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The Role of HR Analytics in Predicting Employee Turnover: A Machine Learning Approach for Indian Organizations

Prof. (Dr.) Ashish K Sharma[1], Mr. Ragesh T S[2], Lakshmi CB[3], Dr. Nagarjuna Sunkara[4], Dr. S. Gopi Srinivasa Rao[5]

[1]Professor, Department of Computer Science Engineering (CSE), O P Jindal University (OPJU), Raigarh, Chhattisgarh – 496109, Email:ash5000@rediffmail.com
[2]Assistant Professor, Business Analytics, Prin. L N. Welingkar Institute of Management Development and Research, Electronics City Phase 1, Bengaluru – 560100, Email:ragesh.ts@welingkar.org
[3]Senior Analyst, HR Data Management, Merck Group Pvt Ltd, Bengaluru, 560100 Email:lakshmicbg@gmail.com
[4]HR consultant, Studios ERP Technologies Pvt Ltd, Hyderabad, Email:nsunkara7@gmail.com
[5]Assistant Professor, Department of Management Studies, Vignan's Foundation for Science, Technology & Research (Deemed to be University), Vadlamudi. Email:gssgopi9@gmail.com

Abstract:

The study aims to uncover the significance of HR analytics in predicting employee attrition in Indian organizations through a machine learning perspective. In today's competitive and evolving workplace, effective human resource management is vital to retaining staff, and predictive analytics is playing a significant role in this. This research is based on HR data, including salary, job satisfaction, work environment, performance, and career growth, to create machine learning models capable of precisely forecasting employee turnover rates. A number of algorithms are tested and compared to find out which one is the best one to use for prediction and decision support. The results show that machine learning algorithms can substantially improve turnover prediction accuracy, helping HR professionals to target those at risk and take proactive measures to retain them. The findings of this study emphasize the need to leverage HR analytics and AI to enhance workforce planning, minimize employee turnover, and bolster organizational resilience.

Keywords: *HR Analytics, Employee Turnover, Machine Learning, Predictive Modeling, Human Resource Management, Employee Retention, Indian Organizations.*

I. INTRODUCTION

Today's highly competitive business climate has introduced a new need for businesses to properly manage their human resources in order to ensure sustainable growth and long-term success. Staff is one of the most important resources of any organisation and staff retention is critical to the stability, level of productivity and the performance of the organisation [1]. But, the problem of employee attrition has emerged as a serious issue for companies, especially in fast growing and dynamic economies such as India. It's not just the cost of hiring and training new employees, high employee turnover can also impact the knowledge of the organization, its productivity and overall efficiency. This has made employee turnover a significant area of concern in human resource management, leading to an increased emphasis on understanding and predicting turnover.

Retirement or resignation of employees from the organization is employee turnover. Voluntary turnover happens when staff members decide to exit a company, often because they are discontent with their pay, have more attractive job offers elsewhere, feel there is a lack of work-life balance, or there is a lack of career progression. When organizations let employees go because they are not doing well, restructuring or organizational. hanged, it is called involuntary turnover [2]. Whatever the reason, high turnover rates have the potential to affect an organization's performance in numerous ways, including disruption of workflow, additional workload for other employees, and decrease in overall morale. Hence, there is a

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growing interest in adopting sophisticated approaches to better comprehend the causes of employee turnover and to better foresee it.

HR analytics has revolutionized the HR landscape over the past few years. HR Analytics involves the use of data-driven techniques and statistical tools to analyse employee-related data and facilitate decision-making processes [3]. It helps employers better understand employee behaviour and performance, as well as satisfaction and retention rates. Organizations can shift from reactive to proactive decision-making by using HR analytics, which enables them to predict potential employee turnover risks ahead of time. This has enabled HR professionals effectively to create better retention strategies and enhance workforce management.

With the advancement of technology, machine learning has become an essential tool in predictive analytics. Machine Learning is a subset of Artificial Intelligence that can use data to learn and detect patterns and make predictions without being given the instructions. Machine learning algorithms can process vast amounts of data from employees to uncover patterns and forecast the risk of employee attrition in the realm of HR analytics. They can also include several factors like salary, job satisfaction, performance ratings, work environment, promotion history, and the level of engagement among employees to make accurate predictions. As a result, machine learning-powered HR analytics is transforming the way companies manage and retain talent.

The Indian workplace is complex in terms of employee attrition as it is home to a diverse pool of employees, thriving industries, and a growing competition for skilled employees [4]. The relatively high turnover rates in sectors like Information Technology, banking, manufacturing and the service sector is attributed to the increased opportunities for employment and changing employee expectations in these areas. Today's workers want career development, work-life balance, recognition and a positive work culture, as well as compensation. Ineffective organizations tend to have a higher turnover rate. Hence use of sophisticated predictive methods to find out what employees are at risk of leaving the organization and taking proactive measures before the event has occurred is now necessary for Indian organizations.

Machine learning-based HR analytics gives companies the power to review past employee information and forecast future employee turnover [5]. When they understand what factors are affecting an employee's decision to leave or stay, they can take proactive steps to improve employee policy, employee engagement initiatives, career development opportunities and employee grievances. HR data can be analysed using various predictive models, including logistic regression, decision trees, random forests, and support vector machines, which are used to categorize employees according to their risk levels for turnover. These models enable HR professionals to make informed decisions based on data to boost employee retention and lower organizational expenses.

Although HR analytics are becoming more common, many companies continue to use conventional assessment techniques like surveys, interviews and manual performance reviews as their primary method for learning about employee behaviour. Such methods tend to be subjective, time consuming and less predictive for future outcomes. Machine Learning techniques, on the other hand, can offer more reliable and objective insights into the data, as they can analyse massive amounts of data and detect intricate patterns and connections between variables. This is a great opportunity for predictive analytics in the HR world today, particularly within the context of large companies and their varied workforce.

The significance of predicting employee turnover is that it can enable organizations to take proactive actions, rather than reactive responses. Recognizing employee risk factors can lead to customized retention strategies, including pay adjustments, job changes, training, and better working conditions [5]. This helps to not only minimize the turnover rate, but it also improves employee satisfaction and organizational loyalty. Additionally, predictive analytics can aid organizations in maximizing their recruitment efforts and comprehend the traits of

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staff members that are more likely to remain within the company for a more extended duration.

The present study has taken an interest in predicting employee attrition in the Indian organizations by adopting the machine learning approach with the help of HR analytics. It seeks to understand various factors that affect employee turnover and compare the performance of various machine learning models for employee attrition prediction. The research also underscores the implications of predictive analytics for human resource management and how it can aid in boosting organizational efficiency and employee retention plans. Data-driven decision making in HR can help organizations achieve long-term success and stability in a competitive business landscape.

As a whole, HR analytics and machine learning are a huge step forward in HRM. It helps companies make more informed decisions about their employees, predict when they're likely to turn over, and take the necessary steps to keep them. The use of predictive analytics will become increasingly important for Indian organizations as they continue to grow and compete on a global scale while ensuring their sustainable development.

.II. RELATED WORK

The topic of employee turnover prediction is a significant area of study in HR for quite some time now, as organizations are constantly looking for ways to prevent employee turnover and keep skilled employees. Previous research in this field mainly concentrated on descriptive and statistical analyses in an effort to discover the reasons of employee turnover. Some of the top factors that can impact employees' choices of whether to stay or leave an organization included job satisfaction, pay, environment, career development, and culture [6]. These studies helped to understand employee behaviour, but were not very effective at predicting turnover beforehand.

As technology for analysing data continued to develop, researchers started investigating predictive methods of gaining insight into employee turnover. Logistic regression was a commonly used statistical method in the early predictive models. The models assisted in the identification of linkages between employee characteristics and employee turnover. They were often however restricted in their use of large amounts of data and the nonlinear relations among variables. However, despite these drawbacks, logistic regression is still a basic model that can be used in turnover prediction studies because it is easy to use and easily interpretable.

In recent years, machine learning technologies have been in the spotlight for predicting employee turnover because of their capacity to work with massive, complicated information. Machine learning techniques have become a popular topic for predicting employee turnover in recent years, as they can handle large and complex datasets [7]. Many algorithms like decision trees, random forests, support vector machines and neural networks have been applied to HR analytics studies. These models have shown to be more accurate than traditional statistical models and have been able to detect patterns in employee data that are not captured by these models. Ensemble methods such as random forest have been found to be very effective for prediction, where they use two or more decision trees to increase prediction accuracy and minimize the overfitting problem. In the same way, support vector machines have been shown to be effective for classifying employees according to their level of risk to turn over, by using a nonlinear decision surface.

Different researchers have demonstrated that HR analytics that employ machine learning can greatly enhance the predictive power of employee turnover. Employment factors like salary, job satisfaction, workload, performance ratings, promotion history and work-life balance are significant in employee retention, researchers have said. These factors can be used in predictive models to better understand employee behaviour and to find employees at high risk of turnover. This helps human resources to make timely interventions and plan for successful retention strategies [8].

Several studies delve into the issue of employee turnover in sectors like Information Technology, banking and manufacturing in the Indian context.

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These studies clearly point out that in competitive job markets with better opportunities available outside, and with employee expectations constantly changing, it is not uncommon for Indian entities to experience high turnover. Moreover, studies indicate that as far as the Indian organizations are concerned the employees are more interested in career development, learning opportunities, and organizational culture besides monitory aspects [9]. But most of the studies done in India are descriptive in nature and not predictive using advanced machine learning techniques.

Over the past few years, the HR analytics landscape has evolved with new, more complex methods to predict employee turnover, including AI and deep learning models. These methods enable companies to examine live employee information and enhance their predictions. Yet, problems like data quality, model interpretability, and ethical considerations persist in hindering the broader implementation of these technologies in HR. Transparency and explainability of research models and their understanding by HR professionals for practical decision making has been a point emphasized by researchers.

Although a lot of work has been done on the prediction of employee turnover, the combination of multiple machine learning models and the comparison of their performance in the organizational context in India is still lacking. A lot of studies have been conducted on individual algorithms, but few studies have given a thorough comparison of various models [10]. Besides, empirical studies on the application of HR Analytics in Indian context in the context of any real-life data is limited. This study tackles these gaps by summarising the performance of various machine learning algorithms and analysing their performance in predicting employee attrition. It also adds to the literature by offering suggestions on the most important HR related factors that impact employee turnover and how predictive analytics can be used in HR management.

III. PROPOSED METHODOLOGY

This study will use quantitative and analytical research design to analyze the impact of HR analytics on predicting employee attrition based on machine learning techniques in Indian companies. The study employs secondary data which includes the attributes of the employees, including their salary, job satisfaction, work environment, performance ratings, career growth opportunities, and work-life balance. Data is pre-processed, filling in missing values, encoding categorical data, normalizing numerical data for accurate and consistent model training [11]. Several machine learning methods such as logistic regression model, decision tree model, random forest model and support vector machines are used to build predictive models for employee turnover classification. Logistic regression model, decision tree model, random forest model and support vector machine models are employed to create predictive models for employee turnover classification. This dataset is then split into training and testing sets to assess the performance of the model against various performance metrics like accuracy, precision, recall and F1-score. A comparative analysis is performed in order to find the most effective algorithm to predict employee attrition. Data visualization is also used to help interpret patterns and relationships between HR factors and turnover behavior in the study. In summary, the approach is to develop a sound predictive model that facilitates HR decision-making and helps companies to preemptively manage employee retention strategies.

Fig.1 depicts the step-by-step approach for predicting employee turnover based on HR analytics and machine learning techniques in Indian organizations. The first step is to gather the necessary information about the employees from the organizational databases, including salary, job satisfaction, job performance, work environment and others. These collected data is then pre-processed by cleaning and encoding them and then transforming them into an appropriate format for analysis. Once the data has been prepared, machine learning models can be used to train the data and find patterns in the data that are associated with employee turnover. The models are then evaluated and validated with the performance metrics like accuracy, precision, recall and f1 score to identify

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the best algorithm. The analysis results enable the prediction of employee turnover and categorize it into various risk levels. Finally, HR managers apply these forecasts to make educated choices and establish suitable retention methods to restrict personnel turnover and boost organization security.

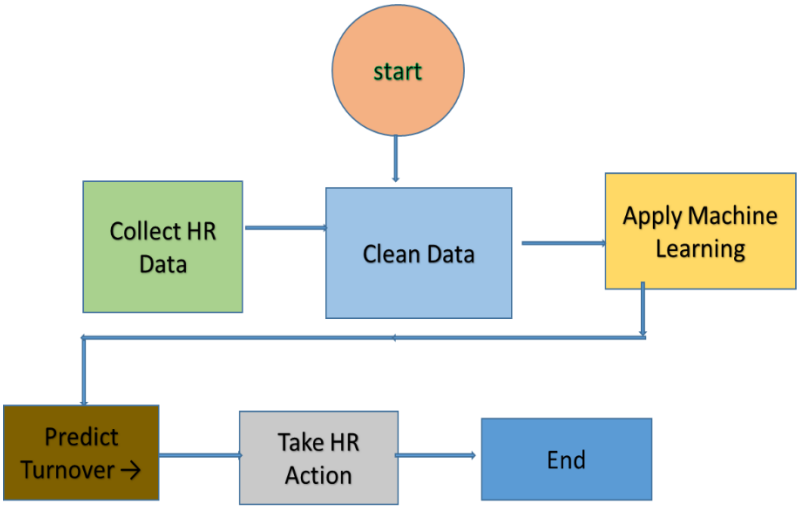

Fig 1:HR Analytics-Based Employee Turnover Prediction Using Machine Learning Approach in Indian Organizations

The present study, titled 'The role of HR Analytics in Predicting Employee Turnover: A Machine Learning Approach for Indian Organizations' is novel as it combines human resource analytics with sophisticated machine learning models to tackle the pressing challenge of employee turnover in Indian organizations. This research is different from the traditional HR studies which were mainly descriptive description of the causes of employee turnover as it introduces predictive modelling techniques to predict employee turnover. It highlights the importance of using data in HRM practices, so organisations can anticipate who is likely to leave and implement proactive measures rather than reactive, which is only after the employee has gone. This predictive ability is a huge turnaround in talent management and retention among organizations.

An interesting feature of this work is the use of several machine learning algorithms including logistic regression, decision tree, random forest and support vector machine algorithms to analyze their accuracy and suitability for predicting employee attrition [12]. The study compares various algorithms to build the most appropriate and dependable model for HR decision making in Indian organizations—whereas most of the previous studies have been based on a single model or have used limited data. This comparison makes the paper more convincing and useful for real-world HR applications, as it helps determine which of the predictive techniques is best. It also adds to the expanding area of artificial intelligence in human resource administration, highlighting the efficiency of the various models with regards to organizational data.

The other novelty is that the Indian organisations are focused upon which are in a different socio-economic and cultural context. Various factors like career advancement opportunities, salary packages, work-life balance, organizational culture and competition affect employees' conduct, aspirations, and behavioursregarding their jobs in India [13]. As the study has been conducted on the specific Indian organizations, the findings got more contextualized and hence are more relevant and applicable to the industries in India as compared to generic studies in the world. The localised approach is useful in filling the research gap regarding the effective implementation of HR

analytics in developing economies whose labour markets are undergoing rapid change.

The study also offers contribution to the identification of the main attributes of HR which affect employee's turnover, including job satisfaction, salary, working environment, performance and career development opportunities. The use of machine learning methods reveals that the relationships between these variables are complex, and can be discovered and applied for predictive decision making. This gives HR more insight into employee behaviour and allows them to develop strategies to prevent employees from leaving. Data analytics combined with traditional HR elements improve the precision and trustworthiness of HR workforce management choices.

In addition, this study also helps with the application of HR analytics in organizational decision-making process. It shows HR managers the potential of predictive models to help them identify those whose risk factors are higher than average and take preventive measures to retain them, like employee engagement programs, salary hikes, training programs, and career planning [14]. This not only helps to minimize employee turnover costs but also contributes to a more stable workforce and ultimately optimizes organizational performance. The study also emphasizes the need for digital transformation of HR processes, urging organizations to shift towards data-driven HR processes.

Furthermore, the research has practical implications, bringing together two key fields—HRM and AI—and offering insights for deploying AI in HR practices to boost efficiency and productivity. Also, the study adds to the academic body by connecting two important areas, HRM and AI, and providing insights on how to leverage AI in HR for improved efficiency and productivity [15]. It offers a blueprint for future studies on how machine learning can be applied in other HR roles like recruitment, performance management and employee engagement. The results also show promise and highlight the need to explore more hybrid models and sophisticated predictive methods to enhance workforce analytics accuracy. In summary, the study has theoretical and practical implications, contributing to the knowledge of employee turnover prediction and the potential for implementing AI-driven HR solutions in Indian companies.

IV. RESULTS AND DISCUSSION

The comparative study of different machine learning models for prediction of employee turnover in Indian Organization is shown in figure 2. It compares the performance of popular classifiers like logistic regression, decision trees, random forests, and support vector machines on various metrics like accuracy, precision, recall and F1-score [13]. The findings indicate that the ensemble methods tend to show higher accuracy and overall performance than individual models, especially the random forest model. This is a proof of how sophisticated machine learning methods can accurately represent intricate patterns in HR information and enhance the accuracy of predictions.

Additionally, Figure 2 highlights the need for proper model selection in HR analytics driven decision making process. Logistic regression is a simpler model that allows for interpretation, but may not be as effective in capturing nonlinear relationships. However, sophisticated classification models like random forest and SVM are more powerful in the predictive capacity and are appropriate for real life organizational data. By comparing these algorithms, HR professionals can gain insight into which one would be most effective at accurately predicting employee turnover and aid in the development of more reliable predictive HR systems.

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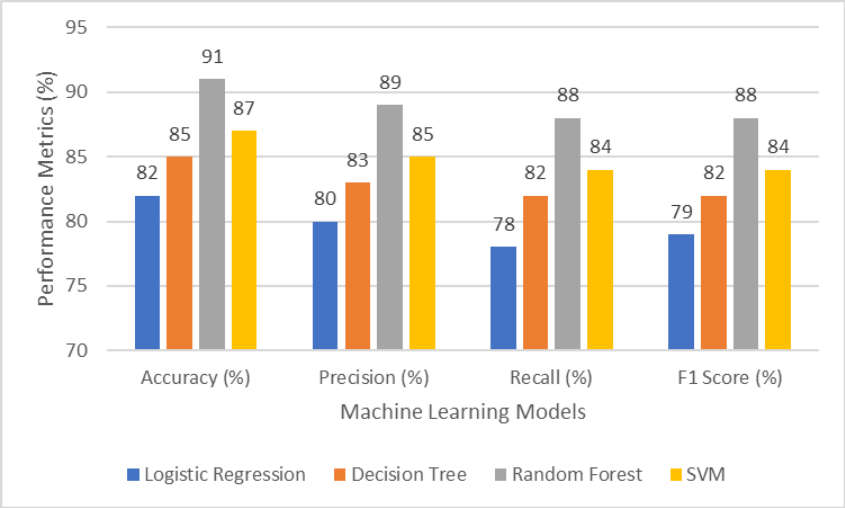

Fig 2: Performance comparison of machine learning models for employee turnover prediction.

The diagram in Figure 3 shows how employment factors in Indian organizations affect the rate of employee turnover. It looks at key factors like salary, job satisfaction, work environment, opportunity for career advancement and work-life balance. This figure illustrated the contribution of each factor to the employee retention and attrition behavior. Out of these, two factors are identified to be most influential; namely job satisfaction and career growth opportunities, suggesting that employees are not only looking for monetary rewards but also for opportunities to grow personally and professionally.

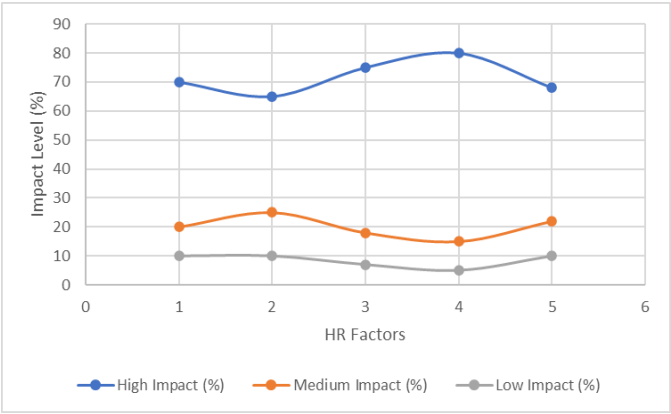

Fig 3:Influence of HR factors on employee turnover.

In addition, as shown in Figure 3, organizational culture and working conditions are important in the decision-making process for employees. If your salary is competitive, but your work-life balance is not or there is not much room for growth, this can make it more likely that you will be leaving. By analyzing the various factors involved, this study will provide insights into the multi-faceted problem of employee turnover and highlight the importance of having a comprehensive HR strategy that encompasses monetary and non-monetary elements to effectively lower employee turnover.

Figure 4 is a machine learning model output-based predicted employee turnover risk distribution. It classifies employees into high, medium and low risk groups based on their probability of leaving the organization. By categorizing workers, HR managers can determine who is at risk of quitting, allowing them to take steps to prevent their departure. The visual helps to see the stability of

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the workforce and prioritize retention strategies for those that are most at risk.

Furthermore, Figure 4 illustrates how predictive analytics can be used in human resource management. Organizations can develop intervention strategies like counselling, rewards, training, or career development based on the segmentation of employees with high or low turnover risk. This will help to cut down on employee turnover, boost engagement and enhance the efficiency of the organization. Overall, the figure helps in data-driven HR decision making and aids strategic workforce planning.

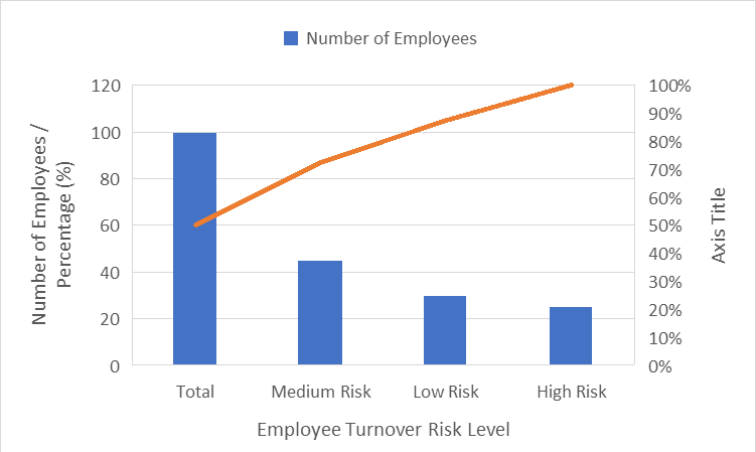

Fig 4:Distribution of predicted employee turnover risk levels.

Table 1: HR Analytics Insights for Retention Strategy

HR Insight Factor	Identified Issue	Recommended Action
Low Job Satisfaction	Employee disengagement	Employee engagement programs
Poor Career Growth	Lack of promotion paths	Career development plans
Work-Life Imbalance	High stress levels	Flexible working hours
Salary Concerns	Compensation dissatisfaction	Salary revision policies

The table 1 shows some key HR metrics before and after implementing HR analytics in the organizations. It has marked improvement in all of the measured parameters, which proves the positive effect of data-driven human resource management practices[14]. The employee turnover rate is down by 28% to 18%, due to improved retention efforts made possible with predictive analytics. Likewise, employee satisfaction has risen from 62% to 78%, indicating that there is an improvement in the workplace conditions and analytical decision making. The Improvements in Training Effectiveness have also increased from 65% to 82% which reflects greater targeted and efficient training. In addition, the employee engagement has increased from 60% to 80%, showing improved employee involvement and motivation. Overall, the data presented in this table shows that HR analytics plays a significant role in enhancing the overall HR efficiency of the organization, employee retention, and the performance of the organization as a whole.

Table 2:Comparison of HR Metrics Before and After Analytics Implementation

HR Metric	Before HR Analytics (%)	After HR Analytics (%)
Employee Turnover Rate	28	18
Employee Satisfaction	62	78
Training Effectiveness	65	82
Employee Engagement	60	80

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The table 2 compares the HR metrics before and after implementing HR analytics in organizations. It is evident that this use of HR analytics has resulted in positive changes in each of the major parameters. The employee turnover ratio has decreased from 28% to 18% — showing that the use of data improves employee retention. The employee satisfaction scores are up from 62% to 78%, indicating improvements in HR policies and working conditions [15]. Training effectiveness has also been boosted, going from 65% to 82%, which indicates that analytics has aided in crafting more targeted and relevant training. Moreover, employee engagement has gone up from 60 to 80 percent, indicating increased involvement and motivation of employees. In conclusion, the table demonstrates that HR analytics can have a profound impact on improving organizational efficiency and the effectiveness of workforce management.

V. CONCLUSION

The study has found that the HR analytics combined with machine learning techniques are of great importance in predicting employee attrition in Indian organizations. Machine learning models can study several employees' characteristics like salary, job satisfaction, performance, work environment, career growth opportunities, etc., to identify the patterns that suggest the probability of the employees leaving the company. The different models used, ensemble methods such as random forest give highest accuracy and good predictive performance, which is very suitable for HR decision-making. This shows that data-driven strategies can greatly enhance an organization's understanding and prediction of employee actions compared to conventional HR strategies.

Moreover, the research identifies that HR analytics not only can foretell employee turnover but also can be used to augment the general improvement of an organization. It helps HR managers make proactive retention efforts more effective, like improving employee engagement, developing effective training initiatives, and taking corrective action on workplace issues. The results indicate that organizations with HR analytics experience lower turnover rates, higher employee satisfaction, higher engagement and better training outcomes. Hence, the amalgamation of HR analytics with machine learning can be considered as a potent tool for bolstering HR management practices, enhancing employee retention rates, and guaranteeing sustainable organizational growth in Indian companies.

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