significant concentration of research output in South Asia, especially India. This regional dominance indicates a strong academic engagement and policy-driven interest in digital transformation but also highlights the need for more globally distributed contributions (Kshetri, 2021). Furthermore, the dominance of conference papers, alongside journal articles and book chapters, suggests that the field is still in a stage of active development and conceptual exploration.

Overall, this study confirms that the field of AI in recruitment is highly interdisciplinary, drawing from computer science, business, management, and social sciences. It is evolving from fragmented, technically driven investigations to a more integrated, reflective, and ethically conscious research domain. The convergence of computational advancements and human-centered

concerns marks a transition toward more holistic approaches in AI-enabled HRM. Future research would benefit from deeper empirical validations, cross-cultural studies, and theoretical developments that bridge technical innovation with organizational psychology, ethics, and strategic management.

Thus, the insights from this bibliometric analysis provide a comprehensive roadmap for researchers, practitioners, and policymakers. For scholars, it highlights emerging themes and methodological trends worthy of further investigation. For HR practitioners, it underscores the dual imperative of technological sophistication and ethical responsibility. For policymakers, it raises the urgency of developing governance frameworks that promote fairness, transparency, and accountability in AI-driven recruitment systems.

5. CONCLUSION

This study presents a comprehensive bibliometric analysis of the scholarly literature on the application of artificial intelligence (AI) in workforce recruitment, offering a systematic overview of publication trends, thematic structures, scientific collaborations, and emerging research areas. By analyzing 404 documents retrieved from the Scopus database and utilizing VOSviewer for visualization, this study identifies key knowledge domains, leading contributors, and future directions within the field.

The findings reveal that AI in recruitment is an increasingly important and multidisciplinary area of inquiry, bridging computer science, management, decision sciences, and ethics. The literature is concentrated around several central themes: the optimization of recruitment processes through machine learning and data analytics; the strategic use of AI in decision-making and workforce planning; and the growing emphasis on ethical considerations, such as fairness, transparency, and algorithmic accountability. Importantly, this study finds that research has begun shifting from purely technical discussions toward more holistic approaches that consider the human, organizational, and societal dimensions of AI implementation.

The co-occurrence and density visualizations demonstrate the coexistence of mature and emerging topics. While traditional concerns such as applicant screening, performance prediction, and HR efficiency remain prevalent, novel concepts—such as generative AI (e.g., ChatGPT), data privacy, and responsible AI design—are gaining scholarly attention. These developments suggest that the field is not only expanding in volume but also maturing in complexity, reflecting an increased awareness of both the opportunities and challenges posed by AI in recruitment.

Moreover, the dominance of conference proceedings and contributions from institutions in South Asia, particularly India, highlights a vibrant and growing academic community focused on this domain. However, the findings also underscore the need for broader global engagement and interdisciplinary collaboration to ensure that AI technologies are developed and deployed inclusively and equitably.

6. LIMITATION AND IMPLICATION

6.1 Limitation

This study provides a comprehensive bibliometric mapping of the literature on artificial intelligence (AI) in workforce recruitment; however, several limitations should be acknowledged to contextualize the findings. First, the selection of data was limited to publications indexed in the Scopus database, which, while extensive, may exclude relevant studies from other reputable databases such as Web of Science or IEEE Xplore. This may affect the generalizability of the results and the completeness of the research landscape captured. Second, the keyword-based search strategy, despite being systematic, may have overlooked studies that use alternative terminologies or non-standard phrasing, which could lead to gaps in the dataset. Third, the analysis relies heavily on metadata and bibliometric indicators, without delving into the full content of the articles, which limits the depth of insight into theoretical frameworks, empirical findings, and methodological rigor.

Temporal limitations also apply, as data collection was restricted to publications up to early 2025 and may not capture the latest developments or emerging themes in real time. Additionally, while VOSviewer offers robust visualization tools, the interpretation of thematic clusters and co-occurrence networks involves a degree of subjectivity. Finally, this study was constrained by time and resources, which limited the possibility of conducting comparative bibliometric analyses across multiple datasets or including interviews with domain experts for qualitative validation.

6.2 Implication

Despite these limitations, this research has significant implications for both academic and practical domains. It extends the current body of knowledge by systematically identifying trends, dominant themes, and collaboration networks in the rapidly evolving field of AI-driven recruitment. The findings support the growing relevance of ethical concerns, fairness, and human-centered design in contrast to purely technical or efficiency-focused approaches, thereby reinforcing or challenging existing theories of digital HR transformation. From a practical standpoint, the results offer strategic insights for HR practitioners, technologists, and policymakers by highlighting areas of opportunity and risk in the adoption of AI technologies for recruitment purposes.

Future research is encouraged to expand the bibliometric scope across databases, combine quantitative mapping with qualitative analysis, and explore longitudinal changes through time-series bibliometric approaches. Furthermore, in-depth studies on user experience, ethical governance, and cross-cultural implications of AI recruitment systems could enrich the current understanding and promote the development of inclusive, fair, and adaptive talent acquisition frameworks.

The implications of these findings are multifaceted. Theoretically, this research enriches the academic discourse on AI in HRM by identifying current trends and emerging challenges, offering a foundation for future theoretical model development. Practically, it informs HR professionals on the importance of embedding ethical considerations into AI systems to enhance fairness and user experience. From a policy perspective, it underscores the need for regulatory frameworks that govern the responsible use of AI in recruitment. Methodologically, it highlights the necessity of fostering cross-regional and interdisciplinary collaboration to broaden the scope and impact of future studies. Future research is encouraged to focus on the development of integrative models that balance algorithmic efficiency with the protection of candidate rights and enhancement of user experience.

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