REST Journal on Banking, Accounting and Business

Vol: 4(4), December 2025

REST Publisher; ISSN: 2583 4746

Website: http://restpublisher.com/journals/jbab/

DOI: https://doi.org/10.46632/jbab/4/4/1

Regression-Based Predictive Analytics for Employee Motivation Assessing Work Environment Quality, Salary Satisfaction, and Training Impact on Productivity

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Abstract: *This study investigates the relationships between key organizational factors that influence employee motivation, performance, and productivity outcomes. Specifically, it examines the impact of work environment quality, salary satisfaction, and training hours on employee productivity indices. Using a dataset of 200 employee records, descriptive statistics indicate moderate mean ratings for work environment (mean = 5.53) and salary satisfaction (mean = 5.41), with training hours averaging 19.89 and productivity indices averaging 54.15 points. Correlation analysis revealed that the productivity index is strongly associated with work environment scores (r = 0.63) and salary satisfaction (r = 0.59), whereas training hours exhibited a weak correlation with productivity. The findings suggest that workplace environment quality and compensation satisfaction exert a more significant influence on employee productivity than training investments alone. This research advances human resource management literature by highlighting effective strategies for enhancing employee motivation at the organizational level. It underscores that comprehensive employee development requires attention to environmental factors and financial recognition, rather than focusing solely on training initiatives. Organizations are advised to balance moderate investment in employee development programs with efforts to cultivate supportive work environments and competitive compensation structures. The regression models used in this study offer practical predictive tools that can help managers identify key motivational drivers, optimize workforce productivity, and ultimately enhance organizational performance and competitiveness in evolving market conditions.*

Keyword: *Employee Motivation, Productivity Index, Work Environment Quality, Salary Satisfaction, Regression Analysis*

1. INTRODUCTION

The primary variables examined in this study are human resource training and development (HRD), management development, organizational development, performance appraisal, employee rewards, recruitment and selection, human resource planning, and communication. How human and non-human resources, along with job-related factors, are planned, organized, and coordinated is expected to influence overall organizational productivity. [1] Employee productivity is a priority for every manager. However, boosting productivity is not a straightforward task. Consistently demanding high performance from employees, regardless of their circumstances, is not only unwise but may also demotivate them or negatively affect their well-being. Productivity should be managed at an optimal level that meets customer expectations, beginning with customer needs and ending with customer feedback. [2] Both employee motivation and productivity are crucial factors that shape organizational success and competitiveness. This study explores strategies to enhance workplace motivation by examining the intrinsic and extrinsic drivers of productivity. [3] Employees are the most valuable assets and strategic advantage for any organization. Low productivity often stems from inadequate employee motivation. The success and performance of an organization largely depend on how effectively its employees are motivated. [4] The aim of this research is to explore the relationships between employee motivation, performance, and intrinsic rewards; the influence of intrinsic rewards on both motivation and performance; and the impact of perceived training effectiveness on employee motivation. Pakistan provides a suitable context for examining these dynamics. [5]Additionally, the study investigates the

effects of workplace conflict on motivation and productivity, analyzing how various types of conflict influence employee outcomes. By addressing these factors, the research seeks to fill gaps in the existing literature and demonstrate that, when effectively managed; workplace conflict can stimulate innovation and enhance performance, despite its typically negative reputation. [6] Finally, the study seeks to understand the relationship between work motivation and employee performance, analyzing major motivation theories and approaches to help organizations identify the most effective methods for enhancing motivation..[7] The research problem and objective focus on assessing the extent to which leadership style and motivation influence employee productivity, both individually and jointly. The study's novelty lies in the use of multiple regression analysis. [8] Employee productivity depends on human resources taking responsibility for completing tasks effectively. Employee motivation reflects an individual's willingness to put in extra effort to achieve organizational goals. [9] Efficient production and delivery require optimal use of resources, producing goods that meet customer needs at minimal cost, and offering them at fair prices. Strong motivation is crucial for productivity, as motivated employees are more likely to produce quality outputs and contribute to organizational profitability. [10] Organizations should reinforce behaviors that generate positive outcomes while discouraging those that lead to negative results, which can be achieved through various strategies. [11] Motivation can arise from the organization or from within the employee. When management actively supports employees and fosters a positive work environment, employees feel more motivated, recognizing that management values their well-being. Excessive control can hinder motivation, while involvement fosters a more productive workplace. [12] This raises the debate over whether motivation should be targeted at individuals or organization-wide. Changing individual behavior often requires significant effort and may yield limited results compared to broader organizational change, though managers are typically focused on motivating individuals in the workplace. [13] Accordingly, this paper examines strategies to enhance productivity through employee motivation. The study primarily relies on secondary research, drawing insights from scholarly articles, books, and credible online sources. Based on this analysis, key factors that can boost employee motivation and productivity are identified. [14] Employee motivation refers to the internal and external factors that stimulate employees to exert effort and perform tasks effectively. Motivated employees are more likely to demonstrate higher levels of commitment, creativity, and persistence in achieving organizational goals. Motivation can arise from intrinsic factors, such as personal growth, recognition, and job satisfaction, or extrinsic factors, such as salary, benefits, and rewards. [15]

2. METHODOLOGY

Work Environment Score: Work Environment Score (WES): The Work Environment Score is measured using the Work Environment Scale (WES), which assesses the social and organizational environment in different workplaces. The scale consists of ten subscales, which are grouped into three categories: relationship dimensions (interpersonal relationships and support), personal growth or goal-orientation dimensions (opportunities for growth and achievement), and organization maintenance and organization change dimensions (organizational structure, rules, and adaptability). A higher score indicates a more positive and supportive work environment, which is linked to increased employee motivation, engagement, and productivity.

Salary Satisfaction: Salary satisfaction refers to the degree of contentment employees feel regarding their compensation.

Training Time: Training time denotes the total hours dedicated to lectures, learning activities, small group sessions, demonstrations, assessments, or practical exercises.

Productivity Index: The Productivity Index (PI) is a metric used to assess performance in various contexts. In business, it is typically calculated by dividing total output (e.g., revenue) by total input (e.g., hours worked) to evaluate efficiency. In petroleum engineering, it specifically measures a well's ability to produce fluids, calculated as the ratio of fluid flow rate to pressure drop.

Optimization techniques:

Linear Regression: A statistical method used a valuable technique to predict quantitative outcomes and has been extensively studied in numerous textbooks over time. Although it may seem less exciting than modern statistical learning methods, it is widely used and very relevant. In addition, it serves as a foundation for more advanced techniques, as many sophisticated statistical learning methods can be seen as extensions or generalizations of linear regression. Therefore, a solid understanding of linear regression is essential before exploring more complex approaches. The fundamental ideas of linear regression are examined in this chapter, along with the least squares method commonly used to build a model. Regression serves two primary purposes. First, it is widely used for

forecasting and prediction, often with significant overlap with machine learning applications. With regression analysis, the dependent variable 'y' is predicted based on different values of the independent variables. The variable 'x'. This paper focuses on linear regression and multivariate regression, both of which are well suited for predictive modeling. Regression can take the form of simple linear regression or multiple regressions, which can be a type a regression. Simple linear regression involves a model with a single independent variable to determine its effect on a dependent variable. It is represented by the equation $y = \beta_0 + \beta_1 x + \varepsilon$, which describes the relationship between the variables. In addition, simple regression helps to distinguish the impact of independent variables from the interactions within the dependent variables.

Random Forest Regression: This method involves training several decision trees on various dataset subsets and their outputs are averaged to improve the prediction accuracy of the method, not only improving performance but also reducing the computational burden associated with training, storing, and predicting with many individual models. Due to their efficiency, random forests are extremely helpful for jobs involving regression, where continuous values are usually predicted.

3. ANALYSIS AND DISCUSSION

The dataset shows wide variation in work environment, salary satisfaction, and training hours, which collectively influence productivity. Higher work environment scores and extensive training generally align with stronger productivity indices, while low salary satisfaction or minimal training often correspond to reduced performance, indicating that balanced employee development factors contribute to improved productivity outcomes.

TABLE 1. Descriptive Statistics

	work environment score	salary satisfaction	training hours	productivity index
count	200	200	200	200
mean	5.52945	5.41325	19.8925	54.14805
std	2.397649	2.658223	11.62914	15.48354
min	1.02	1.03	0	19.07
25%	3.74	3.1375	10.8	42.665
50%	5.685	5.175	19.55	55.965
75%	7.465	7.8225	29.425	65.9525
max	9.96	9.96	40	94.74

Table 1 the descriptive statistics show moderate average ratings for work environment and salary satisfaction, with substantial variability. Training hours range widely, indicating uneven employee development. Productivity levels also vary but center moderately high. Higher quartiles across variables suggest that better workplace conditions, satisfaction, and training are generally associated with stronger productivity outcomes in the sample.

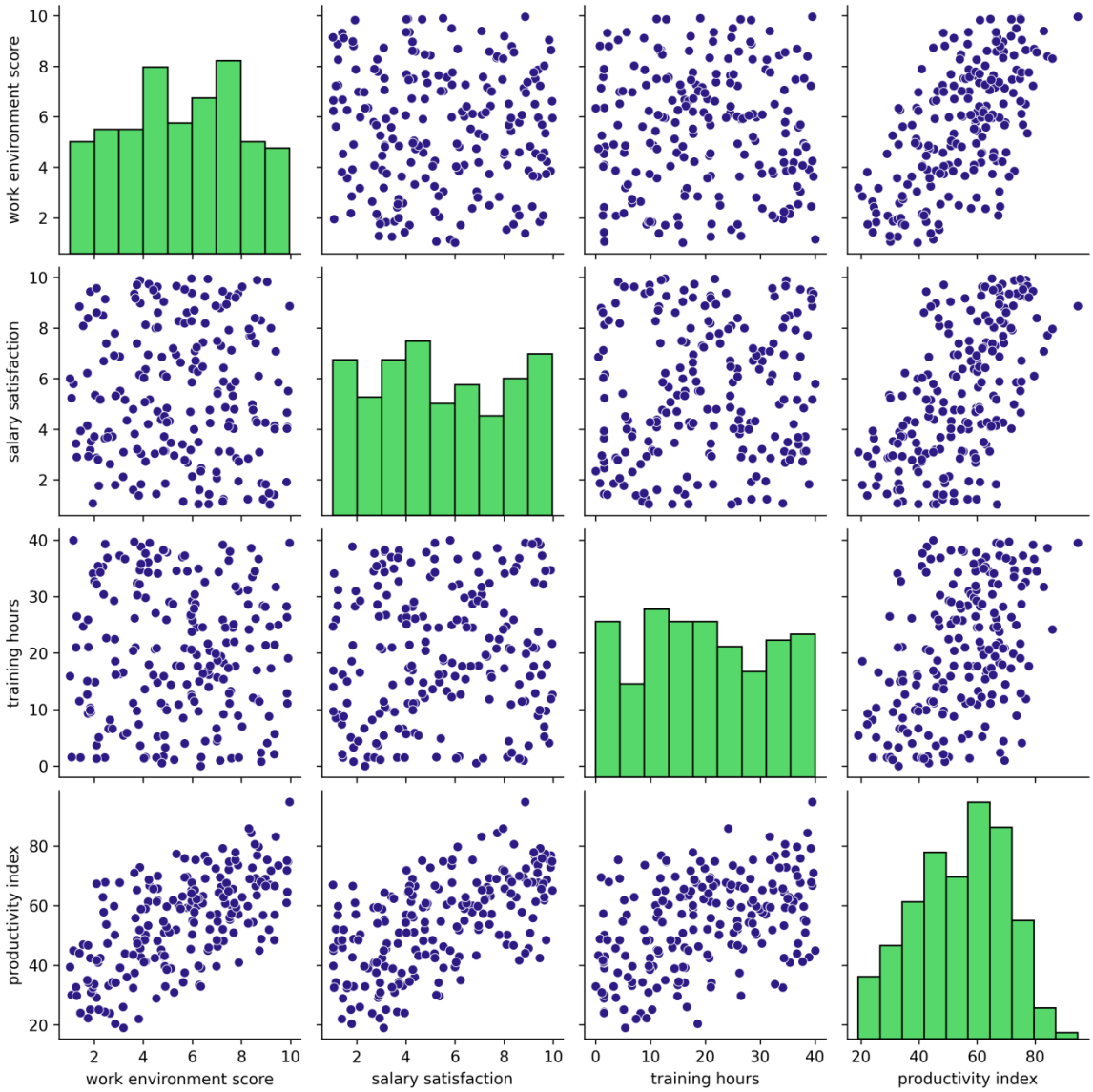

FIGURE 1. Scatter Plot of the various employee motivation productivity

Figure 1 shows scatter plots and histograms of work environment, salary satisfaction, training hours, and productivity. Positive trends indicate that higher work environment scores and salary satisfaction correlate moderately with productivity, while training hours show weaker correlation. Distributions appear fairly spread, highlighting variability in employee motivation and productivity outcomes.

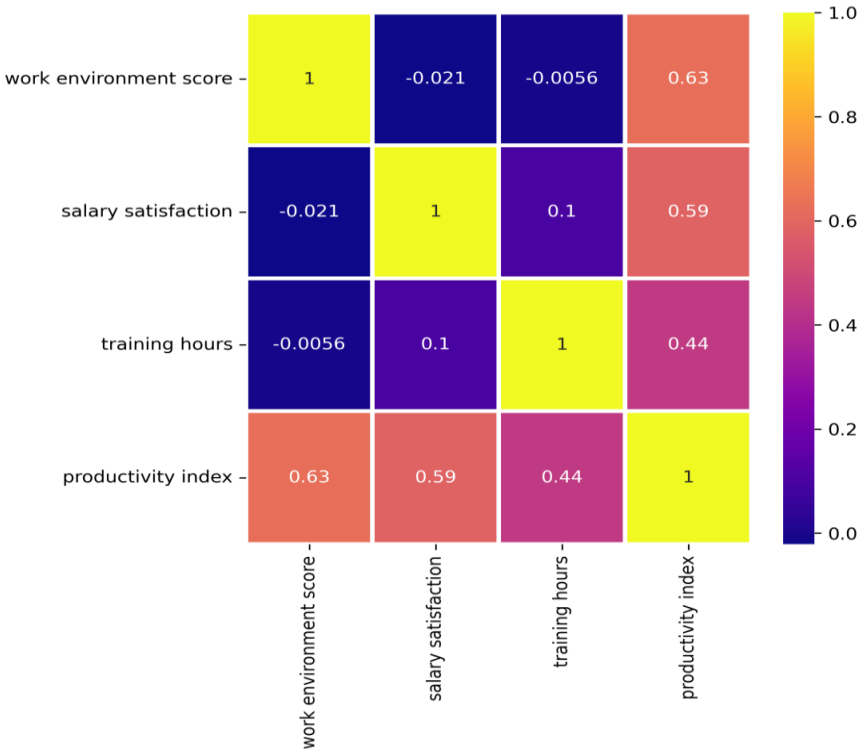

FIGURE 2. Correlation Heat Map on Process Parameters and Effects

Figure 2 the correlation heat map reveals that productivity index is strongly linked to work environment score (0.63) and salary satisfaction (0.59). In contrast, training hours show weak or negligible correlations with other factors, suggesting non-monetary elements are more influential on productivity in this analysis.

FIGURE 3. Linear Regression (Training data)

Figure 3 The linear regression model demonstrates strong predictive power, with high R^2 scores for both training (0.77) and test (0.73) data. The close performance on unseen test data indicates good generalization, meaning the model reliably estimates the target variable without significant over fitting.

FIGURE 4. Linear Regression (Testing data)

Figure 4 the testing data confirms the linear regression model's robustness, achieving an R^2 of 0.73. Its performance metrics align closely with the training data, indicating the model generalizes well to new, unseen data without over fitting and maintains reliable predictive accuracy.

TABLE 2. Performance Metrics of Linear Regression (Training Data and Testing Data)

Data	Model	R2	EVS	MSE	RMSE	MAE	MaxError	MSLE	MedAE
Train	Linear Regression	0.77282	0.77282	1.62839	1.27608	1.03477	3.27883	0.07229	0.87748
Test	Linear Regression	0.72689	0.73552	1.54620	1.24346	1.06313	2.17608	0.04339	1.09970

Table 2 the performance metrics for the linear regression model show strong and consistent results. With high R^2 values for both training (0.77) and testing (0.73) data, the model demonstrates good predictive accuracy and generalizes well to new, unseen data without significant over fitting.

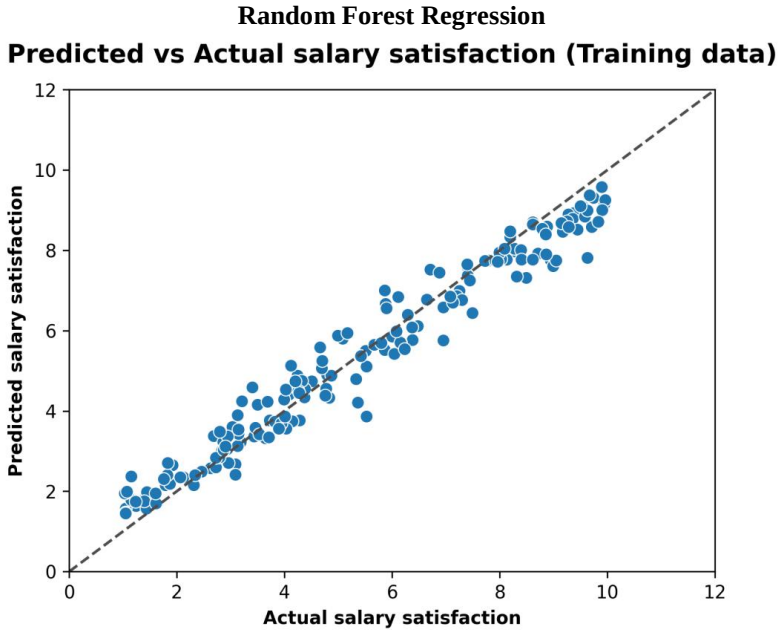

FIGURE 5. Random Forest Regression (Training data)

Figure5 the Random Forest model shows a significant performance gap between training (R^2 0.95) and testing (R^2 0.70). While it fits the training data exceptionally well, its lower test score indicates over fitting, meaning the model's predictive performance on new, unseen data is less reliable.

FIGURE 6. Random Forest Regression (Testing data)

Figure 6 the Random Forest model's testing data reveals significant over fitting. While its training R^2 is near-perfect (0.95), the test R^2 drops substantially to 0.70. This large performance gap indicates the model has memorized the training data and fails to generalize effectively to new, unseen data.

TABLE 3. Performance Metrics of Random Forest Regression (Training Data and Testing Data)

Data	Model	R2	EVS	MSE	RMSE	MAE	MaxError	MSLE	MedAE
Train	Random Forest Regression	0.95364	0.95388	0.33232	0.57647	0.46143	1.81325	0.01262	0.39408
Test	Random Forest Regression	0.69765	0.71248	1.71171	1.30832	1.08312	2.89110	0.06473	1.17258

Table 3The Random Forest model exhibits significant over fitting. Its performance on training data is excellent (R^2 0.95), but it drops considerably on testing data (R^2 0.70). This large gap indicates the model memorized the training set rather than learning generalizable patterns, limiting its predictive usefulness.

4. CONCLUSION

This study provides a comprehensive examination of the relationship between employee motivation and productivity, highlighting that organizational performance is closely tied to the motivational levels of its workforce. Empirical results indicate that work environment quality and salary satisfaction are the most significant drivers of employee productivity, with training hours having a comparatively smaller impact on performance outcomes. The linear regression analysis outperformed random forest regression, suggesting that the link between motivational factors and productivity is largely linear and predictable rather than complex and nonlinear. Strong correlations between work environment (r = 0.63) and salary satisfaction (r = 0.59) support motivation theories that emphasize the role of intrinsic and extrinsic rewards in enhancing productivity. Organizations should understand that investing solely in training programs without simultaneously improving workplace conditions or compensation will yield limited productivity improvements. In contrast, a supportive work environment paired with competitive compensation fosters higher employee engagement, creativity, commitment, and output quality. The predictive models developed in this study offer managers actionable tools to identify motivational gaps and anticipate the productivity effects of organizational interventions. Future human resource strategies should adopt integrated

approaches that address environmental quality, fair compensation, and skill development simultaneously. Additionally, future research could explore how leadership styles interact with industry-specific factors to influence employee motivation and productivity outcomes. This study contributes to closing existing gaps in literature regarding effective motivational strategies. Implementing these insights can lead to tangible benefits, including higher employee retention, lower absenteeism, and enhanced competitive positioning. The findings underscore that sustained improvements in productivity require continuous attention to employee motivation, particularly through environmental enhancement and competitive compensation. By proactively applying these strategies, organizations can transform motivational management into a strategic advantage, achieving organizational objectives while promoting employee well-being and professional satisfaction in increasingly competitive business environments.

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