



(RESEARCH ARTICLE)



IMPACT OF AI-DRIVEN HUMAN RESOURCE ANALYTICS ON EMPLOYEE PERFORMANCE AND ORGANIZATIONAL EFFECTIVENESS IN BANGLADESH

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ABSTRACT

Artificial intelligence is increasingly transforming human resource management by enabling data-driven workforce planning, performance assessment, and organizational decision-making. This study examines the relationship between AI-driven human resource analytics, employee performance, and organizational effectiveness in the context of Bangladesh. A structured synthetic dataset comprising 2,000 employee-level observations was analyzed using reliability analysis, descriptive statistics, correlation analysis, variance inflation factor assessment, multiple regression, mediation analysis, and machine-learning techniques. The measurement constructs demonstrated strong internal consistency, with Cronbach's alpha values ranging from 0.845 to 0.932. The results revealed a significant positive association between AI-driven HR analytics and employee performance ($\beta = 0.417$, $p < 0.001$). The organizational effectiveness model further showed that both AI-driven HR analytics ($\beta = 0.208$, $p < 0.001$) and employee performance ($\beta = 0.390$, $p < 0.001$) were significant predictors. Mediation analysis indicated a significant indirect relationship between AI-driven HR analytics and organizational effectiveness through employee performance, with an indirect effect of 0.101 and a 95% bootstrap confidence interval of 0.083–0.122. Predictive modeling provided additional evidence, with Ridge regression achieving test R^2 values of 0.333 for employee performance and 0.447 for organizational effectiveness. These findings demonstrate the analytical potential of AI-enabled HR practices for understanding workforce and organizational outcomes. However, because the dataset is synthetic, the findings should be interpreted as methodological evidence rather than direct empirical generalizations about Bangladeshi organizations

Keywords: Workforce Intelligence; Predictive Modeling; Employee Engagement; Organizational Support; Digital Transformation; Decision Support

1 INTRODUCTION

Artificial Intelligence (AI) is increasingly transforming Human Resource Management (HRM) by shifting traditional and labor-intensive HR activities toward more automated, data-driven, and strategically oriented practices. AI-based technologies are now being used in recruitment and selection, employee engagement, performance management,

workforce analytics, and other HR functions, enabling organizations to improve efficiency, accuracy, personalization, and decision-making (Bhuiyan et al., 2025). At the organizational level, AI-augmented HRM can contribute to employee performance, engagement, retention, productivity, and sustainable organizational outcomes; however, its effectiveness also depends on organizational strategy, employee capabilities, training, and readiness for technological change (Mollah et al., 2024). In developing economies such as Bangladesh, the adoption of smart and AI-supported HRM is particularly important because technological and organizational factors can significantly influence adoption and subsequent organizational performance, while limited infrastructure, poor digital literacy, financial constraints, and resistance to change may restrict successful implementation (Islam et al., 2026). Furthermore, employees may perceive AI-driven performance management as beneficial for improving transparency, fairness, and efficiency, while simultaneously expressing concerns regarding algorithmic bias, data privacy, and reduced human involvement in HR decisions (Nath et al., 2025). Similarly, cognitive technologies can support more informed HR decisions and efficient talent management, but their responsible implementation requires balancing technological capabilities with human judgment, ethical considerations, and employee-oriented practices (Tohfa et al., 2025). Therefore, examining AI adoption in HRM within the Bangladeshi context is important for understanding both its potential contribution to organizational and employee outcomes and the factors that may facilitate or hinder its effective implementation.

2 LITERATURE REVIEW

2.1. Recent Developments in AI-Driven Human Resource Analytics

Recent developments in artificial intelligence have expanded HR analytics from conventional data analysis toward more intelligent, automated, and predictive approaches. AI-driven tools are increasingly applied to recruitment, employee engagement, performance management, workforce analytics, and strategic HR decision-making, allowing organizations to process workforce information more efficiently and support data-driven decisions (Sarker et al., 2024). Recent research also indicates that AI-supported HRM can improve job performance, employee engagement, retention, productivity, decision-making, and HR cost-effectiveness while supporting recruitment, selection, evaluation, and training activities (K. S. Hossain et al., 2025). In Bangladesh, the growing integration of AI and related technologies into HRM has increased attention toward their potential contribution to employee outcomes and organizational performance, although the relationship between AI-enabled HR functions and broader organizational outcomes still requires further investigation (Iffat & Ahmad, 2025). Furthermore, recent systematic evidence suggests that AI can streamline recruitment, support more objective performance evaluation, and facilitate individualized employee development, while emphasizing the need for responsible implementation as these technologies continue to develop (Asif et al., 2025).

2.2. Theoretical and Practical Foundations of AI-Driven HR Analytics

The theoretical and practical foundation of AI-driven HR analytics lies in using workforce data, predictive analytics, and machine learning to support more strategic and evidence-based HR decision-making. Predictive HRIS systems can transform operational HR data into actionable insights for recruitment, retention, workforce planning, and performance management (Md. Azmir Hossain, 2025). From an organizational perspective, the Technology–Organization–Environment framework explains AI adoption through technological benefits, organizational readiness, top-management support, and external vendor support (M. Md. A. Hossain & Nahid, 2024). Neural networks further strengthen HR analytics by identifying patterns, forecasting outcomes, and supporting recruitment, training, performance evaluation, and employee engagement decisions (Sakib et al., 2025). In practice, the effectiveness of AI also depends on employee engagement and organizational adaptability, showing that technological capability must be combined with human and organizational factors to improve performance (Weiyu et al., 2025).

2.3. Challenges in AI-Driven Human Resource Analytics

Despite its growing potential, AI-driven HR analytics faces several technological, organizational, and ethical challenges. AI adoption in HRM can be constrained by system complexity, employee resistance, insufficient training, and limited technological infrastructure, while trust and transparency remain important for long-term acceptance (Fung et al., 2025). Algorithmic decision-making also creates concerns regarding employee privacy, fairness, discrimination, and the responsible use of personal data, requiring stronger ethical safeguards when AI is integrated into HR functions (Chowdhury et al., 2025). In the Bangladesh context, technological interventions may improve monitoring and data-driven HRM but can also increase surveillance and managerial control when appropriate governance and worker participation are absent (Syed et al., 2026). Furthermore, fragmented governance, limited workforce competencies, weak institutional support, and inadequate organizational capacity can prevent organizations from translating AI adoption into responsible and effective outcomes (Hasnat et al., 2026).

2.4. Limitations of Current AI-Driven HR Analytics and Machine Learning Research

Current research on AI-driven HR analytics and machine learning remains limited by methodological, contextual, and implementation issues. In Bangladesh, HR analytics research is still relatively scarce, while inadequate analytical skills, data quality, management support, and financial constraints can restrict its effective use (Siddiqua et al., 2023). Existing AI-HRM literature also provides limited theoretical and empirical evidence on how predictive AI applications influence HR functions and wider organizational outcomes (Chowdhury et al., 2025). Moreover, AI-enabled workforce management faces ethical concerns, privacy risks, technological disparities, and resistance to adoption, particularly in resource-constrained settings. Recent Bangladesh-based evidence further shows that convenience sampling and cross-sectional research designs can restrict generalizability and causal interpretation of AI-related findings (Emon et al., 2025). Similarly, limited AI adoption, self-reported data, and context-specific samples indicate the need for larger, longitudinal, and cross-country studies to strengthen the applicability of current findings (Gazi et al., 2024).

2.5. Research Gap

Although AI-driven human resource analytics is increasingly used for workforce and organizational decision-making, limited attention has been given to examining its relationship with both employee performance and organizational effectiveness within a Bangladesh-oriented context. In addition, the mediating role of employee performance between AI-driven HR analytics and organizational effectiveness remains insufficiently explored. Therefore, this study examines these relationships and complements statistical analysis with machine-learning-based prediction.

2.6. Research Questions

- What is the relationship between AI-driven human resource analytics and employee performance in the study dataset?
- What is the relationship between AI-driven human resource analytics and organizational effectiveness when employee performance and other relevant organizational and employee-related factors are considered?
- How is employee performance associated with organizational effectiveness?
- Does employee performance mediate the relationship between AI-driven human resource analytics and organizational effectiveness?
- How effectively can machine-learning models predict employee performance and organizational effectiveness using the selected composite HR and organizational factors?

2.7. Research Objectives

The main objective of this study is to examine the relationship of AI-driven human resource analytics with employee performance and organizational effectiveness in the context of Bangladesh. Specifically, the study aims to:

- To examine the relationship between AI-driven human resource analytics and employee performance.
- To assess the relationship between AI-driven human resource analytics and organizational effectiveness while accounting for employee performance and other relevant organizational and employee-related factors.
- To evaluate the relationship between employee performance and organizational effectiveness.
- To determine whether employee performance mediates the relationship between AI-driven human resource analytics and organizational effectiveness.
- To evaluate and compare machine-learning models for predicting employee performance and organizational effectiveness using the selected composite HR and organizational factors.

3 MATERIAL AND METHODS

3.1. Study Area

This study was conducted in the context of AI-driven human resource management in Bangladesh, where organizations are increasingly adopting data-driven approaches to support workforce management, employee performance assessment, and organizational decision-making. The study focused on examining the relationship of AI-driven human resource analytics with employee performance and organizational effectiveness.

3.2. Study Design

This study followed a quantitative and analytical research design. The main purpose of the study was to examine the relationship between AI-driven human resource analytics, employee performance, and organizational effectiveness. Employee performance and organizational effectiveness were considered the major outcome variables, while AI-driven human resource analytics was used as the principal explanatory variable. Organizational support, AI trust and

transparency, and employee engagement were also included as relevant explanatory factors. In addition, employee performance was examined as a mediator between AI-driven human resource analytics and organizational effectiveness.

3.3. Sample Size and Selection

For this research, a synthetic dataset was developed containing 2,000 employee-level observations from 80 simulated organizations. The dataset was designed to represent a Bangladesh-oriented organizational context and included information related to organizational characteristics, employee demographics, AI-driven HR analytics, organizational support, AI trust and transparency, employee engagement, employee performance, and organizational effectiveness. Since the dataset was synthetically generated, no actual employees or organizations were directly surveyed in this study.

3.4. Measures and Variables

The major constructs used in this study included AI-driven human resource analytics, organizational support, AI trust and transparency, employee engagement, employee performance, and organizational effectiveness. AI-driven human resource analytics was measured using 12 items, organizational support using 5 items, AI trust and transparency using 5 items, employee engagement using 5 items, employee performance using 10 items, and organizational effectiveness using 9 items. The items were measured using a five-point Likert scale. Composite mean scores were calculated for each construct and used in the main statistical and machine-learning analyses.

3.5. Data Collection Procedure

The dataset was organized in a structured format to represent employee and organizational characteristics in a Bangladesh-oriented HR analytics context. Before applying statistical and machine-learning methods, the dataset was checked for missing values, duplicate observations, item-range consistency, and construct-level consistency. The relevant composite variables were then prepared for examining the relationships among AI-driven HR analytics, employee performance, organizational effectiveness, organizational support, AI trust and transparency, and employee engagement.

3.6. Research Tools and Techniques

Statistical and machine-learning analyses were performed using Python in a Jupyter notebook environment. Reliability analysis, descriptive statistics, correlation analysis, variance inflation factor analysis, multiple regression, and mediation analysis were applied to examine the relationships among the study constructs. For predictive analysis, Linear Regression, Ridge Regression, Support Vector Regression with an RBF kernel, Random Forest Regression, Extra Trees Regression, and Gradient Boosting Regression were used to predict employee performance and organizational effectiveness.

3.7. Data Analysis Techniques

The internal consistency of the study constructs was evaluated using Cronbach's alpha. Descriptive statistics and correlation analysis were used to summarize the data and examine the relationships among the major variables, while variance inflation factor analysis was used to assess multicollinearity. Ordinary least squares regression with HC3 robust standard errors was applied to examine the relationships between AI-driven HR analytics, employee performance, and organizational effectiveness. Mediation analysis with 2,000 bootstrap resamples was conducted to assess the indirect relationship between AI-driven HR analytics and organizational effectiveness through employee performance.

For machine-learning analysis, the data were divided into 80% training and 20% testing subsets, and five-fold cross-validation was applied to the training data. Model performance was evaluated using R^2 , mean absolute error, and root mean squared error. An additional classification analysis of extreme organizational-effectiveness groups was conducted as a secondary predictive analysis.

4 RESULTS

4.1. Reliability and Correlation Analysis

The reliability analysis showed strong internal consistency for all six study constructs, with Cronbach's alpha values ranging from 0.845 to 0.932. Correlation analysis also revealed positive relationships among the major variables. AI-driven human resource analytics was positively correlated with employee performance ($r = 0.417$, $p < 0.001$) and organizational effectiveness ($r = 0.434$, $p < 0.001$). Employee performance showed the strongest positive correlation with organizational effectiveness ($r = 0.564$, $p < 0.001$).

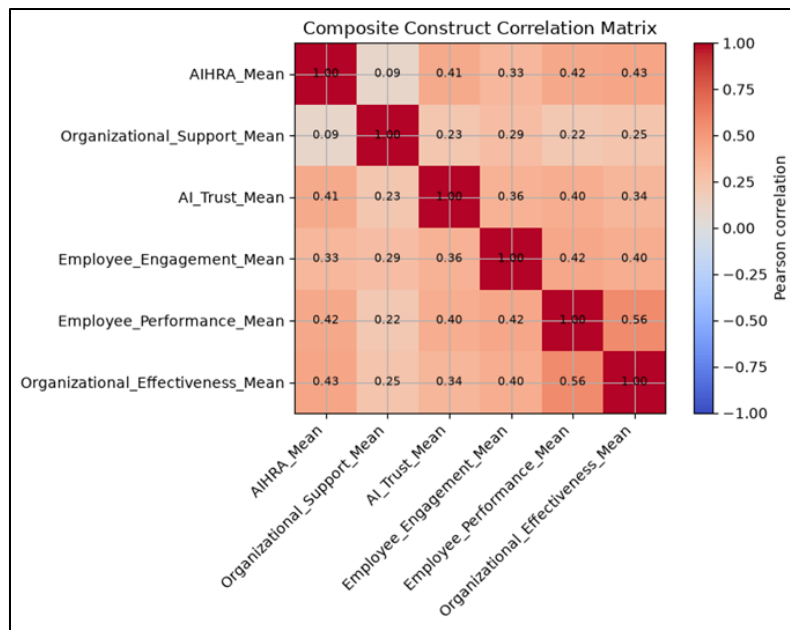


Figure 1: Correlation Matrix of the Major Study Variables

Figure 1 presents the correlation matrix of the major study variables and shows positive associations among AI-driven HR analytics, employee performance, organizational effectiveness, organizational support, AI trust and transparency, and employee engagement.

4.2. Machine-Learning Model Performance

A supplementary classification analysis was conducted using extreme organizational-effectiveness groups. The analysis retained 439 observations, with $OE \leq 1.70$ classified as Low and $OE \geq 4.30$ classified as High. Random Forest achieved the highest test accuracy of 94.32%, followed by SVM and 1D CNN at 93.18%, while XGBoost achieved 90.91% (Table 1 & Figure 2).

Table 1: Performance Comparison of Classification Models

Model	Accuracy	F1-score	ROC-AUC
Random Forest	94.32%	0.9533	0.9868
SVM	93.18%	0.9434	0.9825
1D CNN	93.18%	0.9423	0.9873
XGBoost	90.91%	0.9273	0.9788

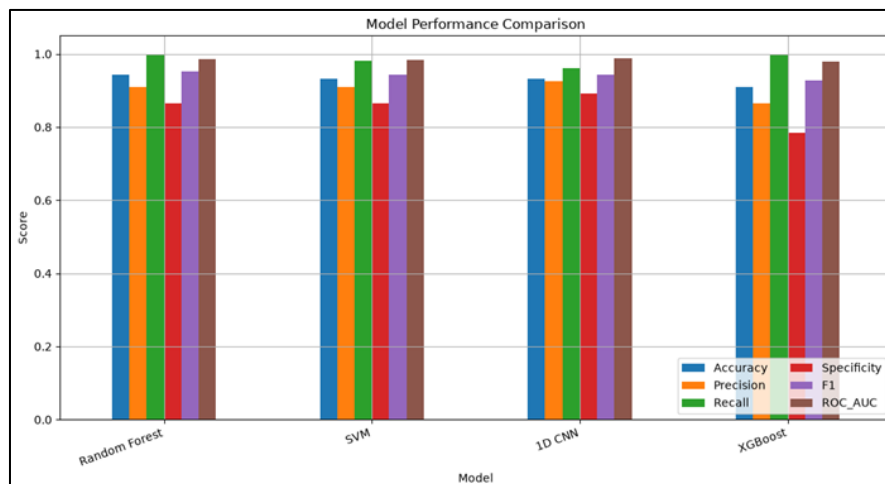


Figure 2: Performance Comparison of the Machine-Learning Models

The results show that all four models provided strong classification performance, with Random Forest achieving the highest overall test accuracy.

4.3. Confusion Matrix and ROC Analysis

The Random Forest confusion matrix showed strong classification performance, correctly identifying all High OE cases in the test set while producing only a small number of errors for Low OE cases.

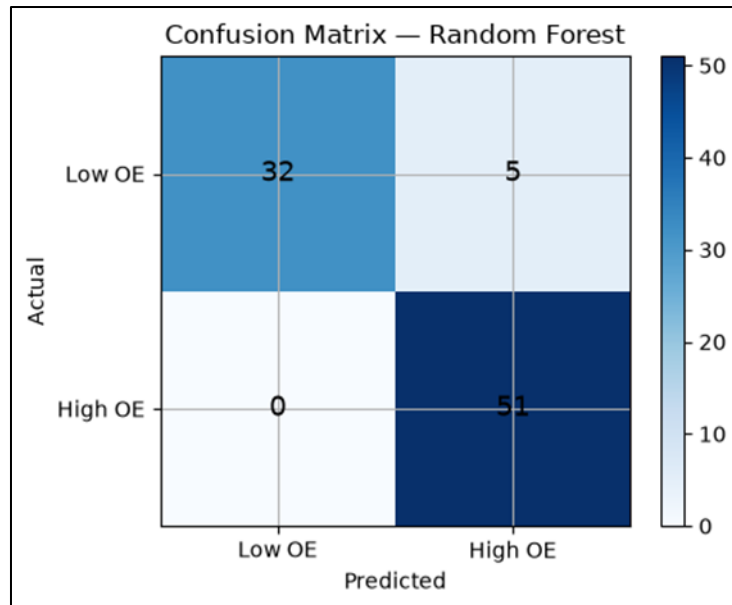


Figure 3: Confusion Matrix of the Random Forest Model

ROC analysis also demonstrated strong discrimination across all four models, with ROC-AUC values ranging from 0.9788 to 0.9873 (Figure 3).

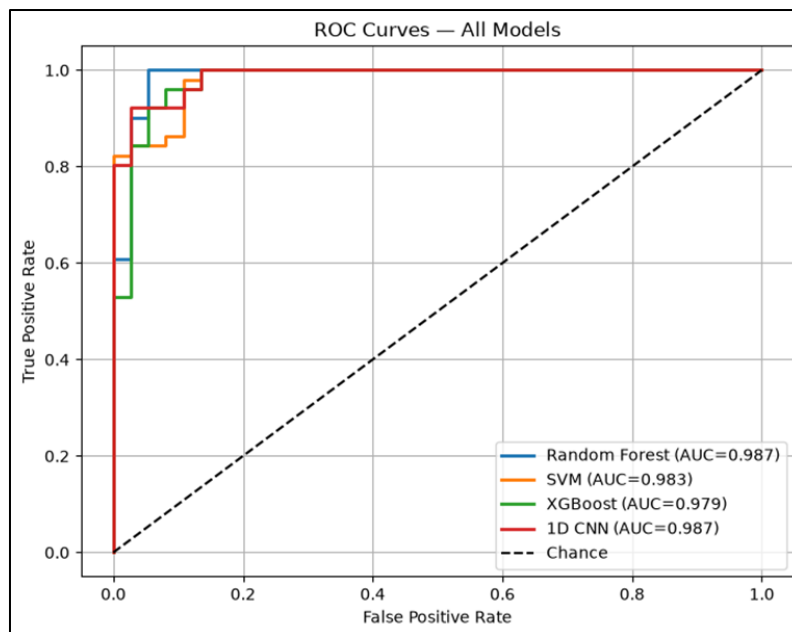


Figure 4: ROC Curves of the Classification Models

The high AUC values indicate that the models effectively distinguished between the selected Low and High organizational-effectiveness groups (Figure 4).

4.4. Feature Importance Analysis

Feature-importance analysis showed that employee performance was the most influential predictor in the Random Forest model. AI-driven HR analytics, AI trust and transparency, employee engagement, and organizational support variables also contributed to classification performance (Figure 5).

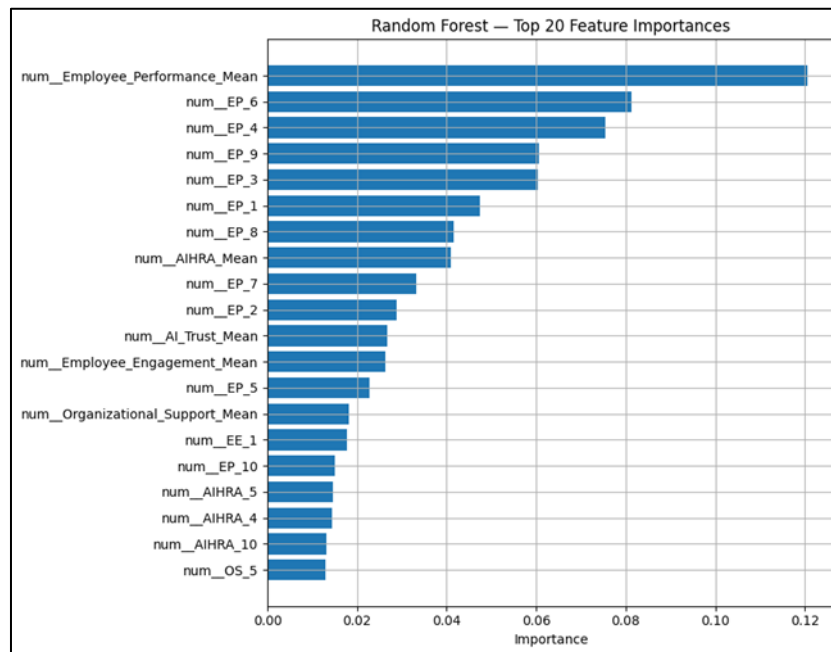


Figure 5: Top Feature Importance Variables of the Random Forest Model

These findings are consistent with the regression results, particularly the strong relationship between employee performance and organizational effectiveness.

5 DISCUSSION

The findings of this study indicate that AI-driven HR analytics can contribute to improved employee performance and organizational effectiveness by supporting more accurate, data-driven, and efficient HR decision-making. This is consistent with recent evidence showing that AI in HRM improves recruitment, performance management, employee engagement, and operational efficiency when supported by employee participation and appropriate governance (Bouzerda et al., 2025). The positive role of AI-supported analytics also aligns with cross-sector evidence that AI-enabled automation enhances efficiency, agility, and decision quality within organizations (Rahman et al., 2024). In the South Asian context, AI and machine-learning tools have similarly been linked with data-driven performance management, employee retention, and better identification of skill gaps, while human oversight remains essential (Hussain, 2026). Furthermore, the importance of employee-related factors in the present study is supported by evidence that fair, respectful, and privacy-preserving AI-based HR practices are positively associated with sustainable employee performance (Tran & Tam, 2026). Overall, the findings suggest that AI-driven HR analytics should be viewed not only as a technological tool but also as a strategic HR capability that can strengthen employee performance and, consequently, organizational effectiveness.

Findings

- The study found that AI-driven human resource analytics has a significant positive relationship with employee performance.
- AI-driven HR analytics is positively associated with organizational effectiveness, while employee performance also shows a strong positive relationship with organizational effectiveness.
- Employee performance partially mediates the relationship between AI-driven HR analytics and organizational effectiveness, indicating that AI-driven HR analytics may influence organizational effectiveness both directly and through employee performance.
- The machine-learning models demonstrated useful predictive performance for employee performance and organizational effectiveness, with Ridge Regression providing the strongest overall performance in the main continuous prediction analysis.

- The supplementary classification analysis further showed that machine-learning models can distinguish extreme organizational-effectiveness groups, with Random Forest achieving the highest classification accuracy of 94.32%.

Recommendations

- Organizations should consider using AI-driven HR analytics to support employee-performance assessment and HR decision-making.
- HR managers should give particular attention to employee performance and engagement because these factors are associated with organizational effectiveness.
- Organizations can integrate AI-driven analytics with existing HR practices to support more data-driven workforce and organizational decisions.
- Machine-learning models can be used as complementary decision-support tools for predicting employee and organizational outcomes.
- Organizations adopting AI-based HR analytics should also maintain appropriate organizational support and transparent HR practices to facilitate effective use of these technologies.

Limitations

- The study used a synthetic dataset, which may not fully represent real organizational conditions in Bangladesh.
- The analysis was limited to selected HR and organizational factors.
- The supplementary classification analysis focused only on extreme organizational-effectiveness groups.

6 CONCLUSION

This study examined the relationship of AI-driven human resource analytics with employee performance and organizational effectiveness in a Bangladesh-oriented context using statistical and machine-learning approaches. The findings showed that AI-driven HR analytics was positively associated with employee performance and organizational effectiveness. Employee performance also emerged as an important predictor of organizational effectiveness and partially mediated the relationship between AI-driven HR analytics and organizational effectiveness.

The machine-learning results further demonstrated the predictive potential of the selected HR and organizational factors. Overall, the findings highlight the potential value of AI-driven HR analytics for workforce analysis and organizational decision support. However, because the study used synthetic data, future research should validate these relationships using primary data collected from actual organizations in Bangladesh.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Disclosure of conflict of interest

The authors declare no conflicts of interest regarding this manuscript.

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