



# AI Usage, Employee Engagement, and Work Performance: Examining the Roles of Job Complexity and AI Knowledge

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**Abstract.** The integration of Artificial Intelligence (AI) in the workplace has revolutionized organizational processes, enhancing efficiency, innovation, and decision-making capabilities. Grounded in the Job Demands-Resources (JDR) theory, this study examines the complex relationships between AI usage, employee engagement, and work performance, while exploring the moderating roles of job complexity and AI knowledge. Using Structural Equation Modeling (SEM) on data collected from 500 professionals across diverse industries, the findings reveal that AI usage positively influences both employee engagement and work performance. Furthermore, employee engagement mediates this relationship, highlighting its critical role in leveraging AI's potential. Job complexity and AI knowledge significantly moderate these effects, suggesting that individual and contextual factors amplify AI's impact. This research contributes to the growing body of knowledge by integrating emerging technologies with established theories, providing valuable insights for academia and practitioners to optimize AI implementation in organizational contexts.

**Keywords:** Artificial Intelligence (AI), Job Demands-Resources (JDR) Theory, Employee Engagement, Work Performance, AI Knowledge, Job Complexity, Moderation Effects, Mediation Effects, Workplace Innovation, Structural Equation Modeling (SEM)

## 1 Introduction

The advent of Artificial Intelligence (AI) has fundamentally transformed the modern workplace, becoming a cornerstone of organizational strategies aimed at enhancing efficiency and innovation (López-García et al., 2024)<sup>[1]</sup>. This transformative technology has been celebrated for its capacity to optimize processes and improve decision-making, yet its broader impact on workforce engagement and performance remains under-explored (Su et al., 2024)<sup>[2]</sup>. AI's integration into the workplace has highlighted new opportunities for improving employee performance, especially when combined with job resources like AI knowledge (Kandpal et al., 2023)<sup>[3]</sup>. However, the complex role of job characteristics, such as job complexity, has yet to be fully understood in the

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context of AI adoption (Luhana et al., 2023)<sup>[4]</sup>. Grounded in the Job Demands-Resources (JDR) theory, this study examines how AI usage as a job resource influences employee engagement and work performance, while considering the moderating roles of job complexity and AI knowledge (Malik, 2024)<sup>[5]</sup>.

## 1.1 Literature Review

### 1.1.1 AI Usage in the Workplace.

AI Usage in the Workplace AI technologies have revolutionized the nature of work by automating repetitive tasks and enabling advanced analytics (Luhana et al., 2023)<sup>[4]</sup>. Scholars have posited that AI usage can enhance employee efficiency by reducing cognitive load and providing actionable insights (Ahn, 2024; Liu & Huang, 2024)<sup>[6][7]</sup>. Moreover, AI's integration into workplace processes offers significant potential for improving decision-making and employee performance, especially in dynamic work environments (Kandpal et al., 2023)<sup>[3]</sup>. For example, AI-powered customer relationship management systems can streamline client interactions, while predictive analytics in manufacturing can prevent equipment failures. However, empirical studies have also highlighted potential downsides, including employee resistance and ethical concerns related to AI implementation (Ghorbanzadeh et al., 2024; Dutta & Mishra, 2024)<sup>[8][9]</sup>.

### 1.1.2 Work Performance.

Work performance, a critical determinant of organizational success, is defined as the efficiency and effectiveness with which employees complete job tasks. AI technologies significantly influence performance by enhancing task accuracy and streamlining decision-making processes (Su et al., 2024)<sup>[2]</sup>. For instance, in high-demand environments such as healthcare, AI systems facilitate diagnostic accuracy and patient management, leading to improved outcomes (Ahn, 2024)<sup>[6]</sup>. However, researchers caution that over-reliance on AI can lead to skill erosion and decreased autonomy, necessitating balanced AI adoption strategies (Zhang, 2024)<sup>[10]</sup>.

### 1.1.3 Employee Engagement.

Employee engagement is defined as a positive, work-related state characterized by vigor, dedication, and absorption (Schaufeli et al., 2006)<sup>[11]</sup>. Research underscores the role of engagement in mediating the relationship between job resources and performance outcomes (Bakker & Demerouti, 2014)<sup>[12]</sup>. AI usage has been linked to enhanced engagement through improved task efficiency and decision support, as AI technologies reduce cognitive load and enhance employees' ability to focus on high-value tasks (Rožman et al., 2023; Zhang, 2024)<sup>[10][13]</sup>. Additionally, AI's ability to provide actionable insights has been shown to positively influence both individual and organizational performance (Kandpal et al., 2023; Liu & Huang, 2024)<sup>[3][7]</sup>. For example, the deployment of chatbots in customer service roles has been shown to alleviate repetitive workloads, allowing employees to engage in more meaningful interactions (Dutta & Mishra, 2024)<sup>[9]</sup>.

### 1.1.4 Job Complexity.

Job complexity refers to the degree of cognitive and physical demands required to perform a role. High-complexity roles often require advanced problem-solving, decision-making, and adaptability, while low-complexity roles are characterized by routine and repetitive tasks (Pap et al., 2022)<sup>[14]</sup>. For instance, in industries like software development, job complexity may involve integrating AI tools to analyze vast datasets or automate coding tasks. Conversely, in clerical roles, AI might assist in managing schedules or automating document processing. These variations underscore the importance of considering job complexity when evaluating the outcomes of AI adoption.

Recent studies have highlighted the differential effects of AI on various sectors. For example, healthcare professionals leverage AI for diagnostics and predictive analytics, significantly enhancing task efficiency in high-complexity roles (Ahn, 2024)<sup>[6]</sup>. On the other hand, in retail, AI adoption is primarily focused on inventory management, illustrating its limited impact in roles with lower complexity (Zhang, 2024)<sup>[10]</sup>. These contrasts demonstrate the need for tailored AI implementation strategies based on job demands.

### 1.1.5 AI Knowledge.

AI knowledge encompasses an individual's familiarity with and ability to effectively utilize AI technologies. Employees with higher AI knowledge are better equipped to integrate these tools into workflows, enhancing efficiency and decision-making (He et al., 2023)<sup>[15]</sup>. For example, a marketing professional with advanced knowledge of AI-powered analytics tools can derive actionable insights from consumer data, whereas a novice may require additional training to achieve similar outcomes. By segmenting employees based on their AI knowledge, organizations can tailor training programs to maximize the benefits of AI adoption.

Emerging evidence suggests that structured training programs significantly enhance employees' AI competencies, fostering greater engagement and performance (Xu et al., 2023)<sup>[16]</sup>. Moreover, industries with higher investments in AI education have reported fewer implementation challenges, emphasizing the role of organizational support in bridging knowledge gaps (Dutta & Mishra, 2024)<sup>[9]</sup>.

### 1.1.6 Research Gaps and Future Directions.

While prior studies have examined the direct effects of AI usage, limited research has explored its interaction with contextual factors such as job complexity and employee expertise (Fitri et al., 2023)<sup>[17]</sup>. Additionally, the mediating role of engagement in linking AI usage to performance remains underdeveloped in the literature (Salimzadeh et al., 2023; He et al., 2023)<sup>[15][18]</sup>. Addressing these gaps, this study integrates insights from the JDR theory to propose a comprehensive framework.

Future research should consider longitudinal studies to examine the evolving impact of AI on workforce outcomes over time. Furthermore, sector-specific investigations could illuminate industry-level variations in AI adoption, particularly in relation to organizational culture and readiness.

## 2 Theory and Hypothesis Development

### 2.1 Job Demands-Resources Theory

The Job Demands-Resources (JDR) theory serves as the theoretical framework for this study, providing a robust model to examine the interplay between job demands, resources, and employee outcomes (Demerouti et al., 2001; Bakker & Demerouti, 2014)<sup>[12][19]</sup>. According to the JDR model, job resources, such as advanced technology, can mitigate the adverse effects of job demands and enhance engagement and performance. AI usage exemplifies a critical job resource, enabling employees to manage workload efficiently and perform complex tasks with greater ease (Demerouti & Bakker, 2021)<sup>[20]</sup>. Recent extensions of the JDR model also explore how external factors, such as leadership and social support, interact with job resources and demands to affect employee well-being and performance (Tummers & Bakker, 2021; Wang et al., 2022)<sup>[21][22]</sup>.

### 2.2 Direct Effects of AI Usage

AI usage has been posited to influence work performance positively by improving task efficiency and decision-making (Su et al., 2024)<sup>[2]</sup>. Studies indicate that the automation of routine tasks and access to real-time data through AI systems enhance employee productivity (He et al., 2023)<sup>[15]</sup>. Therefore, this study:

**H1:** AI usage has a significant positive effect on work performance.

**H2:** AI usage has a significant positive effect on employee engagement.

### 2.3 Role of Employee Engagement

Employee engagement is defined as a positive, fulfilling state characterized by vigor, dedication, and absorption (Schaufeli et al., 2006)<sup>[11]</sup>. Research has consistently demonstrated that engagement mediates the relationship between job resources and performance outcomes (Bakker & Demerouti, 2014)<sup>[12]</sup>. AI usage is expected to enhance engagement by reducing job-related stress and providing cognitive support. This leads to:

**H3:** Employee engagement has a significant positive effect on work performance.

**H4:** Employee engagement mediates the positive relationship between AI usage and work performance.

### 2.4 Moderating Factors

#### 2.4.1 Job Complexity.

Job complexity moderates the effectiveness of job resources. High job complexity amplifies the need for supportive tools like AI, making its usage more impactful in complex tasks (Bakker et al., 2022)<sup>[20]</sup>. Thus:

**H5:** Job complexity moderates the relationship between AI usage and employee engagement, such that the relationship is stronger when job complexity is higher.

### 2.4.2 AI Knowledge.

AI knowledge enhances employees' ability to integrate and utilize AI tools effectively (Dutta & Mishra, 2024)<sup>[9]</sup>. This knowledge may strengthen the impact of engagement on performance outcomes, leading to:

**H6:** AI knowledge moderates the relationship between employee engagement and work performance, such that the relationship is stronger for individuals with higher AI knowledge.

### 2.5 Combined Effects: Moderated Mediation

The interaction between job complexity and AI usage is likely to influence the mediation effect of engagement, emphasizing the need for contextual factors in understanding AI's impact. This forms:

**H7:** Job complexity moderates the mediation effect of employee engagement between AI usage and work performance.

## 3 Framework

The proposed research framework is illustrated in Figure 1. The study examines direct, indirect, and moderated effects of AI usage, job complexity, AI knowledge, employee engagement, and work performance.

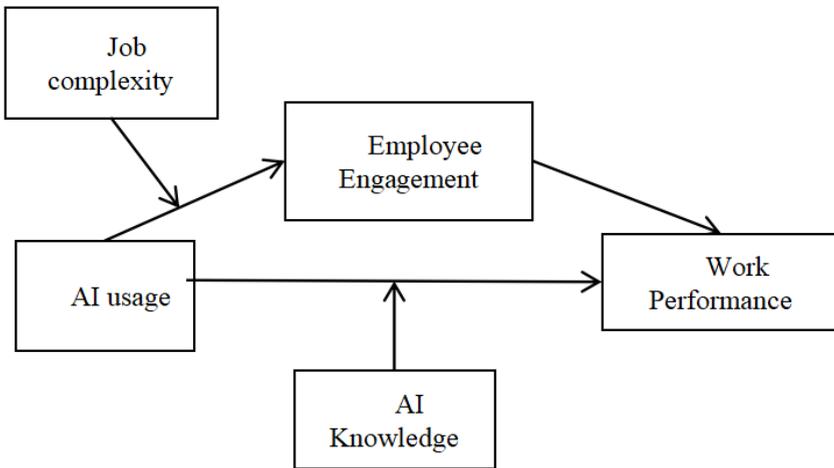


Fig. 1. Research Framework

### 3.1 Sample and Procedure

Data were collected from 500 employees using an online survey. Respondents were from diverse industries to ensure generalizability. Demographics include 55.2% females, 48.5% aged between 21 and 30, and 53.2% with a bachelor's degree.

### 3.2 Measurement Scales

**AI Usage:** Measured using a 3-item scale from Tang et al. (2022)<sup>[23]</sup>. Sample item: “I used artificial intelligence to carry out most of my job functions.”

**Job Complexity:** Measured using 4-item scale the Complexity of Tasks Inventory from Morgeson & Humphrey (2006)<sup>[24]</sup>. Sample item: “The tasks on the job are simple and uncomplicated.”

**Employee Engagement:** Assessed via the 9-item Utrecht Work Engagement Scale (UWES) by Schaufeli et al. (2006)<sup>[11]</sup>. Sample item: “At my work, I feel bursting with energy.”

**AI Knowledge:** Measured using of the 5-item scale the AI Knowledge scale from Chiu, Y., Zhu, Y., & Corbett, J. (2021)<sup>[25]</sup>. Sample item: “I know pretty much about AI”

**Work Performance:** Measured via the Individual Work Performance Questionnaire by Koopmans et al. (2014)<sup>[26]</sup>. Sample item: “I completed my tasks efficiently.”

## 4 Analysis and Results

### 4.1 Model Fit

The model demonstrated excellent fit indices:

**SRMR:** 0.040

**NFI:** 0.913

**Chi-Square (df):** 654.350 ( $p < 0.01$ )

### 4.2 Path Analysis

The results of the path analysis are summarized in Table 1. All hypothesized relationships were supported.

**Table 1.** Hypothesis Testing Results

| Hypothesis | Path   | $\beta$ | p-value | Supported? |
|------------|--|---------|---------|------------|
| H1         | AI Usage $\rightarrow$ Work Performance            | 0.155   | 0.002   | Yes        |
| H2         | AI Usage $\rightarrow$ Employee Engagement         | 0.145   | 0.001   | Yes        |
| H3         | Employee Engagement $\rightarrow$ Work Performance | 0.159   | 0.004   | Yes        |
| H4         | Mediation (via Engagement)                         | 0.023   | 0.031   | Yes        |
| H5         | AI Knowledge $\times$ Engagement                   | 0.109   | 0.030   | Yes        |
| H6         | Job Complexity $\times$ AI Usage                   | 0.178   | 0.002   | Yes        |
| H7         | Moderated Mediation                                | 0.028   | 0.049   | Yes        |

### 4.3 Moderation and Mediation Effects

Fig. 2 illustrates the moderation and mediation analysis. It shows that Job Complexity (JC) positively affects AI Knowledge (AK), with more complex jobs leading to higher AI knowledge. Both Job Complexity (JC) and AI Knowledge (AK) enhance Employee Engagement (EE). Employee Engagement (EE) partially mediates the relationship between AI Usage (AU) and Work Performance (WP), indicating that higher engagement improves work performance. The coefficients (e.g., 0.269, 0.155) represent the strength of these relationships.

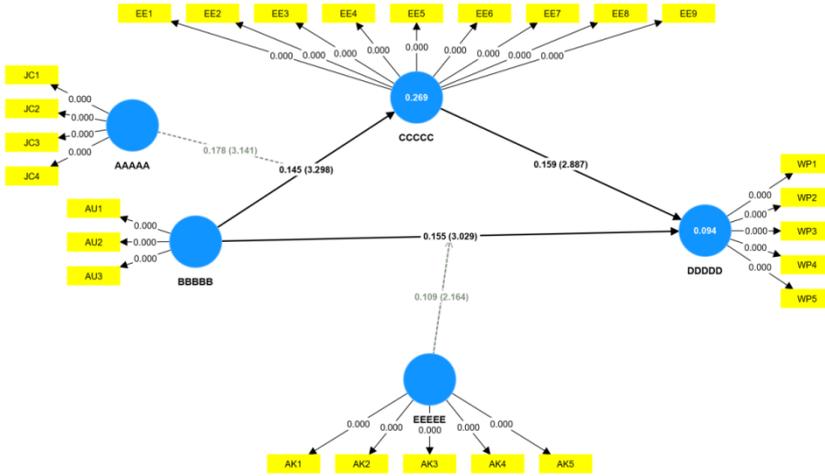


Fig. 2. Mediation Effects

## 5 Discussion

This study highlights the transformative potential of AI technologies in enhancing employee engagement and work performance, using the Job Demands-Resources (JDR) framework. AI usage was found to reduce cognitive load and streamline task efficiency, thereby fostering improved workplace outcomes. These findings align with existing literature on the positive role of AI as a job resource that mitigates job demands (Su et al., 2024)<sup>[2]</sup>.

The moderating effects of job complexity and AI knowledge provide key insights. High job complexity enhances the benefits of AI by optimizing challenging tasks, while employees with advanced AI knowledge are better equipped to leverage these technologies effectively. These observations emphasize the need for customized AI training programs and role-specific adoption strategies to maximize organizational benefits.

Practically, this study suggests that organizations should invest in employee training and align AI solutions with job complexity levels to enhance engagement and performance. Addressing resistance and ethical concerns through clear communication and supportive policies is also essential for successful AI integration.

## 6 Limitations and Future Directions

This study has certain limitations. First, the cross-sectional design limits causal interpretations. Future longitudinal research could provide deeper insights into the evolving effects of AI integration. Second, the diverse sample may not capture industry-specific nuances. Future studies should explore sector-specific dynamics to better understand contextual variations.

Additionally, while this study examined job complexity and AI knowledge, other factors such as organizational culture and leadership styles warrant exploration. Finally, as AI technologies evolve rapidly, updating theoretical frameworks to reflect new workplace trends will be crucial. Addressing these areas can advance understanding and improve practical applications of AI in organizations.

## 7 Conclusion

This study contributes to the literature by integrating the JDR theory with emerging technologies like AI. The findings underscore the importance of AI knowledge and job complexity as boundary conditions and highlight employee engagement as a critical mechanism driving work performance. Future research should explore additional mediators and contextual factors to enrich understanding of AI's organizational impact.

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