AN EXPERIMENTAL STUDY ON THE EFFECTIVENESS OF MACHINE LEARNING ALGORITHM AS AN ATTRITION PREDICTOR

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Article History: Received: 23.02.2023 **Revised:** 08.04.2023 **Accepted:** 23.05.2023

Abstract

The issue of employee attrition is a major concern for organisations, as it can lead to a significant loss of valuable resources, including time, money, and knowledge. In recent years, machine learning techniques have been applied to predict employee attrition and help organisations make data-driven decisions to mitigate this problem.

Objective: This study aims to analyse how machine learning has been used to predict employee attrition. And when it is so used, can it be used as the final determinant of attrition? The study also aims to find out if such findings will really serve the purpose of retaining employees in the organisation.

Methodology: An experimental research methodology was adopted. The employee attrition algorithm using ML was taken from reference papers using secondary sources. Further, using ML, the data was analysed to find the extent of success it has in predicting actual attrition.

Findings and implications: It were found that machine learning can be employed to predict employee attrition nut may require further human inference. Such results can be further used by the HR department to make a final decision about the employee. The caveat expressed through the study is that the results of ML cannot be taken as the sole predictor for employee termination , but must be accompanied by personal analysis by the HR. It can serve as a valuable tool to retain engaged employees in the organisation. But sometimes the use of ML to predict employee attrition can also have an adverse impact on employee morale and engagement. Employees may feel that their every move is being analysed and that they are constantly being monitored, which can lead to decreased job satisfaction and even push them towards leaving the organisation.

Keywords: machine learning, employee attrition, impact of ML, HR decision.

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DOI: 10.31838/ecb/2023.12.s2.344

1. INTRODUCTION

When an employee moves out of the company either voluntarily to involuntarily, it is known as attrition. It can occur for various reasons, including retirement, resignation, termination, and layoffs. The attrition rate is calculated as the percent of employee who have left the organization by the average number of employees. Ideally the average rate should be less than 10% and an attrition rate greater than 20% is alarming for any company. In today's fast-paced business environment, employee attrition has become a significant concern for organisations. High attrition rates can cause disruptions in productivity, loss of institutional knowledge, and increased costs associated with recruiting and training new employees. To combat this, companies are increasingly turning to machine learning techniques to predict and prevent employee attrition. Machine learning algorithms can analyse vast amounts of data and identify patterns that may be difficult for humans to detect. By analysing historical employee data, including demographics, performance metrics, and employee satisfaction surveys, machine learning models can help identify factors that contribute to employee attrition. This information can then be used to develop proactive strategies to retain employees, such as targeted interventions, incentive programs, and skill development initiatives. Research has shown that organizations can reduce attrition rates by implementing strategies such as offering competitive compensation and benefits packages, providing opportunities for career advancement, fostering positive work cultures, and promoting work-life balance. Additionally, predictive analytics and machine learning algorithms can help employers identify employees who are at risk of leaving and develop targeted retention strategies.

Objective of study

- To explore the ML algorithms used to assist HR functions
- To identify the ML algorithm in predicting employee attrition of organization.
- To analyse the effectiveness of the ML algorithm in prediction.

Limitation of study

- Ethical considerations: The use of machine learning in HR decisions raises ethical concerns, such as the potential for bias and discrimination, which may need to be addressed in the study.
- Interpretation of results: The results of the study may be difficult to interpret due to the complexity of machine learning algorithms and the lack of transparency in their decision-making process.
- Long-term effects: The study may not be able to capture the long-term effects of machine learning on employee attrition, as these effects may take years to manifest.

Review Of Literature

In the global competitive scenario as there is no dearth of opportunities for talented persons in this world(Nappanee & Premavathy, 2013). Given a chance, employees are prone to move from one organization to another. Corporates are facing the problem of attrition at this time of economic revival. Organizations spend a lot of effort, time and money on employee's retention. Because losing a valued employee proves to be costly in the form of lost knowledge, worried co-workers and lost money. Retention is more economic than going for fresh recruitment. Organizations should have an effective retention plan to keep the current employees.

Alduayj & Rajpoot, (2018) states that growing interest in machine learning among business leaders and decision makers demands that researchers explore its use within business organizations. One of the major issues facing business leaders within companies is the loss of talented employees. This research studies employee attrition using machine learning models. Organizations usually invest a greater amount of money and time in the hiring of staff and nursing them in the hope to receive value addition. When an employee leaves the company, the reduction of opportunity costs

is borne by the company. Turnover is especially prevalent in large-scale recruitment agencies. The risk of replacing workers remains important for most employers (Chakraborty et al., 2021). This is due to the amount of time spent recruiting and selecting a successor, the sign-on incentives, and the lack of morale for several months as the new employee gets used to the new job. The tangible costs of workforce turnover will be the cost of recruiting new staff, the cost of recruitment and hiring, the time of transition, future product or service quality issues, the cost of temporary staff, the cost of training, the cost of lack of production, the cost of lost expertise and the cost of the job being empty before an acceptable replacement is found. We find that the attributes of workers such as Job Position, overtime, work level affect significantly attrition. Machine learning (ML) is the scientific study of algorithms and statistical models that computer systems use to perform a specific task without being explicitly programmed. Learning algorithms in many applications that's we make use of daily (Mahesh, 2020). Every time a web search engine like Google is used to search the internet, one of the reasons that work so well is because a learning algorithm that has learned how to rank web pages. These algorithms are used for various purposes like data mining, image processing, predictive analytics, etc. to name a few. The main advantage of using machine learning is that, once an algorithm learns what to do with data, it can do its work automatically.

Machine learning is predominantly an area of Artificial Intelligence which has been a key component of digitalization solutions that has caught major attention in the digital arena (Ray, 2019). Machine learning addresses the question of how to build computers that improve automatically through experience (Jordan & Mitchell, 2015). Recent progress in machine learning has been driven both by the development of new learning algorithms and theory and by the ongoing explosion in the availability of online data and low-cost computation. The adoption of data-intensive machine-learning methods can be found throughout science, technology and commerce, leading to more evidence-based decision-making across many walks of life, including health care, manufacturing, education, financial modelling, policing, and marketing. The growing interest in machine learning among business leaders and decision makers demands that researchers explore its use within business organizations(Alduayj & Rajpoot, 2018). Using a synthetic data created by IBM Watson, three main experiments were conducted to predict employee attrition. The first experiment involved training the original class-imbalanced dataset with the following machine learning models: support vector machine (SVM) with several kernel functions, random forest and k-nearest neighbour (KNN).Results obtained from the study shows that employee salary and length of service were determining factors for predicting employee attrition in the institution whose data was used for the case study(Alao & Adeyemo, 2013). Employees who have worked longer in the organization with no reasonable increase in income are likely to be more discouraged which influences their attrition. Also, low ranking employees with very few years of service put in are likely to turnover when they realize the income may not improve given their low ranks, they therefore leave in search of better paying jobs.

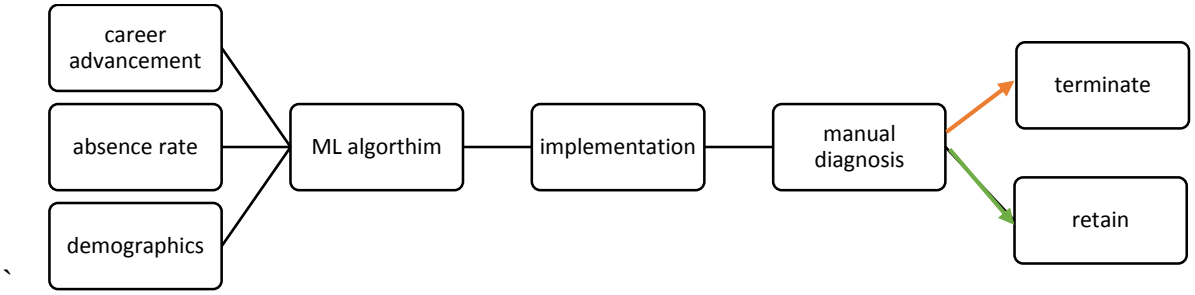
Srivastava &Eachemmpati , in their paper aim to examine the factors that influence employee attrition rate using the employee records dataset from kaggle.com. It also aims to establish the predictive power of deep learning for employee churn prediction over ensemble machine learning techniques like random forest and gradient boosting on real-time employee data from a mid-sized fast-moving consumer goods (FMCG) company. The results are further validated through a regression model and also by a multi-criteria fuzzy analytical hierarchy process (AHP) model which takes into account the relative variable importance

and computes weights. R. Jain & Nayyar, 2018 found that, to overcome this problem, organizations are now taking support via machine learning techniques to predict the employee turnover. With high precision in prediction, organizations can take necessary actions at due course of time for retention or succession of employees. Most of the data comes from basic HR-based database systems, which are not highly efficient in prediction and modelling and these models are not very accurate in data models and cannot assist the organizations to take successful decisions. (P. K. Jain et al., 2020) used IBM attrition dataset is used in this work to train and evaluate machine learning models; namely decision tree, random forest regressor, logistic regressor, adaboost model, and gradient boosting classifier models. There could also be some cases of false positives where human resource thinks that employee will leave the company in a short span of time, but actually, the employee does not. These mistakes could be affluent and troublesome for both employees and human resource but is a better deal for relational growth. If an employee is getting high pay, then the kind of treatment given to him by the company will be immoderate. The employee attrition prediction problem is about people's decision making Further research can be conducted with the same data set using python, and the result can be compared.(Raza et al., 2022) The employee attrition prediction by using the four advanced machine learning techniques ETC, SVM, LR, and DTC, were applied in comparison in this study. The applied machine learning techniques achieved accuracy scores of 87% by SVM technique, 72% by LR technique, and 83% by DTC technique. The proposed Extra Trees Classifier (ETC) achieved 93% accuracy, precision, recall, f1 score, and ROC accuracy scores.

2. Research Methodology:

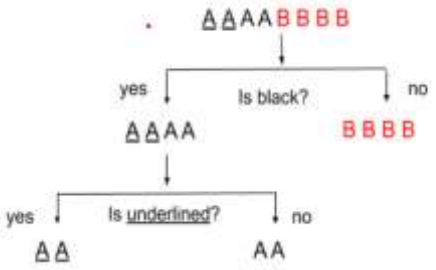
The research design for this study was experimental, focusing on the impact of ML algorithm on employees. As a first step secondary sources were acquired through databases such as google scholar dataset. The main keywords that were used was "Human resource management", "Artificial Intelligence", "Machine learning", "Random Forest", "Support vector machine", "Regression analysis", "Multiple regression" and "Prediction models". These keywords led to many insightful publications and researchers, where some of the researchers was found to have several interesting publications within the subject of the study and these were also used. As a second step the study involved implementing the ML algorithm in Fintech companies and observing its impact over a period of two months. The employees are identified based on their organisation behaviour, attendance, performance. Then there is a manual exploration of the employee so identified by the HR and discrepancies if any is identified. The process is depicted as a model below

RESEARCH MODEL

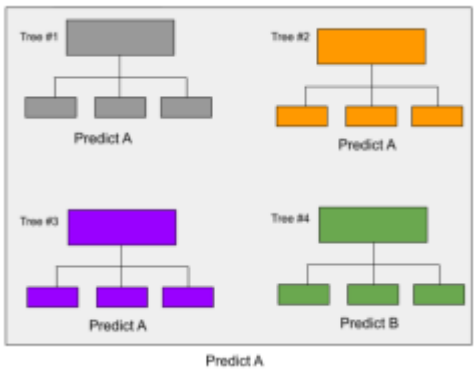


Step 1 Identification of a Machine learning algorithm to predict attrition

As stated earlier, the ML algorithm was identified. A brief review of it is done in the following paragraphs. The random forest model is a combination of several decision trees that work together. An overview of a decision tree can be seen. In this example, the dataset consists of A's and Bs with different characteristics. A decision tree is then used to classify the data set into classes. In this case, it classifies the dataset based on colour and whether the letter is underlined or not. When splitting at a node in a normal decision tree, the feature which splits the set into the biggest difference in the next right and left node from the initial set is always chosen. The first split is happening at the top, at the "Is black?" question. Here, the dataset is split into two separate classes where one consists of black letters and the other one red letters. All the letters to the right are all the same, so the classification is done on the right side in the tree. To the left, it is possible to see that there are A's which are underlined and not, so these are split by the question "Is underlined?". This resulted in two new classes, one with A's underlined and one where the A's does not have an underline. This is a simple overview of decision trees, and in practice they can be much more complicated.



The random forest model uses the individual trees within the forest by letting each tree make a class prediction, then putting together all the answers from each individual tree to make the random forest model prediction.



There are 4 trees within the forest where each tree predicts A or B. All the predictions in the trees in the forest are then counted, and the prediction which has the highest count becomes the random forest prediction. Which was A in the figure above.

To prevent that each tree's behaviour is similar to each other, two techniques are used. The first one is called bootstrap aggregation or bagging, and ensures that each tree in the random forest is trained on different datasets. This is done in the following way: Each tree randomly chooses a sample from the dataset which is used by the random forest. Each sample is the same size as the original dataset, but with the

difference that duplicates can occur. The second technique is called feature randomness. With feature randomness, the trees in a random forest selects a random chunk of features and then selects the feature from the random chunk which creates the biggest separation between the newly created left and right node. A support vector machine solves classification problems simply by finding a line, called a hyperplane, that separates input data into different data classes. If new data was added, issues may arise. To solve this problem, SVM uses two different techniques. The first one is allowing misclassifications.

Misclassification is allowing for data points to be ignored when the hyperplane is drawn. The distance between the observations and the hyperplane is called the soft margin or support vector classifier. SVM uses cross validation to decide how many misclassifications and observations that are allowed to be within the soft margin. The second technique that is used by SVM is when a problem is not linearly separable. SVM can transform the data into a higher dimension, to be able to separate it in that space. To solve this, each data can be transformed into a 2-dimensional space by taking each point and calculate the square value. So, a SVM tries to find a line which classifies the data by allowing misclassifications with support vector classifiers and if the data is inseparable then recalculates the data to represent it in a higher dimension.

STEP 2: E**xperimental implementation**

ML algorithm was implemented in Fintech companies and its impact was observed over a period of two months. The data sources included employee behaviour, attendance, performance. The impact of machine learning algorithms in predicting employee attrition was significant. By analysing large amounts of employee data, these algorithms could identify patterns and trends that may be difficult to detect using traditional methods.

Step 4: Analysing impact

Here are some of the impacts of machine learning algorithms in predicting employee attrition:

1. **Cost savings:** Employee attrition can be costly for organizations, as it leads to the cost of recruiting, hiring, and training new employees. By predicting attrition risks, machine learning algorithms can help employers take preventive measures and save on these costs.
2. **Better retention strategies:** Machine learning algorithms can identify the factors that contribute to employee attrition. Employers can use this information to develop targeted retention strategies, such as personalized training programs, career growth opportunities, and incentives, to retain employees.
3. **Improved employee morale:** By analysing employee data and creating personalized retention strategies, machine learning algorithms can help improve employee morale. When employees feel valued and supported, they are more likely to stay with the company, leading to a more stable and productive workforce.
4. **Efficient HR operations:** Machine learning algorithms can automate HR processes, such as data analysis, employee profiling, and performance evaluation, which helps HR teams save time and resources. This allows HR teams to focus on more strategic tasks, such as employee engagement and retention.
5. **Improved employee satisfaction:** By predicting attrition risks and developing targeted retention strategies, employers can create a more engaged and satisfied workforce. This leads to higher productivity, reduced absenteeism, and lower attrition rates.
6. **Early warning system:** Machine learning algorithms can provide an early warning system to identify employees who are likely to leave before they do. This allows employers to intervene and take preventive measures to retain their valuable employees.

The flip side of predicting employee attrition while using ML algorithms:

Here are some potential negative views of the impact of ML algorithms in prediction of employee attrition:

Lack of transparency: Machine learning algorithms can be complex and difficult to interpret. This lack of transparency can make it challenging for employees to understand how decisions about their employment are being made.

Unintended biases: Machine learning algorithms can perpetuate existing biases if they are trained on biased data or if their underlying assumptions are biased. This can lead to unfair decisions about which employees are predicted to leave the company.

Reduced human interaction: The use of machine learning algorithms can reduce human interaction in the process of predicting employee attrition. This can make employees feel devalued and disengaged from the company.

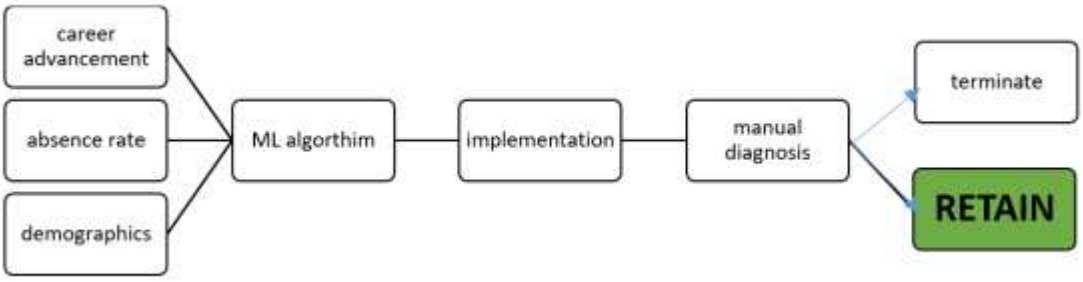
Over-reliance on data: While machine learning algorithms are designed to use data to make predictions, they may not always take into account the full range of factors that contribute to employee attrition. This can lead to inaccurate predictions and decisions.

Ethical concerns: The use of machine learning algorithms in predicting employee attrition raises ethical concerns about privacy and the potential misuse of data. Employees may feel uncomfortable with the collection and analysis of their personal information for these purposes.

Step 5 :Diagnosis by HR:

Employee attrition can be a challenging issue for organizations, and effective decision-making is critical for HR leaders in managing this issue. Emotional intelligence can be a valuable asset for HR leaders in making sound decisions that support employee retention and mitigate the negative impacts of attrition. Emotional intelligence involves the ability to recognize and manage one's own emotions as well as the emotions of others. HR leaders with high emotional intelligence are better able to understand the needs and concerns of employees and make decisions that support their well-being. One way that emotional intelligence can support decision-making during attrition is by helping HR leaders to identify the root causes of turnover. Instead of simply reacting to high turnover rates, HR leaders with emotional intelligence will seek to understand why employees are leaving and address the underlying issues. This may involve conducting exit interviews to gain insights into employee experiences and concerns. Emotional intelligence can also support HR leaders in developing effective strategies to retain employees. This involves understanding the unique needs and preferences of employees and developing personalized solutions that address their concerns. For example, an HR leader with high emotional intelligence may work with individual employees to develop career development plans or flexible work arrangements that meet their needs and keep them engaged with the organization. HR leaders can use emotional intelligence to prevent attrition by building strong relationships with employees and fostering a positive workplace culture. By creating a supportive and engaging environment, HR leaders can help employees feel valued and motivated to stay with the organization.

Overall, emotional intelligence can be a valuable asset for HR leaders in making sound decisions during times of attrition. By understanding the needs and concerns of employees, developing personalized solutions to retain employees, and communicating effectively with employees, HR leaders can mitigate the negative impacts of attrition and support a positive workplace culture.



Critical thinking for HR:

Critical thinking is an important skill for HR professionals to have, as it helps them analyse complex problems and make informed decisions. Here are some ways in which critical thinking is important for HR:

- **Identifying problems:** HR professionals need to be able to identify problems and understand their root causes. They should be able to gather information, analyses data, and evaluate different perspectives to identify the underlying issues.
- **Developing solutions:** Once a problem has been identified, HR professionals need to develop effective solutions. This requires creative thinking, the ability to evaluate different options, and the capacity to anticipate the potential impact of each solution.
- **Evaluating information:** HR professionals need to be able to evaluate information from a variety of sources, including employee feedback, performance data, and industry trends. They should be able to distinguish between fact and opinion and identify biases and assumptions that may impact the validity of the information.
- **Making decisions:** HR professionals are often responsible for making important decisions that impact the organization and its employees. They need to be able to weigh different factors and make informed decisions that are aligned with the organization's values and goals.
- **Continuous improvement:** Critical thinking is also important for HR professionals to continuously improve the organization's processes and practices. By evaluating the effectiveness of current programs and processes, HR professionals can identify areas for improvement and develop strategies for enhancement.

SUGGESTIONS:

In our research we find the employee attrition through machine learning of decision tree making and SVM algorithms, which has almost 90% of accuracy in the result. But HR can make his decision based on only algorithm results. Definitely not only with this result because algorithm get the result through data analytics of employee of the organization. Although machine learning are not critical thinker and emotional intelligence. It provides result according to the dataset. But HR can make use of this algorithms result for his decision which make easier and reduce time cost. For question one:

Organisations and the HR community itself realise the importance of this function and how decision-making is integral to human resource roles in current times. When we refer to decision-making in HR, it means all people processes are involved. The decisions taken within this function or by it cover the entire employee lifecycle, from the time potential talent is identified to hiring, performance management, compensation, and exit. HR relies on market data as well as internal feedback and insights, using AI tools to enable faster and better decision-making.

All HR decisions have a direct and deep-rooted link to organisational goals. Given how teams now function, there is hardly any organisation where HR operates in silos. Overall organisational goals, such as what kind of business parameters are being

assessed, will percolate down to the individuals in the form of performance goals. As a result, HR decisions have a direct impact on both the organisation and the employee. Finally, we conclude that this ML result can be part of decision-making for HR but not a final decision.

The effect of machine learning (ML) data on individual employees during employee attrition can be both positive and negative, depending on how the data is used and the context in which it is applied.

On the negative side, ML data can also be used to automate decisions related to employee attrition, such as identifying employees who are at high risk of leaving and automatically terminating their employment or reducing their job responsibilities. This can have negative consequences for individual employees, who may feel that their employer is using data to unfairly target them or make decisions that are not in their best interests.

Overall, the impact of ML data on individual employees during employee attrition will depend on how the data is used and the specific policies and practices of the organization. It's important for organizations to use ML algorithms in a responsible and ethical manner, with a focus on improving employee retention and satisfaction, rather than simply automating decisions that can have negative consequences for individual employees.

Machine learning algorithms can help in retaining potential employees during employee attrition in several ways:

1. Identify factors that contribute to attrition: Machine learning algorithms can analyses various data points, such as employee demographics, job role, performance metrics, and engagement levels, to identify the factors that contribute to employee attrition. By understanding the root causes, employers can take corrective measures to retain potential employees.
2. Predict potential attrition risks: By analysing employee data, machine learning algorithms can predict which employees are at a high risk of leaving the company. Employers can use this information to intervene and offer retention incentives, such as salary hikes, training programs, or career growth opportunities, to encourage them to stay.
3. Personalize employee engagement: Machine learning algorithms can analyses individual employee data and personalize engagement strategies. Employers can create custom retention plans for employees based on their preferences and career aspirations. Personalized engagement can foster a sense of belonging and loyalty, leading to higher retention rates.
4. Analysed exit feedback: Machine learning algorithms can analyse exit feedback from former employees to understand the reasons for their departure. Employers can use this feedback to identify gaps in their retention strategies and make changes accordingly.

In summary, machine learning algorithms can help in retaining potential employees during employee attrition by identifying factors that contribute to attrition, predicting potential attrition risks, personalizing employee engagement, and analysing exit feedback. By leveraging these insights, employers can create proactive strategies to retain potential employees and build a more stable and productive workforce.

3. CONCLUSION:

In conclusion, machine learning algorithms have had a significant impact on predicting employee attrition. By analysing large amounts of data, including historical employee data, performance metrics, and engagement levels, machine learning algorithms can identify patterns and predict potential attrition risks accurately. This allows employers to take proactive measures to prevent employee turnover, retain valuable employees, and reduce the costs associated with recruiting and training new employees.

The benefits of using machine learning in predicting employee attrition include improved accuracy, early identification of attrition risks, increased efficiency, personalized retention strategies, and continuous improvement. Machine learning

algorithms can help employers create proactive strategies to retain valuable employees, build a stable and productive workforce, and ultimately increase their bottom line.

In today's competitive business environment, companies must prioritize employee retention to succeed, and machine learning algorithms provide a powerful tool to achieve this goal. By leveraging these insights, employers can create data-driven strategies to retain valuable employees and build a more stable and productive workforce.

Attrition is a complex issue that requires a multifaceted approach to address effectively. By understanding the causes and effects of attrition and implementing strategies to retain valuable employees, organizations can build a stable and productive workforce, reduce costs, and improve their bottom line. Further research into this topic can help employers develop more effective retention strategies and create a more stable and productive work environment.

High attrition rates can be costly for organizations, as they can result in lost productivity, increased recruitment and training costs, and decreased morale. Furthermore, high attrition rates can be an indication of deeper organizational issues, such as poor management practices, lack of career advancement opportunities, or inadequate compensation and benefits.

The impact of attrition can be significant for organizations. When employees leave, the organization loses their knowledge, skills, and experience, and this can affect productivity, profitability, and overall organizational performance. High attrition rates can also be expensive for organizations, as they may have to spend time and resources on recruiting, hiring, and training new employees.

Retention strategies may include initiatives such as offering competitive compensation and benefits packages, providing opportunities for growth and development, promoting work-life balance, fostering positive relationships between employees and managers, and providing a supportive work environment. These initiatives can help to improve job satisfaction, increase employee engagement and motivation, and ultimately reduce attrition rates.

In research studies, attrition can pose a significant challenge to the validity and reliability of findings. For example, if a high percentage of participants drop out of a study, the remaining sample may not be representative of the original population. This can lead to biased or inaccurate results.

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