Artificial Intelligence in HR: A Bibliometric Analysis Through VOS Viewer

Sushil Minz

Ph.D. Scholar KIIT KSOM Bhubaneswar, Odisha, India PIN 751024

email: 2381093@ksom.ac.in

Abstract

Introduction: The emergence of artificial intelligence (AI) has changed several domains, Human Resources (HR), included. The aims of this study are to provide a comprehensive bibliometric analysis of AI applications in HR, highlighting the transformation of HR functions done traditionally and identifying emerging trends. By addressing a research gap in the literature, this study identifies, the extent and impact of integration of AI in HR practices. **Objective:** To explore its evolving landscape of through a detailed bibliometric analysis. And to investigate key areas of management such as recruitment, performance, and engagement of employee, aiming to enhance both academic understanding it's practical implementation. **Methodology:** Relevant literature was collected from SCOPUS using specific search criteria. The 934 selected articles from 1984 to 2024 were analysed through VOS viewer to identify prevailing themes and trends. Advanced bibliometric tools and techniques, such as co citation analysis and keyword mapping, were employed for a thorough examination. **Results:** Application of AI in HR is steadily growing, with significant research focusing on predictive analytics, automated recruitment processes, and AI driven employee performance assessments. There is an increasing volume of publications in recent years, indicating heightened scholarly and practical interest. These findings illustrate the dynamic nature of adoption of AI in HR practices. **Conclusion:** The bibliometric analysis highlights worthy insights into the present state and its future prospects. It also highlights key areas requiring study in the near future, emphasizing the need for interdisciplinary approaches to leverage AI's capabilities, completely. For HR professionals, the findings emphasise the importance of embracing AI technologies to enhance efficiency and effectiveness in HR management.

Keywords: ***Artificial Intelligence (AI), Human Resources (HR), Bibliometric Analysis, Recruitment, Predictive Analytics***

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1. Introduction

Integration of Artificial Intelligence (AI) at a rapid pace across various industries has marked a significant turning point in the digital transformation era [1]. Among the most promising applications is its role in Human Resources (HR), where AI is being utilized to optimize hiring processes, enhance employee engagement, and streamline various administrative tasks [2]. In an increasingly competitive global market, businesses are turning to AI to drive operational efficiency and harness the potential of big data to make smarter, faster decisions [3]. However, the true impact of AI on HR remains a topic of debate, necessitating a deeper exploration of its benefits, limitations, and implications [4]. This study is to investigate the role played by AI in HR through, bibliometric analysis, using the VOS Viewer tool to map out trends, collaborations, and key areas of research [5]. By shedding light on its evolving landscape, it will also add in good measure to a growing body of literature that seeks to understand the implications of technology on the workforce [6].

AI's penetration into HR is a relatively recent phenomenon, but its trajectory is accelerating at a remarkable pace [7]. Initially confined to automating repetitive tasks like payroll management and employee record keeping, AI has since expanded into more strategic functions such as creating talent pool, its acquisition, performance management, and employee retention strategies [8]. The potential of AI to revolutionize HR stems from its ability to process big data, providing HR professionals with actionable insights that would otherwise be impossible to attain [9]. A report by Deloitte [10], and Tomojzer, M notes that over 70% of organizations now use some form of AI in their HR departments, a sharp increase from just a few years ago. However, with this rise comes concerns about data privacy, the ethical implications of AI driven decisions, and the risk of human bias being embedded into algorithms [11]. These factors make AI in HR an area ripe for scholarly analysis [12].

While the literature on AI in business processes is growing, research specifically focused on HR applications remains somewhat fragmented [13]. Previous studies have largely centred on case specific analyses or anecdotal evidence from individual companies, without providing a holistic overview of the global research landscape. This is where bibliometric analysis proves invaluable [14]. By applying the VOS Viewer software, which enables visualization of co-authorship mapping, keyword cooccurrence, and relationships of citations, the study seeks to bring a clear view of academic discourse on AI in HR

[15]. This will allow for an examination of not just the volume of research being conducted but also the relationships and collaborations that drive the field forward [16]. Such insights are critical to understanding how it is being perceived, studied, and utilized by HR professionals and academics alike [17].

The primary problem in this research that this paper tries to resolve is the missing clear, consolidated understanding of how it is shaping HR practices across different sectors. Although many studies highlight the potential advantages, there is little agreement on the specific ways in which it is transforming HR workflows. Additionally, HR professionals often express concerns about the ethical dilemmas posed by it, particularly regarding issues like automated decision making in hiring processes. This research prime target is to lessen the gap between theoretical discussions and practical applications by analysing the full spectrum of its influence on HR, as reflected in academic literature [18].

In order to explore these dynamics, focus will be on answering the following questions:

(RQ 1) What are the prevailing themes in AI-related HR research?

(RQ 2) How are researchers collaborating across disciplines and geographic boundaries to explore its role in HR?

(RQ 3) What gaps exist in the current literature that require further exploration?

These questions aim to offer a deeper insight into AI's impact on the evolving landscape of HR and to identify and focus on key areas for future research.

Research value stems from its ability to contribute meaningfully to both scholarly discussions and practical applications in the field. As more organizations adopt AI-driven systems, it becomes increasingly important to understand both the benefits and the limitations of these tools [19]. This paper's findings could provide valuable insights for HR professionals who are considering implementing AI technologies, as well as for policymakers who need to navigate the complex ethical landscape surrounding AI adoption. Additionally, by identifying gaps in the current literature, this research could help guide future academic inquiry into AI's long-term effects on HR practices.

In conclusion, AI's growing role in HR represents a major shift in how organizations manage talent, structure workflows, and make

critical decisions. Through a comprehensive bibliometric analysis using VOS Viewer, this paper will chart the key trends and collaborations that are shaping the future of AI in HR [20]. The findings will enrich academic discourse while also offering practical guidance for HR experts and policymakers as they adapt to the rapidly evolving landscape of AI driven solutions.

2.Literature Review

AI is playing an increasingly pivotal role in HR, especially in functions like recruitment, performance evaluation, and employee engagement [21]. As businesses strive to optimize operations and make data-driven decisions, AI provides a solution to many of the challenges faced by HR departments [22]. However, while the inert capabilities of AI in HR are well-documented, there is still a need for a systematic exploration of the research trends and key contributions in this field. The objective is to provide gist of the available academic discourse on AI in HR, analyse the historical development of this research, and identify key gaps that require further exploration. Through a bibliometric analysis using VOS Viewer, this review will chart the growth of AI in HR literature and identify underexplored areas that my research will address.

2.1. Historical Development and Key Findings

The integration of AI into HR began with automating repetitive tasks, such as payroll and employee data management, but has since evolved to include more strategic applications like talent acquisition and performance evaluation [23]. Key early studies, such as those conducted by Deloitte and McKinsey, revealed the capabilities of AI to align HR processes and improve decision-making [24]. Past decade, has revealed that research has shifted from theoretical explorations of AI's capabilities to more empirical studies focused on case analyses and the real-world applications of AI in HR. Scholars have also explored AI's role in addressing HR challenges, such as reducing bias in hiring and improving employee retention.

2.2. Methodological Approaches and Their Outcomes

Much of the research on AI in HR has employed qualitative case studies and quantitative analyses, highlighting the effects of AI tools in specific organizations [25]. Bibliometric analysis has emerged as a valuable methodological approach, offering insights into the collaboration networks and keyword trends that shape the field. For instance, VOS Viewer has been used to map co-authorship patterns and

keyword co-occurrence in AI-HR studies, revealing key areas of focus such as employee performance prediction and AI ethics [26]. While qualitative studies provide insights, quantitative and bibliometric methods give a broader view on how the field is evolving.

2.3. Current Debates, Conflicts, and Emerging Trends

As AI continues to permeate HR, debates around its ethical implications have gained prominence. Data privacy, algorithmic bias, and the displacement of human jobs is still a matter of concern and remain contentious topics [27]. Moreover, emerging trends such as AI-powered emotional intelligence tools and personalized employee experiences are shaping the future of HR [28]. However, scholars are divided on how effective AI truly is in enhancing HR functions, with some questioning its long-term impact and ethical ramifications. These debates are central to both academic and industry discussions.

2.4. Gap Identification

Despite the growing body of literature, several research gaps persist. Few studies offer a holistic view of how AI is being adopted across different industries, and there is a want of longitudinal studies that examine the future effects of AI integration in HR [29]. Furthermore, while ethical concerns are frequently raised, few studies propose concrete solutions to mitigate these issues. This underscores the requirement for further research that links between theoretical discussions and practical implementation.

2.5. Connection to Proposed Research

My research, through a bibliometric analysis using VOS Viewer, seeks to fill these gaps by providing a more complete picture of AI's influence on HR. By mapping the global trends and identifying underexplored areas, this study will contribute new information and knowledge to the existing literature. Specifically, it will address the lack of longitudinal data and offer recommendations on addressing the ethical concerns associated with AI in HR [30].

In conclusion, while existing research has made progress in understanding the role of AI in HR, several gaps remain. This literature review has highlighted the historical development, key findings, and ongoing debates within the field.

By finding ways to plug these gaps, the study will enhance understanding of AI's opportunities and challenges in HR, situating

itself at the crossroads of technology, ethics, and human capital management.

3.Research Design and Methodology

This study will employ a bibliometric analysis to systematically map the academic research landscape surrounding the application of Artificial Intelligence (AI) in Human Resources (HR). Bibliometric analysis is an ideal approach for identifying trends, patterns, and collaboration networks within a specific field of study [31]. VOS Viewer, a software tool is used for mapping and visualizing bibliometric networks, this study will focus on co-authorship networks, keyword co-occurrence, and citation patterns [32] within the research on AI in HR. The research design is structured to provide a detailed examination of the literature, offering insights into how AI is impacting HR practices globally.

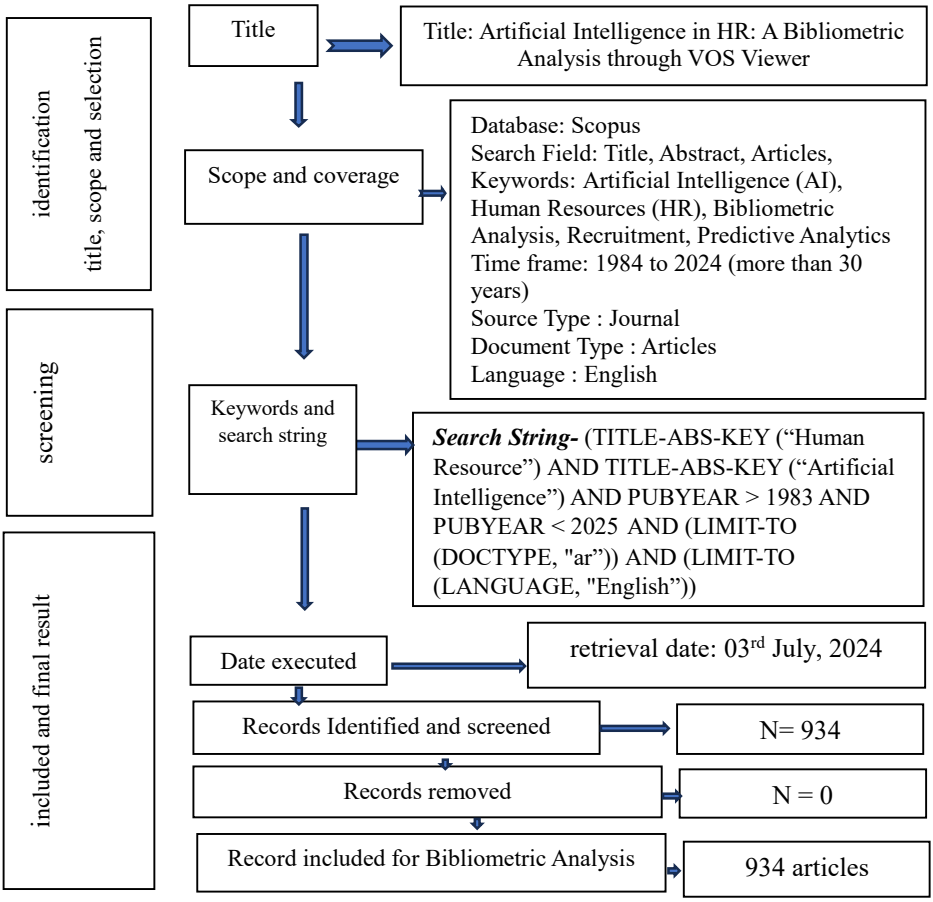
3.1. Research Approach

This study adopts a quantitative research approach as it primarily relies on numerical data such as citation counts, publication frequency, and co-authorship links. Bibliometric analysis, being inherently quantitative, enables the study to examine large datasets of academic papers and articles, providing a macroscopic view of research trends. While the quantitative data is the core, qualitative insights may also be drawn from the patterns and trends that emerge. However, quantitative analysis is prioritized due to the focus on measurable research outputs, making it the best-suited approach for this research paper.

3.2. Data Collection

The collection of data for this study will focus on extracting metadata from academic databases, such as Scopus and citation from Google Scholar. The strategy undertaken in this regard has been stated at chart 1.

Chart 1: - showing the search strategy for data collection.



This metadata includes titles, abstracts, author affiliations, citation counts, and keywords from articles related to AI in HR. Bibliographic data will be imported into VOS Viewer for analysis.

The SCOPUS database, well-regarded for its wide thematic coverage and regular updates, was employed for the study [33]. It is widely acknowledged as a leading resource for bibliometric analysis, offering powerful citation analysis features and convenient data export options. Nonetheless, SCOPUS has certain limitations, including a more limited historical range and selective indexing of sources, which can introduce potential biases. Despite these shortcomings, it continues to be a preferred choice due to its strengths in timeliness, broad subject coverage, and ease of usen [34].

3.3. Sampling

The selection of sources will be based on specific criteria, such as publication date (focusing on articles published between 1984 and 2024), relevance to the topic of AI in HR, and inclusion in reputable academic databases. Only peer-reviewed journal articles related to AI in HR will be considered. Keywords like "Artificial Intelligence," and "Human Resources" will be used to filter the most relevant sources. The sample will be representative of the cited articles only.

3.4. Data Analysis: Analytical Techniques

The data analysis will be conducted using VOS Viewer, which allows for the construction of bibliometric networks. This software will enable the identification of co-authorship networks, highlighting collaborations between researchers and institutions. Keyword co-occurrence analysis will identify the most frequently researched topics within AI-HR literature. Additionally, citation analysis will highlight the most influential papers and emerging research trends. This quantitative data will be supplemented with a qualitative interpretation of the thematic trends.

3.5. Limitations

There are several limitations to this study. First, bibliometric analysis only reflects the research that has been published and indexed in major databases, potentially excluding valuable work that remains unpublished or outside mainstream platforms [35]. Additionally, VOS Viewer may have some limitations in visualizing highly complex data relationships [36]. Finally, this study will focus solely on academic literature, limiting the generalizability of its findings to practical, industry-level applications of AI in HR. However, these limitations will be mitigated by ensuring a comprehensive dataset and by acknowledging the potential scope for future research.

4. Data Analysis Results and findings.

This section is divided into three main parts: -

4.1. Analysis of Citations and co-citations

To identify the most cited publications in the study area, a citation analysis was carried out. The type of analysis selected was Citation, keeping Documents as the unit of analysis. As per the requirement documents to have minimum one citation, resulting in

documents meeting this threshold. There are 746 documents which have met the threshold. This points out that 188 documents (934-746), or 20.12% of the total, have no citations, a significant percentage, which indicates gaps exists. On processing further Vos Viewer popped out the message only 191 items are connected out of the 746 documents which were finally shown after due verification and cleaning of data as in Figure 1.

Average citations per document was also determined. Based on 7,723 citations across 934 documents (SCOPUS exported CSV file), the average comes to a 8.26(approx.) citations per publication. Authors were also filtered whose works have received citations exceeding the average by at least nine or more, highlighting the top 10 authors or documents that meet this criterion (see Figure 1). Of the 934 articles, 113 have citation counts above this average, representing 12.09% of the total. From the CSV data, the 10 most cited documents totalling 3,398 citations, which constitutes 43.99% of all citations. Furthermore, examining their publication years (2017 to 2023) reveals a peak in 2018 with 1,418 citations, as illustrated in Figure 1, where the largest pinkish purple node at the centre represents Huang (2018).

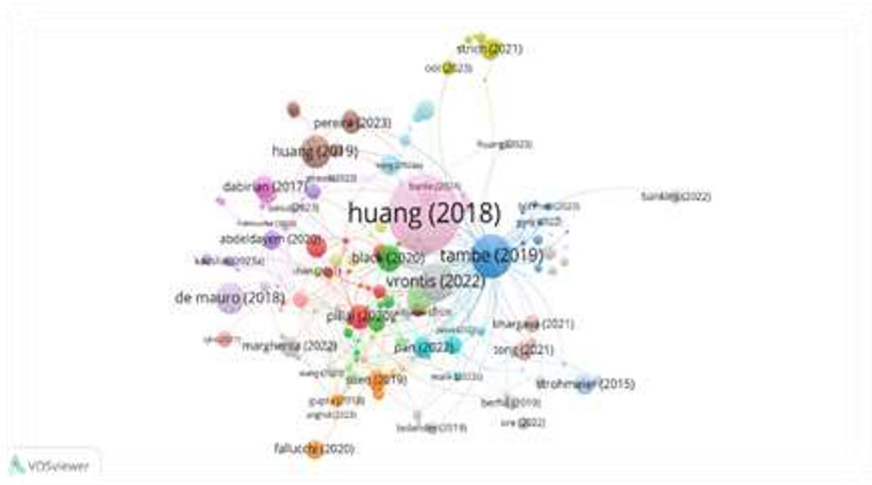


Figure 1 Vos viewer mapping Citation analysis with Documents

The 191 items are further clustered into 32 different coloured clusters. Each having different number of items. Most of them has items ranging from 15 to 1. The nodes size as well as the thickness of the lines indicates the number of citation as well as the strength of the association. The top 10 authors are Huang (2018) shown in cluster 18 having 1418 citations. The second most important author is Tambe

(2019) in cluster 3 which is blue in colour is having 442 citations. The others in the series are Vrontis (2022) having 346 citations in cluster 24, again Huang (2019) having 246 citations in cluster 8. The rest are de Mauro (2018) with 234 citations, Chowdhury (2023a) with 170 citations, Black (2020) and Pillai (2020) having 164 and 142 citations, respectively. Followed by Dabirian (2017) and Caputo (2019) having 121 and 115 citations respectively. This shows the attention of the scientific community gathered momentum only at the end of the year range taken into consideration. There is scope of further in-depth research.

Co-citation analysis reveals the papers are frequently cited together, showing their intellectual connection, Figure 2.

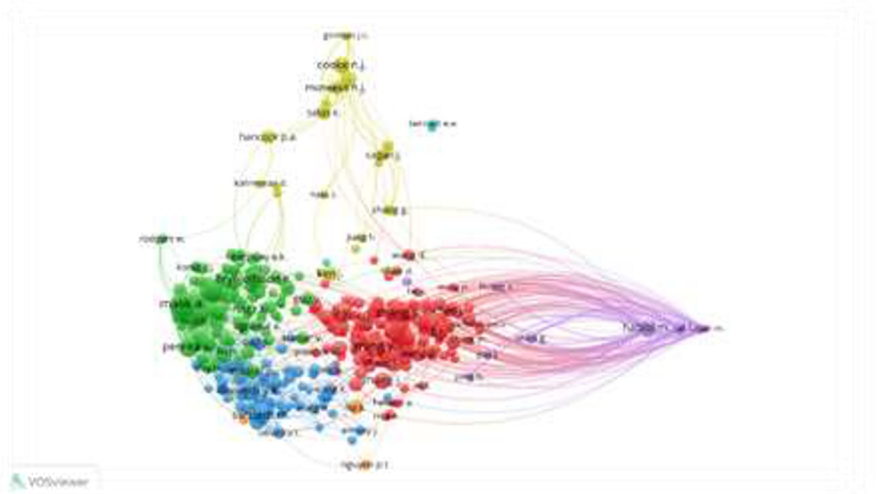


Figure 2 Vos viewer mapping Co-Citation analysis with Cited Authors

Unit of Analysis: In this study, individual articles or publications is the unit of analysis. This approach helps identify papers of influence and trace the evolution of key ideas as time unfolds. Co-citation analysis plays a vital role in mapping the intellectual structure of knowledge within the scope of the current bibliometric investigation.
To prepare the data, the analysis type (co-citation) and the unit of analysis (cited authors) were specified. As large number of authors were there, the default VOS viewer settings were applied. By setting the selection threshold to a minimum of 20 citations per author, 371 authors out of 72,696 met the criterion. The author list was reviewed, verified, and cleaned before final processing, resulting in the generation of the co-citation map (Figure 2).
The map contains 371 items grouped into seven clusters: Red Cluster with 143 items, Green Cluster with 123 items, Blue Cluster with 69

items, Cluster 4 with 21 items, Cluster 5 with 9 items, and Clusters 6 and 7 with just 3 items each. The largest and most influential clusters are red, green, and blue. Author names appear when their citation counts are notably high, which shows the qualitative strength of their scholarly connections. Examples of major co-cited authors include Wang (139 co-citations), Budhwar (141 co-citations), and Malik (169 co-citations).

The authors' countries of origin provide valuable insights into cultural and geographical differences and highlights disparities in access to resources and funding, which directly influence the scope and quality of research output. Country-wise analysis (Figure 3) offers clear guidance on where and when to allocate resources. Furthermore, countries policies regarding research priorities and directions are also significant factors shaping these patterns [37].

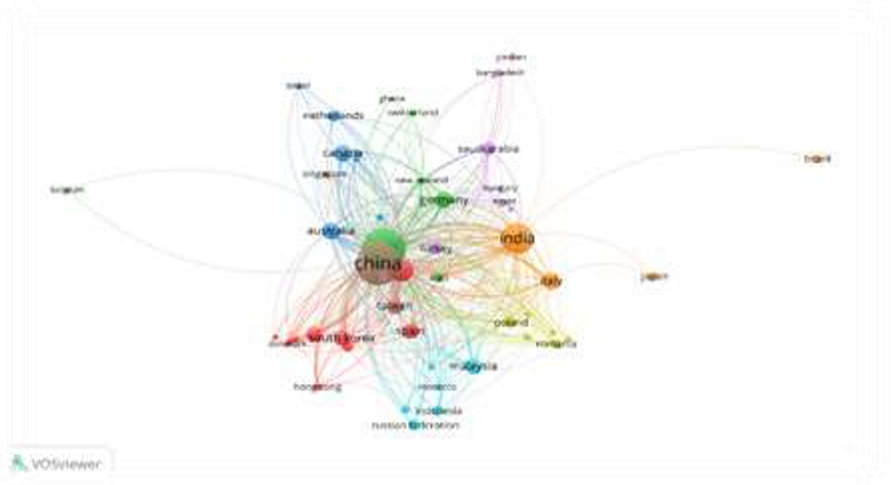


Figure 3 Vos viewer mapping countries of origin of authors

According to CSV file exported from Vos viewer, there are 112 countries depicted. As per the default setting in the Vos viewer the threshold parameter chosen is keeping 5 as the minimum number of a country's document. Consequent of which 57 countries meet the threshold. However, out of which only 54 countries are connected. These 54 items are into 9 clusters. Each showing different colours. USA leads with 161 documents as contributions with 5197 citations, followed by the India with 100 documents having 1374 citations. France, UK and China have 45, 61 and 178 documents each published, respectively, and each one of them have 1875, 2037 and 2302 of global citation, respectively. Here it can be seen that quality publication has great impact. The number of contributions is not the factor which influences the citation. Other significant contributors include Australia,

Taiwan, Germany, Italy, and UAE, each having 38,31,36, 37 and 20, respectively, having citations of 851,2096, 799. 1247, and 318, respectively. It states quality document has greater impact.

4.2. Analysis of Sources of Articles

It is essential for assessing their impact within a specific subject area. In this case, the chosen analysis type was co-citation, with the unit of analysis set to *cited sources* with *full counting* method was applied. This approach helps highlight the quality of the research and its acceptance within the scientific community.

A total of 20,937 sources were identified, of which 208 met the threshold of having at least 20 citations. After further processing and verification, the final mapping was completed, resulting in eight clusters containing 57, 49, 41, 31, 17, 7, 4, and 2 items respectively. In the generated map, the size of each node represents the number of publications, while the node colour indicates the total number of citations.

Using the established criteria, a VOS viewer map Figure 4 was generated.

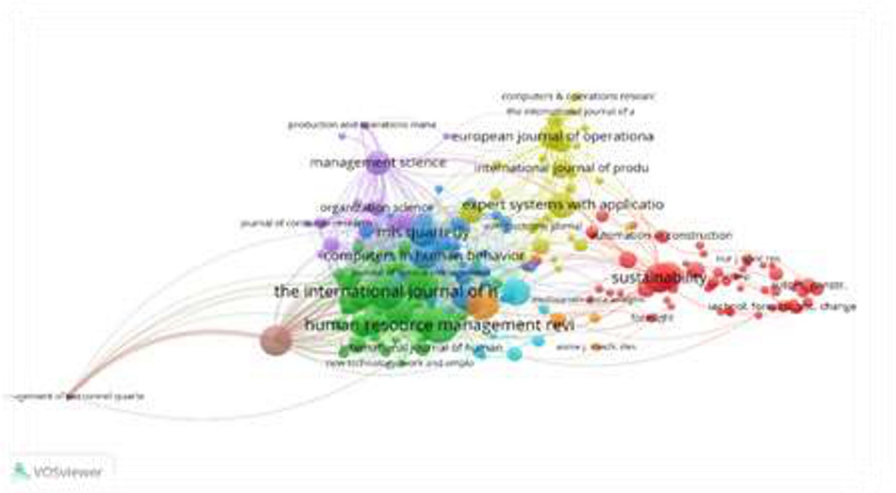


Figure 4 Vos viewer mapping co-citation with cited source.

The map indicates that the orange nodes represent sources with the highest number of citations, with *Human Resource Management Review* standing out as the leading source in this case. Among other sources, the blue nodes highlight *MIS Quarterly* as another highly prominent journal, as also confirmed by Table 1. To provide deeper insights, the Cite Score and the number of published documents—

retrieved from the SCOPUS database—are also presented, reflecting each journal's impact within the global research community. Notably, *Human Resource Management Review* holds a particularly high Cite Score.

The Cite Score metric represents the average annual citations a journal receives for articles published over the past three years. It is determined by dividing the total number of citations with the total number of documents published in Scopus within that three-year period. The journal with High Cite score are rated higher for their Impact Value.

Table 1 showing the source with the Citation and Cite score and Documents Published.

Doc	Cite score/ Citation	Source
12	20.2 /277	Human Resource Management Review
7	11.7/266	The international Journal of Human Resource Management
8	13.3/184	MIS Quarterly
10	NA/199	Sustainability
15	13.5/178	IEEE Access

As shown in Table 1, the journal *MIS Quarterly* has published numerous high-impact articles by prominent scholars, including V. Venkatesh. Noteworthy contributions include the work of Jeyaraj, A., et al [38], on intentions in information systems adoption and use. Several other journals listed in the table have also produced scientific papers comparable to those of leading journals, thereby making substantial contributions to the academic knowledge base and to society at large.

4.3. Analysis of Keywords

VOS viewer can be used to create maps based on keywords, performing keyword co-occurrence analysis to reveal relationships between terms used in publications and relate how themes and topics are interlinked. The unit of analysis encompasses both keywords and indexed keywords from the authors and publications. By examining the frequency of keyword occurrences, this analysis identifies the dominant themes and topics within the literature, highlighting areas of thematic concentration [39].

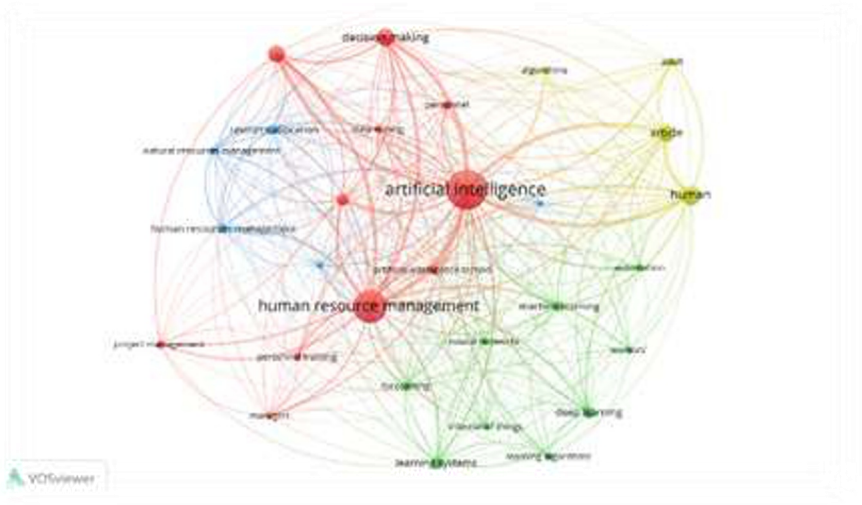


Figure 5 showing **co-occurrence with index keywords**

Figure 5 presents the generated map, beginning with the selection of co-occurrence using indexed keywords. Minimum threshold was to keep keywords appearing not less than 20 times, resulting in 31 out of 5,389. After reviewing the list, repetitive or irrelevant terms such as *"humans"* and *"algorithms"* were removed, reducing the final count to 29 keywords from the default list of 278 words (with a minimum co-occurrence of 5). In the beginning, the list was reduced by 89.57% of its size, with the final 29 keywords selected based on VOS viewer's optimization recommendations. These keywords were grouped into four clusters—yellow (10 items), blue (8 items), green (6 items), and red (5 items). This process ensured an optimal map structure, highlighting dominant topics and revealing subtle interconnections between them. In the resulting visualization, the largest nodes—shown in green and red—represent terms such as *"artificial intelligence"*, *"human resource management"*, *"article"*, *"humans"*, and *"decision making"*.

Figure 6 displays another map generated with minimum of five occurrences per keyword, as set by the developer's default parameter. Out of 2,886 items, only 79 met this threshold and were included in the analysis. These were distributed into 12 clusters, with individual cluster sizes ranging from 15 items to a single item.

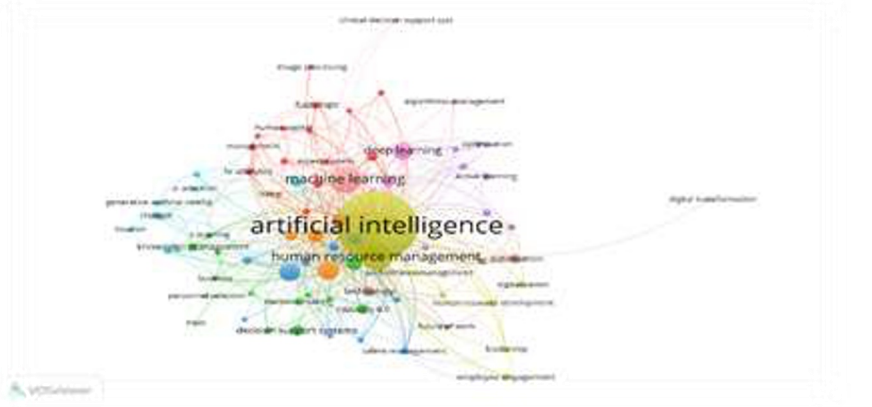


Figure 6 showing **co-occurrence with authors keywords.**

The highest density was found in yellow cluster, followed by various other colours such as the green, blue, yellow, orange, violet, purple and others. Cluster 4, shown in yellow and the most prominent in the map, is dominated by the term *"Artificial Intelligence,"* while it also prominently features *"Human Resource Management."* As illustrated in Figure 6, a closer examination reveals that *"Artificial Intelligence"* appears 370 times, whereas *"Human Resource Management"* occurs 79 times. Given their respective frequencies—the highest and second highest—these terms represent the most extensively discussed topics within the research field.

The other evolving terms are Machine Learning, Deep Learning, Human Resource and Recruitment. One new term is also evolving very fast that is "Digital Transformation".

5. Conclusion. and discussion.

The integration of (AI) into (HR) has emerged as a transformative development, reshaping traditional HR practices. This research, through a bibliometric analysis using VOS Viewer, highlights the increasing interest in the intersection of AI and HR, as evidenced by the growing body of literature. The analysis identifies key themes, influential authors, major research clusters, and emerging trends that are shaping this field. It is evident that AI applications, such as talent acquisition, employee management, performance evaluation, and decision-making, are rapidly gaining traction within HR operations, enabling organizations to optimize efficiency, improve decision-making, and enhance employee experience.

Key areas of focus in the literature include the use of AI for predictive analytics in hiring, automation of routine HR tasks, and the ethical considerations surrounding AI's role in decision-making processes. As AI technologies continue to evolve, HR professionals must navigate challenges such as data privacy, algorithmic bias, and transparency to ensure fair and responsible AI usage [40].

This study also underscores the global collaboration and interdisciplinary nature of research in AI and HR, with contributions from various fields such as computer science, management, and psychology. The bibliometric analysis reveals that while significant progress has been made, there is still much room for further exploration, particularly in the ethical implications, long-term impacts on job roles, and the integration of AI with human-centric HR practices.

In conclusion, AI in HR is a rapidly growing field with the potential to revolutionize how organizations manage their human capital. However, to fully realize the benefits, future research and practical applications must address ethical challenges and ensure that AI complements rather than replaces human judgment in HR functions.

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