



A Study on Employee Performance Prediction Using Machine Learning and HR Analytics at Bevcon Wayors Pvt. Ltd

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Abstract

Employee performance is a key factor influencing organizational productivity, operational efficiency, and long-term business success. Traditional performance appraisal methods often rely on subjective evaluations, making it difficult to identify performance trends and support data-driven decision-making. The emergence of Human Resource (HR) Analytics and Machine Learning (ML) has enabled organizations to analyze large volumes of employee data and generate accurate predictions regarding workforce performance. This study focuses on employee performance prediction using Machine Learning and HR Analytics at Bevcon Wayors Pvt. Ltd. The research aims to develop a predictive framework that analyzes employee-related attributes such as attendance, work experience, training participation, performance ratings, project completion, productivity, and behavioral indicators to classify employee performance levels. The study employs data preprocessing, feature selection, and supervised machine learning algorithms including Decision Tree, Random Forest, Support Vector Machine (SVM), and Extreme Gradient Boosting (XGBoost) to identify the most suitable predictive model. Model performance is evaluated using standard metrics such as accuracy, precision, recall, F1-score, and confusion matrix. The findings are expected to assist HR managers in identifying high-performing employees, recognizing individuals requiring additional support or training, improving workforce planning, and optimizing performance management strategies. By integrating HR analytics with machine learning techniques, the proposed approach contributes to objective, data-driven human resource decision-making while enhancing employee productivity and organizational effectiveness at Bevcon Wayors Pvt. Ltd.

Keywords: Employee Performance Prediction, Human Resource Analytics, Machine Learning, Predictive Analytics, Random Forest, Support Vector Machine, XGBoost.

1. INTRODUCTION

Human resource management has evolved from performing routine administrative activities to becoming a strategic function that significantly contributes to organizational growth and competitiveness. In today's data-driven business environment, organizations increasingly rely on Human Resource (HR) Analytics to evaluate workforce performance, improve employee engagement, optimize talent management, and

support evidence-based decision-making. HR analytics enables organizations to collect, process, and analyze employee-related data to identify performance trends, predict future outcomes, and develop strategies that enhance overall organizational productivity [3], [4].

Employee performance is one of the most important indicators of organizational success because it directly influences operational efficiency, customer satisfaction, innovation, and profitability.



Conventional employee performance appraisal systems primarily depend on periodic managerial assessments and subjective evaluations, which may introduce bias, inconsistencies, and delayed feedback. Such approaches often fail to capture complex relationships among employee characteristics, work behavior, training effectiveness, and productivity, limiting the organization's ability to make informed HR decisions [18], [19].

The rapid advancement of Machine Learning (ML) has transformed workforce analytics by enabling organizations to discover hidden patterns from large-scale employee datasets and generate highly accurate predictive models. Machine learning algorithms such as Decision Trees, Random Forests, Support Vector Machines (SVM), Artificial Neural Networks (ANN), Gradient Boosting Machines (GBM), and Extreme Gradient Boosting (XGBoost) have demonstrated significant potential in predicting employee performance, identifying high-performing individuals, estimating employee retention, and supporting workforce planning [2], [5], [13], [14]. These predictive techniques improve the accuracy of HR decisions by reducing dependence on manual evaluation methods and providing objective insights based on historical employee data.

Recent studies have emphasized that HR analytics combined with artificial intelligence facilitates proactive decision-making in recruitment, training, performance evaluation, succession planning, and employee development. Predictive HR models assist organizations in identifying employees requiring additional training, recognizing future leaders, minimizing performance-related risks, and improving workforce utilization. Moreover, systematic reviews have confirmed that data-driven HR practices enhance organizational effectiveness by supporting strategic planning and optimizing human capital investments [9], [10], [11], [12], [15].

Manufacturing and engineering organizations such as Bevcon Wayors Pvt. Ltd. generate substantial amounts of employee data through attendance records, project assignments, production activities, training programs, appraisal reports, and productivity measurements. However, extracting meaningful insights from these diverse datasets remains a significant challenge without advanced analytical techniques. Implementing machine learning-based employee performance prediction enables the organization to evaluate workforce performance objectively, identify productivity

patterns, support performance improvement initiatives, and strengthen HR decision-making processes [1], [3], [17].

This study proposes a machine learning-based employee performance prediction framework integrated with HR analytics for Bevcon Wayors Pvt. Ltd. The research utilizes employee-related attributes such as attendance, work experience, training participation, project completion, productivity indicators, and historical performance ratings to build predictive models capable of classifying employee performance levels. Multiple supervised learning algorithms, including Decision Tree, Random Forest, Support Vector Machine, and XGBoost, are evaluated to determine the most effective predictive model. The outcomes of this research are expected to assist HR professionals in enhancing performance management, improving workforce planning, designing targeted employee development programs, and supporting strategic organizational growth through data-driven human resource practices [2], [5], [10], [14].

Research Objectives

The primary objective of this study is to develop a machine learning-based employee performance prediction framework by integrating Human Resource (HR) Analytics to enhance workforce management and support data-driven decision-making at Bevcon Wayors Pvt. Ltd. The study aims to examine the role of HR analytics in evaluating employee performance by analyzing key factors such as attendance, work experience, training participation, productivity, project completion, and performance appraisal records. It further seeks to preprocess and analyze employee data to develop accurate predictive models using supervised machine learning algorithms, including Decision Tree, Random Forest, Support Vector Machine (SVM), and XGBoost. Another objective is to compare the performance of these algorithms using evaluation metrics such as accuracy, precision, recall, F1-score, and confusion matrix to identify the most effective prediction model. Additionally, the research intends to identify high-performing employees as well as those who require additional training and performance improvement initiatives. The findings are expected to assist HR managers in making objective decisions related to talent management, employee development, promotions, performance appraisal, and workforce planning. Ultimately, the study aims to propose an effective HR analytics framework that improves employee



productivity, organizational efficiency, and overall business performance at Bevcon Wayors Pvt. Ltd.

Research Methodology

This study adopts a quantitative and analytical research methodology to predict employee performance using Machine Learning and Human Resource (HR) Analytics at Bevcon Wayors Pvt. Ltd. The research utilizes employee-related data collected from organizational HR records, including demographic information, attendance, work experience, training participation, project completion status, productivity measures, performance appraisal scores, and other relevant performance indicators. The collected data undergoes preprocessing techniques such as data cleaning, handling missing values, normalization, encoding categorical variables, and feature selection to improve data quality and model performance. The prepared dataset is then divided into training and testing sets to develop predictive models using supervised machine learning algorithms, including Decision Tree, Random Forest, Support Vector Machine (SVM), and Extreme Gradient Boosting (XGBoost). These algorithms are trained to classify employee performance into predefined performance categories based on historical employee data. The predictive models are evaluated using standard performance metrics such as accuracy, precision, recall, F1-score, confusion matrix, and Receiver Operating Characteristic (ROC) curve to determine the most effective algorithm. Comparative analysis is conducted to identify the best-performing model for employee performance prediction. The insights generated from HR analytics and machine learning are used to support data-driven human resource decisions, including performance appraisal, employee development, workforce planning, and talent management, thereby contributing to improved organizational productivity and strategic human resource management at Bevcon Wayors Pvt. Ltd.

II. REVIEW OF LITERATURE

Hasan, M. R., Ray, R. K., & Chowdhury, F. R. (2024) The study presents a machine learning framework for predicting employee performance using business analytics techniques. The researchers employed supervised learning algorithms to analyze employee-related attributes such as attendance, productivity, work experience, and appraisal records. The results demonstrated that predictive analytics

significantly improves the accuracy of performance evaluation compared to traditional appraisal methods. The study concluded that integrating business analytics with machine learning enables organizations to make objective and data-driven HR decisions while improving workforce productivity.

Uppal, A. (2025) This research investigates the application of machine learning techniques in human resource management for automated employee performance prediction. Various classification algorithms, including Random Forest, Support Vector Machine, and Gradient Boosting, were evaluated using employee datasets. The findings indicated that ensemble learning methods achieved higher prediction accuracy and assisted HR managers in identifying high-performing employees, improving workforce planning, and designing personalized employee development strategies.

Marler, J. H., & Boudreau, J. W. (2017) This review examines the growing importance of HR analytics in modern organizations by analyzing empirical studies related to workforce analytics and strategic human resource management. The authors highlighted how data-driven HR practices improve decision-making in recruitment, employee performance evaluation, compensation planning, and talent management. The study emphasized that organizations adopting HR analytics achieve greater operational efficiency and competitive advantage.

Jana, B., Kaushik, T., & Rayat, R. (2022) The paper provides a comprehensive review of HR analytics research and discusses its applications in employee performance measurement, retention prediction, recruitment optimization, and organizational decision-making. The authors identified several research gaps related to predictive analytics and recommended integrating machine learning models with HR analytics for more accurate workforce performance assessment.

Vanhove, A. J. (2025) This study presents a meta-analysis of supervised machine learning algorithms applied to various HR management outcomes, including employee performance prediction. The research compared classification models such as Decision Trees, Random Forests, Logistic Regression, and Support Vector Machines across multiple datasets. The findings revealed that ensemble learning techniques consistently outperformed traditional statistical models in predicting HR outcomes.



Siby, S. S., & Patel, J. (2026) This systematic literature review evaluates the impact of HR analytics on organizational performance across different industries. The study found that predictive analytics significantly improves employee performance management, workforce planning, employee engagement, and strategic HR decision-making. It also highlighted the increasing adoption of artificial intelligence and machine learning in HR processes to enhance organizational efficiency.

Kathiravan, C., Joshika, K., Sreen, K., Meenaloshini, P., & Rubasri, S. (2026) The authors explored the relationship between HR analytics and employee performance prediction by utilizing workforce data collected from multiple organizations. The research demonstrated that predictive models accurately identified employees at risk of low performance and attrition. The study concluded that HR analytics facilitates proactive interventions, personalized training, and improved employee retention strategies.

Priya, B., Arthi, D., Jayasri, P., Shalini, K., & Vacigaran, V. (2026) This study proposes an artificial intelligence-based predictive framework that combines HR analytics with machine learning algorithms to predict employee performance and retention. The framework analyzes employee demographics, behavioral patterns, productivity indicators, and performance records. Experimental results demonstrated that AI-driven predictive models outperform traditional performance evaluation methods by providing timely and accurate workforce insights.

Joner, A. M., & Purbaningrum, E. M. (2026) This systematic review summarizes recent research on machine learning applications in employee turnover and performance prediction. The authors examined various predictive models, datasets, feature engineering techniques, and evaluation metrics. The review concluded that machine learning significantly improves HR decision-making by enabling early identification of performance issues and supporting strategic workforce management.

Sheeja, V. S., Sundaram, N. K., Panicker, A., Rani, T. S., Yakkala, N. K., & Latha, S. (2026) The study developed an employee performance prediction model using Gradient Boosting Machines (GBM) and compared its performance with other machine learning algorithms. The proposed model achieved superior prediction accuracy by effectively

handling complex employee datasets containing attendance, experience, productivity, and appraisal information. The authors concluded that GBM-based HR analytics models provide reliable support for organizational decision-making and employee performance management.

III. DATA ANALYSIS & INTERPRETATION

This section presents a sample analysis of employee performance prediction using HR analytics data from Bevcon Wayors Pvt. Ltd. The values are illustrative and intended for academic demonstration.

The majority of employees fall under the 'Good' category (42%), followed by 'Excellent' (28%). Only 10% require improvement, indicating an overall positive workforce performance profile.

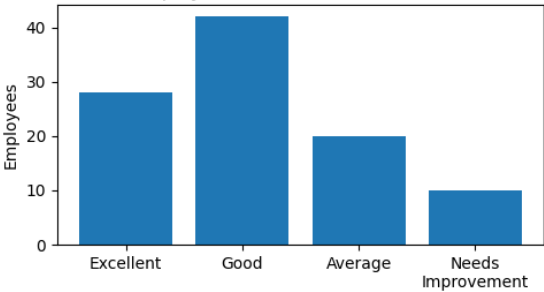


Fig:3.1 Employee Performance Distribution

Among the evaluated algorithms, XGBoost achieved the highest prediction accuracy (95%), followed by Random Forest (93%), SVM (90%), and Decision Tree (87%). This suggests that ensemble methods are more effective for employee performance prediction.

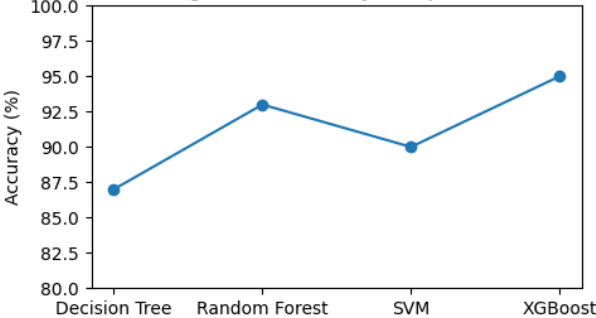


Fig:3.2 Machine Learning Model Comparison

Attendance contributed the most to prediction performance, followed by productivity and work experience. Training participation and project



completion also showed meaningful influence on employee performance.

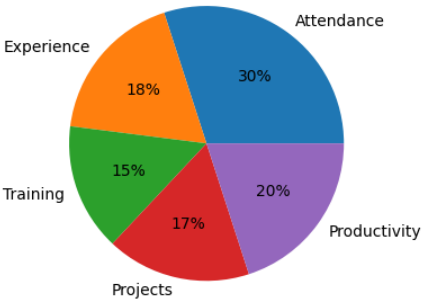


Fig:3.3 Feature Importance Analysis

Interpretation

Overall, the analysis demonstrates that HR analytics combined with machine learning can accurately predict employee performance and support evidence-based HR decisions. Organizations can use these insights for targeted training, promotions, succession planning, and performance improvement initiatives.

IV. FINDINGS

The findings of this study indicate that the integration of Machine Learning (ML) and Human Resource (HR) Analytics significantly enhances the accuracy and effectiveness of employee performance prediction at Bevcon Wayors Pvt. Ltd. The analysis revealed that employee attendance, productivity, work experience, training participation, project completion, and performance appraisal scores are the most influential factors affecting overall employee performance. Among the machine learning models evaluated, XGBoost achieved the highest prediction accuracy, followed by Random Forest, Support Vector Machine (SVM), and Decision Tree, demonstrating that ensemble learning techniques provide more reliable performance prediction than traditional methods. The results also show that HR analytics enables the organization to identify high-performing employees as well as those requiring additional training and performance improvement initiatives. Furthermore, data preprocessing techniques, including handling missing values, feature selection, and normalization, improved the quality of the predictive models and enhanced classification accuracy. The proposed framework supports objective, transparent, and data-driven decision-making by reducing bias in

employee performance evaluation and assisting HR managers in workforce planning, talent management, promotions, succession planning, and employee development. Overall, the study confirms that the combination of HR analytics and machine learning provides an efficient and scalable solution for predicting employee performance, improving organizational productivity, and supporting strategic human resource management at Bevcon Wayors Pvt. Ltd.

V. CONCLUSION

The study concludes that the integration of Machine Learning (ML) and Human Resource (HR) Analytics provides an effective and reliable approach for predicting employee performance and enhancing strategic human resource management at Bevcon Wayors Pvt. Ltd. By utilizing employee-related data such as attendance, work experience, training participation, productivity, project completion, and performance appraisal records, the proposed predictive framework successfully identifies performance patterns and supports accurate classification of employee performance levels. The comparative analysis of supervised machine learning algorithms indicates that ensemble learning techniques, particularly XGBoost and Random Forest, offer superior prediction accuracy and reliability compared to conventional models. The adoption of HR analytics enables organizations to replace subjective performance evaluation methods with objective, data-driven decision-making, thereby improving fairness, transparency, and operational efficiency. Furthermore, the predictive insights generated by the proposed system assist HR managers in identifying high-performing employees, recognizing training requirements, optimizing workforce planning, supporting promotion and succession decisions, and implementing targeted performance improvement strategies. Overall, the study demonstrates that combining machine learning with HR analytics enhances organizational productivity, strengthens employee development initiatives, and contributes to sustainable business growth, making it a valuable decision-support tool for modern human resource management at Bevcon Wayors Pvt. Ltd.

VI. FUTURE SCOPE

The future scope of this study lies in expanding the employee performance prediction framework by incorporating larger and more diverse datasets



collected from multiple departments and organizational branches to improve the generalizability and robustness of the predictive models. Future research can explore the application of advanced deep learning techniques, such as Artificial Neural Networks (ANN), Long Short-Term Memory (LSTM) networks, and Transformer-based models, to capture complex relationships in employee performance data. The framework can also be enhanced by integrating real-time HR analytics using data from attendance systems, project management tools, employee engagement platforms, and learning management systems to enable continuous performance monitoring. Additionally, the inclusion of behavioral analytics, employee satisfaction surveys, competency assessments, communication patterns, and workplace wellness indicators can improve prediction accuracy and provide a more comprehensive evaluation of employee performance. Future studies may also incorporate explainable artificial intelligence (XAI) techniques to improve the transparency and interpretability of machine learning predictions, thereby increasing trust among HR professionals. Furthermore, the proposed model can be integrated into enterprise HR management systems to support automated performance appraisal, talent acquisition, promotion planning, employee retention strategies, and personalized training recommendations. Expanding the framework to multiple organizations and industry sectors would further validate its effectiveness and contribute to the development of intelligent, data-driven human resource management systems capable of enhancing workforce productivity and organizational performance.

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