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Use of Artificial Intelligence in HR Recruitment and Selection in Start-up Companies

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ABSTRACT

This bibliometric study analyzes the evolving landscape of human resource management (HRM), emphasizing the integration of technology into HR practices, particularly in recruitment and selection processes. Utilizing VOSviewer, the research maps the co-occurrence of keywords within a comprehensive dataset, revealing dominant themes, trends over time, and less explored areas. The analysis identifies core thematic clusters such as "human resource management," "recruitment," and "analytics," highlighting the significant focus on optimizing traditional HR functions through technological advancements. The study observes a marked shift in research trends, particularly influenced by the challenges posed by the COVID-19 pandemic, which accelerated the adoption of remote work technologies and digital HR tools. The visualization also identifies underexplored research opportunities in areas like "blockchain" and "internet," suggesting potential for groundbreaking research in enhancing HR operations. Furthermore, the network analysis underscores the importance of author collaboration in expanding the multidisciplinary scope of HRM research. This study contributes to the understanding of HRM's dynamic evolution and outlines strategic directions for future research, ensuring HR practices align with technological advancements and organizational needs.

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1. INTRODUCTION

The integration of Artificial Intelligence (AI) into human resource processes represents a transformative shift in how companies approach recruitment and selection, especially within the dynamic environment of start-up companies [1]. Start-ups, characterized by their need for rapid growth and scalability, are increasingly turning to AI to streamline their recruitment processes and enhance decision-making capabilities [2], [3]. This technological advancement allows for the automation of

routine tasks, such as resume screening and initial candidate assessments, thereby enabling HR professionals to focus on more strategic aspects of their roles [4]. Furthermore, AI-driven tools are equipped with sophisticated algorithms that can analyze large datasets to identify the best candidates based on a variety of parameters including skills, experience, and potential cultural fit [5].

As AI technologies continue to evolve, their applications in recruitment and selection have become more nuanced and complex [6]. AI systems are now capable of deploying natural language processing to understand and interact with potential candidates in a human-like manner, improving the candidate experience and the efficiency of the recruitment process [7]. Additionally, predictive analytics used by these systems can help foresee future hiring needs based on company growth patterns and market trends [8]. However, despite these advancements, the practical implications and long-term effectiveness of AI in recruitment within start-ups remain under-explored, necessitating a comprehensive examination through bibliometric analysis [9].

The use of AI in HR recruitment and selection in start-ups also raises significant ethical considerations and challenges, including privacy concerns and potential biases in algorithmic decision-making [10]. These challenges are compounded in the start-up ecosystem, where the pressure to innovate rapidly can sometimes lead to the overlooking of thorough ethical reviews and bias mitigation strategies in AI implementations [11]. This complex interplay of technology advancement, ethical considerations, and the unique needs of start-ups makes it crucial to systematically study the literature available on this subject to identify trends, gaps, and future directions [12]–[14].

While there is growing interest in the use of AI for recruitment and selection in start-ups, there is a lack of comprehensive research that systematically analyzes the existing academic and industry literature on this topic. Current studies often focus on isolated aspects of AI applications in HR without providing a holistic view of how these technologies are being implemented specifically in start-up environments. This gap in research limits the understanding of the practical benefits, challenges, and developmental trajectories of AI tools in enhancing recruitment outcomes in these highly volatile and innovative business settings.

The primary objective of this research is to conduct a bibliometric analysis of the literature on the use of AI in HR recruitment and selection within start-up companies. This study aims to map out the existing academic and practical knowledge landscape, identify the most influential studies, discern prevalent research themes, and uncover the networks of scholarly communication. By doing so, the research intends to synthesize comprehensive insights that can guide future research and practical implementations of AI in start-up recruitment and selection processes.

2. LITERATURE REVIEW

2.1 Evolution of AI in HR Recruitment

The integration of Artificial Intelligence (AI) in human resources (HR), particularly in recruitment and selection, has evolved significantly over the past decade. Early applications of AI in recruitment primarily focused on automating administrative tasks, such as sorting through resumes and scheduling interviews. Researchers like [15] noted that these initial uses significantly reduced the administrative burden on HR professionals, allowing them to dedicate more time to strategic decision-making. As technology advanced, AI applications expanded to include more sophisticated functionalities like semantic search technologies that match candidates' resumes with job descriptions based

on contextual understanding rather than keyword matching [16]. These advancements have helped improve the quality of match between job requirements and applicant capabilities, enhancing the efficiency of the recruitment process.

2.2 AI-Driven Analytics and Candidate Assessment

With further technological advancements, AI tools began incorporating complex algorithms to assess candidate profiles using predictive analytics. According to [17], these systems analyze historical hiring data and outcomes to predict the success of potential hires, thereby refining the recruitment process over time. Moreover, AI-driven personality and skill assessments, as discussed by [18], utilize psychometric testing and video interviews analyzed by AI to gauge candidate suitability beyond what is evident from their resumes. This deeper level of analysis helps start-ups not only fill positions but also ensure that hires are well-suited to their fast-paced, evolving work environments.

2.3 Ethical Considerations and Bias Mitigation

As the deployment of AI in recruitment processes has grown, so too have concerns regarding ethical issues and potential biases. AI systems, as noted by [19], can perpetuate existing biases if they are trained on biased historical data or use flawed algorithms. This can lead to discriminatory practices, unintentionally favoring certain groups of candidates over others. Recognizing these challenges, recent research has focused on developing more transparent and accountable AI systems. Initiatives like those discussed by [20] aim to implement ethical guidelines and bias-mitigation strategies that ensure AI recruitment tools are fair and inclusive, aligning with broader societal values and legal standards.

2.4 Impact of AI on Startup Recruitment Strategies

In the context of start-ups, the use of AI in recruitment is particularly impactful due to their need for agility and optimal human resource allocation. Research by [21] highlights how start-ups leverage AI-driven tools to enhance their competitive edge by rapidly identifying and recruiting top talent who are not only skilled but also a good fit for the innovative and often unstructured startup environment. Furthermore, the ability of AI to process vast amounts of data rapidly allows startups to efficiently navigate the large pools of candidates, a task that would be considerably more resource-intensive without AI.

3. METHODS

This bibliometric study employs a systematic approach to analyze the existing literature on the use of Artificial Intelligence (AI) in HR recruitment and selection within start-up companies. The data for this analysis was extracted from Google Scholar, encompassing publications from the years 1983 to 2024. Keywords such as "AI in recruitment," "AI in HR," "start-up hiring practices," and "technology in recruitment" were used to refine the search results. The retrieved documents were then subjected to a rigorous screening process to ensure relevance, focusing on peer-reviewed articles, conference proceedings, and authoritative industry reports. Using bibliometric software tool like VOSviewer, the study analyzes patterns of publication, co-citation networks, authorship, and keyword occurrences. This methodology not only identifies the most influential works and authors in the field but also elucidates the thematic and conceptual developments over time. The study aims to

provide a comprehensive overview of the scholarly landscape, offering insights into the evolution of AI applications in start-up recruitment practices and highlighting emerging trends and gaps in the existing research.

4. RESULTS AND DISCUSSION

4.1 Research Data Metrics

Table 1. Data Citation Metrics

Publication years	1983-2024
Citation years	41 (1983-2024)
Paper	980
Citations	90245
Cites/year	2201.10
Cites/paper	92.09
Cites/author	60319.46
Papers/author	599.48
Author/paper	2.25
h-index	104
g-index	292
hI,norm	84
hI,annual	2.05
hA-index	50
Papers with ACC	: 1,2,5,10,20:713,590,409,265,147

Source: Publish or Perish Output, 2024

Table 1 presents a bibliometric analysis of publications from the years 1983 to 2024, spanning a total of 41 years of citation data. The dataset includes 980 papers, which collectively have accrued 90,245 citations, averaging 2,201.10 citations per year and 92.09 citations per paper. This high citation rate per paper reflects the influential nature of the research within this dataset. Additionally, the data shows a substantial number of citations per author (60,319.46) and papers per author (599.48), indicating a productive and collaborative authorship with an average of approximately 2.25 authors per paper. The h-index for this dataset is 104, which suggests that at least 104 papers have been cited at least 104 times, underscoring the significant impact of these publications in their respective fields. The g-index is even higher at 292, indicating that the top 292 papers have together received at least 85,264 citations. The normalized individual h-index (hI,norm) stands at 84 and the annual h-index (hI,annual) at 2.05, both metrics further confirming the enduring influence and relevance of the work by these authors over time. The hA-index is noted at 50, providing an adjusted view of the h-index considering author collaboration. The table also details the papers with accumulated citation counts (ACC) at various thresholds, showing a strong citation depth across numerous publications.

Table 2. Top Cited Research

Citations	Authors and year	Title
20153	[22]	The fourth industrial revolution
7620	[23]	Armstrong's handbook of human resource management practice
5133	[24]	Competitive advantage through people
2157	[25]	Building dynamic capabilities for digital transformation: An ongoing process of strategic renewal

Citations	Authors and year	Title
1940	[26]	Artificial Intelligence (AI): Multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice and policy
1919	[27]	The atlas of AI: Power, politics, and the planetary costs of artificial intelligence
1767	[28]	The mismanagement of talent: Employability and jobs in the knowledge economy
1721	[29]	Self-employment as a career choice: Attitudes, entrepreneurial intentions, and utility maximization
1561	[30]	Reward management: A handbook of remuneration strategy and practice
1203	[31]	Start-up nation: The story of Israel's economic miracle

Source: Publish or Perish Output, 2024

Table 2 lists the top cited research within a specified field, providing insights into the most influential works based on their citation counts, as sourced from "Publish or Perish Output" in 2024. The table is led by K. Schwab's "The Fourth Industrial Revolution," which significantly outstrips others with 20,153 citations, indicating its profound impact on discussions around technological advances and their societal implications. Following are M. Armstrong and S. Taylor's practical guide on HR management, "Armstrong's Handbook of Human Resource Management Practice," with 7,620 citations, and J. Pfeffer's "Competitive Advantage Through People," accruing 5,133 citations, both reflecting enduring relevance in HR and strategic management literature. Other notable works include interdisciplinary perspectives on AI, studies on digital transformation, and analyses of employment trends in the knowledge economy. The diversity of topics—ranging from strategic HR management to the socioeconomic impacts of technological innovation—illustrates the broad spectrum of research that shapes understanding and policy in business and technology domains. This table underscores the significance and varied impact of these works within their respective fields.

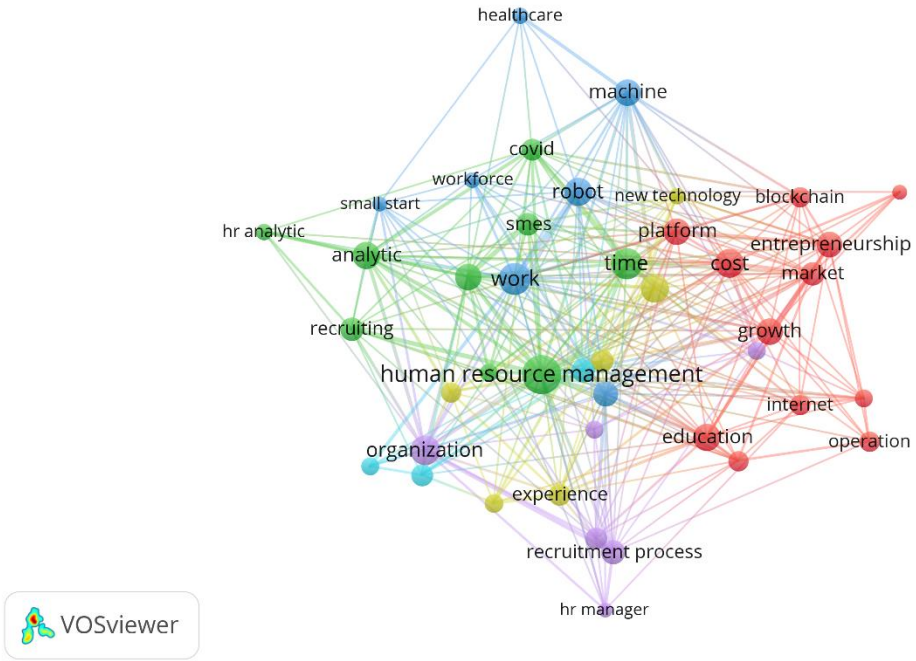

Figure 1. Network Visualization
Source: Data Analysis Result, 2024

The image you provided is a network visualization from VOSviewer, a tool used for constructing and visualizing bibliometric networks. This specific network likely maps out the co-occurrence of keywords within a dataset of scholarly articles focused on human resource management, particularly in the context of recruitment processes. The central node and predominant theme here is "human resource management," which connects to various subthemes and related terms. This suggests that the main focus of the literature in this dataset revolves around HR management practices.

Prominent connected nodes include "recruiting," "hr analytics," "organization," and "recruitment process." These terms suggest a strong emphasis on the recruitment strategies and analytics used within HR departments. There are nodes like "analytics," "robot," "new technology," and "blockchain," indicating that recent technological advancements and digital transformation trends are significant topics within the HR management field. Nodes like "healthcare," "SMEs" (small and medium-sized enterprises), "work," and "covid" indicate that the research also considers sector-specific HR practices and the impact of external factors such as the COVID-19 pandemic on HR management. Other notable terms include "cost," "growth," "market," and "operation," which are indicative of studies focusing on the economic and operational impacts of HR management practices in businesses.

Based on the visualized network, the overarching research theme appears to be the exploration of how modern HR management, particularly recruitment and selection processes, is evolving under the influence of new technologies and external changes in various sectors. The theme encompasses the integration of technological innovations like analytics and robotics into HR practices, the impact of these changes on organizational strategy and operations, and the specific challenges faced during disruptive events such as the pandemic.

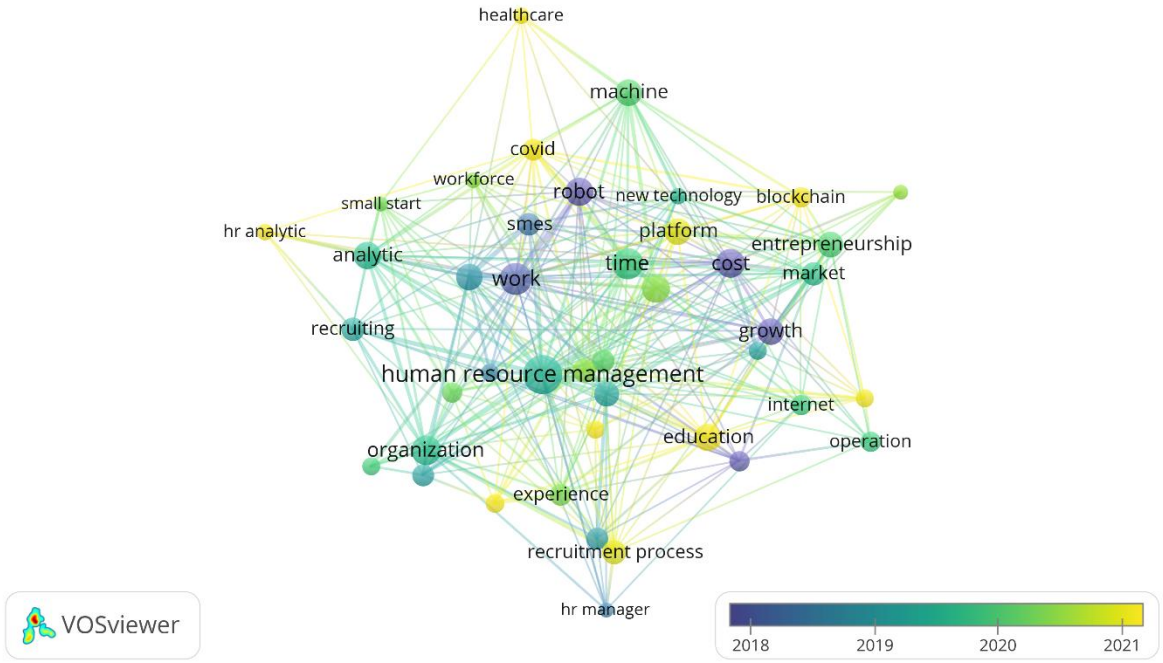

Figure 2. Overlay Visualization
Source: Data Analysis Result, 2024

The second figure is a VOSviewer network visualization that shows the co-occurrence of keywords over a period from 2018 to 2021, highlighting the evolution of research themes within human resource management, particularly in recruitment and technology integration. This visualization uses a color gradient from yellow to blue, indicating the timeline of keyword prevalence, with yellow representing 2018 and blue representing 2021.

During 2018-2019, the focus seems to have been strongly on foundational aspects of human resource management, with prevalent keywords such as "human resource management," "recruiting," and "organization" appearing in yellow. This suggests a concentration on traditional HR practices and their adaptation to emerging technologies. The visibility of "analytics" and "HR analytic" in this period also indicates an initial interest in data-driven HR practices, possibly reflecting the early integration of analytical tools into HR processes.

As the visualization shifts to green around 2020, there is a notable emergence of terms like "COVID" and "workforce," which are closely linked with "remote" and "new technology." This shift likely corresponds to the global impact of the COVID-19 pandemic, which forced a rapid pivot to remote work and necessitated the adoption of new technologies to manage remote workforces effectively. The focus on "machine," "robot," and "internet" during this time highlights the accelerated adoption of digital tools and platforms to support these changes.

By 2021, the nodes transition to blue, signaling a further evolution of the research themes. Keywords like "blockchain," "education," and "operation" become more prominent. The shift towards "blockchain" suggests an exploration of more advanced technologies in HR processes, possibly for enhancing security and efficiency in remote and digital transactions. "Education" and "operation" imply a consolidated focus on developing HR strategies that incorporate ongoing education and operational adjustments to adapt to post-pandemic realities.

Over these years, the research trends in HR management reflect a journey from

traditional recruitment and organizational strategies through a transformative phase driven by technological adoption and pandemic-related challenges, towards a more innovative and technologically integrated approach. This progression underlines the field's responsiveness to external shocks and its readiness to incorporate emerging technologies to address new challenges and opportunities. This analysis shows a clear trajectory towards increasingly sophisticated technological integration in HR practices, emphasizing the importance of agility and continuous learning in organizational strategies.

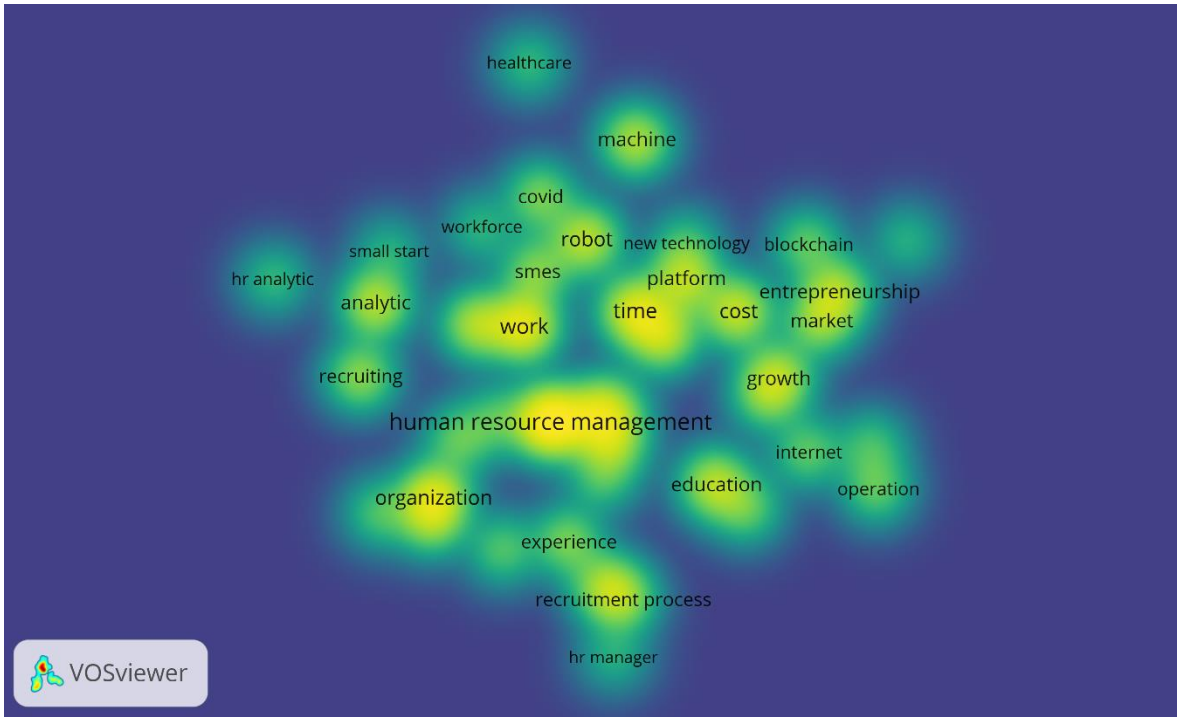

Figure 3. Density Visualization

Source: Data Analysis, 2024

This last figure depicts a VOSviewer visualization based on density mapping, which represents the concentration and relative frequency of topics within a field, in this case, human resource management. The intensity of colors, ranging from dark blue (least dense or less discussed topics) to bright yellow (most dense or frequently discussed topics), helps identify areas that are either heavily researched or potentially underexplored.

Interpretation of the Density Map

1. High-Density Areas (Bright Yellow/Green)

   Central and overlapping areas like "human resource management," "work," "recruiting," and "organization" are highlighted in bright green and yellow, indicating these topics are heavily researched. These nodes suggest strong academic and practical interest, likely reflecting extensive literature and ongoing discussions about traditional and evolving HR practices.

2. Moderate Density Areas (Light Green)

   Topics like "analytics," "hr analytic," "new technology," and "robot" appear in lighter green, signifying a healthy amount of research but possibly room for further exploration, particularly in how these technologies integrate with and impact HR functions.
3. Low-Density Areas (Blue)

   The darker regions of the map, shown in blue, include keywords like "blockchain," "internet," "education," and "platform." The relative darkness in these areas suggests these topics are less frequently discussed in the current literature.

The less bright, or darker blue areas, particularly around terms like "blockchain" and "internet," indicate topics that might be underexplored within the context of human resource management. This observation suggests several potential research opportunities:

1. Blockchain in HR, exploring the potential applications of blockchain technology for improving transparency, security, and efficiency in HR processes such as payroll management, employee verification, and maintaining secure employee records could be a promising research direction.
2. Internet and HR, the role of the internet in transforming HR practices, especially in remote recruitment, online training, and digital employee engagement strategies, presents a broad area for further investigation, especially considering the shifts to remote work and the global expansion of workforces.
3. Educational platforms in HR, investigating how online educational platforms can be leveraged for employee development, continuous learning, and certification within organizational settings could provide valuable insights into enhancing workforce capabilities in a digitally-driven economy.

5. CONCLUSION

The bibliometric analysis presented through VOSviewer network visualizations offers a comprehensive view into the thematic clusters, research trends, and opportunities within the field of human resource management, particularly focusing on technology's integration into HR practices. Central to the discussion are densely interconnected themes such as "human resource management," "recruitment," "analytics," and "organization," highlighting ongoing academic and industry focus on enhancing traditional HR functions through advanced analytics and strategic management. The visualizations also reveal a shift in research trends over recent years, particularly due to technological advancements and external factors like the COVID-19 pandemic, which pushed themes like "remote work" and "new technology" to the forefront. The identification of less bright areas in the density maps, such as "blockchain" and "internet," uncovers underexplored topics, suggesting fertile grounds for future research aimed at integrating emerging technologies into HR practices. Furthermore, the network's structure indicates active author collaboration, which is instrumental in driving forward the multidisciplinary research agenda in HR management. These collaborations are pivotal in exploring new territories and enhancing the depth and impact of research findings, ultimately contributing to the evolution and adaptation of HR practices in a rapidly changing technological landscape.

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