ARTIFICIAL INTELLIGENCE IN HUMAN RESOURCES FUNCTIONS: A BIBLIOMETRIC ANALYSIS OF PEER-REVIEWED RESEARCH 1990-2022

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Abstract - Artificial intelligence (AI) and digital technologies are swiftly integrating into many functions of organizations as a competitive drive to enhance innovation, productivity, efficiency, and better decision-making. Despite many gaps and inconsistencies, AI in HR disciplines is gaining momentum. For the benefit of researchers, academics, policymakers, and practitioners, this study highlights the trends, key themes and players, gaps and future directions. This research analyzes the 437 peer-reviewed research indexed in the Scopus database between 1990 to 2022. The articles were coded and analyzed for themes, topics, and findings using Excel, VOS Viewer, and R software. The results highlight AI in many HR functional disciplines, e.g., employee development and motivation, coaching, mentoring, performance improvement, employee relations, creating organizational culture, and innovations are yet to explore. AI in HR informatics in high-tech firms is the dominant theme in most publications. While there is increasing attention from researchers and practitioners, there are many gaps between the promise, potential, and real AI applications in HR disciplines. A higher knowledge gap raised many unanswered questions regarding AI's legal, ethical, and moral aspects in HR disciplines. The study is limited to peer-reviewed empirical, theoretical, conceptual, and review publications in the Scopus. The implications for theory, practice, and future research directions are discussed.

Keywords - Artificial Intelligence, Human Resources, Bibliometric Analysis, Research Directions, Topics and Themes Mapping, Visualization of Networks

I. INTRODUCTION

Artificial intelligence (AI) is progressively integrating into many aspects and all types of organizations aiming to enhance innovation, manage resources, productivity, efficiency, and precise decision-making (Guo, Hao, Zhao, Gong, & Yang, 2020; Hewapathirana & Almasri, 2021). Because AI often replicates human capabilities like cognitive, emotional, and social intelligence (Wamba, Bawack, Guthrie, Queiroz &Carillo, 2021). AI technology will soon replace some or most of the work that imitates human brains (Haenlein& Kaplan, 2019). It is predicted that 30% of the world's jobs will be replaced with AI in many industries by 2030 (Matsa&Gullamajj, 2019). AI technologies will take over the most individual, organizational, national, and global functions (Betz et al., 2019).

Though there is substantial bibliometric mapping and systematic literature reviews of influential research publications in healthcare, science, and technology, there needs to be more research on human resources disciplines (Masta&Gullamajji, 2019). Already published reviews are limited to narrow focus and single domains such as tactical HRM (Votto et al., 2021), HR information systems (Collins et al., 2021), recruitment (Garg et al., 2021; Nawaz & Gomes, 2019), individual, team and organizational performance appraisals (Tambe, Cappelli, &Yakubovicj, 2019), employee satisfaction (Pratt et al., 2021), human relations (Cregan et al., 2021), AI applications in HRM (Abdeldayem, &Aldulaimi, 2020) and HRM in general (Vrontis et al., 2021) in a scattered manner (Votte et al., 2021). Due to a lack of comprehensive reviews, this new stream of AI research is fragmented and limited in scope to provide a holistic understanding of the use of AI-based technologies in specific HR functions; hence there is a need for more research that provides a broader view of AI in HR functions (Budhwar et al., 2022). Besides its speed of integrating AI into many disciplines and organizations, most educators, researchers, practitioners, and policymakers still lack a comprehensive, up-to-date understanding of the impact and the utilization of AI technologies and a variety of AI tools and techniques applied in HR disciplines (Vrontis et al., 2021). Hence, there is a need to conduct a comprehensive bibliometric analysis to illustrate a holistic picture of AI research in all HR domains and highlight gaps to benefit future researchers and other stakeholders such as practitioners and entrepreneurs.

1.1. The Significant Contributions

The current trend is that AI in HR fields such as employee management, recruitment, screening applicants, and performance assessments are rapidly integrated into many organizations. AI is reshaping how companies manage their employees, increasing productivity and employee engagement. That means sizeable global recruitment firms already adopt AI to recruit, onboard, develop employees, and manage HR functions. Though already published research provides a substantial understanding of various AI applications in practice specific to HRM, changing technological innovations make knowledge obsolete in no time. The current research aims to generate new knowledge that will be a resource for many

stakeholders and those who need to become more familiar with the field and are interested in AI applications in HR functional disciplines. AI applications are used in most management areas and many disciplines (Zhang et al., 2021). However, there can have many risks and high costs when AI is misused. Therefore, continuous learning and development of employees are inevitable for better performance and greater efficiency (Guo et al., 2020). To be competitive in the market, all stakeholders, including employees, researchers, experts, and organizations, need to develop field-specific AI knowledge constantly. Thus, the authors attempt to fill the knowledge gaps to a certain degree and provide up-to-date AI-specific knowledge in all HR disciplines by conducting a bibliometric mapping and highlighting critical areas and gaps that require future attention.

The subsequence sections present purpose, methods, research questions, the results, mapping, and visualization followed by a discussion of salient findings and gaps. Lastly, summarize the policy, practice, theory, future research directions, limitations, and conclusion.

II. PURPOSE, METHODS, AND RESEARCH QUESTIONS

This bibliometric analysis aims to provide a Polaroid view of HR disciplines-specific AI research. The overarching research question explores the most recent AI research evolutions, the structure of AI applications, status, trends, disciplinary and geographical expansion, emerging topics/keywords, leading contributors, and future directions. This study attempts to inform the academics, researchers, policymakers, and practitioner communities with new insights and a holistic picture of where AI research and applications are lacking and thriving. For that purpose, the following research questions have been explored.

RQ1. What is the state-of-the-art development of AI research in HR disciplines? (Scientific production, publications, relative contributions, authors, references, and journals specific to HR functions).

RQ2. What are the researchers' contributions, institutions and geography, and specific Al applications).

RQ3. What are the trajectories of AI-specific topics/keywords/themes and their recent changes in research specific to all HR disciplinary areas?

Bibliometric analysis has been an effective tool to evaluate research trends in different fields (Lei & Lue, 2018) and provide a bird's eye view of structural patterns, emerging trends, knowledge structure, objective, informative, evidence-based knowledge of the field of study (Guo et al., 2020). It enables visualization, quantifiable and reproducible data that guide and facilitate researchers, policymakers, and communities of interest to gain a comprehensive knowledge of the application of AI technology in a specific discipline or a topical area. It provides a comprehensive picture of the entirety of AI-related research on specific subjects, disciplines and the AI-related research conducted in the fields of HR provides a greater understanding of the field.For example, A two-dimensional layout algorithm used on the geomatric triangulation process is used to conduct keywords time zone analysis, co-citation analysis, and co-authorship analysis (Chen 2006).

III. RESULTS AND DISCUSSION

3.1. Current Status of AI Research in HR Disciplines

AI application research in HR disciplines has shown a rapid increase from 2018 onwards and will continue to grow. Figure 1 illustrates the renewed interest in AI in HR-related research with the most recent rapid growth of publications. The increasing trend illustrates that business communities have progressively embraced AI applications, yet there is a much larger scope for future AI research. This finding is consistent with White &Fredriksen (2014) findings that AI has become an imperative technological drive for businesses, governments, and scientific communities. Technological advancements have made it more user-friendly and attracted many stakeholders and organizations. Increasing interest in AI applications is also an indicator of the highest value and importance that generated researchers' interest as it produced a large amount of data from the user's and developers' edges (Agrawal & Dhar, 2014). Despite the increasing number of articles on AI in HR fields from 2018 until 2022, AI research is still in the infancy stage and is expected to grow. There is a need to conduct more theoretical and empirical studies to enhance knowledge on AI in the domain of HR disciplines (Hewapathirana & Almasri, 2021; Votte et al., 2021).

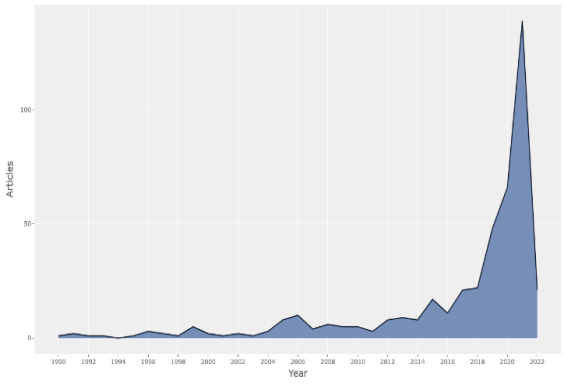


Figure 1: AI in HR Publication Trend

The analysis consists of 437 articles (400 empirical and conceptual and 37 literature reviews) authored by 1387 researchers. In total 22034 references, 1576 author generated keywords and 2302 system generated keywords. While 73 single-authored

articles, the rest were multi-authored articles and the average citations per document was 13.09.

3.2. Geographic Dispersion of AI Applications in HR Fields.

The AI and HR combination research growth is also evident from the corresponding author's geography involved. Figure 2 depicts AI in HR research by corresponding Authors country.

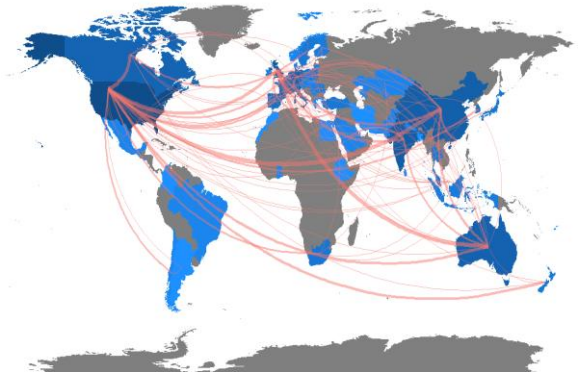


Figure 2: Geographic Representation of AI in HR

The results revealed cross country research collaborations is low because the highest number of corresponding Authors were from the USA, UK, China, India, Australia, Germany, and Italy. Despite growing number of publications, most publications were single country productions. The USA has the highest single country production while UK, Italy and New Zealand show multi-country research.

3.3. The Most Influential Authors in AI in HR

The most influential authors who contributed to AI in HR research based on citation analysis areHuang and Rust (2018) titled "Artificial intelligence on service" published in the Journal of Service Research has the highest citation 491. This theory building article focuses on performance enhancements by replacing employees with AI in service-oriented industries and it hints the eminent danger of losing human employment. White and Zhao (2014). titled "Causal model progressions as a foundation for intelligent learning environments" has the second highest citations (191). Their article focuses on creating intelligent learning environments using machine intelligence that benefit all ages learners. Most importantly, this research developed a mental model that may benefit advancing AI technology, while organizations use intelligent machines to educate employees and it also includes propositions for future research.

Most importantly a bibliometric analysis has been used widely to identify authors dominance by dividing the number of multi-authored articles in which the author is the first or a co-author by the total number of multi-authored articles (Kumar & Kumar, 2008; Elango& Rajendran, 2012). The most dominating authors were Chan, A.P.C. from 2017 until 2021; however, Chan was not the first author. Next, Sivathanu B. dominated from 2018 to 2021. Although newcomers entering to the field since AI in HR is still in the infant stage the above mentioned two authors standout among others. "Evenness/concentration of authors' contribution" (Mercediz-Sola &Bariviera, 2019) is a commonly used metric in bibliometric analysis which can be quantified using Lotka's law (Lotka, 1926). Lotka's law implies that the number of authors producing a certain number of articles is a fixed ratio, 2, to single-article authors. The results suggests that the Lotka's law appears to hold in AI research (K-S two sample test $p > 0.05$). Hence, the dominant author over time seems a reliable measure to understand the impact of author contribution.

3.4. Co-citation Network Analysis

A co-citation network analysis has been considered as an effective tool to distinguish an intellectual structure of a field of study. Co-author citation network analysis enables to identify "who cites whom" (Leon et al, 2013).

AI in HR research co-cited authors' network portrays five distinct clusters. The key author (s) generally considered as influential as they have uneven impact on the information transmission on the network (Bakshy et al., 2011). The collaboration institutions are dominated by health care industry, schools of informatics, medical research and universities limited to the USA. Such findings show still AI research is mainly limited to healthcare and information technology research and academic institutions. A few authors published AI research related to recruitment and HR informatics. There is a lack of research in HR specific disciplines and industry specific AI applications. Such gaps hinder our understanding of the type of AI and their consequences in specific industry sectors.

IV. DISCUSSION

Our bibliometric analysis suggests several important findings related to our knowledge of AI in HR disciplines. First, although there have been increasing studies related to AI, AI research remains in infancy in HR disciplines. This is consistent with previous reviews (Hewapathirana & Almasri, 2021; Votte et al, 2021) and the current emerging status of AI in HR practices. Although AI has a long history of development, its applications in HR functions remain limited, limiting the business phenomenon for empirical studies which explains the lack of empirical studies on the business sector specific topics. Second, AI research in HR is geographically concentrated in several leading countries without cross-border cooperation even though most studies were results of the multi-author collaboration. This could be due to the development of AI remaining concentrated in several countries with higher digital transformation and to the development of the geographical areas'

research capabilities. The less dispersed network of both authors and sources is a feature of emerging fields suggesting many opportunities for the field's development as it becomes more mature. Third, studies in AI have closely linked with digital transformation and technology while less focusing on other HR disciplines. Our analysis showed several studies on recruitment, e-learning, while AI with its range of techniques could be manifested in many other applications of HR activities such as selection, training, and development, etc. AI-related research lacks in-depth coverage of AI-powered technologies and their specificities to prepare different stakeholders for the adoption of AI-powered tools in practice.

V. CONCLUSIONS, LIMIATIONS AND IMPLICATIONS

We conclude that AI in HR functional disciplines is evolving rapidly. However, available research publications are limited to HRM in general, HR informatics, performance assessment, recruitment, and selection. Still, many gaps restrict our understanding of the type of AI applied in different industries and HR functions and their economic contributions. Our study suggests several theoretical implications. First, our analysis concludes that AI remains a technology while emerging applications in HR disciplines may alter how work is structured and perceived. In terms of future research directions, our bibliometric analysis suggests several future research directions. First, while AI has been incorporated into businesses, its effects still need to be better understood. Second, there needs to be more understanding of specific AI tools and technology used in various HR functions and their effectiveness. Some studies conceptualized AI as strategic adoption to achieve organizational goals. AI in HR disciplines is expected to grow and is fertile ground for empirical and theoretical studies. For instance, there is a need for empirical studies on AI-powered applications in HR functions. Besides, AI has been conceptualized as a technology; its application might have a more profound impact on how work is structured and the nature of decision-making. However, more research is needed to ensure our understanding of the effectiveness of specific AI technologies and their impacts on stakeholders' performance and the potential pitfalls. Organizational practitioners, hence, must speed up their abilities to learn and integrate appropriate AI tools and techniques. Despite a few leading countries such as the USA and UK, many nations' practitioners, educators, policymakers, researchers, and interested communities long to continuously understand the status, applications, innovations, and trends (Wamba, Bawack, Guthrie, Queiroz &Carillo, 2021). Though this study is limited to peer-reviewed publications from 1990 to 2022, it supports many stakeholders, such as researchers, policymakers, and practitioners, in understanding the status of AI in HR-specific functional disciplines and their implications in terms of economic and ethical aspects. With the expansion of AI applications in many organizational functions, unemployment can increase. Such questions guide macro-level policymakers while academic institutions innovate new courses to educate the workforce for future nations' development.

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