Artificial Intelligence and Human Capital: A Review

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Abstract: *Artificial Intelligence (AI) has primarily impacted the global human capital. The human capital has been elucidated, focusing on their developing relationship with AI. The complex facets of human capital, including aptitude, proficiency, and competence, have been examined in this review, concentrating on the intricate association between AI and human capital. A secondary data analysis was conducted for this study, incorporating 16 studies that were meticulously chosen from online search engines. Key search words such as "Human Capital and AI" and "AI and Human Resource Management" were employed for collecting the articles. Compelling data was extracted from these articles to uncover the linkage between AI and human capital. The study yielded both affirmative and negative outcomes following a thorough review of articles. The research identified major concerns associated with AI-powered HR processes concerning bias, fairness, privacy, and security. It underscores the urgency for incorporating responsible AI practices and harnessing the potential of AI while mitigating risks and ensuring equitable human capital development. The connection between AI and human capital provides an invaluable resource for researchers, practitioners, and policymakers navigating the evolving landscape of workforce development in an era of AI-driven innovation.*

Key words: Human Capital; Artificial Intelligence; Human Resource Management

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1. Introduction: Human capital, consisting of knowledge, skills, and competence possessed by the labour force, is crucial for economic growth and considered as the driving force of economic growth in economic growth theories (Aldieri et al., 2023). It refers to the inherent productive abilities of individuals that can be enhanced by investing in education, on-the-job training, and health (Eide & Showalter, 2010). Its per capita and human capital per worker is measures of human capital quality that represent the average human capital intensity for the total population and labour force, respectively. Both measures impact current economic activities, while the human capital quality of the population also affects future economic activities when younger generations enter the labour force (Xiong et al., 2021).

The term human capital is difficult to define and measure, and has been studied by social scientists from various perspectives. Its significance in economic well-being cannot be overstated. It includes knowledge, talents, skills, experience, intelligence, judgment, and wisdom possessed by individuals, and is a form of wealth that can be used to achieve national or state goals (Srivastava & Das, 2015). It has become an important indicator to boost economic growth (Jing, 2019).

Human capital refers to the accumulation of skills and talents within the workforce of a region, which can be measured through education and training. Human capital is not limited to formal education, but includes practical experience and non-traditional technical training. It has a positive impact on economic development (Ogunade, 2011).

AI involves making computers perform tasks that were previously limited to humans. Its rapid development has brought about changes in people's lifestyles, making it an important strategy for countries to enhance competitiveness and maintain security (Zhang & Lu, 2021).

AI is a recent critical development in electronic markets and a growing topic for information systems research. While some focus on creating AI to replace humans, information systems and decision support systems research prioritize using AI to support humans. Recent research

on hybrid intelligence and human-AI collaboration aims to synthesize AI research across fields, achieve synergy and complementarity between human and artificial intelligence (Kühl et al., 2022).

We have gained understanding on human capital and AI. The review concentrates on the relationship between AI and human capital.

2. Materials and Methods: A secondary analysis of the data was conducted in the present study. Sixteen articles were included to explore the link between AI and Human Capital. The analysis was conducted following a four-step process: (1) Defining the objective of the study, (2) Conducting a thorough search using online search engines with specific keywords such as "Human Capital and AI" and "AI and Human Resource Management" (3) Shortlisting articles based on relevance and (4) Analysing each of the 16 chosen articles in-depth. The data obtained from the secondary analysis was utilized to evaluate the scope of AI in human capital, investigate trends, and identify challenges.

3. Results and Discussion:

3.1. AI and Human Capital: The following literatures are linking with AI and human capital.

A recent study explored the use of artificial intelligence to identify suitable candidates for specific positions and create cohesive teams with aligned goals. The research utilized machine-learning models to cluster and analyse personality traits of applicants to determine weaknesses and strengths. The study used a publicly available dataset of Big-Five personality traits, with pre-processing and Pearson's correlation testing applied. Results indicated a positive correlation between agreeableness, conscientiousness, extraversion, and openness, and a negative correlation with neuroticism. K-means clustering was performed to label the dataset, and supervised machine-learning models, including random forest (RF), support vector machine (SVM), K-nearest neighbour (KNN), and AdaBoost, were applied to classify

applicants. The SVM model had an accuracy of 98%, outperforming other models, and the study contributes to the literature on the application of artificial intelligence in human-resource management. This research may benefit companies, organizations, and human-resource executives seeking to improve their hiring decisions and team cohesion (Ammer et al., 2023a).

A research on how human capital and the use of artificial intelligence in the fourth industrial revolution augment the relationship between them. The research took a qualitative approach and analysed 79 relevant articles for the proposed model's variables. The findings suggest that humans should be re-educated and trained to take on the roles that artificial intelligence requires. Although manual labour will become obsolete, occupations in science, administration, communication, health, and education will be in high demand. While machines may possess technical perfection and precision, the human workforce can benefit from the opportunities provided by artificial intelligence. In industrial revolutions, jobs may disappear, but other positions will arise where human skills like judgment, knowledge, decision making, and critical thinking outperform automation (Huertas-Lopez et al., 2021).

A study on AI's contributions to HR digitalization and practices, focusing on five AI applications and three HR readiness elements examined the input of 271 HR experts in IT, manufacturing, and administration, the data was analysed through SPSS and AMOS. Results indicate a fundamental role for organizational analysis in acquiring sustainable development, with adaptability and human capability supported by AI applications. Finally, health and safety are essential components of HR under AI application (Murugesan et al., 2023).

A study was conducted to enhance machine learning models and analyse personality traits to make correct and effective hiring decisions. By applying data-labelling techniques, several supervised machine learning models were implemented for classification purposes. These models were used to identify an applicant's weaknesses and strengths. Furthermore, this study

contributed to the development of artificial intelligence in human-resource management, which can positively impact companies and organizations in selecting the right individuals while achieving their goals. The SVM classification method attained the highest accuracy rate (98%), making it an ideal choice for future classification models (Ammer et al., 2023b)**.**

AI is a computer science field that aims to solve human intelligence and cognitive problems. AI gives machines the ability to think like humans, perform tasks such as problem-solving, learning, reasoning, and language processing. AI is driven by two basic technologies-machine learning and deep learning. The increasing use of AI and existing technologies is helping enterprises solve problems by automating tasks behind the scenes through data analysis. Integrating AI intelligence with human resource management can help companies save costs, improve the quality of talent, and enhance the effectiveness of employee team plans. The study offers a new approach to human resource management in the age of AI, emphasizing its impact on human resource management (Balu & Sowmya, 2022)**.**

A study aimed to establish best practices for integrating human capital with artificial intelligence in organizations. It revealed that artificial intelligence has become a new category of human capital, with its own set of learning requirements that need to be integrated into employee competencies. Additionally, there needs to be a transformation of job processes and position redesigns to enable collaboration between employees and technology for more efficient outcomes. The information presented in this study is beneficial for practitioners, learners, and academics looking for ways to improve business growth and adaptive progression in the face of the fifth industrial revolution (Burton, 2019).

A study on the use of machine learning in knowledge-based industries and the biases that can arise from ML predictions suggests a new source of bias that may result from incomplete real-time inputs due to strategic behaviour by agents. Domain expertise of users can complement ML by mitigating this bias. The authors conducted an observational and

experimental analysis in the patent examination context and found that ML is biased towards finding prior art textually similar to focal claims and that domain expertise is needed to find the most relevant prior art. The study also highlights the importance of vintage-specific skills and discusses the implications for artificial intelligence and strategic management of human capital (Starr & Agarwal, 2020).

Study on the implementation of artificial intelligence in human resources, as most companies in the IT industry are using it for various purposes, such as automating recruitment, performance appraisal and administering employee benefits. The aim is to improve overall employee experience, as leaders and executives believe that integrating AI into HR functions could increase efficiency. However, there are differing opinions regarding the benefits and drawbacks of AI in the workplace. It provides examples of top companies using AI and explores the challenges and limitations they face in implementing this technology. Finally, the study provides insights into the future of AI in human resources (Verma &Bandi, 2019).

A study on the challenges associated with using data science techniques for HR tasks. Four main challenges are identified: complexity of HR phenomena, small data sets, fairness and ethical constraints, and possible negative employee reactions. The article proposes three principles to address these challenges: causal reasoning, randomization and experiments, and employee contribution. All three principles would be economically efficient and socially appropriate for using data science in the management of employees (Tambe et al., 2019).

The CEO of ChatGPT has suggested that the impact of these technologies could be as significant as the printing press, with consequences for employment, stakeholder relationships, business models, and academic research. More advanced generative AI tools have escalated the "AI arms race," creating uncertainty for workers while expanding business applications and heightening risks related to well-being, bias, misinformation, privacy, ethics, and security. This editorial proposes various research pathways to extend HRM scholarship

in the realm of generative AI, contributing to shaping the future of HRM research (Budhwar et al., 2023).

The usage of Machine Learning is prevalent in Human Resources to automate processes, enhance decision making, and improve efficiency. However, the lack of interpretability may hinder its efficacy in Human Resources, as transparency is crucial in decision-making affecting people's lives directly. A study applies Anchors, a model-agnostic post-hoc explanation technique, to a Human Resources dataset. The dataset aims to create a predictive pipeline for employee attrition to enact timely retention policies. The results suggest that by using Anchors, Decision Makers can act prescriptively and retain valuable resources, with each decision easily interpretable by a non-expert (Abonamah et al., 2022).

Human resources is the most valuable asset for organizations as its performance is the key factor for the organization to achieve its objectives. In today's digital era, the use of Artificial Intelligence (AI) has become widespread in companies and government organizations in Indonesia. Although companies are responsible for delivering tasks and profit to their stakeholders, no research has investigated the influence of AI (Machine Learning Algorithm, Deep Learning and Big Data) on Human Capital Management in Indonesia. This study aimed to examine the effects of AI on Human Capital Management in Indonesia, using a sample of 85 organizational leaders and HR managers. The results indicated that the adoption of Deep Learning and Big Data had a significant positive impact on Human Capital Management (Purwaamijaya&Prasetyo, 2022).

Impact of AI on economic growth and household utility study in both short and long run finds that the development of AI can increase economic growth and household short-run utility if it leads to rising productivity in the goods or AI sector. However, if the increase in AI accumulation is due to firms using it to replace human labour, it can be detrimental to household short-run utility. The study also finds that the long-term effects of AI on household

welfare are uncertain. The conclusions are not affected even if AI can improve the accumulation of human or physical capital (Purwaamijaya&Prasetyo, 2022).

3.2. Trends and Challenges of AI and Human Capital: A study deliberates the reasoning behind these fears, highlighting the distinctiveness of AI and contrasting prior waves of automation and robotization with the ongoing advancements facilitated by AI's widespread adoption. It asserts that enormous opportunities in terms of intensified productivity can ensue, encompassing developing countries, thanks to the extreme reduction in capital costs demonstrated by a few applications, coupled with the potential for enhanced productivity, particularly among the low-skilled. Nonetheless, the hazards in the form of increased inequality need to be tackled so that the AI-fueled technological progress's benefits are shared widely. Accomplishing this objective requires skills policies, although insufficient in themselves. Additionally, the digital economy's fresh regulations are demanded to impede a further escalation of the market's concentration, guarantee suitable data protection and privacy, and assist in sharing the advantages of productivity growth through the combination of profit sharing, (digital) capital taxation, and a curtailment of working hours. The paper advocates for a moderately affirmative outlook on the opportunities and hazards brought about by artificial intelligence, provided they are squeezed in light of these technologies' distinctive features by policy-makers and social partners (Ernst et al., 2018).

A review article endeavours to present a comprehensive portrayal of contemporary deliberations in the field of social sciences regarding the foreseen effect of artificial intelligence on the domain of labour. The topics encapsulated comprise technological joblessness, algorithm-driven administration, platform-based labour, and the political aspects of AI-enabled work. The analysis is successful in identifying the principal scholarly and methodological viewpoints pertaining to AI's impact on labour, and acknowledging the difficulties that these viewpoints confront while making predictions. Additionally, the study

emphasizes two determinants incentivizing the emergence and implementation of AI in the economy: the capitalist drive and the influence of nationalistic viewpoints (Deranty& Corbin, 2022).

A recent study on the impact of artificial intelligence on unemployment rates in highly developed high-tech countries. Despite the proliferation of discussions surrounding artificial intelligence and its futuristic implications, comprehensive empirical analyses are scarce in the literature. Hence, we employ a dataset spanning from 2005 to 2021, covering 24 high-tech developed countries, and explore the correlation between a country's Google Trend Index related to AI and its unemployment rate. Employing a dynamic panel data and GMM-system estimation approach, we account for the dynamic effect of unemployment and establish the effect of AI on it. Our primary findings indicate that artificial intelligence reduces unemployment, validating the "displacement effect" of AI. (Guliyev, 2023).

4. Conclusion: The aforementioned articles have examined the various linkages between artificial intelligence and human capital. The investigation delves into the intricate interplay between these two entities and illuminates their evolving relationship in contemporary society. The research reveals that AI is not an independent force but rather a transformative instrument that can significantly impact human capital. The argument forwarded by this study suggests that AI can positively contribute to the development of human capital. To harness the potential of AI for human capital growth, it is crucial to prioritize learning and upskilling initiatives. Additionally, ethics is a fundamental element that must be considered concerning the connection between AI and human capital. Issues such as job transformation, research, and policy making should be actively discussed in the context of AI and human capital. The research underscores the importance of a proactive approach to AI integration that emphasizes continuous education, and strategic investments for unlocking the full potential of AI in enhancing human capital in the digital era.

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