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Machine Learning Analysis of High-Performance Work Systems: The Role of Employee Engagement and Growth Mindset

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Abstract

This paper reviews High-Performance Work Systems (HPWS), employee engagement, and job performance with a focus on the role of growth mindset as a moderator. Using machine learning algorithms Decision Trees, Random Forest, and Support Vector Machines (SVM), we extracted 217 employees working at software companies in Lahore, Pakistan. The findings of this study point to the interaction between HPWS and both job performance as well as engagement, which is significantly moderated by a growth mindset. This study contributes to the solution of the research question and contributes to the numerous area of research and modern data Driven human resource management for better performance of the workforce and overall improved organizational results.

Keywords: High-Performance Work Systems; Employee Engagement; Growth Mindset; Machine Learning; Job Performance; Support Vector Machines; SVM.

1 | Introduction

Albeit falling under the realm of the theoretical for some time, High-Performance Work Systems (HPWS) are gradually acquiring a central role in organizations' strategic plans, especially in the context of competitive and rapidly evolving markets [1]. The practices that define HPWS are seen as the strategic clustering of HRM practices meant to increase organizational effectiveness by increasing employee extra-role performance [2,3]. That's why elements of HPWS usually comprise such factors as recruitment, skills, and incentives, which can be defined as performance-focused, decision-making participation [4]. That is, it has been established that HPWS directly affects engagement among the employees and yet certain psychological characteristics of employees which include a growth mindset do affect the functioning of these systems [5]. In the case of organizations where employees have development capital, such employees tend to embrace difficulty, persistency, and OPTION Assets, seeking challenges and thus increasing the strengthening of the other positive impacts of HPWS on organizations [6-8]. The application of machine learning techniques in human resource management is a unique way of extending the understanding of the complex link between HPWS, engagement, and performance [9]. These algorithms can handle a large data set and provide opportunities to expose unknown relationships and provide predictions, which ordinary statistical models may not reveal

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[10,11]. This research aims at applying machine learning tools to examine the degree of the relationship between HPWS and engagement and job performance with the moderator variable being growth mindset [12].

1.1 | Research Objectives

This study aims to achieve the following research objectives:

i). To analyze the moderating effect of High-Performance Work Systems (HPWS) on the level of employee engagement.

ii). To first determine whether HPWS influences job performance.

iii). The following hypothesized the research model to test how employee engagement moderated the relationship between HPWS and job performance.

iv). To test the moderating role of growth mindset on the relationship between HPWS and employee engagement.

v). Therefore implement Machine Learning models to forecast and analyze job performance and levels of engagement of the employees.

1.2 | Significance of the Study

This work further develops the knowledge of High-Performance Work Systems (HPWS) and employees' responses by applying machine learning techniques to the investigation. The paper provides useful information to HR managers about the outcomes of HPWS and helps them understand the importance of practicing the growth mindset in the workforce.

2 | Literature Review

2.1 | High-Performance Work Systems

A High-Performance Work System (HPWS) is a strategic combination of human resource management practices that organizational performance is driven through utilizing employee capabilities to the maximum [13,14]. Literature shows that HPWS has positive effects on job satisfaction, turnover, and performance [15]. The primary components of HPWS are:

- Recruitment and selection procedures that only target the most qualified persons for the existing job openings.
- Detailed courses that aim at improving the abilities of persons in an organization.
- Incentives that inspire increased goal attainment and mainstream individual and organizational goals as one.
- Employees participation approach which would involve workers in the organizational decision-making processes.

2.2 | Employee Engagement

Employee engagement is an important factor that reflects the considerable level of interest, commitment, and performance of the employees [16,17]. A higher level of employee engagement proves that employees do better in their organizations, work harder, and have a low turnover rate [18]. It is a well-established fact that HPWS practices lead to greater engagement levels since the practice frowns on non-involvement and non-recognition of the workers [19].

2.3 | Growth Mindset

According to Dweck (2006), the growth mindset dweck2006mindset is the attitude in people that propels the idea that intelligence can be increased through effort. However, people with fixed mindsets believe that abilities are carved in stone and cannot be changed [20]. The research has found that people with a growth mindset are willing to engage in more challenges, use feedback to enhance performance and achieve greater performance standards [21,22]. Such a mentality is highly relevant in situations that support growth and learning within an organization [23].

2.4 | Machine Learning in HRM

Machine learning has permeated human capital analysis to predict employees' behavior and results, as well as analyze large datasets [24]. Decision Trees, Random Forests, and Support Vector Machines (SVM) detect intricate patterns in our data set regarding both employee performance and engagement [25]. These methods help HR professionals outline facts and courses of action that can enhance workforce productivity and satisfaction [26].

2.5 | Research Framework

A conceptual framework designed to illustrate the periphery of communications interconnectivity in the global environment of the 21st century is presented in Figure 1. Here, the following relationships are discussed using a theoretical framework: HPWS, engagement, performance, and growth mindset.

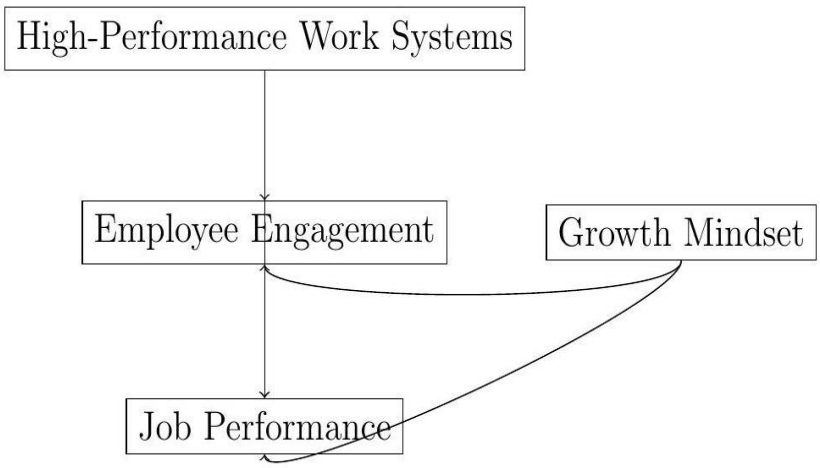

Figure 1. Proposed research framework.

3 | Research Methodology

3.1 | Data Collection

Information was collected from 217 employees working in software firms in Lahore, Pakistan. A structured question was used to gather data on the employees' perception of HPWS, engagement, performance, and growth orientation. The missing values in the collected data were omitted and normalized for effective machine-learning analysis.

3.2 | Measurement Instruments

The study employed the following measurement tools:

- HPWS: Assessed using a 20-item questionnaire adopted [27] in main areas of recruitment, training, pay, and systematic employee involvement in organizational decision-making.

- Employee Engagement: According to the UWES developed by Schaufeli et al. (2002), UWES were used to assess work engagement [28,29].
- Job Performance: Facet III focused on self-appraisal of job performance rated on a 5 Likert scale worth of individual performance and accomplishment [30].
- Growth Mindset: Closing questions to complete a newly constructed 18-item Mindset Measure by [31].

3.3 | Measurement Instruments

The gathered data were analyzed using a range of machine-learning algorithms:

- Decision Trees: Chronic used to make a distinction concerning the cadres by their commitment and their response caution to HPWS.
- Support Vector Machines (SVM): Applied while testing the moderating role of growth mindset on the relationship between HPWS and employee engagement.
- Random Forest: Introduced to determine the significance of each feature and to examine the model accuracy in determining job performance.

3.4 | Training and Testing

The data was split 80:20 into a training data set and a test data set. Cross-genesis validation techniques were used to reduce overfitting, and model performances were evaluated using evaluation metrics, including accuracy, precision, recall, and the F1 Score.

4 | Results

4.1 | Descriptive Statistics

Descriptive statistics for the key variables in the study are presented in Table 1.

Table 1. Descriptive statistics of variables.

Variable	Mean	Standard Deviation	Range
HPWS Score	4.25	0.56	$1-5$
Employee Engagement	3.85	0.63	$1-5$
Job Performance	4.10	0.68	$1-5$
Growth Mindset	4.35	0.55	$1-5$

4.2 | Model Performance

4.2.1 | Linear Regression

Thus, based on results of linear regression analysis it was concluded that HPWS had high positive correlations with both the level of employee engagement and job performance ($p < 0.001$). This model explained 75% of the variability in job performance.

4.2.2 | Decision Tree Classification

The decision tree as a tool for classification distinguished the level of employee engagement with 85% accuracy. The most significant findings were that training and employee involvement dimensions were the strongest HPWS antecedents of engagement. The format of the decision tree is given in Figure 2 below.

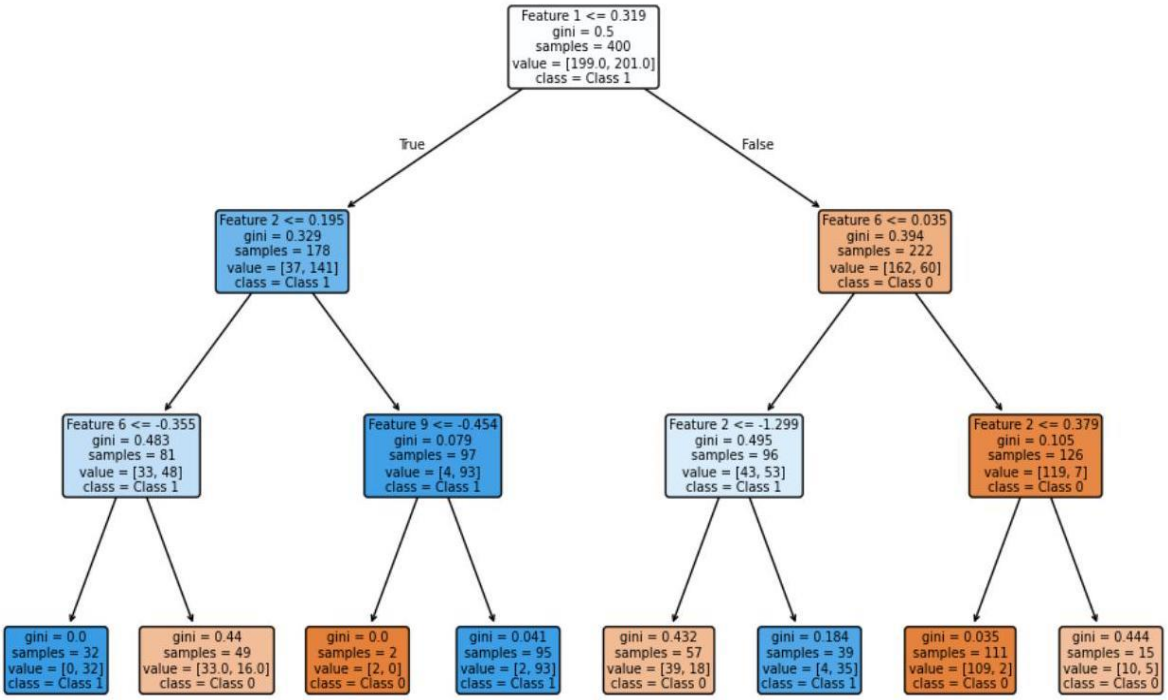

Figure 2. Decision Tree for Employee Engagement Classification.

4.2.3 | SVM Results

A classification accuracy of 82% was obtained from the Support Vector Machine (SVM) model in favor of analyzing the research hypothesis stating that growth mindset moderates between HPWS and employee engagement. Organizational growth can be attributed to the belief that employees with a growth mentality negotiate higher engagement from HPWS.

4.2.4 | Random Forest Feature Importance

Random forest showed that the two features determining the job performance of the employee were employee engagement and growth mindset. The feature importance is presented in the following figure, Figure 3.

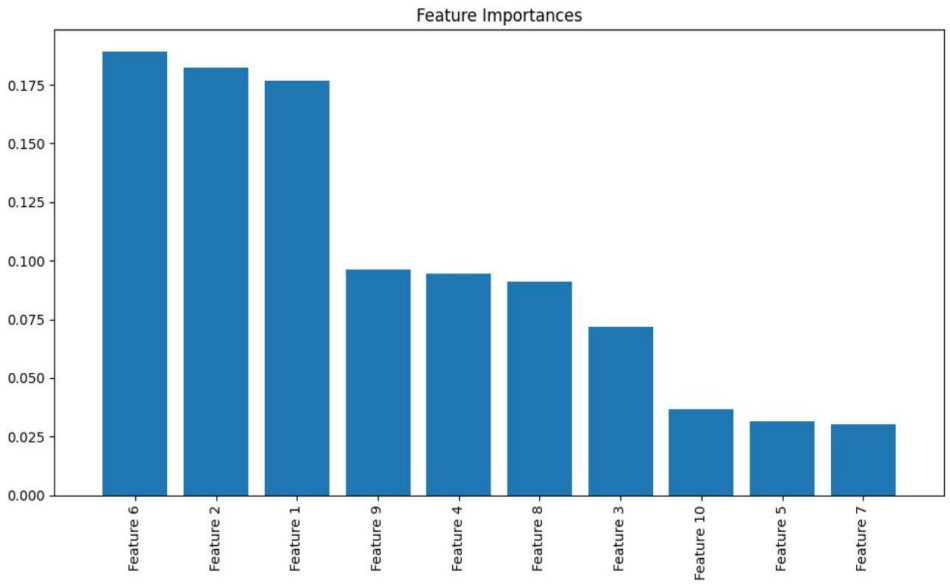

Figure 3. Feature importance in Random Forest model.

5 | Discussion

5.1 | HPWS and Employee Engagement

This shows that HPWS significantly influences employee engagement support, a result also supported in prior research [32-35]. Selective recruitment, employee training and training in special programs, and active incentive arrangements offer better performance on the job among the employees and indicate a higher degree of engagement [36].

5.2 | Moderating Role of Growth Mindset

The present research shows that HPWS are positively related to employee engagement and a growth mindset moderates this relationship. As earlier mentioned in the paper, employees with a growth mindset are more likely to engage in the challenges presented by HPWS than employees with a fixed mindset. As established by Dweck (2006) in the growth mindset research undertaking [37].

5.3 | Implications for HRM

The findings of this research offer useful information to the HR managers. Indeed, through the following machine learning technique, the researchers can help the HR personnel to find out which of the employees will benefit most from HPWS. Finally, also requiring employees to embrace the growth mindset would help to build on the benefits that come with these practices.

6 | Conclusion

6.1 | Summary of Findings

In this work, the above hypothesis was examined using a machine learning approach on the extent of HPWS, employee engagement, and job performance. The research outcomes establish that HPWS affects employee engagement positively which in turn increases job performance. Moreover, the current study was carried out under the contextual contingency of growth mindset meaning that only those employees willing to embrace an attitude that perceives the possibility of personal change can prosper within an organization displaying qualities of an HPWS.

6.2 | Limitations and Future Research

However, certain things show weakness in this study including the restricted geographical location of the study to software companies in Lahore, Pakistan. Other work could build upon these findings by looking at whether the results found were similar in other industries or geographical locations. In addition, the wider implementation of the research could also propose the use of more advanced algorithms, including neural networks, to improve the efficiency of the predictions.

6.3 | Practical Recommendations

It is suggested that relevant HR managers should start to incorporate ML models in their emergency management strategies for forecasting employees' engagement and performance. In addition, practically applying a growth mindset perspective in the form of reasoning into the organization can help boost the success of HPWS.

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Data Availability

The datasets generated during and/or analyzed during the current study are not publicly available due to the privacy-preserving nature of the data but are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that there is no conflict of interest in the research.

Ethical Approval

This article does not contain any studies with human participants or animals performed by any of the authors.

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