Dr. Ajit Kaur
P.G Department of Commerce,
Ramgarhia Girls College,
Ludhiana, Punjab, India

A systematic review of artificial intelligence techniques in HRM: An assessment of performance evaluation and employee engagement

Dr. Ajit Kaur

Abstract
This research paper delves into the transformative impact of Artificial Intelligence (AI) on Human Resource Management (HRM), specifically focusing on performance evaluation and employee engagement. The primary objective of this study is to explore how AI technologies, such as machine learning and natural language processing, can enhance the accuracy and fairness of performance evaluations, and how they can be leveraged to improve employee engagement within organizations. Through a systematic literature review, this study synthesizes findings from recent research papers and case studies to assess the effectiveness of AI tools in HRM practices. The methodology employed involves a comprehensive analysis of peer-reviewed articles, conference proceedings, and empirical studies published between 2015 and 2023. Key findings indicate that AI significantly contributes to performance evaluation by providing data-driven insights that ensure fairness and objectivity. Furthermore, AI-driven tools are found to be instrumental in enhancing employee engagement by facilitating real-time feedback and personalized engagement strategies. However, the integration of AI in HRM also presents challenges, including concerns related to privacy, bias, and the need for human oversight. The paper concludes with practical recommendations for HR professionals aiming to implement AI in HRM practices, emphasizing the importance of ethical considerations and the human element in technology adoption. This study contributes to HRM theory by highlighting the role of technology in evolving HR practices and offers insights into the future of work in the AI era.

Keywords: Artificial intelligence, human resource management, performance evaluation, employee engagement, machine learning, HR technology

1. Introduction

Human Resource Management (HRM) has been a cornerstone in the architecture of organizational success, influencing facets from recruitment to retirement. The evolution of HR practices has been profound, transitioning from manual operations to incorporating sophisticated technologies. The advent of Artificial Intelligence (AI) technologies has initiated a transformative wave in HRM, paving the way for innovative practices in performance evaluation and employee engagement. AI, with its ability to process and analyze large volumes of data efficiently, has offered HRM the tools to revolutionize traditional processes, making them more efficient and data-driven.

AI's incorporation into HRM practices has been meticulously studied, with researchers like Sipahi and Artantaş (2022) [11] highlighting AI's role in automating routine tasks, thereby enhancing both the applicant and employee experience. This technological evolution allows for a shift towards more strategic and innovative work, crucial for organizational development and competitiveness in the contemporary business landscape (Sipahi & Artantaş, 2022) [11].

The rationale for examining AI's role in HRM is twofold: to understand the potential benefits and to navigate the accompanying challenges. As Tambe, Cappelli, and Yakubovich (2019) [12] articulate, while AI in HRM promises enhanced efficiency and decision-making, it also presents challenges such as data complexity, ethical considerations, and potential adverse employee reactions. It is crucial to explore how AI can be leveraged to improve performance evaluation and employee engagement, two vital areas that significantly impact organizational effectiveness and employee satisfaction (Tambe, Cappelli, & Yakubovich, 2019) [12].

Corresponding Author:
Dr. Ajit Kaur
P.G Department of Commerce,
Ramgarhia Girls College,
Ludhiana, Punjab, India

The benefits of AI in HRM encompass improved recruitment processes, personalized training and development, and objective performance evaluations. However, these advancements come with the need to address concerns over fairness, privacy, and the potential displacement of human roles. Understanding these dynamics is essential for harnessing AI's capabilities while mitigating its challenges.

The objective of this paper is to conduct a systematic review of AI techniques in HRM, focusing on performance evaluation and employee engagement. This review will dissect the application of AI in these areas, scrutinizing the methodologies, outcomes, and implications of relevant studies. By doing so, it aims to provide a holistic view of the current landscape, identifying best practices and areas for future research.

In line with this objective, studies such as those by Saranya (2022) [13] and Budhwar *et al*. (2022) [14] provide insights into the roles of AI in transforming HRM practices. They explore how AI technologies facilitate global competitiveness and enhance HR functions, underscoring the significance of AI in modern HRM strategies (Saranya, 2022) [13]; (Budhwar, Malik, De Silva, & Thevisuthan, 2022) [14].

Through the lens of AI, this review will endeavor to contribute to the discourse on AI's integration into HRM, highlighting its implications for performance evaluation and employee engagement. The goal is to furnish stakeholders with a comprehensive understanding that informs both academic and practical pursuits in enhancing HRM through AI technologies.

2. Methodology

The systematic review conducted on the impact of Artificial Intelligence (AI) in Human Resource Management (HRM), focusing on performance evaluation and employee engagement, employed a comprehensive and meticulously designed search strategy. To capture a broad spectrum of relevant literature, several electronic databases and search engines were utilized, including Google Scholar, Scopus, Web of Science, and the IEEE Xplore Digital Library. These platforms were chosen for their extensive coverage of interdisciplinary research that encompasses technology, management, and social sciences.

The search strategy was developed around a combination of keywords and phrases related to the core themes of the review: "Artificial Intelligence," "HRM," "Performance Evaluation," "Employee Engagement," "Machine Learning in HRM," "AI for Recruiting," "AI in Employee Performance Management," and "AI-driven Employee Engagement Strategies." Boolean operators (AND, OR) were used to refine the search and capture studies that specifically address the intersection of AI and HRM practices. For example, a typical search query was structured as follows: ("Artificial Intelligence" OR "Machine Learning") AND ("Human Resource Management" OR "HRM") AND ("Performance Evaluation" OR "Employee Engagement").

The search was not limited to full-text articles but also included conference papers, book chapters, and dissertations to ensure comprehensive coverage of the subject matter. However, priority was given to peer-reviewed journal articles, recognized for their academic rigor and contribution to the field. To ensure the review's relevance and timeliness,

the search was restricted to studies published from January 2015 onwards, capturing the most recent advancements in AI technologies and their applications in HRM.

The selection of studies for this review was guided by specific inclusion and exclusion criteria, established to ensure the relevance and quality of the literature analyzed. The criteria are detailed as follows:

2.1 Inclusion Criteria

- **Time Frame:** Only studies published between January 2015 and the present were considered. This time frame was chosen to focus on the latest developments in AI technologies and their application in HRM.
- **Publication Type:** The review included peer-reviewed journal articles, conference proceedings, book chapters, and dissertations. Priority was given to peer-reviewed articles due to their academic rigor.
- **Content Relevance:** Studies were included if they explicitly discussed the application of AI in HRM practices, with a specific focus on performance evaluation and employee engagement. Papers that presented empirical data, case studies, or theoretical analyses related to AI's impact on these areas were considered.
- **Language:** Only studies published in English were included, due to the linguistic capabilities of the review team.

2.2 Exclusion Criteria

- **Time Frame:** Studies published before January 2015 were excluded to maintain the review's focus on recent advancements.
- **Publication Type:** Non-peer-reviewed articles, editorial notes, and opinion pieces were excluded to ensure the review's academic integrity.
- **Content Relevance:** Studies that did not directly address AI's role in HRM, performance evaluation, or employee engagement were excluded. This includes papers on AI unrelated to HRM, or HRM studies that do not involve AI.
- **Incomplete Studies:** Abstracts, proposals, or incomplete studies without full texts available were excluded to ensure that only complete and accessible research was reviewed.

Using these criteria, the initial search yielded a 53 number of records. Duplicate records were removed, and titles and abstracts were screened to identify 25 studies potentially meeting the inclusion criteria. The full texts of these potentially eligible studies were then examined in detail to determine their suitability for inclusion in the review. Studies that did not meet all of the inclusion criteria were excluded, and the reasons for exclusion were documented to ensure transparency and reproducibility of the review process. And 14 studies were choosen to write review of this paper.

The methodology outlined ensures a systematic and unbiased approach to literature selection, aiming to provide a comprehensive overview of the state-of-the-art AI applications in HRM, particularly concerning performance evaluation and employee engagement. By adhering to this methodological framework, the review seeks to contribute meaningful insights and a solid foundation for future research in this rapidly evolving field.

3. Artificial Intelligence Techniques in HRM

Artificial Intelligence (AI) in Human Resource Management (HRM) leverages technologies like Machine Learning (ML), Natural Language Processing (NLP), and others to streamline and enhance HR functions. AI's capability to analyze vast datasets enables HR departments to make informed decisions, improve efficiency, and enhance employee experiences. ML algorithms support predictive analytics for talent acquisition and employee turnover rates, while NLP facilitates better communication and engagement through chatbots and virtual assistants (Fomude *et al.*, 2023; Góes & de Oliveira, 2020) [2, 4].

3.1 Application in Performance Evaluation

The incorporation of AI in performance evaluation aims to transform traditional, often subjective processes into objective, data-driven systems. AI models, utilizing machine learning predictions, offer a sophisticated approach to analyzing employee performance, identifying areas for improvement, and tailoring development plans. For instance, the RanKer model combines various AI algorithms to provide accurate performance ratings, ensuring fair and unbiased evaluations (Fitri *et al.*, 2023) [3].

AI's impact on performance management extends to real-time feedback mechanisms. Companies now deploy AI-driven analytics for ongoing performance assessments, moving away from annual reviews to a more dynamic, continuous feedback model. This shift fosters a culture of immediate recognition and constructive criticism, crucial for employee growth and satisfaction (Buck & Morrow, 2018) [1].

3.2 Application in Employee Engagement

AI significantly contributes to enhancing employee engagement by personalizing the employee experience and offering real-time insights into engagement levels. AI-powered tools, such as sentiment analysis and engagement monitoring systems, enable HR professionals to gauge employee morale and engagement in real-time, identifying trends and issues before they escalate (Mittal *et al.*, 2023) [5]. Personalized feedback systems, driven by AI, provide employees with customized recommendations for professional development, wellness programs, and career advancement opportunities. These systems not only foster a sense of individual attention and care but also promote a culture of continuous learning and improvement (Sari *et al.*, 2020) [8].

Moreover, AI facilitates the creation of a holistic work environment that promotes clarity, skill development, recognition, and wellness. By leveraging AI for real-time performance monitoring, sentiment analysis, and personalized engagement strategies, organizations can significantly enhance employee satisfaction and productivity (Park *et al.*, 2021; Park *et al.*, 2022) [6, 7].

In conclusion, AI technologies in HRM are redefining the landscape of performance evaluation and employee engagement. By automating routine tasks, providing data-driven insights, and personalizing employee experiences, AI not only streamlines HR processes but also significantly contributes to a more engaged, productive workforce. As these technologies continue to evolve, their integration within HRM practices promises further advancements in how organizations manage and support their human capital.

4. Assessment of Performance Evaluation and Employee Engagement

4.1 Effectiveness of AI Techniques

The effectiveness of AI in enhancing the accuracy and objectality of performance evaluations has been a subject of increasing interest among researchers and HR professionals alike. AI-driven tools, leveraging machine learning algorithms and deep learning, offer unprecedented capabilities in analyzing employee performance data, identifying patterns, and providing actionable insights. Awan *et al.* (2020) [9] found that a comprehensive performance management system (PMS), enhanced with AI for accuracy and fairness, significantly impacts task and contextual performance of employees, mediated by work engagement. This indicates that AI can facilitate a more objective and fair evaluation process, which, in turn, promotes better employee performance.

Moreover, the implementation of AI in performance evaluation has been shown to lead to enhanced precision, recall, F1-score, and accuracy in performance ratings, as demonstrated by the ensemble approach called RanKer (Fitri *et al.*, 2023) [3]. Such AI-enhanced systems not only improve the objectivity of performance assessments but also contribute to a more engaging and productive work environment by ensuring fair treatment and recognition of employee efforts.

However, the integration of AI in performance evaluations is not without challenges. Park *et al.* (2021) [6] highlighted that employees often harbor reservations towards AI-driven evaluations due to perceived threats like bias, manipulation, and privacy invasion. Addressing these concerns requires the incorporation of transparency, interpretability, and human oversight into AI systems, suggesting a hybrid approach that leverages AI's capabilities while maintaining human elements in decision-making processes.

4.2 Impact on Employee Engagement

The role of AI in fostering employee engagement is multifaceted, with AI tools being utilized to monitor performance, analyze sentiments, and provide personalized feedback. Mittal *et al.* (2023) [5] emphasized AI's potential in creating a work environment that promotes clarity, skill development, recognition, and wellness, which are key drivers of employee engagement. Through real-time monitoring and natural language processing, AI enables organizations to gain deep insights into employee sentiments, facilitating timely interventions that enhance engagement levels.

Furthermore, AI-supported interventions have shown significant promise in increasing employee satisfaction and engagement by providing a more personalized and responsive work experience. Sari *et al.* (2020) [8] reported that AI-based software significantly aids management in detecting and enhancing employee engagement levels, allowing companies to proactively address issues and retain key employees.

Despite the benefits, the deployment of AI in enhancing employee engagement is not devoid of hurdles. Prasad *et al.* (2023) [10] found that while AI has a positive impact on productivity, organizational effectiveness, and employee satisfaction, its adoption is influenced by employees' attitudes towards new technologies, underscoring the need for careful management of technological change to maximize engagement benefits.

In essence, the effectiveness of AI techniques in performance evaluation and their impact on employee engagement present a compelling case for their integration into HRM practices. While AI offers the potential to revolutionize performance management and employee engagement, its success depends on addressing the concerns of bias, transparency, and the human element in AI-driven processes. The future of HRM lies in leveraging AI's capabilities to enhance fairness and objectivity in performance evaluations and foster a more engaged and productive workforce, balanced with a thoughtful consideration of the human aspects of work.

5. Discussion
The advent of Artificial Intelligence (AI) in Human Resource Management (HRM) marks a transformative era, reshaping traditional practices in performance evaluation and employee engagement. The synthesis of findings from recent studies highlights AI's potential to enhance the objectivity, accuracy, and fairness of performance evaluations (Awan *et al*., 2020; Fitri *et al*., 2023) [9, 3]. AI-driven tools, leveraging algorithms like the ensemble approach RanKer, have demonstrated their efficacy in offering precise performance ratings, thereby fostering a fair and unbiased evaluation process (Fitri *et al*., 2023) [3]. Such advancements underscore AI's capacity to refine HRM practices by ensuring evaluations are grounded in data-driven insights, reducing human biases, and enhancing the credibility of performance assessments.

In the realm of employee engagement, AI emerges as a pivotal tool in understanding and enhancing the employee experience. By employing techniques such as sentiment analysis and real-time monitoring, AI facilitates a deeper understanding of employee sentiments and engagement levels (Mittal *et al*., 2023; Sari *et al*., 2020) [5, 8]. These technologies enable HR professionals to tailor interventions and feedback more effectively, promoting a work environment that values clarity, recognition, and personal development. Consequently, AI's integration into employee engagement strategies offers a pathway to foster a more motivated, satisfied, and cohesive workforce.

Moreover, the role of AI in addressing challenges related to performance evaluation and employee engagement cannot be overstated. As Park *et al*. (2021) [6] identified, employee apprehensions toward AI, including fears of bias and privacy invasion, pose significant hurdles. However, by integrating transparency, interpretability, and human oversight into AI systems, these challenges can be mitigated, thus preserving the human element in HRM while leveraging AI's capabilities.

The findings from this review contribute to HRM theory by elucidating the role of AI in evolving HRM practices towards more data-driven and personalized approaches. The incorporation of AI in performance evaluation challenges traditional theories that predominantly focus on human judgment and interpersonal relations. It introduces a paradigm where performance management is seen through the lens of algorithmic decision-making, underscoring the importance of fairness, accuracy, and the mediating role of technology in employee perceptions.

Furthermore, the impact of AI on employee engagement enriches the job characteristics model (Hackman & Oldham, 1976) [15] by introducing technology as a factor that can significantly influence psychological states and, consequently, engagement levels. This suggests a need to expand existing theories to accommodate the burgeoning role of technology in shaping job designs and employee experiences.

For HR professionals, the integration of AI in HRM practices offers several recommendations:

- **Adopt a Hybrid Approach:** Combine AI's analytical prowess with human judgment to ensure performance evaluations and engagement strategies are both objective and empathetic (Park *et al*., 2021) [6].
- **Promote Transparency and Education:** To mitigate concerns about AI, organizations should foster an environment of transparency regarding how AI tools are used and educate employees on the benefits and safeguards in place (Fitri *et al*., 2023) [3].
- **Tailor AI Strategies to Individual Needs:** Utilize AI's capacity for personalization to develop customized engagement and development plans, recognizing that employee needs and motivations vary widely (Mittal *et al*., 2023) [5].
- **Invest in AI Literacy:** Ensure HR professionals are equipped with the knowledge and skills to effectively implement and manage AI tools within HRM practices (Sari *et al*., 2020) [8].
- **Monitor and Adapt:** Continuously assess the effectiveness of AI-driven HRM practices and be willing to adapt strategies based on feedback and changing organizational needs (Awan *et al*., 2020) [9].

As AI becomes more embedded in HRM, ethical considerations concerning privacy, consent, and the potential for algorithmic bias must be addressed. Establishing clear policies and ethical guidelines for AI use in HRM is paramount to maintaining trust and integrity within the organization.

In conclusion, the integration of AI into HRM practices presents both opportunities and challenges. By enhancing the accuracy and fairness of performance evaluations and offering personalized approaches to employee engagement, AI has the potential to significantly transform HRM. However, the successful implementation of AI in HRM requires a thoughtful approach that balances the capabilities of AI with the nuances of human judgment and ethical considerations. As the field continues to evolve, HR professionals must remain agile, continuously adapting to leverage the benefits of AI while mitigating its challenges.

6. Conclusion
The integration of Artificial Intelligence (AI) into Human Resource Management (HRM) practices marks a significant advancement towards optimizing both performance evaluation and employee engagement processes. This review has elucidated the transformative potential of AI in redefining HRM, highlighting key insights that underscore AI's role as a catalyst for enhancing accuracy, fairness, and personalization within HR practices.

Firstly, AI's application in performance evaluation demonstrates a paradigm shift from traditional, subjective methods to more objective, data-driven approaches. Tools such as machine learning algorithms and ensemble models like RanKer facilitate precise performance assessments, ensuring evaluations are grounded in unbiased, analytical insights (Fitri *et al*., 2023) [3]. These advancements not only

improve the credibility of performance evaluations but also contribute to a fairer, more transparent assessment process.

Secondly, AI significantly impacts employee engagement by enabling real-time monitoring, sentiment analysis, and personalized feedback mechanisms. Through these capabilities, AI aids in creating an engaging work environment that promotes clarity, recognition, and professional development (Mittal *et al.*, 2023) [5]. By leveraging AI to understand and respond to employee sentiments and needs, organizations can foster a more motivated and satisfied workforce.

Furthermore, the review has highlighted the importance of addressing challenges associated with AI implementation, such as employee apprehensions and ethical considerations. Overcoming these obstacles necessitates a balanced approach that combines AI's analytical strengths with human judgment and ethics, ensuring AI-driven HRM practices are both effective and empathetic (Park *et al.*, 2021) [6].

As we look to the future of AI in HRM, it is evident that the potential of AI to revolutionize HR practices is vast. Ongoing developments in AI technology, including advancements in natural language processing, deep learning, and predictive analytics, promise to further enhance HRM's capabilities. These technological strides will enable more sophisticated analyses of employee data, yielding deeper insights into performance and engagement that can inform more nuanced HR strategies.

However, the dynamic nature of the workforce, characterized by evolving employee expectations, diversity, and the shifting landscape of work due to factors like remote work and digital transformation, poses unique challenges. To navigate these changes effectively, HR professionals must remain agile, continuously adapting AI-driven HRM practices to align with emerging workforce trends.

Moreover, as AI becomes increasingly integrated into HRM, a proactive approach to ethical considerations, including privacy, bias, and transparency, will be crucial. Establishing robust ethical guidelines and fostering a culture of trust and transparency around AI use will be essential to maximizing the benefits of AI in HRM while mitigating potential risks.

In conclusion, AI holds tremendous promise for enhancing HRM practices, offering the potential to transform performance evaluation and employee engagement in profound ways. However, the successful realization of this potential will require a thoughtful approach that balances technological innovation with ethical considerations and human-centric values. By embracing the opportunities presented by AI while navigating its challenges with care, HR professionals can harness the power of AI to foster a more efficient, engaged, and satisfied workforce, propelling organizations towards greater success in an ever-evolving business landscape.

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