

DATA-DRIVEN EMPLOYEE RETENTION STRATEGIES IN INDIA:
A SEARCH FOR A BEST-FIT MODEL

by

Sreekanth Settur

DISSERTATION
Presented to the Swiss School of Business and Management Geneva
In Partial Fulfillment
Of the Requirements
For the Degree

DOCTOR OF BUSINESS ADMINISTRATION

SWISS SCHOOL OF BUSINESS AND MANAGEMENT GENEVA

November, 2024

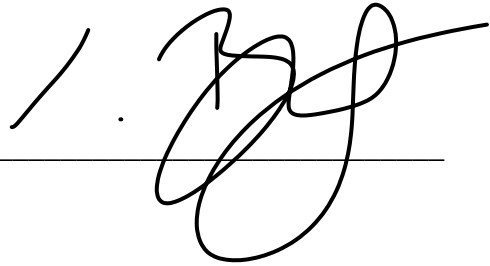
DATA-DRIVEN EMPLOYEE RETENTION STRATEGIES IN INDIA:

A SEARCH FOR A BEST-FIT MODEL

by

Sreekanth Settur

APPROVED BY

A handwritten signature in black ink, consisting of several loops and a long horizontal stroke extending to the right.

Dissertation chair

RECEIVED/APPROVED BY:

Admissions Director

Dedication

This work is dedicated to my family, whose unwavering support and encouragement have been my greatest source of strength.

To my fellow researchers who aspire to push the boundaries of knowledge and extend the limits of understanding, this dissertation is also dedicated to you. May our collective efforts continue to advance the field and inspire future innovations.

Acknowledgements

I am deeply indebted to everyone who provided guidance and support throughout the course of this dissertation.

Firstly, I extend my heartfelt gratitude to my supervisor, Prof. Umar Lawal Aliyu. His unwavering guidance, insightful feedback, and steadfast encouragement have been instrumental in the completion of this work. His mentorship has been a cornerstone of my academic journey, and I remain profoundly thankful for his dedication and invaluable insights.

I also wish to express my sincere thanks to my group members, whose constant support and motivation helped me overcome numerous challenges. Their collaboration, camaraderie, and determination enriched this journey, making it both rewarding and enjoyable. The teamwork and mutual support they demonstrated have been a significant source of inspiration, and I am truly grateful for their contributions.

In addition, I acknowledge my former mentor, Prof. Madison Ngafeeson, for laying the foundational groundwork during the early stages of my Doctor of Business Administration program. His guidance shaped my initial approach to research and learning. His wise counsel and encouragement have been pivotal in achieving this milestone, and I am deeply appreciative of his impact.

Lastly, I express my profound gratitude to my family, whose unwavering support has been a pillar of strength throughout this journey. Their patience, sacrifices, and belief in my abilities have motivated me to persevere. Their encouragement has been invaluable, and I am forever thankful for their role in this accomplishment.

To all these individuals, I owe a deep debt of appreciation. Their collective efforts have played a vital role in helping me reach this milestone, and I sincerely thank them for their invaluable support.

ABSTRACT
DATA-DRIVEN EMPLOYEE RETENTION STRATEGIES IN INDIA:
A SEARCH FOR A BEST-FIT MODEL

Sreekanth Settur
2024

Dissertation Chair: Iva Buljubasic

This research focuses on the field of Human Resource Management (HRM), particularly on crafting effective, data-driven strategies to tackle employee attrition. It moves beyond traditional theories and subjective perspectives by leveraging interpretable machine learning models to gain actionable insights. The study aims to build a strong framework for understanding and mitigating the factors contributing to employee turnover by predicting their likelihood of leaving the organization. By employing data analytics, it seeks to refine HR decision-making processes, improve retention rates, and cultivate a more stable and engaged workforce.

Additionally, the research underscores the significance of data-driven methodologies in developing retention strategies that not only address attrition but also strengthen employer branding. By using interpretable machine learning models, the study ensures that predictive outcomes are both clear and practical, enabling HR professionals to apply targeted interventions effectively. This approach combines methodological rigor with customization, ensuring strategies are evidence-based and tailored to

organizational needs. The study introduces a range of machine learning techniques, including linear, tree-based, and ensemble methods, to predict employee turnover.

Ultimately, this research contributes to HRM by demonstrating how advanced analytics can be leveraged to establish a more resilient and appealing workplace, thereby enhancing the organization's competitive position in the talent marketplace.

Key words: Data-Driven HR, Employee Engagement, Employee Retention Strategies, Human Resource Management (HRM), Interpretable Machine Learning Models, Organizational Behavior

TABLE OF CONTENTS

List of Tables	ix
List of Figures	x
CHAPTER 1: OVERVIEW	1
1.1. Introduction.....	1
1.2. Problem Statement.....	4
1.3. Purpose of Research.....	8
1.4. Significance of the Study	12
1.5. Research Design.....	15
1.6. Data Collection Techniques - Source of Data.....	17
1.7. Research Questions	18
1.8. Assumptions.....	21
1.9. Definition of Terms.....	23
1.10. Summary	24
CHAPTER 2: LITERATURE REVIEW	25
2.1. HRM System in Organization.....	25
2.2. Evolution of HRM	29
2.3. Challenges in HRM.....	32
2.4. Factors That Affect Employee’s Intention to Stay	81
2.5. Why Employee Attrition is a Major Challenge to Solve	82
2.6. Employer Branding on Retention	85
2.7. Employee Retention for Gen X, Gen Y and Gen Z	87
2.8. Effect Of Data Driven Employee Retention Strategy in India	89
2.9. Significance of Data-Driven Employee Retention Strategies.....	92
2.10. Impact of Data Driven employee retention strategy in India.....	94
CHAPTER 3: RESEARCH METHODOLOGY	98
3.1. Research Design.....	98
3.1.1. CRISP-DM Framework.....	99
3.2.1. Exploratory Data Analysis	120
3.2. Population Of the Study.....	121
3.3. Sample Technique and Size	123
3.4. Instruments Of Data Collection	123
3.4.1. Survey Design for Employee Attrition Factors.....	124
3.4.2. Public Dataset from Kaggle	124
3.4.3. Data Validity and Reliability.....	124
3.5. Justification For the Instruments Used	125
3.6. Method Of Data Collection.....	126
3.6.1. Methods Of Collection of Primary Data	126

3.6.2. Sources Of Secondary Data Collection	127
CHAPTER 4: RESULTS AND DISCUSSION.....	129
4.1. Exploring Data	129
4.1.1. Primary Data:	130
4.1.2. Secondary Data:	136
4.2. Solving Research Questions	141
4.2.1. Which employee factors influence employee retention?	144
4.2.2. Which Employee Retention Factors Are Important to an Emerging Economy Like India?	149
4.2.3. What Is the Best Fit Model for Employee Retention?	151
4.2.4. What Are Some Data-Driven Retention Strategies for Competitive HR?	154
4.3. Tailored Retention Strategies: Across All Employee Levels	168
CHAPTER 5: CONCLUSION	170
5.1. New Joiners.....	172
5.2. Mid-Senior Employees	172
5.3. Senior Employees	173
5.4. Recommendations:.....	173
5.5. Suggestions for Future Research	176
REFERENCES	178
APPENDIX A - SURVEY DATA	184
APPENDIX B – PUBLIC DATA.....	187

LIST OF TABLES

<i>Table 1:</i> The Definitions of Terms.....	29
<i>Table-2:</i> Historical evolution of HRM	30
<i>Table-3:</i> Key Factors Influence Employee Attrition	43
<i>Table-4:</i> Factors Affecting Employee Retention.....	45
<i>Table-5:</i> Employee Retention In Selected IT Companies	46
<i>Table-6:</i> Factors Affecting Employee Retention: Demographic Perspective.....	47
<i>Table-7:</i> CRISP-DM process model description	102
<i>Table-8:</i> Sample table for illustration pertaining gender values.....	106
<i>Table-9:</i> Data after dummy transformation	106
<i>Table-10:</i> Dropped ‘Gender_Female’ to avoid duplication data.....	107
<i>Table-11:</i> Confusion Matrix	111
<i>Table-12:</i> EDA techniques based on data and purpose	121
<i>Table-13:</i> Employee demographic category and groups under each category ...	184
<i>Table-14:</i> Research question with significance and purpose.....	187
<i>Table-15:</i> Research question with significance and purpose.....	188

LIST OF FIGURES

<i>Figure-1: CRISP-DM Methodology</i>	99
<i>Figure-2: Hyperparameter Range - Decision Tree</i>	109
<i>Figure-3: Hyperparameter Range - Logistic Regression</i>	109
<i>Figure-4: Hyperparameter Range - Random Forest</i>	110
<i>Figure-5: Age Distribution of The Sample Considered</i>	130
<i>Figure-6: Correlation Matrix of Numerical Data of The Public Data.</i>	136
<i>Figure-7: Attrition Rate Captured for Each Department.</i>	140
<i>Figure-8: Plot of Feature Importance Obtained from Decision Tree</i>	144
<i>Figure-9: Significant Demographic Variables</i>	145
<i>Figure-10: Significance Of Organization Related Factors</i>	147
<i>Figure-11: Significance Of Leadership Related Attributes</i>	148
<i>Figure-12: Attrition Factors - Employee View</i>	149
<i>Figure-13: Attrition Factors - Organization View</i>	150
<i>Figure-14: Triggering Intent to Leave the organization</i>	151
<i>Figure-15: Employee Experience Range More Susceptible To Attrition</i>	151
<i>Figure-16: Confusion Matrix Obtained From Decision Tree</i>	153
<i>Figure-17: Confusion Matrix Obtained From Logistic Regression</i>	153
<i>Figure-18: Confusion Matrix Obtained From Random Forest</i>	153
<i>Figure-19: Intent to Stay - New Joiners</i>	156
<i>Figure-20: Assessing 1-Year Employee Retention Intent</i>	157
<i>Figure-21: Retention Intent of 1-Year Employees with Mentorship</i>	158

<i>Figure-22: Attrition Probability - Mid-Senior (Default Factors)</i>	160
<i>Figure-23: Retention Probability - Mid-Senior (Rewards & Involvement)</i>	161
<i>Figure-24: Attrition Probability - Mid-Senior (Overtime)</i>	162
<i>Figure-25: Retention - Satisfied Mid-Seniors (Overtime)</i>	163
<i>Figure-26: Attrition Probability - Senior (Default Factors)</i>	164
<i>Figure-27: Attrition Probability - Senior (Mentoring/Supervision)</i>	165
<i>Figure-28: Reduced Attrition - Senior (Perks & Supervision)</i>	166
<i>Figure-29: Reduced Attrition - Senior (Perks)</i>	167
<i>Figure-30: Reduced Attrition - Rewards & Involvement</i>	167

CHAPTER 1: OVERVIEW

1.1. Introduction

The World Economic Society highlights that the ability to attract and retain top-tier talent is poised to be a decisive factor in shaping a company's long-term sustainability in the coming years (Alsayegh et al., 2020). Many industries face the challenge of frequent job-hopping by employees, a trend noted by (Pawar et al., 2023).

Employee turnover represents a substantial hurdle for organizations, deeply affecting their performance and overall competitiveness. High turnover rates often result in numerous adverse effects, such as elevated costs for recruitment and training, loss of critical institutional knowledge, and disruptions in both workflow and productivity. The departure of seasoned employees can strip organizations of essential expertise while placing the demanding task of finding and onboarding new talent on HR teams, which is both expensive and resource-intensive.

To address these challenges effectively, it is imperative for HR managers to identify and analyze the root causes of employee exits. Common contributors to turnover include dissatisfaction with job roles, limited career advancement opportunities, insufficient compensation, and an imbalance between work and personal life. Addressing these factors requires a strategic approach, such as offering competitive salaries, creating robust career development programs, enhancing workplace conditions, and cultivating a supportive and positive organizational culture.

By implementing such targeted initiatives, companies can significantly reduce turnover, secure their top performers, and reinforce their competitive position in the market. Managing employee turnover is a critical aspect of sustaining organizational efficiency, preserving continuity, and fostering a workforce that is both stable and engaged (Fallucchi et al., 2020).

Retention rates play a pivotal role in reducing costs and improving organizational performance, as employees are a company's most valuable resource.

When employees are satisfied and remain committed to their organization, the expenses related to recruitment, onboarding, and training of new hires are significantly reduced. Retaining skilled employees also safeguards institutional knowledge and expertise, fostering consistency in productivity and operational efficiency. Consequently, employee satisfaction becomes a critical factor in achieving organizational success, as engaged and motivated employees demonstrate higher levels of commitment and performance.

Amidst the current economic challenges, such as recessions and fierce competition, organizations must adopt innovative strategies to attract and retain talent on a global scale. The heightened demand for skilled professionals necessitates that companies position themselves as desirable workplaces. This can be achieved by cultivating a positive work environment, offering competitive compensation packages, and providing avenues for career advancement and skill development. By integrating advanced HR practices and leveraging technology, organizations can build a dynamic workforce capable of navigating economic uncertainties and ensuring long-term success.

Human Resource Analytics (HRA) represents a transformative approach in workforce management, revolutionizing how organizations collect, analyze, and interpret internal data. Through advanced analytical tools, HRA enables organizations to transcend traditional HR practices, offering a data-driven perspective on workforce trends and performance. This approach empowers HR professionals to identify effective strategies and areas that require improvement, ultimately driving organizational growth.

The primary strength of HRA lies in its capacity to convert raw data into actionable insights. By systematically gathering data such as employee performance, engagement levels, and turnover rates, organizations can uncover patterns and trends that may go unnoticed with conventional methods. For example, HRA might reveal that a particular team is experiencing low job satisfaction, leading to higher turnover.

With this insight, HR can implement targeted measures, such as enhanced engagement initiatives or managerial support, to address the issue.

Moreover, HRA facilitates strategic decision-making and proactive workforce planning. By leveraging predictive analytics, organizations can forecast trends such as employee attrition risks or emerging skill gaps. This foresight allows HR to address potential challenges before they escalate, ensuring workforce stability. For instance, if predictive data highlights a high attrition risk among top performers, HR can design tailored retention strategies, such as personalized development programs or incentives, to retain critical talent.

A significant advantage of HRA lies in its use of statistical tools for analysis. Descriptive analytics help organizations understand past trends, predictive analytics anticipate future outcomes, and prescriptive analytics recommend actionable strategies based on predictions. For example, if data suggests that employees receiving regular training exhibit higher retention rates, HR can advocate for expanded training initiatives as a retention strategy.

HRA's versatility extends beyond the HR function, influencing other departments like marketing, finance, and operations. For instance, in marketing, HRA can ensure optimal staffing during high-demand periods, while in finance, it aids in forecasting employee-related expenses. This cross-functional application highlights HRA's potential to drive organization-wide improvements.

Despite its advantages, HRA remains underutilized in many organizations due to limited awareness or understanding of its potential. However, as the business landscape grows increasingly complex, the adoption of HRA is expected to rise. Organizations that embrace these tools are likely to gain a competitive edge through data-driven decisions that enhance workforce management and overall performance.

By integrating HRA into their strategic framework, companies can unlock the full potential of their workforce, fostering resilience and adaptability to thrive in today's challenging economic environment.

1.2. Problem Statement

As highlighted by (Margherita, 2022), business analytics has evolved into a critical strategic capability for organizations, enabling the development of data-driven human resource management systems and advanced analytics platforms. These tools are instrumental in connecting employee performance with essential business value drivers and overall organizational outcomes. Through business analytics, organizations can derive actionable insights into how their workforce contributes to success, allowing them to make informed decisions that boost productivity, engagement, and profitability. Integrating analytics into HR practices aligns human capital strategies with broader organizational goals, fostering a sustained competitive edge and improved performance. (Margherita, 2022) further notes that the internal evaluation of HR activities has been described using various terms such as people analytics, workforce analytics, human capital analytics, talent analytics, and human resources analytics. While these terms are often used interchangeably, they highlight different facets of a data-driven approach to managing human resources.

According to research by (Lisa Marie Giermindl and Redzepi, 2022), people analytics has the potential to transform how organizations identify, nurture, manage, and oversee their workforce. Rather than referring to specific technologies, people analytics embodies a quantitative, evidence-based, and data-centric methodology for workforce management. This approach enhances the effectiveness of key HR functions, including workforce planning, recruitment, training, and development, while also optimizing overall employee and organizational performance. (Lisa Marie Giermindl and Redzepi, 2022) conclude that it is unsurprising that organizations worldwide increasingly adopt people analytics to examine and correlate data on

employee behavior, social interactions, and characteristics with business information from both internal and external sources.

Workforce analytics is particularly impactful in areas like workforce planning and evaluating reward systems, with its greatest influence seen in large organizations capable of investing in the required technology and expertise. When forming a workforce analytics team, organizations face the challenge of deciding whether to situate the team within HR. While HR domain expertise is crucial for accurate data interpretation, there is a risk that analytics outcomes may not effectively inform strategic decisions. For example, JPMorgan Chase employs a steering committee for workforce analytics within its HR department, underscoring the role of trust in fostering successful talent analytics initiatives (Nocker and Sena, 2019).

(Nocker and Sena, 2019) suggest that talent analytics has grown into a robust set of methodologies, empowering organizations to identify workforce patterns, manage talent more efficiently, and enact meaningful changes that drive value. By examining the links between training and productivity, businesses can enhance efficiency and minimize errors. Retention strategies, such as competitive compensation and career advancement opportunities, reduce turnover and associated costs. Employee well-being initiatives improve satisfaction and performance, while analyzing the impact of educational qualifications on productivity refines hiring strategies. Moreover, understanding the contributions of permanent employees compared to temporary staff enables companies to achieve an optimal balance of stability and flexibility, enhancing overall workforce management and organizational performance.

Initially, HR analytics was a simple administrative function, but it has advanced into a sophisticated tool with diagnostic and predictive capabilities. These capabilities now play a vital role in improving employee engagement and retention, delivering considerable benefits through digitally-driven analytics solutions. As noted by (Margherita, 2022), the increasing need for and potential of specialized HR

analytics tools have drawn significant attention. Human capital analytics, for example, integrates diverse HR data points to assess and enhance the value employees bring to an organization. Utilizing such analytics allows businesses to better understand their workforce, enabling more strategic HR practices that enhance business outcomes.

Employee attrition remains a complex issue that significantly impacts organizational performance and competitiveness. When employees leave, companies face both direct and indirect costs, including those related to recruitment, training, and the loss of institutional knowledge. High turnover disrupts workflows, reduces morale among remaining staff, and can compromise the quality of services or products. Consequently, understanding the reasons behind employee departures is a critical challenge for HR management.

Attracting and retaining top talent is costly and resource-intensive. Organizations invest heavily in recruiting, onboarding, and training employees to integrate them into the company culture. Premature departures result in lost investments and necessitate additional resources to fill vacancies. High turnover also damages employer branding, making it harder to attract skilled candidates in the future.

To address these challenges, organizations prioritize employee retention as a strategic goal. High retention rates reduce turnover costs and bolster organizational performance. Employees are fundamental to both daily operations and long-term strategies. Retaining experienced talent ensures competitive advantage and sustainable growth.

HR professionals play a key role in cultivating an environment conducive to employee satisfaction and retention. Effective strategies typically include competitive pay and benefits, career advancement opportunities, recognition programs, work-life balance initiatives, and fostering a positive organizational culture. Together, these elements create an environment where employees feel valued and motivated.

Competitive compensation and benefits are foundational to retention efforts. Salaries aligned with industry standards and comprehensive benefits packages, including health insurance, retirement plans, and perks, enhance job satisfaction and loyalty. Career development opportunities are equally vital, offering employees pathways for professional growth through training, mentoring, and clear progression plans. Recognition programs further reinforce employee engagement by acknowledging their contributions through feedback, awards, and incentives.

Work-life balance is another critical component. Flexible work arrangements, such as remote work or adaptable schedules, help employees balance professional and personal responsibilities. Similarly, cultivating a positive culture of inclusion, collaboration, and open communication ensures employees feel a sense of belonging and trust.

Finding effective retention strategies requires a nuanced, data-driven approach. Advanced analytics enable organizations to understand the root causes of attrition and implement tailored solutions. By leveraging data, companies can not only reduce turnover but also enhance organizational performance and competitiveness.

This research explores the critical factors influencing employee retention within India's unique economic landscape. As a rapidly growing economy, India presents distinct challenges and opportunities in employee retention, with its dynamic industrial growth, expanding middle class, and competitive job market. Understanding the drivers of retention in this context is essential for sustaining business success. This study aims to identify these determinants and develop predictive models to provide actionable insights for HR professionals.

The research adopts a data-driven methodology, combining quantitative and qualitative techniques to gather comprehensive retention data. Surveys, interviews, and organizational records will be analyzed using advanced statistical and machine learning tools to uncover patterns and predictors of retention. These insights will guide

the development of targeted strategies, such as enhancing career development opportunities or improving organizational culture.

By bridging the gap between theory and practice, this study aims to offer actionable, analytics-based retention strategies. These strategies will help organizations retain top talent, improve employee satisfaction, and boost overall productivity. The findings will be especially relevant for businesses in India, enabling them to navigate the challenges of a rapidly evolving economy and maintain a competitive edge.

The research employs a data-centric approach, integrating both quantitative and qualitative methods to collect detailed information on employee retention. Data will be gathered through surveys, interviews, and analysis of organizational records, then processed using sophisticated statistical and machine learning techniques. This analysis aims to identify key patterns and factors that influence retention, providing the foundation for creating focused strategies, such as fostering career advancement opportunities or enhancing the workplace culture.

This study strives to bridge the divide between theoretical frameworks and practical applications by delivering actionable, analytics-driven retention solutions. These solutions are designed to help organizations retain skilled employees, enhance overall job satisfaction, and drive higher levels of productivity. The findings are particularly significant for Indian businesses, as they offer insights to address the complexities of a fast-changing economic landscape while sustaining a competitive advantage.

1.3. Purpose of Research

The primary aim of implementing employee retention policies and strategies in organizations is twofold: to lower employee turnover rates and to significantly reduce the associated costs of recruiting, onboarding, and training new hires. Employee turnover creates considerable challenges for businesses, encompassing not

only financial burdens but also operational disruptions and the loss of critical institutional knowledge. By prioritizing retention efforts, organizations work towards cultivating a stable and dedicated workforce that consistently contributes to growth and success.

Reducing turnover is essential as frequent employee departures drive up recruitment expenses, requiring significant investments in time and resources to identify suitable replacements. Moreover, training new employees to achieve the productivity levels of their predecessors entails further financial and time commitments. Beyond financial implications, turnover disrupts team cohesion and workflow, negatively impacting productivity and employee morale.

Effective retention strategies are designed to foster a work environment that encourages satisfaction, engagement, and loyalty. These strategies often incorporate competitive compensation aligned with industry standards, robust benefits packages addressing employee needs, and opportunities for career progression and skill enhancement. Supportive leadership that recognizes and values employee contributions is equally vital. Additionally, promoting a positive organizational culture, work-life balance, and opportunities for meaningful work helps to retain top talent.

The ultimate objective of such strategies is not only to retain employees but also to create a workplace where individuals feel appreciated, motivated, and committed to achieving organizational goals. This holistic approach helps reduce turnover costs and enhances organizational efficiency and competitiveness. In the face of a dynamic and competitive business landscape, investing in strong retention policies is critical for achieving long-term sustainability and success (Khan et al., 2024).

Retaining key tech talent poses a universal challenge, especially in India, where strategies often emphasize continuous skill development, merit-based promotions, and agile career paths. The rapidly evolving tech industry demands specialized expertise, and employees must consistently update their skills to remain relevant. As such,

retaining talented professionals in this sector requires proactive and innovative measures beyond conventional incentives.

Continuous learning is pivotal in engaging and retaining tech employees. Organizations that provide access to training programs, certifications, workshops, and the latest technologies demonstrate their commitment to employee development. This approach not only helps employees maintain industry relevance but also equips them for emerging challenges, fostering satisfaction and loyalty.

Experience-based promotions are another effective strategy in Indian tech organizations. Unlike rigid hierarchical structures, tech firms often focus on merit and reward employees for their contributions and expertise. Offering career advancement opportunities to skilled employees boosts morale and encourages others to strive for similar recognition. This meritocratic approach helps create a culture of achievement where employees feel valued.

Agile career development is particularly appealing in the Indian tech sector, where employees seek diverse roles and opportunities. Flexible career paths, cross-functional training, and internal mobility allow employees to explore new areas while contributing to organizational success. This adaptability not only improves job satisfaction but also aligns employee aspirations with business needs, fostering long-term loyalty.

These strategies are often reinforced by competitive compensation, comprehensive benefits, and a collaborative work culture that emphasizes innovation, inclusivity, and work-life balance. By focusing on continuous learning, merit-based recognition, and flexible career paths, tech organizations in India can effectively address retention challenges and sustain a committed workforce (Haque, 2024).

Employee turnover has a direct impact on an organization's competitiveness and performance. It presents a significant challenge for HR management to understand and address the reasons for employee departures, which are both costly and time-

intensive (Fallucchi et al., 2020). High retention rates help reduce these costs while improving organizational performance, as employees are essential assets. Their satisfaction directly influences an organization's success. Firms proficient in IT, innovation, and entrepreneurship are more likely to retain skilled employees and attract loyal customers, as effective digital communication strengthens employee engagement and clarifies their roles, contributing to higher retention (Lee et al., 2022).

Understanding the root causes of turnover is vital for effective retention strategies. Employee turnover can be categorized as voluntary or involuntary. Voluntary turnover often involves skilled employees leaving organizations for better opportunities, presenting complex challenges and higher costs compared to involuntary turnover. This distinction has been studied extensively, revealing important insights into organizational management practices.

Involuntary turnover, which occurs due to factors like restructuring or performance issues, is often anticipated and managed through HR policies. However, voluntary turnover, driven by factors such as dissatisfaction, limited growth opportunities, poor work-life balance, or better external options, poses greater difficulties for organizations.

Decades of research highlight the significant costs associated with voluntary turnover, including recruitment and training expenses, as well as the loss of valuable expertise. This has spurred the development of targeted management strategies aimed at reducing turnover and improving employee retention.

To address voluntary turnover, organizations focus on creating positive work environments where employees feel valued and supported. Strategies include competitive pay and benefits, career advancement opportunities, skill development programs, open communication, and work-life balance initiatives. Additionally, advancements in HR management emphasize data-driven approaches, such as predictive analytics, to address turnover. By identifying early indicators like declining

satisfaction or absenteeism, organizations can take proactive measures to retain valuable employees.

While involuntary turnover remains a manageable aspect of workforce dynamics, voluntary turnover continues to demand focused attention. By addressing factors influencing employee satisfaction, career growth, and organizational commitment, businesses can create a workplace where employees are motivated to stay and contribute to long-term success (Singh and Ramdeo, 2023).

1.4. Significance of the Study

The objective of this research is to comprehensively examine the factors that influence employee retention. This study will utilize an extensive dataset, capturing diverse aspects of employee-related variables. Financial elements such as salary levels, the percentage of salary increments, and stock options will be analyzed as these are critical indicators of employee satisfaction and organizational commitment. Personal attributes, including proximity to the workplace, educational qualifications, age, and perceptions of work-life balance, will also be explored due to their significant impact on job satisfaction and an employee's decision to remain with an organization.

The study will also investigate leadership characteristics that affect retention. Variables such as tenure with the organization, overtime commitments, the nature of job roles, responsibilities, and the frequency of business travel will be examined. These leadership-driven factors play a vital role in shaping organizational culture and work environments, influencing employee morale and dedication. By understanding the influence of leadership, organizations can better align management practices with strategies that enhance employee retention.

Through a detailed analysis of these multidimensional data points, this research aims to uncover the most influential factors contributing to employee retention. The insights will empower organizations to design targeted retention strategies that address financial incentives, employee well-being, and effective leadership. By fostering a

supportive and engaging work environment, businesses can create a culture where employees feel valued and motivated to contribute to the organization's long-term success.

Human resource management (HRM) is instrumental in driving employee retention by focusing on several critical factors. One of the foundational aspects of HRM is providing training to enhance employees' skills and competencies. By offering ongoing learning opportunities, HRM supports professional development, which not only boosts job satisfaction but also signals the organization's commitment to its workforce, fostering greater loyalty and retention.

Compensation is another pivotal area managed by HRM. Fair and competitive pay structures that reflect industry standards and recognize employee contributions are key to attracting and retaining talent. HRM ensures that these compensation packages are transparent, equitable, and aligned with employees' skills and experiences, thus enhancing satisfaction and motivation.

Job security is also a crucial factor influencing retention. HRM plays a significant role in promoting stability through workforce planning, performance management, and clear communication of job expectations. By addressing employees' concerns regarding career progression and organizational stability, HRM reduces uncertainty and turnover intentions.

Additionally, HRM practices in employee engagement, recognition, and work-life balance are essential in cultivating an environment conducive to retention. A positive organizational culture that prioritizes employee well-being, open communication, and recognition of achievements boosts morale and satisfaction. Initiatives such as flexible work arrangements, wellness programs, and other work-life balance strategies further create a workplace where employees feel appreciated and motivated to stay.

HRM's strategic focus on training, compensation, job security, and overall employee well-being highlights its critical role in retention. By addressing these factors, HRM not only attracts skilled individuals but also secures their long-term commitment and contribution. This comprehensive approach underlines the importance of HRM in creating a workplace culture that promotes employee satisfaction and enhances organizational success (Malik et al., 2020). Research indicates that retention practices originated in the United States and later expanded globally, emphasizing employee satisfaction as a cornerstone of organizational success. Employee retention is multifaceted, encompassing social dynamics, task characteristics, and physical conditions. Employees tend to stay loyal when they feel part of a cohesive team and their work holds meaningful value (Dhingra et al., 2021). Management can further improve retention by focusing on predictors such as work-life balance and employee recognition. Adopting a holistic retention strategy that integrates organizational and HR factors is vital for ensuring employee commitment and long-term tenure (Cachón-Rodríguez et al., 2022).

Effective HRM practices are fundamental to employee retention, with engagement, skill development, competitive compensation, and supportive management being central to maintaining a stable workforce. Organizations need to implement these practices strategically to balance support with performance expectations, adapt to evolving workplace trends, and achieve sustained organizational success (Bangsu et al., 2023).

As organizations strive to retain top talent, it is critical to adapt HRM practices to address emerging trends in engagement, skill enhancement, equitable compensation, and leadership support. By aligning these strategies with employees' needs and organizational objectives, businesses can maintain a competitive edge and ensure their long-term success in an ever-changing business environment (Park et al., 2024).

1.5. Research Design

This research aims to analyze survey data collected from a diverse sample of IT professionals in India, supplemented by publicly available data, to understand employee sentiments and predict their likelihood of leaving their current jobs. The study will focus on key factors such as job satisfaction, length of service under current management, overtime requirements, availability of stock options, and job engagement to identify the primary drivers of employee retention.

Data organization and analysis will be conducted using pivot tables in Excel, providing a structured framework to summarize and explore the relationships among these variables and their impact on employees' decisions to stay or leave. This systematic approach seeks to uncover underlying patterns and correlations, offering a deeper perspective on turnover dynamics within India's IT sector.

By combining survey insights with external data sources, this study will contribute meaningful findings to the development of effective retention strategies tailored to the specific challenges faced by IT professionals in India. The results aim to support HRM practices that enhance job satisfaction, strengthen managerial relationships, balance workloads, utilize stock options strategically, and encourage higher job engagement—all crucial components of a supportive work environment that fosters talent retention in the IT industry.

The initial phase of this research will focus on data preprocessing and exploratory data analysis (EDA) to ensure the dataset is prepared for machine learning model development. Preprocessing will involve tasks such as addressing missing data, standardizing data formats, and encoding categorical variables to ensure consistency and reliability in subsequent analyses. Pivot tables in Excel will be employed during EDA to aggregate and visualize key variables, uncovering patterns, anomalies, and relationships that may influence the predictive models' performance. This phase is critical for gaining initial insights and ensuring data quality before proceeding with advanced modeling.

Incorporating public data sources will add context to the analysis by providing industry benchmarks and market trends. These external data points will complement the survey data, creating a more comprehensive dataset and enabling the study to account for external factors affecting employee retention. This enriched dataset will offer a holistic view of the variables influencing turnover in India's IT sector.

Together, the steps of preprocessing, EDA using pivot tables, and integrating public data form a solid foundation for the next phase of machine learning model development. This systematic preparation will ensure the analysis is both thorough and actionable, producing insights that inform strategic HRM decisions aimed at improving retention rates in the IT industry.

In the subsequent phase, machine learning models will be developed and deployed using Dataiku DSS, leveraging its comprehensive suite of tools for data preparation, modeling, and deployment. A variety of algorithms, including linear regression, tree-based models, and ensemble methods, will be utilized to predict the likelihood of employee turnover based on the key factors identified in the analysis. The use of Dataiku DSS will streamline the workflow, ensuring efficiency and precision in model development and deployment.

Rigorous evaluation and comparison of the trained models will be conducted to determine their accuracy and reliability in predicting employee turnover. This process will identify the best-performing model that aligns with the dataset's characteristics and captures the unique nuances of India's IT workforce. Insights generated from these models will guide the development of targeted retention strategies, addressing the specific needs and challenges of IT professionals.

This research design offers a robust, data-driven approach to understanding and addressing employee turnover in the IT sector. The findings are expected to enable organizations to implement proactive measures that improve employee satisfaction, reduce turnover rates, and cultivate a positive work environment. By integrating advanced machine learning techniques with strategic HRM practices, this study aims

to empower organizations in India to optimize workforce management strategies and drive sustainable growth and success.

1.6. Data Collection Techniques - Source of Data

Employee retention is a significant concern for organizations across various industries, particularly in the Information Technology (IT) sector, where demand for skilled professionals is consistently high. Identifying the factors influencing employees' decisions to stay with or leave their organizations is essential for HR management to craft effective retention strategies. This study integrates both primary and secondary data sources to investigate the complexities of employee retention within the IT sector. Primary data collected through surveys provides direct insights into IT professionals' motivations, behaviors, and perceptions related to retention. These insights are further complemented by secondary data sourced from a Kaggle dataset, offering an industry-wide perspective on employee profiles, job roles, and factors contributing to turnover. Together, these datasets facilitate a comprehensive analysis of employee retention dynamics, supporting the development of strategic HR interventions aimed at retaining IT talent.

Primary Data: The primary data for this study was obtained through a survey distributed to IT professionals using Google Forms. The survey explored a wide range of topics, including employee retention, skills, motivations, behaviors, personal characteristics, and levels of organizational commitment. Participants responded to statements on these topics using a five-point Likert scale, which ranged from 1 (strongly disagree) to 5 (strongly agree). Additionally, the survey gathered demographic details, such as age, gender, educational qualifications, and years of experience in the IT industry, to provide a comprehensive understanding of the participants' backgrounds.

Secondary Data: In addition to the primary survey data, this research utilizes a secondary dataset from Kaggle, which contains detailed information about employees and their propensity to leave their current roles. This dataset includes variables such

as job roles, performance metrics, salary details, employment conditions, and indicators of satisfaction and engagement. The structured format of the dataset facilitates analysis and enables predictions about employee turnover, providing valuable insights into trends and patterns affecting retention in the IT sector.

By combining primary survey data with secondary data from Kaggle, this study provides a holistic view of employee retention in the IT sector. The primary data offers granular insights into employees' attitudes and perceptions, reflecting the realities of their workplace experiences. Meanwhile, the secondary data introduces broader industry trends and benchmarks, allowing for a more comprehensive exploration of the factors influencing retention and attrition. This dual approach ensures a well-rounded analysis, enhancing the accuracy and relevance of findings.

The integration of these datasets enables the identification of key factors driving retention, including job satisfaction, organizational commitment, and employee engagement. These findings are intended to guide HR professionals in developing targeted strategies to address employee needs and foster a supportive work environment. Ultimately, this research contributes valuable insights into employee retention within the IT sector, equipping organizations with the tools to improve retention rates and strengthen their workforce management practices.

1.7. Research Questions

The primary aim of this research is to explore the factors that influence employee retention. The study analyzes a dataset containing a wide range of variables, including employee financial factors (e.g., salary, percentage of salary increases, and stock options), personal characteristics (e.g., distance from home, educational background, age, and work-life balance), and leadership attributes (e.g., tenure with the current company, overtime involvement, job roles, and travel frequency).

To achieve this, the study is guided by the following research questions (RQ):

- Which employee factors influence employee retention?

- **Demographic Variables:** This includes attributes like age, gender, distance from home, education, total working years, and the number of companies an employee has worked for.
 - **Organization-Related Variables:** Key organizational factors include business travel, department, environment satisfaction, job level, job satisfaction, monthly income, overtime hours, percentage of salary hikes, performance ratings, stock option levels, average monthly working hours, and the number of projects handled.
 - **Leadership-Related Attributes:** These factors examine job involvement, work-life balance, years spent at the company, years in the current role, years since the last promotion, years with the current manager, and decision-making skills.
- Which employee retention factors are important to an emerging economy like India?
 - What is the best fit model for employee retention?
 - What are some data-driven retention strategies for competitive HR?

This research organizes employee retention factors into three primary feature categories to develop a strategic framework aimed at reducing turnover and fostering workforce loyalty:

- Demographic Features:

This category includes personal attributes that influence retention, such as age, gender, distance from home, education level, total working years, and the

number of companies worked at. By analyzing these features, the organization can identify trends that correlate with turnover. For example:

- Tailored career development plans designed for employees at different stages of their careers.
- Targeted retention initiatives for demographics that exhibit higher attrition rates.

- Organization-Related Features:

This group focuses on aspects of the employee's professional environment and role, such as business travel, department, environment satisfaction, job satisfaction, job level, monthly income, overtime hours, percentage salary hikes, performance ratings, stock options, and average monthly hours worked. Strategies in this area may include:

- Enhancing reward and recognition systems to motivate employees.
- Creating supportive work environments and clearer career progression pathways.
- Reducing unnecessary overtime and ensuring equitable compensation practices.

- Leadership-Related Features:

Leadership qualities and managerial practices play a pivotal role in influencing employee retention. Factors in this category include job involvement, work-life balance, years at the company, years in the current role, time since the last promotion, years with the current manager, and decision-making processes. Retention strategies in this area could involve:

- Leadership development programs that promote mentorship, guidance, and employee recognition.

- Policies fostering a balanced work-life environment, addressing employee well-being.
- Initiatives that recognize and reward long-term commitment and achievements.
- Comprehensive Retention Strategies:

By systematically analyzing and grouping these features, organizations can develop targeted and effective strategies that cater to the unique needs of their workforce. The ultimate objective is to create an environment where employees feel valued, supported, and motivated to grow within the company. This approach aims to reduce turnover, improve job satisfaction, and cultivate a loyal and high-performing workforce.

This research provides a robust framework for addressing employee retention challenges, particularly in the context of emerging economies like India, where dynamic workforce needs and competitive markets demand innovative and data-driven HR solutions.

1.8. Assumptions

The IT industry is characterized by its rapid pace, continuous technological innovations, and an ever-present demand for skilled professionals. This dynamic environment often leads to frequent job transitions as employees seek opportunities for better compensation, career advancement, and personal growth. In such a competitive landscape, addressing employee retention challenges in the IT sector becomes a critical priority.

This research aims to develop targeted retention strategies tailored to the unique demands and challenges of IT professionals. Key factors identified as crucial for improving retention include job satisfaction, work-life balance, managerial support, and opportunities for career progression. By addressing these elements, organizations can create a supportive and engaging work environment that minimizes

turnover and fosters long-term loyalty among their IT workforce. A culture that emphasizes employee well-being and professional development not only reduces attrition but also enhances organizational stability and employee engagement.

The retention strategies proposed in this study are particularly relevant to navigating the competitive IT landscape. Organizations that prioritize employee satisfaction and career advancement can strengthen their ability to retain top talent, improve productivity, and foster innovation. Adopting a proactive approach to workforce management ensures that IT companies remain competitive in attracting and retaining highly skilled professionals, thus bolstering organizational success.

The insights derived from this research primarily target IT professionals, as their perspectives are instrumental in shaping effective retention strategies. The proposed approaches aim to address specific challenges within the IT sector, such as high turnover driven by skill shortages and a competitive job market. Strategies such as customized career development plans, improved recognition and reward systems, and flexible work arrangements are highlighted to cater to the evolving expectations of IT employees.

These retention strategies are designed to cultivate an environment where IT professionals feel valued, supported, and motivated, leading to enhanced job satisfaction and lower attrition rates. While the findings and recommendations are specifically tailored to the IT industry, their applicability to other sectors may be limited due to the distinct challenges and dynamics of the IT field. Factors like rapid technological change, a highly competitive talent market, and specialized skill demands underscore the unique context of retention efforts in the IT industry.

Organizations within the IT sector can gain significant advantages by implementing these tailored strategies. Prioritizing employee well-being, career growth, and a positive workplace culture enables companies to retain top talent while maintaining a competitive position in the market. Ultimately, this study emphasizes the importance of aligning retention initiatives with the unique needs of IT

professionals to sustain organizational success and foster an innovative, high-performing workforce.

1.9. Definition of Terms

Data-Driven HR: This dissertation utilizes the concept of "Data-Driven HR" to describe the practice of making informed decisions and crafting strategies grounded in measurable, empirical data rather than relying on subjective judgments typically made by HR teams.

Employee Engagement: The term "employee engagement" is used broadly to capture the various ways employees connect with, contribute to, and show dedication to their organization's mission and goals.

Employee Retention Strategies: In the context of this dissertation, "employee retention strategies" are defined as carefully planned approaches based on insights derived from historical data, such as exit interviews and employee surveys. These strategies aim to create a workplace where the aspirations of employees align harmoniously with the objectives of the organization, benefiting both parties.

Human Resource Management (HRM): HRM refers to a pivotal function within organizations, tasked with managing employee well-being, shaping workplace policies, and fostering a positive and productive organizational environment.

Interpretable Machine Learning Models: This term relates to machine learning algorithms whose outputs are designed to be comprehensible and transparent to human users. Unlike complex mathematical frameworks, these models provide explanations that can be easily understood and applied to decision-making processes.

Organizational Behavior: For the purposes of this dissertation, organizational behavior is identified as the examination of individual and group dynamics within an organization. This field of study sheds light on factors that affect organizational culture and overall effectiveness.

1.10. Summary

This research highlights the importance of implementing data-driven strategies to address employee retention challenges in Human Resource Management (HRM), particularly within the IT sector, which is characterized by its high levels of volatility and frequent employee turnover. To explore this issue, an extensive survey was conducted among employees from prominent Indian IT firms, including IBM, TCS, Tech Mahindra, and Accenture. To protect respondent confidentiality, the identities of these companies were anonymized during the study. The primary objective of the survey was to collect firsthand insights from employees about the key factors influencing their decisions to stay with or leave their organizations, providing a practical perspective on the challenges faced in managing retention within the IT industry.

Beyond the survey, publicly available data on various elements affecting employee attrition were also analyzed to enrich the study. This dual methodology—combining direct workforce feedback with secondary data that provides a comprehensive understanding of the complex factors driving employee turnover. By integrating these diverse data sources, the research presents a nuanced analysis of retention issues and proposes actionable strategies tailored to the unique demands of the IT sector. The findings underline the critical role of data-driven approaches in formulating effective HRM strategies, fostering a more stable and committed workforce in an industry defined by rapid change.

CHAPTER 2: LITERATURE REVIEW

2.1. HRM System in Organization

Human Resource Management (HRM) is defined as the strategic coordination and management of an organization's workforce to effectively achieve its objectives with optimal efficiency (Yusriadi, 2020). HRM underlines the importance of aligning employee-related decisions with the broader mission and strategy of the organization. Consequently, its scope is inherently tied to achieving organizational goals while addressing critical personnel aspects (Okolie et al., 2021). These "people issues" encompass various areas:

Performance: Effective HRM places a strong emphasis on implementing systems and processes that actively monitor and improve employee performance. This includes structured evaluations such as performance appraisals, real-time feedback mechanisms, and measurable performance metrics. The objective is not merely to assess performance but to identify areas requiring development, provide constructive feedback, and design personalized growth plans. By prioritizing performance enhancement, organizations can ensure their workforce operates at peak efficiency, contributing directly to strategic objectives.

Development: HRM highlights the importance of developing both current and future employee capabilities. This involves structured training and development initiatives that prepare employees for present roles and future challenges. Special attention is given to leadership development programs aimed at equipping managerial staff with the necessary skills to guide teams effectively. By fostering a culture of continuous improvement, HRM ensures that employees remain adaptable and capable of meeting evolving organizational needs.

Culture: HRM views organizational culture as a dynamic element that can be shaped and directed to support the organization's goals. This shift often involves moving from traditional authoritative management styles to more modern approaches

that integrate cultural values to drive performance and positive behaviours. Actively managing culture allows HRM to promote key values such as collaboration, innovation, and accountability, creating an environment conducive to sustained success.

Integration: A defining feature of HRM is its ability to consolidate diverse employment policies into a unified framework. This ensures all HR activities—recruitment, performance management, development, and employee relations—align with organizational strategy. Such integration fosters employee commitment and strengthens their connection to the organization, contributing to a motivated and engaged workforce. This holistic approach enhances overall organizational performance and employee satisfaction.

HRM practices are acknowledged as strategic approaches that help organizations manage their workforce effectively. They play a critical role in cultivating firm-specific skills, fostering meaningful social connections, and building organizational knowledge that offers a competitive edge. (Otoo, 2019) highlighted essential HRM practices, including selection processes, performance evaluations, incentivization, grievance procedures, employee participation, and additional training opportunities. Similarly, Delaney categorized HRM activities into recruitment, training, participation, and reward systems.

The importance of HRM continues to grow, with ethical leadership becoming a central theme in modern management discussions. Ethical practices in HRM not only influence overall organizational performance but also shape the company's ethical standards and commitment to social responsibility (Saudin, 2024). When HRM practices become deeply integrated into an organization's operations and are embraced by all employees, they cultivate diverse perspectives and foster innovation. This collaborative approach drives personal and collective growth, creating a workplace environment conducive to adaptability and learning in a dynamic business landscape.

HRM should transcend traditional departmental boundaries and become a shared organizational responsibility. By promoting leadership-driven participation in HR initiatives, organizations can achieve a more engaged and performance-oriented workforce, paving the way for long-term success (Okolie et al., 2021).

HR Analytics (HRA) represents a transformative approach to gathering, analysing, and utilizing data within HRM. Analytical tools enable organizations to assess what practices work effectively and identify areas for improvement. These insights drive more strategic decision-making and future planning. HR analytics applies statistical methodologies to data, designing interventions, proposing policies, and evaluating their impact across departments like marketing and finance. Although HR analytics holds tremendous potential, its adoption and exploration remain relatively limited (Pawar et al., 2023).

Artificial Intelligence (AI) is increasingly integrated into HRM, offering potential benefits for employees, customers, and organizations. Despite significant investment in AI technologies, many organizations have yet to realize its full potential. Recent studies focus on AI's applications, anticipated advantages, and its influence on organizational dynamics and the workforce (Chowdhury et al., 2023).

HR analytics, once a minor administrative function, has evolved into a sophisticated tool providing diagnostic and predictive insights. These capabilities enhance employee engagement and retention, creating organizational value through digital analytics solutions. (Margherita, 2022) notes that while HR analytics is increasingly recognized as a “game changer” for HR's future, its conceptual framework remains underdeveloped. Further research is necessary to define its scope, assess its applications, and identify barriers to its adoption. Advancing the understanding of HR analytics will help organizations move from basic reporting to impactful, data-driven HR strategies.

In the field of Human Resources (HR), analytics serves as a powerful tool for transformation. Different forms of analytics play distinct roles: **Workforce Analytics**

focuses on improving strategic alignment and execution; **People Analytics** provides computational insights into employee behaviors and trends; **HR Analytics** supports data-driven decision-making processes; **Human Capital Analytics** examines individual, process, and structural dynamics; and **Talent Analytics** identifies workforce patterns to drive value and implement organizational changes. The table below summarizes these diverse analytical approaches within HR analytics.

Term	Definition
Workforce Analytics	Understanding, measuring, and promoting their role in strategy execution and value creation requires not just metrics but also analytics and technology for supporting organizational decision-making.
People Analytics	A new data-driven approach, using computational techniques to make sense of diverse aspects of employee behaviour. Various tools and technologies, including predictive modelling, are employed to arrive at evidence-based decisions. This continuous process translates workforce data into meaningful insights at every level of sophistication to aid managerial decisions. It is an innovative HRM practice that leverages IT, data analytics, and visualization tools to generate strategic insights about workforce dynamics, human capital, and performance, enhancing organizational effectiveness, efficiency, and employee experience.
HR Analytics	An evidence-based HR practice empowered by information technology. It relies on descriptive, visual, and statistical analyses of data related to HR processes, human capital, and organizational performance. External economic benchmarks are also considered to establish business impact and enable data-informed decision-making. Tools range from basic HR metrics reports to advanced predictive modelling. This practice focuses on data collection, analysis, and reporting to improve decision-making about people, utilizing statistical techniques, algorithms, and research designs to evaluate employee data and produce actionable reports.

Human Capital Analytics	An organizational capability founded on three micro-level categories: individuals, processes, and structure. It incorporates three dimensions: data quality, analytical skills, and strategic capacity to act.
Talent Analytics	A suite of techniques designed to identify trends in workforce data, facilitating workforce management, instigating actions, and driving value creation.

Table 1: The Definitions of Terms (Lee and Yunsoo, 2023)

As organizations navigate challenges such as globalization, rapid technological advancements, and evolving workforce dynamics, the alignment of HR practices with business objectives has become increasingly critical. Strategic Human Resource Management (SHRM) in the modern era leverages tools such as data analytics, artificial intelligence (AI), and automation to revolutionize key HR functions, including talent acquisition, employee engagement, and workforce planning. SHRM also places a strong emphasis on employee well-being, integrating initiatives that support work-life balance, mental health, and inclusive workplace environments. This holistic approach not only boosts individual and team performance but also fosters organizational resilience and long-term sustainability.

Research by (Kess-Momoh et al., 2024) underscores SHRM's dual role in adapting to and driving change. By embracing innovative strategies and fostering inclusive cultures, SHRM provides actionable insights for navigating the complexities of the contemporary workplace while ensuring organizations remain agile and future-ready.

2.2. Evolution of HRM

According to (Cvenkel, 2020), the origins of Human Resource Management (HRM) can be traced back to the 18th century when businesses began prioritizing employee welfare by focusing on health and education. (Cvenkel, 2020) also highlights Elton Mayo's Human Relations theory, which emphasized the psychological

dimensions of management. These early developments, influenced by competitive markets, have shaped the evolution of HRM into its modern form.

1890 – 1910	Frederick Taylor introduced scientific management, advocating a scientific method for selecting personnel, where credentials were key. He also encouraged incentive-based pay schemes to boost employee motivation.
1910 – 1930	Many organizations established dedicated departments focused on employee safety and well-being. The development of industrial psychology began, and, alongside World War I, significant progress was made in employment assessment and selection processes.
1930 – 1945	The Hawthorne Studies greatly influenced management practices by highlighting how social and informal workplace factors affect productivity. Emphasizing employee happiness emerged as a key strategy for boosting productivity.
1945 – 1965	The U.S. saw a significant increase in union membership between 1935 and 1950, which brought labor relations and collective bargaining to the forefront of personnel management. As unions gained influence, managing pay and benefits, along with negotiating for paid leave, holidays, and insurance, became essential.
1965 – 1985	The Civil Rights Act of 1964 marked a turning point for HR by prohibiting discrimination based on race, sex, national origin, religion, or color. After the Act's enactment, HR responsibilities expanded to include equal employment opportunities and affirmative action.
1985 – Present	HRM is shaped by three key trends: growing workforce diversity in terms of age, gender, and ethnicity; globalization, which has transformed labor markets, communication, and transportation; and the evolution of HR from a compliance-based function to a strategic one focused on managing diversity and operational efficiency.

Table-2: Historical evolution of HRM (Ochieng, 2023)

Between 1890 and 1910, Frederick Taylor introduced scientific management, marking a significant transformation in personnel management practices. Taylor advocated for a systematic approach to employee selection based on objective criteria

like qualifications and credentials, minimizing the influence of subjective judgment. His focus on efficiency extended to performance incentives, promoting pay-for-performance schemes as a means to motivate workers and enhance productivity. Taylor's methodologies laid the groundwork for many contemporary HR practices, particularly in performance management and employee motivation.

From 1910 to 1930, organizations began creating dedicated departments to address employee welfare and workplace safety. This period saw the rise of industrial psychology, which sought to understand and optimize human behavior in organizational settings. The onset of World War I further emphasized the need for systematic approaches to recruitment and workforce management on a large scale. During this era, companies increasingly recognized the value of employee well-being, leading to the development of more structured hiring and management systems, which helped pave the way for a more comprehensive understanding of employee relations.

The years 1930 to 1945 were heavily influenced by the Hawthorne Studies, which profoundly changed management perspectives. These studies revealed that social and informal workplace factors significantly affected employee productivity. Consequently, organizations began focusing on improving worker satisfaction and happiness to drive performance. This marked a shift from treating employees as mere components of a production process to acknowledging the importance of their psychological well-being. The findings from the Hawthorne Studies encouraged managers to adopt more employee-centered approaches to workplace engagement.

Between 1945 and 1965, labor unions gained substantial influence, particularly during the period of rapid unionization between 1935 and 1950. As union memberships surged, issues such as collective bargaining, labor relations, and worker rights became central to HR practices. Unions successfully negotiated improvements in wages, benefits, and working conditions, including paid leave, holidays, and insurance. HR departments became instrumental in mediating between management

and unions, ensuring fair treatment through collective agreements. This era solidified HR's role in balancing organizational objectives with employee demands.

The period from 1965 to 1985 was significantly shaped by the passage of the Civil Rights Act of 1964, which introduced sweeping changes to HR practices. Title VII of the Act outlawed discrimination based on race, gender, national origin, religion, and color. This legal framework required organizations to implement policies ensuring equal employment opportunities and combating discriminatory practices. During this era, HR departments expanded their focus to include affirmative action and diversity initiatives, promoting workplace equity. This marked the emergence of HR as a key player in fostering inclusive environments and ensuring compliance with non-discrimination laws.

From 1985 onwards, three key trends, workforce diversity, globalization, and the strategic role of HR—have significantly influenced HRM. Increased diversity in age, gender, ethnicity, and cultural backgrounds has driven HR to implement diversity and inclusion strategies. Globalization, fuelled by advances in technology and communication, has created a more interconnected labour market, requiring HR professionals to navigate cultural differences and international competition. Additionally, HR has evolved from an administrative function to a strategic partner, aligning its initiatives with overarching business goals to enhance organizational competitiveness. These trends have positioned HR as a vital contributor to organizational success in today's dynamic and complex business environment.

2.3. Challenges in HRM

Human Resource Management (HRM) faces numerous contemporary challenges, with employee engagement, communication, strategic planning, and performance management emerging as critical areas of focus. Among these, employee engagement has become a cornerstone of organizational success, significantly influencing workforce productivity and contributed to better financial outcomes.

Employee engagement goes beyond fulfilling daily responsibilities, it reflects an employee's deep commitment and voluntary dedication to their role. Engaged employees are intrinsically motivated and connected to their work and colleagues, fostering a positive workplace culture. This emotional involvement encourages productivity, creativity, and alignment with organizational objectives. To sustain engagement, organizations often implement initiatives such as performance-based bonuses, comprehensive health benefits, and personalized coaching programs. Modern managerial practices emphasize guiding employees toward improvement rather than mere oversight (Susanto and Sawitri, 2023). According to (Budrienė and Diskienė, 2020), cultivating employee engagement requires intentional strategies rooted in an organization's culture, where deliberate actions foster employee satisfaction and alignment with the company's mission.

Effective communication is another critical pillar of HRM, directly impacting organizational efficiency and collaboration (Sutrisno et al., 2024). Clear communication fosters teamwork, enhances job satisfaction, and ensures operational success. It involves more than exchanging information; true communication includes understanding, engaging actively, and addressing individual needs within a team. Verbal and non-verbal cues, such as gestures, tone, and body language, play an integral role in this process. (Sutrisno et al., 2024) also adds that communication involves generating, transmitting, and interpreting messages in a context-specific manner. Active listening and thoughtful responses are vital, making communication a fundamental element not just in professional settings but also in personal and social relationships.

Strategic HRM, which evolved from traditional personnel management in the early 1980s, now serves as a framework for aligning organizational values with employee needs. (Albarqi, 2022) emphasizes that strategic HRM focuses on essential areas such as employee training, organizational culture, psychological and physical well-being, recruitment, and retention. This strategic approach ensures organizations can anticipate challenges, maintain employee safety, and foster a supportive work

environment. Proper planning and forecasting are essential for aligning HR practices with long-term organizational goals, making strategic HRM an indispensable aspect of modern HR practices.

Performance management, another key area, has gained significant attention from both scholars and practitioners. Effective performance management now involves ongoing interactions between managers and employees rather than solely relying on annual reviews. (Tseng and Levy, 2019) suggest that techniques such as feedforward interviews, which focus on constructive future-oriented discussions, can lead to improved peer performance ratings. This approach underscores the importance of dynamic, continuous dialogue in building strong manager-employee relationships and enhancing overall performance.

Addressing these challenges, employee engagement, communication, strategic planning, and performance management that requires a comprehensive and proactive approach. HRM can navigate these complexities by fostering meaningful work experiences, maintaining open communication, aligning strategies with organizational goals, and prioritizing robust performance management practices. (Stojanović and Bernik, 2022) highlight that these measures not only tackle existing challenges but also drive sustainable success in today's competitive business landscape.

Strong employee engagement plays a pivotal role in talent retention, customer loyalty, and overall organizational performance (Budrienė and Diskienė, 2020). Engaged employees tend to exhibit higher levels of happiness, leading to better creativity, reduced absenteeism, increased safety, and higher profitability. To retain talent effectively, organizations must view employees as valuable assets and prioritize their development and satisfaction. As (Aburub and others, 2020) assert, employees should be treated as ends in themselves rather than merely as means to achieve operational goals.

Research of (Omar, 2021), identifies 12 key challenges in HRM, as listed below,

- **Retention of Employees:** Employee retention involves developing strategies and practices to ensure that talented and valuable employees remain with the organization. This includes creating a positive work environment, offering competitive compensation and benefits, providing opportunities for career growth and development, and recognizing and rewarding employee achievements.
- **Globalization:** Managing a diverse workforce spread across different cultures and geographies requires understanding and respecting cultural differences, ensuring effective communication across time zones, and aligning global HR practices with local customs and regulations. Globalization also involves leveraging a diverse talent pool to enhance innovation and competitive advantage.
- **Retrenchment of Employees:** Handling layoffs or downsizing is a sensitive and challenging aspect of HR management. It involves planning and executing the process with empathy and transparency, providing support and resources to affected employees, and maintaining morale and productivity among remaining staff.
- **Women Workforce:** Addressing gender-related issues and promoting diversity involves creating policies and practices that support gender equality, such as equal pay for equal work, flexible working arrangements, and opportunities for leadership roles. It also includes fostering an inclusive culture where women feel valued and empowered.
- **Multicultural Workforce:** Navigating cultural differences within the organization involves promoting cultural awareness and sensitivity, encouraging inclusive practices, and leveraging diverse perspectives to enhance creativity and problem-solving. It also includes providing training and development programs to help employees understand and appreciate cultural diversity.
- **Change in Government Demand:** Adapting to shifts in regulatory requirements involves staying informed about changes in laws and regulations, ensuring

compliance, and implementing necessary adjustments in policies and practices. It also includes working with government agencies and industry bodies to anticipate and respond to regulatory changes.

- **Technology:** Keeping up with technological advancements involves staying abreast of emerging technologies, implementing new tools and systems to enhance efficiency and productivity, and providing training and support to employees to adapt to technological changes. It also includes leveraging technology to improve HR processes, such as recruitment, onboarding, and performance management.
- **Initiating Process of Change:** Implementing organizational changes effectively involves careful planning, clear communication, and engagement with employees at all levels. It includes identifying the need for change, developing a change management strategy, and providing support and resources to help employees navigate the transition.
- **Leadership Development:** Fostering leadership skills among employees involves identifying high-potential individuals, providing leadership training and development programs, and offering opportunities for mentorship and coaching. It also includes creating a culture of continuous learning and development to nurture future leaders.
- **Organizational Effectiveness:** Ensuring efficient operations involves optimizing processes and systems, setting clear goals and objectives, and continuously measuring and improving performance. It also includes fostering a culture of accountability and collaboration to drive organizational success.
- **Change Management:** Successfully managing transitions involves understanding the impact of change on employees, providing clear communication and support, and implementing strategies to minimize resistance and maximize buy-in. It also includes monitoring and evaluating the change process to ensure successful outcomes.

- **Compensation:** Designing fair and competitive compensation structures involves conducting market research, benchmarking salaries, and creating compensation packages that attract and retain top talent. It also includes ensuring internal equity, aligning compensation with organizational goals, and providing transparency in compensation practices.

Human Resource Management (HRM) faces numerous challenges in today's dynamic business environment. Retaining employees is critical, necessitating strategies that foster a positive work environment, competitive compensation, career growth, and recognition. Globalization requires managing a diverse workforce across cultures and geographies, while retrenchment demands handling layoffs with empathy and transparency. Promoting gender diversity involves supporting equality and creating an inclusive culture. Multicultural workforces require cultural sensitivity and inclusive practices to harness diverse perspectives. Adapting to regulatory changes ensures compliance and responsiveness to government demands. Technological advancements necessitate staying updated with emerging tools, implementing new systems, and providing employee training. Initiating organizational change effectively involves careful planning, clear communication, and employee engagement.

Leadership development focuses on nurturing future leaders through training, mentorship, and a culture of continuous learning. Organizational effectiveness is achieved by optimizing processes, setting clear goals, and fostering accountability. Change management ensures smooth transitions with minimal resistance through strategic communication and support. Finally, designing fair and competitive compensation structures attracts and retains top talent, requiring market research, benchmarking, and ensuring internal equity. Together, these HRM practices create a robust framework for managing and enhancing the workforce, driving organizational success, and maintaining a competitive edge in a rapidly evolving landscape.

(Bargavi et al., 2023) concludes, Employee Retention (ER) is an indispensable agenda for organizations operating in the extremely competitive Information

Technology (IT) sector. In an industry characterized by rapid technological advancements and high demand for skilled professionals, retaining top talent is critical for maintaining a competitive edge. High turnover rates can lead to increased recruitment and training costs, disruption in project continuity, and loss of institutional knowledge. (Bargavi et al., 2023) also adds, implementing effective retention strategies, such as offering competitive salaries, fostering a positive work environment, providing career development opportunities, and ensuring job satisfaction, is essential. These measures help build a stable, motivated, and experienced workforce, ultimately contributing to the organization's long-term success and sustainability.

- **Employee Engagement**

According to (Budrienė and Diskienė, 2020), Employee engagement has become a widely recognized organizational concept in recent years. Interestingly, it has been a critical focus for HR long before the term became popular. Today, employee engagement, stands as one of the top priorities for human resource practitioners and senior managers. Consequently, employee engagement has garnered significant attention among HR professionals also (Budrienė and Diskienė, 2020) confirms that high engagement levels help retain talent, boost customer loyalty, and enhance organizational performance and stakeholder value.

Identifying the factors that foster employee work engagement is crucial for organizational sustainability and growth. Most research on employee engagement focuses on individuals, showing that employees are more engaged when they are self-motivated and trust management. Between 2015 and 2019, a survey of 90 organizations from various sectors, including over 19,000 respondents representing 48,000 workers, found that global engagement increased from 56% to 62%. Worldwide, 6,000 companies from 155 countries surveyed 7 million respondents. Organizations in the top quartile of engagement had 18% higher productivity, with 59% of engaged employees feeling their job inspires creativity, and a 40% lower

turnover rate compared to companies with low engagement levels (Budrienė and Diskienė, 2020).

Employee Engagement underscores the importance of intentional strategies and practices that foster an environment where employees feel valued, motivated, and connected to their work. High levels of employee engagement contribute significantly to the overall success and sustainability of an organization, making it a critical focus for management.

To begin with, creating a culture of engagement starts with strong leadership. Leaders play a pivotal role in shaping the organizational climate and setting the tone for engagement. They must be committed to fostering an inclusive and supportive environment where employees feel their contributions are recognized and appreciated. This involves transparent communication, where leaders regularly share the organization's vision, goals, and progress with their teams. By doing so, employees understand how their work aligns with the broader objectives of the company, enhancing their sense of purpose and commitment.

Furthermore, recognizing and rewarding employees' efforts is essential in building a culture of engagement. Regular feedback and acknowledgment of achievements, whether big or small, make employees feel valued and motivated. Implementing recognition programs that celebrate individual and team accomplishments can boost morale and encourage a positive work environment. Additionally, providing opportunities for career growth and development is crucial. When employees see a clear path for advancement within the organization, they are more likely to be engaged and invested in their roles.

Another key factor in fostering employee engagement is creating a supportive work environment that promotes work-life balance. Organizations that prioritize the well-being of their employees by offering flexible working arrangements, mental health resources, and wellness programs demonstrate a commitment to their staff's

overall health and happiness. Such initiatives help reduce burnout and stress, leading to higher levels of engagement and productivity.

Moreover, empowering employees to have a voice and participate in decision-making processes is vital. When employees feel that their opinions and ideas are valued, they are more likely to be engaged and take ownership of their work. This can be achieved through regular surveys, feedback sessions, and open-door policies that encourage open communication between employees and management. Involving employees in problem-solving and innovation also fosters a sense of belonging and loyalty to the organization.

Creating a culture of engagement also involves fostering a sense of community within the workplace. Building strong relationships among colleagues through team-building activities, social events, and collaborative projects can enhance employee engagement. A supportive and collaborative team environment encourages employees to work together towards common goals, increasing their commitment to the organization.

Training and development opportunities are another critical component of employee engagement. Providing employees with the skills and knowledge they need to excel in their roles not only boosts their confidence but also demonstrates the organization's investment in their professional growth. Offering workshops, courses, and mentoring programs can help employees develop new competencies and advance their careers within the company.

Effective communication is also a cornerstone of employee engagement. Organizations must establish clear channels for communication that facilitate the flow of information between all levels of the organization. Regularly updating employees on company news, changes, and successes helps keep them informed and connected. Additionally, encouraging two-way communication where employees can share their thoughts and feedback fosters a culture of openness and trust.

Employee engagement is a deliberate and strategic effort that is deeply rooted in the organization's culture. By prioritizing strong leadership, recognition, work-life balance, employee empowerment, community building, professional development, and effective communication, organizations can create an environment where employees are motivated, committed, and engaged. Such an environment not only enhances individual performance but also drives the overall success and growth of the organization. Therefore, it is essential for leaders and managers to continuously evaluate and refine their strategies to foster and sustain high levels of employee engagement.

(Budrienė and Diskienė, 2020) also highlights employee engagement as a key organizational priority, noting its positive effects on talent retention, customer loyalty, and performance. Research shows that engaged employees are more productive, creative, and less likely to leave their jobs. Between 2015 and 2019, surveys revealed that global engagement levels rose from 56% to 62%, with companies in the top quartile of engagement experiencing an 18% productivity boost and 40% lower turnover rates.

Creating a culture of engagement starts with strong leadership. Leaders must foster an inclusive environment, clearly communicate organizational goals, and align employee contributions with broader objectives. Recognizing employee achievements, offering career development opportunities, and providing work-life balance initiatives further enhance engagement.

Engaged employees feel valued and connected to their work, which drives individual and organizational success. Empowering employees through participation in decision-making, fostering teamwork, and offering professional development programs helps create a sense of community and loyalty. By prioritizing these practices, organizations can sustain high engagement levels, ensuring resilience and growth in today's competitive environment.

- **Employee Retention**

Employee attrition presents a complex challenge for organizations, as it directly impacts performance, productivity, and competitiveness. Retaining employees is essential for organizational success due to the high costs and time associated with attracting, hiring, and training new talent. HR management prioritizes strategies to enhance employee retention rates, aiming to minimize costs and maximize performance outcomes. Employees are among the most valuable resources for any organization, and keeping them satisfied is crucial for sustaining growth and achieving long-term success. Retention requires a structured approach to designing a work environment that fulfills employees' needs through effective policies and practices, a central focus of human resource management initiatives.

Employee attrition refers to the loss of employees for various reasons, including voluntary resignations, layoffs, failure to return from leave, illness, or death (Thilaka et al., 2020). In the United States alone, the cost of turnover exceeds \$360 billion annually, encompassing expenses related to recruiting, hiring, training, and rewarding new employees. Attrition not only incurs financial costs but also results in the loss of valuable skills and institutional knowledge. Replacing employees often requires additional time and resources, further amplifying the burden on organizations.

Employee turnover, a related concept, involves employees leaving an organization either voluntarily or involuntarily. Voluntary turnover can be categorized as **functional**, where low-performing employees exit, or **dysfunctional**, which occurs when high-performing employees leave. The latter has a more significant negative impact on both the organization and the labor market (Lazzari et al., 2022).

Labor turnover, defined as the movement of employees within or out of an organization, is a multifaceted issue that significantly influences organizational success. Factors such as job satisfaction, organizational commitment, and employee expectations play critical roles in turnover rates. Research indicates that turnover is often influenced by tenure and is shaped by variables such as stress, management style,

and compensation. Effectively managing these dynamics is essential for reducing attrition and controlling associated costs.

Several factors drive employee attrition, and understanding these is key to designing effective retention strategies. Research employing model synthesis and validation through the Delphi method (Lahti et al., 2024) highlights **compensation** and **work-life balance** as the most significant factors influencing job satisfaction and retention. While other aspects, such as the work environment, opportunities for promotion, career growth, and training programs, are important, they are not as impactful as competitive compensation and balanced workloads (Macaraig et al., 2024).

By addressing these critical factors, organizations can develop targeted strategies to reduce attrition, ensuring the retention of skilled and experienced employees while minimizing the financial and operational challenges associated with turnover.

Factor	Impact on Employee Attrition
Compensation	Significant influence on job satisfaction and retention.
Work-Life Balance	Drives job satisfaction, crucial for retention.
Work Environment	Less significant but still affects employee retention.
Promotion and Opportunity for Growth	Impacts motivation and the decision to continue working with the company.
Training and Development	Important for employee growth, but less significant for retention compared to other factors.

Table-3: Key Factors Influence Employee Attrition (Macaraig et al., 2024)

The research conducted by (Chatzoudes and Chatzoglou, 2022) highlights three critical workplace dimensions that significantly influence employee retention. These include: (a) the **tangible HR practices** implemented by organizations to manage and support their workforce, (b) the **intangible aspects of working conditions** that shape employees' daily experiences and job satisfaction, and (c) the **strategic alignment** between the organization's mission and its employees' core values. Together, these factors determine the extent to which employees feel engaged, appreciated, and aligned with organizational objectives. This alignment plays a pivotal role in shaping their commitment to the organization and ultimately impacts their decision to remain or seek opportunities elsewhere.

Factor	Description	Effect on Employee Attrition
Prospects for Development	Possibilities for professional growth and career advancement.	Enhances retention; lack thereof increases turnover.
Compensation	The adequacy and fairness of the pay and benefits provided.	Directly correlates with job satisfaction and retention rates.
Work-Life Balance	Being able for balancing work commitments with personal life.	Poor balance leads to burnout and higher attrition.
Management/Leadership	The quality of leadership and management practices.	Poor management increases turnover; good leadership fosters loyalty.
Work Environment	The physical and psychological conditions of the work atmosphere.	Negative environments contribute to higher attrition rates.
Social Support	The support received from colleagues and the organization.	Strong support networks improve retention.
Autonomy	The level of control employees have over their work.	Higher autonomy reduces turnover by

		increasing job satisfaction.
Training and Development	The availability and quality of professional development opportunities.	Lack of development options can lead to increased turnover.

Table-4: Factors Affecting Employee Retention (Chatzoudes and Chatzoglou, 2022)

The research findings of (Taj and Hajira, 2022) outline various factors that contribute to employee attrition, with key highlights including work-life balance, recognition, and organizational support. These findings underscore the importance of elements such as talent perception, acknowledgment of employee efforts, active participation, biographical traits, and the availability of training programs. Each of these factors plays a pivotal role in shaping job satisfaction, fostering loyalty, and strengthening organizational commitment. The study places particular emphasis on how these dynamics influence retention rates, especially among younger employees, who often prioritize opportunities for growth and alignment with organizational values.

Factor	Description	Effect on Employee Attrition
Work-Life Balance	A healthy balance between work and life fosters synergy between professional and personal realms.	Work-life balance boosts satisfaction, lowers turnover, and strengthens work culture.
talent perception	Recognition and valuation of employees' skills and potential within organizations.	Directly correlates with job satisfaction and retention rates.
Acknowledgment	Acknowledgment in IT industry boosts morale and encourages employee loyalty.	Acknowledgment boosts morale, job satisfaction, and enhances employee retention.
employee work participation	Active involvement of employees in tasks and organizational activities.	Employee work participation positively impacts employee retention by fostering engagement and commitment.

biographical characteristics	Study found significant demographic variations impact career concerns and retention factors.	Biographical characteristics impact retention via psychological contract and career development theories.
Young employees' benefits	The continued employment of young employees is determined by several factors, including orientation, fulfilment with work, and job performance, each one of these add positively to their retention.	The vitality of employee retention is made apparent by aspects such as training, job satisfaction, and job performance, especially advantageous for younger workers.
organizational support	Leadership style, personal drive, and organizational backing foster employee dedication.	Transformational leadership, intrinsic motivation, and organizational support enhance employee retention significantly.
expectations and training programs	Senior members expect high salaries, better conditions, training, career growth, support, recognition.	Retention influenced by meeting expectations with fair training and development programs.

Table-5: Employee Retention In Selected IT Companies (Taj and Hajira, 2022)

The table outlines key factors affecting employee retention as identified by (Bargavi et al., 2023), including job security, work environment, training and development, and employee compensation. These elements are analyzed based on their impact on reducing employee turnover, providing actionable insights for organizations seeking to enhance retention through strategic focus on these areas.

Factor	Description	Effect on Employee Retention
Job Security	Job security ensures confidence and predictability, protecting roles from termination.	Job security significantly reduces employee attrition.

Work environment	Work environment encompasses physical conditions, culture, and interpersonal relationships.	A positive work environment significantly reduces employee attrition.
Training and Development	Training and development involve improving knowledge and skills for better performance	Training and development reduce employee attrition by boosting skills and satisfaction.
Employee Compensation	Employee compensation includes salaries, benefits, bonuses, and other financial rewards.	Employee compensation impacts attrition by influencing satisfaction, retention, and organizational commitment positively.

Table-6: Factors Affecting Employee Retention: Demographic Perspective (Bargavi et al., 2023)

Employee retention is shaped by a range of factors, some of which are consistently highlighted across multiple studies, while others are unique to specific analyses. The most widely recognized factors across all four tables are Work-Life Balance, Work Environment, Training and Development, and Compensation. These elements are universally acknowledged as critical areas that organizations must address to retain their workforce effectively.

Work-Life Balance plays a vital role in helping employees achieve harmony between their professional and personal responsibilities, reducing the risk of burnout and increasing job satisfaction. A supportive Work Environment promotes employee well-being and productivity, making it an essential aspect of retention strategies. Opportunities for Training and Development enable employees to enhance their skills and pursue career growth, fostering motivation and engagement. Fair and competitive

Compensation directly influences employee satisfaction and loyalty, as equitable pay and benefits are fundamental to talent retention.

Each table also highlights additional unique factors. For instance, Table 2 underscores the importance of Promotion and Growth Opportunities for career advancement. Table 3 brings attention to Development Opportunities, Management/Leadership, Social Support, and Autonomy, emphasizing the value of an empowering and inclusive workplace culture. Table 4 broadens the perspective by including Talent Perception, Acknowledgment, Employee Work Participation, Biographical Characteristics, Benefits for Younger Employees, Organizational Support, and Expectations and Training Programs, showcasing a diverse range of employee engagement strategies. Lastly, Table 5 highlights the significance of Job Security as a pivotal concern for employee stability and retention.

By addressing both the common and unique factors highlighted across the tables, organizations can develop comprehensive retention strategies that address employees' diverse needs. Whether by fostering a healthy work-life balance, ensuring job security, or promoting opportunities for professional growth, these strategies are crucial for building a committed and satisfied workforce.

Understanding key factors such as development opportunities and compensation allows organizations to devise effective strategies that foster employee retention. These strategies contribute to creating a dedicated, engaged, and high-performing workforce.

As a fellow researcher exploring employee attrition prediction, this section delves into 17 critical factors, elaborating on each aspect's significance and its impact on both employee attrition and retention. This analysis represents a synthesis of my interpretations and perspectives, building on insights derived from previous research contributions. By critically evaluating these factors, I aim to provide a nuanced understanding of their influence, highlighting the complex interplay between organizational strategies and employee behavior. This discussion not only

contextualizes the findings within existing literature but also offers original insights that can inform targeted HR interventions.

- **Development Opportunities**

Development opportunities encompass the range of initiatives organizations implement to support professional growth and career advancement. In my perspective from the above references, these may include structured training programs, mentoring relationships, educational sponsorships, and clear career progression pathways. By offering these resources, companies enable employees to enhance their skills, gain new expertise, and prepare for future roles within the organization. This emphasis on development fosters a culture of continuous learning and improvement, empowering employees to set ambitious personal and professional goals. Knowing their growth is supported, employees are more motivated to invest in their work and align their aspirations with organizational objectives.

Providing robust development opportunities significantly impacts employee retention. When employees recognize that their employer is genuinely invested in their growth, they are more likely to develop a sense of loyalty and commitment to the organization. Such an environment not only boosts individual morale and engagement but also reduces turnover rates. Employees who feel supported in achieving their career goals are less likely to seek opportunities elsewhere. Conversely, organizations that neglect employee development risk losing talent to competitors who prioritize growth opportunities, leading to higher attrition and reduced workforce stability.

- Impact of Development Opportunities on Retention

Employees value opportunities for growth and advancement. Organizations that prioritize professional development through initiatives like training, mentorship, and career progression pathways create a culture of growth that drives retention. Employees are more likely to stay with employers who demonstrate a commitment to their personal and professional success. However, it is observed that, when growth opportunities are limited or absent, employees may feel stagnant and seek roles that

offer better prospects, increasing turnover rates.

- **Compensation**

Compensation refers to the financial and non-financial rewards employees receive in exchange for their work. It includes base salaries, bonuses, stock options, health insurance, retirement plans, and other benefits. Competitive compensation packages are vital for meeting employees' financial needs and expectations while reflecting their skills, experience, and industry benchmarks. Fairness in compensation is equally important, ensuring that employees are equitably rewarded for their contributions compared to peers within and outside the organization. Transparent pay practices and equal opportunities for financial advancement further foster trust and satisfaction, creating a positive workplace environment.

Unfair or inadequate compensation can lead to dissatisfaction, reduced morale, and disengagement. Employees who feel undervalued may question their worth to the organization, which can negatively affect productivity and teamwork. Disparities in pay can also breed resentment, undermining collaboration and unity within teams. Moreover, poor compensation practices can tarnish an organization's reputation, making it challenging to attract and retain top talent. Regularly reviewing compensation structures to ensure they align with market standards and address disparities is essential for maintaining employee satisfaction and trust.

- Impact of Compensation on Retention

Compensation plays a pivotal role in influencing employee retention. Employees expect fair and competitive remuneration that reflects their contributions, skills, and experience. Organizations that offer strong compensation packages, including competitive salaries and comprehensive benefits, are better equipped to attract and retain top talent. Conversely, inadequate compensation increases turnover risks, as employees seek better-paying opportunities elsewhere. This results in higher recruitment and training costs and disrupts team dynamics, ultimately impacting organizational performance. By prioritizing fair and competitive compensation

strategies, companies can enhance employee satisfaction, loyalty, and retention while fostering a stable and motivated workforce.

- **Work-Life Balance**

Work-life balance represents the equilibrium between professional responsibilities and personal life, enabling employees to manage work demands without compromising their health, family time, or leisure activities. In today's demanding and competitive work environment, achieving this balance is critical for maintaining employees' mental and physical well-being. Organizations that recognize this need often implement flexible work arrangements, such as adjustable working hours, remote work options, and encouragement to take regular breaks and vacations. Supporting work-life balance fosters employee satisfaction, improves morale, and boosts both productivity and creativity. Employees who can harmonize their work and personal lives are generally more engaged, less stressed, and more committed to their roles, contributing to a positive and effective workplace.

However, achieving work-life balance can be challenging due to the high expectations of modern workplaces. Many employees face multiple responsibilities that extend their working hours, making it difficult to disconnect from work. This imbalance can lead to stress, fatigue, and dissatisfaction in the long term. To address these challenges, employers and employees must collaboratively recognize and address signs of imbalance. Initiatives such as wellness programs, childcare support, and time management training can significantly enhance work-life integration. Organizations that prioritize such policies tend to attract and retain top talent, as employees value employers who support their overall well-being.

When work demands overshadow personal life, employees may experience burnout, marked by chronic stress, fatigue, and disengagement from work. Poor work-life balance often leads to diminished productivity, creativity, and job performance. Employees struggling to recharge may also face health issues, including anxiety, depression, and other stress-related conditions. Over time, these challenges can lead

to increased absenteeism and lower job satisfaction, eroding workplace morale and creating a less effective organizational environment.

High attrition rates are another significant outcome of poor work-life balance. Employees who feel unable to manage their professional and personal commitments often seek employment in organizations that better support a balanced lifestyle. This turnover imposes considerable costs on businesses, including recruitment, onboarding, and training expenses, as well as the loss of institutional knowledge. By creating a culture that values work-life balance, employers can address these risks, fostering a more loyal and motivated workforce. Encouraging employees to set boundaries and take time off is essential for reducing burnout and maintaining overall workforce stability.

Organizations that actively promote work-life balance reap numerous benefits, including improved employee retention. Flexible working hours, remote work opportunities, and manageable workloads help employees fulfill personal responsibilities and enjoy their leisure time. These practices lead to higher job satisfaction and engagement, reducing turnover rates. Conversely, failing to provide a balanced work environment can lead to stress, burnout, and attrition. Employees overwhelmed by excessive work demands are more likely to leave in search of roles that offer a healthier work-life integration.

- Impact of Work-Life Balance on Employee Retention

Work-life balance has become a priority for employees, as it allows them to manage personal and professional obligations effectively. Companies that support a balanced lifestyle through flexible schedules and supportive policies see higher retention rates and employee satisfaction. Poor work-life balance, on the other hand, contributes to burnout and dissatisfaction, driving employees to seek better opportunities. By fostering a workplace culture that prioritizes well-being and flexibility, organizations can enhance retention, reduce turnover costs, and build a dedicated, productive workforce.

- **Management and Leadership**

The role of management and leadership within an organization is fundamental in shaping overall performance, employee satisfaction, and workplace culture. Effective leadership directly impacts the work environment, influencing employee morale and engagement. Strong leaders set clear goals and expectations, inspiring and motivating their teams to achieve them. They prioritize open communication, transparency, and empathy, fostering trust and rapport with their employees. Additionally, good managers provide constructive feedback, encourage skill development, and create opportunities for career growth, ensuring that employees feel supported and valued. When employees perceive their leaders as supportive and empowering, they are more likely to remain engaged, committed, and satisfied in their roles, resulting in higher productivity and organizational success.

In contrast, poor management practices can harm employee retention and negatively affect the workplace atmosphere. Ineffective communication, unclear direction, and a lack of recognition from managers can create a toxic work culture marked by low morale and high stress. Employees who feel micromanaged, undervalued, or unsupported often become disengaged and dissatisfied, leading to reduced productivity and a higher likelihood of turnover. Such environments push employees to seek opportunities elsewhere, particularly where their contributions will be better appreciated. As a result, organizations must prioritize leadership development and adopt effective management practices to build a motivated and loyal workforce.

The link between management quality and employee turnover is undeniable. Ineffective leadership significantly raises turnover rates as employees grow dissatisfied with their work environment. Issues such as insufficient recognition, poor communication, and lack of managerial support can lead to frustration and disconnection. Employees who do not feel valued or heard are more likely to experience reduced motivation and engagement, prompting them to leave for

organizations offering a more supportive culture. High turnover not only disrupts operational efficiency but also imposes financial burdens related to recruiting, onboarding, and training replacements. Addressing shortcomings in management practices is critical for reducing attrition and ensuring organizational stability.

Conversely, strong leadership practices cultivate loyalty and long-term employee commitment. Leaders who prioritize the well-being of their teams, celebrate achievements, and facilitate growth opportunities foster a positive, inclusive, and supportive workplace. Employees in such environments are more likely to invest in their roles and contribute meaningfully to the organization's success. Effective leaders build trust and collaboration, which enhances job satisfaction and retention. Employees are less inclined to leave an organization where they feel valued, empowered, and recognized for their contributions. By nurturing skilled leadership and adopting effective management strategies, organizations can enhance retention, improve overall performance, and maintain a competitive advantage in the marketplace.

- Impact of Management and Leadership on Employee Retention

Management and leadership quality play a vital role in influencing employee retention. Effective leaders inspire their teams, provide clear guidance, and offer consistent support and recognition. This fosters a positive work environment, boosts employee engagement, and builds trust. Employees who feel appreciated and supported by their leaders are more likely to remain with the organization. On the other hand, poor management practices, such as ineffective communication, lack of recognition, and micromanagement, lead to dissatisfaction and higher turnover. Employees who feel mismanaged or undervalued are more inclined to leave for organizations that offer better leadership and support.

- **Work Environment:**

The work environment encompasses both the physical and psychological conditions that define an organization's workplace. It includes tangible factors such as

office layout, lighting, noise levels, and ergonomic furniture, which collectively influence employees' physical well-being and efficiency. A well-structured and comfortable workspace promotes better morale, enhances productivity, and minimizes physical strain, contributing to higher job satisfaction.

From a psychological perspective, the work environment also refers to the emotional and social climate of the workplace. Key elements include interpersonal dynamics, organizational culture, and access to resources and support systems. When employees feel secure, valued, and connected, they are more likely to remain engaged, motivated, and committed to their roles.

Conversely, an adverse work environment can have significant negative repercussions on employees and the organization. Suboptimal physical conditions such as poor lighting, inadequate ventilation, and cramped workspaces may cause discomfort, stress, and even health problems, leading to diminished productivity and job dissatisfaction. Psychologically, environments with excessive stress, poor communication, inadequate support, or a toxic culture create feelings of disengagement and undervaluation among employees. These factors can drive talent away, increasing turnover and harming overall morale.

High employee turnover exacerbates the challenges of a negative environment. Departing employees often leave remaining staff with heavier workloads, creating a cycle of stress and dissatisfaction. Organizations that fail to address these issues risk perpetuating a downward spiral of attrition and declining morale.

To retain top talent, organizations must prioritize improving the physical and psychological conditions of their workspaces. Ensuring safety, comfort, and accessibility in the physical environment is critical. This includes ergonomic design, adequate lighting, and maintaining air quality. Psychologically, fostering a culture of respect, collaboration, and recognition creates a supportive and inclusive atmosphere where employees feel valued and motivated.

A positive work environment not only boosts retention but also enhances overall organizational performance. Employees who feel supported and engaged are more productive, innovative, and loyal. By addressing physical and emotional needs, organizations can establish a workplace that attracts and retains exceptional talent.

- **Impact of Work Environment on Employee Retention:**

A key step to reducing high attrition rates is actively mitigating the factors that contribute to a negative work environment. Poor management practices, lack of career growth opportunities, and inadequate recognition often lead to employee dissatisfaction. Offering development opportunities, maintaining open communication, and acknowledging contributions are essential strategies to create a thriving workplace.

In today's competitive job market, employees have numerous opportunities, making it critical for organizations to maintain environments where individuals feel safe, supported, and valued. By focusing on both physical and psychological elements, organizations can cultivate a workplace conducive to employee retention and long-term success.

This renewed emphasis on the importance of a positive work environment highlights its role not just in retention but also in shaping a dynamic and high-performing workforce.

- **Social Support:**

Social support in the workplace refers to the assistance, resources, and encouragement that employees receive from colleagues, supervisors, and the organization as a whole. It manifests in various forms, including emotional support, practical assistance, and knowledge-sharing. Emotional support involves empathy, understanding, and encouragement, helping employees navigate workplace challenges and stress. Practical assistance entails helping with tasks, providing solutions, and offering resources to make work more manageable. Meanwhile, the exchange of

knowledge and expertise fosters a collaborative atmosphere that supports professional growth. A workplace that prioritizes social support creates an inclusive and positive environment where employees feel valued and respected.

The significance of social support cannot be overstated. Employees who receive encouragement and help from their peers and supervisors tend to feel a stronger connection to the organization. This sense of belonging fosters job satisfaction and alleviates isolation, especially in demanding work environments. Supported employees are typically more engaged, motivated, and productive, contributing positively to organizational goals. Additionally, social support mitigates burnout, strengthens employee loyalty, and reduces turnover rates, which are critical for organizational stability. By nurturing a culture of support, companies can boost employee well-being, satisfaction, and retention.

Strong support networks within a workplace serve as a vital element in retaining talent. These networks provide a foundation of reliability, helping employees feel secure and valued. Access to supportive colleagues and supervisors equips employees to overcome challenges, manage stress, and maintain a positive perspective on their roles. This environment of teamwork and camaraderie enhances overall morale and fosters a sense of unity. Employees who feel part of a supportive community are more likely to remain with the organization, appreciating its collaborative and encouraging culture.

Supportive workplaces cultivate loyalty and a deep connection to organizational objectives. Employees in such environments are more willing to go above and beyond their responsibilities, driven by their attachment to the workplace. Moreover, social support helps individuals manage work-related stress effectively, reducing the risk of burnout and attrition. Organizations that invest in building robust support systems benefit from a stable and committed workforce. Low turnover rates and high employee satisfaction underscore the value of prioritizing support in the workplace.

- Impact of Social Support on Employee Retention:

Social support directly influences employee retention by promoting a culture of collaboration, empathy, and teamwork. Employees who feel supported are more engaged and committed, reducing the likelihood of seeking opportunities elsewhere. A strong sense of community and belonging enhances job satisfaction and fosters long-term loyalty. On the other hand, the absence of social support can lead to feelings of isolation, disengagement, and eventually, attrition.

Organizations that emphasize social support, creating environments where employees feel understood and valued, are more likely to retain their talent. These efforts result in stronger organizational cohesion and a workforce that thrives in a nurturing and collaborative atmosphere.

- **Autonomy**

Autonomy in the workplace refers to the degree of control and independence employees exercise over their responsibilities, decision-making, and the methods they use to accomplish their work. It includes the ability to set schedules, determine task priorities, and choose methods to achieve goals. When employees experience high levels of autonomy, they feel empowered and trusted by their organization. This empowerment fosters a motivated and engaged workforce, as employees can utilize their skills and creativity to execute their responsibilities in ways that align with their strengths and preferences. Autonomy also encourages employees to take ownership of their work, promoting a deeper sense of accountability and pride in their accomplishments.

Granting employees autonomy has a direct and positive impact on job satisfaction. Employees who have the freedom to control their work environment are more likely to find fulfillment in their roles. Autonomy enables individuals to tailor their work processes to fit their unique needs, reducing frustrations that arise from rigid structures or excessive oversight. The flexibility provided by autonomy contributes to a more balanced work-life dynamic, as employees can manage their time

and energy more effectively. This balance plays a critical role in preventing stress and burnout, leading to enhanced job satisfaction.

High levels of autonomy are strongly correlated with improved employee retention. When employees feel trusted to manage their work, they are more motivated, productive, and loyal to their organization. The sense of empowerment that autonomy provides creates a stronger emotional connection to the workplace, encouraging employees to stay long-term. On the other hand, a lack of autonomy can lead to frustration, disengagement, and feelings of being undervalued, which are significant factors driving turnover. Micromanagement and overly rigid work structures are common culprits behind low retention rates.

Organizations that prioritize autonomy foster a culture of trust, innovation, and collaboration. Empowered employees often bring new ideas and improvements to their roles, contributing to the organization's overall success. Additionally, autonomy reduces the need for constant supervision, allowing managers to focus on strategic initiatives while employees handle their responsibilities independently. This dynamic not only strengthens productivity but also builds a workplace atmosphere where employees feel respected and valued.

Workplaces that fail to provide autonomy often experience higher levels of dissatisfaction and attrition. Employees in such environments may feel micromanaged or constrained, preventing them from reaching their full potential. This lack of freedom can stifle creativity and hinder problem-solving abilities, ultimately leading to reduced job satisfaction and a decline in morale. Furthermore, employees who feel undervalued or restricted are more likely to seek opportunities elsewhere, increasing turnover rates and the associated costs for the organization.

- Impact of Autonomy on Retention Strategies

For organizations aiming to improve employee retention, fostering autonomy should be a key strategy. Providing employees with the freedom to make decisions, manage their tasks, and control their schedules not only enhances their work

experience but also strengthens their commitment to the company. Employees who feel empowered are more likely to develop a sense of loyalty and motivation, reducing the likelihood of seeking alternative employment.

By embedding autonomy into workplace policies and practices, organizations can create an environment that values trust, innovation, and personal accountability. This approach not only improves individual satisfaction but also builds a resilient and committed workforce, benefiting both employees and the organization as a whole.

- **Training and Development:**

Professional development encompasses a variety of activities aimed at enhancing employees' skills, knowledge, and expertise. These initiatives may include formal training programs, workshops, certifications, online courses, and experiential learning on the job. By offering these opportunities, organizations enable employees to stay abreast of industry advancements, emerging technologies, and evolving best practices. High-quality professional development not only boosts individual performance but also fosters a culture of learning and growth, driving organizational success. Employees with access to such opportunities often feel recognized and motivated, as they perceive a clear pathway for career progression and personal development.

The availability and quality of professional development programs are vital factors in enhancing employee satisfaction and retention. Effective programs are tailored to address the specific needs of employees while aligning with broader organizational objectives. Delivered by skilled trainers, these programs equip employees with practical, immediately applicable skills. Organizations that prioritize employee growth demonstrate a commitment to their workforce, which can enhance morale, build loyalty, and improve overall job satisfaction. In today's competitive job market, robust professional development offerings serve as a key differentiator in attracting and retaining top talent.

The absence of professional development opportunities can have significant negative implications for employee retention. Without opportunities to advance their skills or progress in their careers, employees may feel stagnant and unfulfilled. This sense of stagnation can lead to disengagement and demotivation, prompting them to seek roles in organizations that prioritize growth and development. High turnover rates caused by a lack of development not only disrupt operations but also impose costs related to recruitment, onboarding, and lost productivity.

Providing professional development opportunities enhances an organization's ability to remain competitive in its industry. Continuous learning ensures that employees are equipped to adapt to technological advancements and evolving methodologies, enabling them to perform at their best. Conversely, without proper training, employees may struggle to meet industry standards, which can reduce productivity and compromise service quality. This can leave the organization vulnerable to competitors that invest in innovative, well-prepared workforces.

- Impact of Training and Development on Employee Retention

Investing in training and development programs is crucial for fostering employee loyalty and retention. When organizations commit to nurturing their workforce through continuous learning, employees feel valued and empowered. Opportunities to enhance skills and grow professionally lead to increased job satisfaction, as employees see their future within the organization. This reduces turnover rates, as employees are less likely to leave a workplace that supports their career aspirations.

Conversely, a lack of such opportunities can result in frustration and disengagement, pushing employees to seek growth elsewhere. By making professional development a priority, organizations can build a committed and high-performing workforce while driving long-term success and innovation.

- **Promotion and Opportunity for Growth:**

Employee motivation is a fundamental determinant of whether individuals choose to remain with a company. Motivated employees exhibit higher levels of engagement, productivity, and loyalty, significantly contributing to organizational success. Factors such as work-life balance, competitive compensation, a positive work environment, and recognition influence motivation. When employees feel appreciated and valued, their motivation increases, making them more inclined to stay. Conversely, insufficient motivation often leads to disengagement, reduced performance, and higher turnover. Organizations that prioritize motivation foster a workplace culture that supports retention and encourages long-term contributions from their workforce.

Both intrinsic and extrinsic factors play a vital role in shaping employee motivation. Intrinsic motivators include personal growth, job satisfaction, and a sense of achievement, which are often cultivated through meaningful and challenging work. Providing opportunities for employees to explore their strengths and tackle stimulating projects enhances their sense of fulfillment.

Extrinsic motivators, such as competitive salaries, performance-based bonuses, and other tangible rewards, also significantly impact employee retention. Employers who address these motivational needs holistically—by offering both intrinsic and extrinsic rewards—create an environment that supports long-term engagement and loyalty.

Opportunities for career growth and advancement are pivotal for employee motivation and retention. Employees who perceive clear and attainable paths for progression within the organization are more likely to remain committed and invest their efforts in their roles. Career advancement can be facilitated through promotions, participation in professional development programs, and access to skill-building initiatives.

Without such opportunities, employees may feel undervalued and stagnant, prompting them to seek growth elsewhere. Organizations that prioritize career

development not only retain talent but also foster a workforce that is motivated, skilled, and aligned with the company's objectives.

The availability of career advancement opportunities demonstrates an organization's commitment to its employees' professional growth. This commitment builds trust and loyalty, strengthening the bond between employees and their employer. Regular performance reviews, mentorship programs, and specialized training workshops are effective ways to support employee development. By aligning organizational goals with individual career aspirations, companies can create a culture of mutual growth and shared success.

- The Impact of Growth on Employee Retention

Providing clear opportunities for promotion and skill development significantly enhances employee retention. Career growth initiatives give employees a sense of value and progression, boosting their job satisfaction and reinforcing their commitment to the company. When employees see a future within the organization, their motivation to contribute increases, reducing turnover rates.

Conversely, the absence of growth opportunities can result in dissatisfaction and disengagement, leading employees to seek advancement elsewhere. Organizations that invest in employee development foster a motivated and dedicated workforce, driving long-term success and stability. By emphasizing career growth, companies ensure their employees feel valued and equipped to meet both personal and professional goals.

- **Talent Perception:**

Talent perception in an organizational context refers to the recognition and evaluation of employees' skills, capabilities, and potential contributions. It reflects how management and colleagues assess an individual's value to the organization. When talent is effectively acknowledged and appreciated, it fosters a sense of motivation and morale among employees. Recognition can take many forms, such as

regular feedback sessions, constructive performance evaluations, or opportunities for career growth based on an employee's strengths. Such recognition reinforces employees' sense of worth, encouraging them to stay committed to their roles and the organization.

Talent perception plays a vital role in shaping the overall culture of an organization and its impact on employee engagement. When employees feel that their talents and abilities are acknowledged, they experience higher levels of job satisfaction. This stems from a sense of validation and respect for their contributions, which translates into improved productivity and loyalty. Conversely, a lack of recognition or negative perceptions of talent can lead to dissatisfaction and disengagement, driving employees to seek opportunities where their contributions are better valued.

An organization's approach to valuing and perceiving talent has a direct impact on job satisfaction. Employees who feel recognized for their skills and potential often experience a sense of fulfilment, knowing their work aligns with organizational objectives. This alignment fosters a positive and collaborative work environment. Employees are more likely to demonstrate loyalty and long-term commitment to organizations that actively recognize their contributions and offer opportunities for personal and professional growth.

Positive talent perception is a critical factor in improving employee retention rates. Employees who feel appreciated and valued are less likely to seek employment elsewhere, helping to reduce turnover and the associated costs. By investing in understanding and utilizing employees' strengths, organizations can build a supportive workplace culture. This culture not only enhances individual job satisfaction but also fosters collective engagement, reducing attrition and promoting organizational stability.

Talent perception serves as a foundational element in shaping employee attitudes and behaviors. When employees believe their talents are recognized, they are

more likely to remain motivated and engaged, contributing to the organization's success. Furthermore, organizations that prioritize talent perception benefit from a more cohesive and loyal workforce. Acknowledging and leveraging employee strengths enables companies to build strong relationships with their teams, aligning individual and organizational goals to achieve sustained growth.

To leverage the benefits of positive talent perception, organizations must actively recognize and nurture employees' skills. This can be achieved through consistent feedback, development programs, and opportunities for advancement tailored to individual strengths. By aligning recognition practices with the organization's objectives, companies create an environment where employees feel valued and empowered.

Such a culture fosters collaboration, innovation, and long-term dedication to the organization's goals. Ultimately, prioritizing talent perception helps businesses drive retention, enhance productivity, and establish a workforce committed to collective success.

- Impact of Talent Perception:

Talent perception, which involves recognizing and appreciating employees' skills, capabilities, and potential, plays a crucial role in shaping workplace dynamics. When organizations actively identify and leverage the unique talents of their workforce, it leads to increased job satisfaction and the cultivation of a supportive work environment. Employees who feel acknowledged for their contributions are more likely to remain engaged, motivated, and committed to their responsibilities.

This recognition fosters loyalty and significantly boosts retention rates, as employees are less likely to seek opportunities elsewhere when their value is acknowledged. By promoting a culture that emphasizes talent appreciation, organizations can minimize turnover, enhance overall productivity, and build a dedicated team that contributes to long-term success and the achievement of collective goals.

- **Acknowledgement:**

Acknowledgment serves as a cornerstone for employee motivation and loyalty within the IT sector. In an industry characterized by rapid innovation and high-pressure demands, recognition of employees' contributions plays a pivotal role in maintaining morale. Whether through verbal praise, awards, or formal acknowledgments, recognizing efforts affirms employees' value, validating their hard work and dedication. This recognition acts as a catalyst for boosting job satisfaction, instilling a sense of purpose and pride in their roles, and fostering a deeper emotional connection to their organization.

In addition to morale, acknowledgment builds a foundation of loyalty among IT professionals. Employees who feel genuinely valued are more likely to commit to their teams and organizations. Such recognition inspires them to go beyond expectations, knowing their contributions are noticed and appreciated. Consequently, this loyalty reduces turnover rates, as employees feel more inclined to stay in an environment where their efforts are respected.

Acknowledgment influences various facets of workplace dynamics, significantly benefiting both employees and organizations. On a personal level, consistent recognition of achievements fosters a culture of appreciation and positivity. Employees feel more motivated and engaged, leading to heightened morale and increased job satisfaction. Recognized employees tend to perceive their work as meaningful and fulfilling, which further enhances their overall well-being.

From an organizational perspective, acknowledgment is a powerful tool for employee retention. Valued employees are more likely to remain with their current employer, perceiving the organization as supportive and appreciative of their contributions. This sense of belonging and respect strengthens trust and mutual understanding between employees and management, resulting in long-term workforce stability.

- Impact of Acknowledgment on Employee Retention

In the IT sector, acknowledgment is a critical driver of employee retention. Recognized employees experience heightened morale and job satisfaction, creating a workplace environment that encourages dedication and productivity. This positive atmosphere fosters loyalty, making employees less inclined to seek external opportunities. Regular acknowledgment highlights the organization's commitment to its workforce, reinforcing the perception that employees are integral to its success. This mutual respect and recognition reduce turnover rates and build a robust, stable workforce committed to the company's growth.

Acknowledgment is more than just a gesture—it is a strategic approach that aligns individual fulfillment with organizational goals, ensuring mutual growth and long-term success.

- **Employee work participation:**

Active participation of employees in organizational activities and tasks is a cornerstone of a productive and engaged workforce. When employees are deeply involved in their responsibilities, they bring their unique skills, creativity, and expertise to the table, driving the organization toward achieving its goals. This engagement not only boosts overall productivity but also instils a sense of ownership and accountability. Employees who feel connected to their work often experience higher job satisfaction and motivation, leading to enhanced performance.

Moreover, fostering employee participation strengthens teamwork and collaboration within the organization. Actively involved employees are more likely to communicate effectively, exchange ideas, and work cohesively to achieve shared objectives. These collaborative efforts enrich organizational culture, forge stronger interpersonal relationships, and create an environment of mutual respect and learning. As employees share their insights and experiences, they contribute to continuous personal and professional development.

Creating avenues for employee involvement fosters a workplace atmosphere where employees feel valued and engaged. Such an environment not only drives

innovation and productivity but also promotes employee retention. A sense of belonging and fulfilment developed through active participation reduces turnover and builds a stable, committed workforce.

- Contribution of Employee Participation to Retention

The active involvement of employees significantly impacts their decision to remain with an organization. When employees are engaged in their work and organizational activities, they feel a deeper connection to their roles, responsibilities, and the organization's mission. This connection translates into increased loyalty, driving them to contribute their best efforts toward achieving the company's objectives. Employees who take pride in their tasks are more likely to stay with the company over the long term.

Additionally, active participation fosters accountability and ownership, with employees taking pride in their accomplishments. This sense of achievement enhances job satisfaction and reinforces the value of their contributions. Employees who find meaning and purpose in their work are more inclined to view their roles as impactful, further strengthening their commitment to the organization. Organizations can enhance employee retention by implementing strategies that encourage active participation. These include:

Fostering Collaboration: Creating opportunities for teamwork ensures that employees feel supported and connected.

Empowering Employees: Providing employees with the autonomy to make decisions fosters a sense of responsibility and trust.

Recognizing Contributions: Acknowledging and celebrating employee achievements builds morale and reinforces their commitment.

By emphasizing these strategies, organizations create a positive workplace culture where employees feel valued, motivated, and engaged. This environment not only enhances productivity and innovation but also ensures long-term retention,

contributing to a thriving and stable workforce.

- **Biographical Characters:**

Research highlights that demographic variations significantly impact employees' career aspirations and retention decisions. Understanding these differences is critical for organizations to address the diverse expectations of their workforce effectively. Factors such as age, gender, race, and marital status shape how employees perceive their career paths and what motivates them to stay in their roles. Younger employees, for instance, often prioritize opportunities for rapid advancement and continuous learning, while older employees may place greater importance on job security and long-term stability. Gender differences also play a significant role, with women frequently valuing flexible work arrangements to balance family responsibilities, while men may focus more on financial incentives. Recognizing and accommodating these demographic distinctions allows organizations to design more effective career development and retention strategies.

Generational cohorts bring distinct expectations to the workplace, which influence job satisfaction and retention. Millennials and Generation Z employees tend to seek purposeful work, regular feedback, and avenues for personal growth. On the other hand, Baby Boomers often prioritize loyalty, stability, and comprehensive benefits. These generational preferences necessitate tailored approaches to workforce engagement, as failure to address these differences can lead to higher turnover rates. By adapting organizational practices to meet the expectations of different age groups, employers can cultivate a more inclusive and harmonious work environment, which bolsters employee satisfaction and retention.

Biographical characteristics such as age, gender, and cultural background are pivotal in shaping the psychological contract—an unwritten understanding of mutual expectations between employees and employers. For example, younger employees may expect frequent opportunities for advancement and feedback, whereas older employees often value job security and respect for their experience. When these

psychological contracts are honored, employees tend to feel more satisfied and committed to their roles, thereby reducing the likelihood of turnover.

Career development theories also emphasize that biographical factors influence career aspirations and developmental needs. Women in the workplace may benefit from mentorship and leadership development programs designed to address historical barriers to career progression, while employees from minority backgrounds might prioritize diversity and inclusion initiatives that celebrate their unique contributions. Aligning organizational support with these diverse needs enhances job satisfaction and promotes long-term retention.

To address demographic differences effectively, organizations should implement personalized career development strategies, such as targeted training, mentorship programs, and inclusive policies. Creating an environment that values diversity and supports the distinct career paths of employees strengthens the psychological contract and aligns with career development theories advocating for continuous growth. Employers who proactively assess and address the evolving needs of their workforce foster a sense of belonging and commitment among employees.

- Impact of Demographical Characters on Employee Retention:

Demographic factors such as age, gender, and cultural background are critical in shaping employee retention strategies. Younger employees emphasize opportunities for rapid career progression and skills development, while older workers value respect and stability. Gender-related preferences often focus on achieving a balance between work and personal responsibilities, with flexible arrangements being highly valued by many women. Similarly, generational differences reveal varying priorities: Millennials and Generation Z seek purpose-driven work and feedback, whereas Baby Boomers emphasize loyalty and comprehensive benefits.

By addressing these demographic nuances through tailored career development programs and fostering an inclusive workplace culture, organizations can enhance employee engagement and commitment. Recognizing and meeting these diverse

expectations not only reduces turnover rates but also ensures that employees feel valued and supported in their career journeys, contributing to the long-term success of the organization.

- **Young Employees' Benefits**

In today's competitive job market, retaining young employees requires a comprehensive approach that addresses critical elements such as training, job satisfaction, and job performance. Organizations must recognize that their young workforce is essential for long-term success and invest in strategies that meet their expectations and aspirations.

Training is a cornerstone of employee retention, as it provides young employees with the skills and knowledge necessary to excel in their roles. Companies that offer tailored and robust training programs signal their commitment to employee development, fostering a sense of loyalty and belonging. When employees see opportunities for career advancement within the organization, they are more likely to remain committed. Additionally, continuous learning programs help young professionals feel confident in their abilities, which boosts overall job satisfaction and performance.

Job satisfaction is a key determinant of employee retention, particularly for younger workers who often value a sense of purpose and recognition in their roles. A positive work environment, where contributions are appreciated and professional growth is encouraged, creates a sense of fulfillment that reduces turnover rates. Moreover, when employees feel satisfied with their jobs, they are more engaged, motivated, and aligned with the organization's goals, which leads to greater commitment and loyalty.

Job performance is intrinsically linked to retention, as high-performing employees are more likely to feel accomplished and valued. Organizations can enhance performance by providing regular feedback, acknowledging achievements, and offering opportunities for further development. Effective training programs and a

supportive work culture play a pivotal role in this process, creating a cycle where improved performance leads to higher satisfaction and a stronger desire to stay with the organization.

For young employees, training, job satisfaction, and job performance are deeply interwoven, forming the foundation of a retention strategy. Effective training enhances job performance, which in turn boosts satisfaction and reduces the likelihood of turnover. A supportive work environment that emphasizes these factors helps young professionals feel competent and appreciated, encouraging them to build long-term careers within the organization.

Investing in the retention of young employees yields significant organizational benefits. A stable and engaged workforce drives innovation, productivity, and competitiveness. Tailored training programs enhance employee skills, fostering a dynamic environment where talent thrives. Similarly, job satisfaction initiatives that focus on recognition and positive reinforcement contribute to a motivated and cohesive team. When employees perceive their company as a place where they can grow and succeed, they are more likely to reciprocate with long-term loyalty and dedication.

As the workplace continues to evolve, companies must adapt their strategies to meet the changing expectations of young employees. Focusing on professional growth, recognition, and competency development ensures that organizations remain attractive to top talent. By addressing these retention factors with intention and care, companies not only reduce turnover rates but also cultivate a workforce capable of driving sustained growth and success.

- Impact of Young Employee Benefits on Retention

Retention of young employees depends on a balanced focus on training, satisfaction, and performance. Comprehensive training enhances skills and fosters loyalty, while job satisfaction, driven by a positive work environment and recognition—boosts engagement. High job performance, achieved through ongoing development and encouragement, ensures employees feel competent and valued.

These interconnected factors create a growth-oriented workplace, enabling organizations to retain top talent and maintain a dynamic, innovative workforce that supports long-term success.

- **Organisational Support:**

Support from colleagues and the organization is a cornerstone of employee satisfaction and engagement. When employees feel supported by their peers, it nurtures a sense of camaraderie and belonging, which directly enhances their workplace experience. Colleague support can manifest in numerous ways, such as sharing expertise, providing help with tasks, offering emotional encouragement during tough times, and celebrating team successes. These actions foster an atmosphere of teamwork and mutual respect, creating a workplace where employees feel valued and understood.

Equally essential is the support extended by the organization itself. Organizations that actively invest in their employees' well-being demonstrate that their growth and happiness are valued. This commitment can take many forms, including:

Organizations can foster a supportive work environment by implementing several key initiatives. Offering resources for professional development helps employees enhance their skills and advance their careers, demonstrating the organization's commitment to their growth. Maintaining open and transparent communication between employees and leadership builds trust and ensures that employees feel heard and valued. Implementing fair performance evaluation systems ensures equity and clarity in assessing employee contributions, reinforcing a sense of fairness. Additionally, providing support services such as counselling, wellness initiatives, and flexible work arrangements promotes overall well-being and work-life balance. Together, these measures create a workplace where employees feel supported, valued, and motivated to contribute to the organization's success. Such measures not only help employees manage work-related pressures but also promote a healthy work-

life balance, a key driver of long-term satisfaction and loyalty.

A robust support network within the workplace acts as a buffer against stress and challenges. Employees who can rely on their colleagues and organization for guidance and emotional support feel more secure and motivated. This security fosters resilience and confidence, enabling them to navigate workplace demands effectively. Organizations that emphasize building and sustaining these networks create an environment where employees are encouraged to grow both personally and professionally.

Organizations that prioritize support see significantly higher retention rates. Employees who feel genuinely valued by their peers and organization are less likely to seek opportunities elsewhere, as they appreciate the positive relationships and supportive culture they have developed. When organizations demonstrate a genuine commitment to employee development and well-being, employees respond with loyalty and long-term engagement.

Moreover, supportive environments foster high levels of engagement and satisfaction, key predictors of retention. Engaged employees are more committed to their work and consistently contribute to organizational success. By investing in support systems, organizations benefit from a productive, loyal, and motivated workforce.

To cultivate a supportive workplace environment, organizations can implement a range of impactful practices. Encouraging teamwork and knowledge sharing among colleagues fosters collaboration and strengthens professional relationships. Providing resources and opportunities for career growth demonstrates a commitment to employee development, enhancing engagement and loyalty. Offering wellness programs and flexible policies addresses work-life balance needs, promoting overall well-being and reducing stress. Transparent communication and fair performance management processes build trust and ensure that employees feel recognized and appreciated. Collectively, these initiatives create an inclusive and

supportive culture where employees feel valued, motivated, and committed to staying with the organization long-term.

- **Impact of Support on Retention**

The support employees receive from their colleagues and organization is integral to retention. When organizations prioritize fostering strong support networks, they create an environment where employees feel secure, engaged, and fulfilled. This sense of security and value reduces turnover, as employees are less inclined to leave an environment where they feel appreciated and supported.

By focusing on professional development, transparent communication, and wellness programs, organizations not only enhance satisfaction and productivity but also strengthen employees' commitment to the company. Supportive workplaces encourage loyalty and create the conditions for sustained success and growth.

Support within the workplace is indispensable for fostering job satisfaction, engagement, and long-term retention. Organizations that recognize and invest in the importance of colleague and organizational support create a positive and inclusive work environment. This investment benefits both employees and the organization by reducing turnover, boosting morale, and enhancing productivity. Through strong support networks, companies can ensure sustained success and cultivate a workforce that is both loyal and committed to achieving organizational goals.

- **Job Security:**

Job security serves as a fundamental pillar of a stable career, offering employees the reassurance that their positions are protected against unexpected layoffs or dismissals. This sense of stability allows individuals to concentrate on their professional growth without the constant fear of job loss. By acting as a shield against economic fluctuations and market volatility, job security not only provides immediate peace of mind but also enables employees to make long-term plans, such as purchasing a home or investing in their children's education. With the ability to anticipate their

career trajectory, employees can set realistic goals and work towards them with confidence.

For employers, job security is equally advantageous, as it cultivates a loyal and committed workforce. Employees who feel secure in their roles are more likely to invest in the company's success, knowing that their contributions are valued. This alignment of employee and organizational interests creates a mutually beneficial relationship that fosters long-term collaboration. Job security also acts as a differentiator for companies in competitive job markets, positioning them as employers of choice for top talent.

The assurance of job security is a key factor in retaining skilled employees. When workers feel secure, they are less likely to explore other opportunities, leading to reduced attrition rates. Retaining experienced staff is critical for organizations, as it preserves institutional knowledge and maintains team cohesion. High turnover, on the other hand, can disrupt workflows, weaken team dynamics, and result in significant costs associated with recruiting and training new employees.

Job security also nurtures a culture of loyalty and commitment. Employees who perceive their roles as stable are more inclined to contribute actively to the company's vision and objectives. This sense of shared purpose strengthens organizational bonds and enhances employee satisfaction, creating a workforce that is engaged, motivated, and aligned with long-term goals.

In an era where frequent job changes have become the norm, companies that offer job security stand out as attractive employers. This stability appeals to individuals seeking predictability and career growth, making it a key factor in attracting top talent. Moreover, job security fosters a sense of partnership between employees and employers, reducing short-term turnover and building a sustainable, forward-thinking workforce.

- Impact of Job Security on Employee Retention

Job security plays a pivotal role in retaining employees by providing them with confidence and stability. It enables workers to navigate economic uncertainties with assurance, fostering an environment where they can thrive professionally and personally. This stability enhances job satisfaction, encourages long-term commitment, and minimizes attrition rates. Furthermore, organizations that prioritize job security retain critical institutional knowledge and maintain continuity, ensuring they remain competitive in their industries.

By aligning employee aspirations with organizational goals, job security fosters a sense of loyalty and shared purpose. This alignment not only reduces the likelihood of employees seeking opportunities elsewhere but also strengthens the company's reputation as a desirable place to work. In a highly competitive job market, prioritizing job security is a strategic advantage that benefits both employees and employers, contributing to sustained success and growth.

- **Remote Working:**

Remote working, or telecommuting, is a work arrangement that allows employees to perform their duties outside the traditional office environment. With advancements in communication technologies such as high-speed internet, video conferencing, and cloud-based tools, remote working has become an increasingly viable and popular option for organizations and employees alike.

One of the most significant advantages of remote working is its impact on employee retention. Offering flexibility and work-life balance, remote working appeals to employees who value autonomy and control over their schedules. By eliminating the daily commute, employees can save time and reduce stress, leading to improved morale and overall well-being. These benefits contribute to increased job satisfaction, which in turn lowers turnover rates and strengthens employee loyalty.

Remote working also has the potential to enhance productivity and efficiency. Many employees report fewer workplace distractions when working from home, enabling them to concentrate more effectively on their tasks. This improved focus

often translates to higher engagement and commitment to their roles. For organizations, offering remote work options can lead to operational cost savings, as fewer employees require dedicated office space and related resources.

However, remote working is not without challenges. Organizations must proactively address issues such as communication gaps and feelings of isolation among remote employees. Providing the necessary technological tools, fostering regular virtual interactions, and establishing clear expectations are critical for ensuring remote teams remain connected and aligned with organizational objectives. Employers also need to create robust remote work policies to maintain accountability while supporting flexibility.

- Impact of remote working on Employee Retention

Remote working has emerged as a key factor in modern employee retention strategies. Its ability to attract and retain talent by providing flexibility, enhancing job satisfaction, and improving productivity makes it an attractive option for organizations looking to thrive in a competitive labour market. However, effective implementation requires thoughtful planning, consistent communication, and support systems to address potential challenges. Organizations that embrace remote working as part of their workplace strategy can position themselves as employers of choice, fostering a culture of inclusivity, engagement, and long-term commitment.

Employee attrition is strongly influenced by factors such as compensation and work-life balance, which are pivotal in determining whether employees remain with an organization. Competitive compensation not only reflects the value of employees' contributions but also meets their financial expectations, making it a cornerstone of talent retention. Equally important, work-life balance has become a primary focus for employees seeking harmony between professional responsibilities and personal priorities.

Organizations that prioritize flexible work arrangements, such as remote working and wellness programs, demonstrate a commitment to employees' holistic

well-being. These efforts enhance retention rates by fostering a positive and supportive work environment. Additionally, a workplace culture characterized by inclusivity, effective leadership, and open communication promotes engagement and satisfaction, further reducing turnover. Opportunities for career growth, supported by robust training and development programs, also contribute to retention by offering employees a clear path for advancement within the organization.

While multiple factors impact attrition, focusing on compensation and work-life balance is paramount for organizations aiming to create a nurturing and fulfilling workplace. By addressing these critical needs, companies can inspire long-term loyalty and commitment, cultivating a resilient and engaged workforce that drives organizational success.

Employee retention refers to the efforts made by organizations to encourage employees to remain with the company for an extended period or until the completion of specific projects (Kamalaveni et al., 2019). Retention is shaped by various factors, including organizational identification, employee engagement, commitment, and job satisfaction (Chatzoudes and Chatzoglou, 2022). Key drivers of retention include organizational culture, communication, strategic alignment, and career development opportunities, all of which contribute to creating a supportive and fulfilling workplace environment.

A strong organizational culture, where employees feel valued and aligned with the company's mission, fosters loyalty and reduces turnover. Effective communication, encompassing both top-down and bottom-up channels, ensures employees are informed, feel heard, and understand their roles, contributing significantly to job satisfaction and retention. When employees are engaged in open dialogue with leadership and peers, their sense of connection and commitment to the organization strengthens.

Strategic planning is another crucial element in retention, as it aligns employee goals with the organization's objectives. Employees are more likely to stay when they

see clear career advancement opportunities and perceive that the company is invested in their personal and professional growth. This alignment enhances engagement and reduces the temptation to seek external opportunities, creating a workforce that is both loyal and motivated.

Periods of organizational change, such as mergers or restructuring, can increase job insecurity and prompt employees to seek more stable opportunities. To address this, companies must implement retention strategies focused on providing reassurance, stability, and clear communication during transitions. By demonstrating the value and importance of their workforce, organizations can maintain trust and reduce attrition during uncertain times.

Employee development programs play a critical role in retention. When employees feel satisfied in their roles and have access to opportunities for learning and growth, their commitment to the organization deepens. This satisfaction leads to reduced turnover and positively impacts customer satisfaction, as experienced and engaged employees deliver superior service. Additionally, involving employees in decision-making processes and organizational initiatives fosters a sense of belonging and ownership. Recognizing employee contributions further strengthens loyalty, making employees more likely to remain committed to the organization.

Employee retention is a priority for employers as it ensures the continuity of a skilled and experienced workforce while reducing the costs associated with high turnover. Recruiting, hiring, and training new employees is not only costly but also time-consuming, impacting productivity and operational efficiency. By focusing on effective retention strategies, organizations can mitigate these challenges, retain valuable talent, and improve overall performance.

Retention strategies such as career development programs, clear and open communication, and fostering a positive organizational culture play a crucial role in minimizing turnover. Career development initiatives help employees envision a long-term future with the organization, enhancing their engagement and loyalty. Effective

communication ensures that employees feel valued and informed, creating a sense of inclusion and alignment with organizational goals. Additionally, a positive work culture fosters collaboration, job satisfaction, and a sense of belonging, all of which contribute to reduced attrition.

Employee attrition remains a significant concern for organizations, as it directly affects operational efficiency, increases costs, and undermines overall performance. Addressing this issue requires a deep understanding of the factors influencing attrition. Key elements such as lack of career advancement opportunities, insufficient communication, and an unsupportive work environment often lead to employee dissatisfaction and turnover. By identifying and addressing these factors, companies can design targeted retention strategies that not only reduce attrition rates but also support a more engaged and productive workforce.

Effective retention practices are critical to maintaining organizational stability and enhancing customer satisfaction. A committed and experienced workforce ensures consistent service quality and fosters stronger customer relationships. Employers who invest in retaining their top talent not only gain a competitive edge but also build a sustainable foundation for long-term success.

2.4. Factors That Affect Employee's Intention to Stay

To retain top talent and sustain operational efficiency, organizations must understand and address the factors that contribute to employee attrition. Several critical elements influence employee retention, including development opportunities, compensation, work-life balance, leadership quality, workplace environment, social support, autonomy, and access to training and development.

Focusing on these areas allows organizations to implement strategies that enhance job satisfaction and engagement, ultimately reducing turnover rates. Development opportunities play a pivotal role in showing employees that their growth and progression are valued. Similarly, offering competitive compensation ensures that

employees feel rewarded for their contributions, meeting both their financial and professional expectations.

Promoting work-life balance is another vital aspect, enabling employees to manage their personal and professional responsibilities effectively, which leads to increased satisfaction and well-being. Effective leadership fosters trust, guidance, and inspiration, encouraging employees to stay committed to organizational goals. A positive workplace environment and strong social support systems build camaraderie and a sense of belonging, which further enhances retention.

Granting employees autonomy in their roles empowers them to take ownership of their tasks, fostering creativity and accountability. Additionally, providing continuous access to training and development opportunities ensures that employees remain skilled, engaged, and confident in their abilities.

By integrating these components into a comprehensive employee retention strategy, organizations can build a loyal, motivated, and high-performing workforce. Investing in employees' professional and personal satisfaction not only reduces attrition but also creates a culture of trust and commitment, driving long-term success.

2.5. Why Employee Attrition is a Major Challenge to Solve

Employee turnover significantly affects an organization's performance and competitive edge. It poses a challenge for HR management to identify and address the underlying reasons for employee departures, as turnover is both costly and time-intensive to manage (Fallucchi et al., 2020). High retention rates are critical for reducing these expenses and maintaining consistent organizational performance. Employees are a core asset, and their satisfaction plays a pivotal role in driving the overall success of the organization.

Organizations operating in fields such as IT, innovation, and entrepreneurship are particularly well-positioned to retain talent by leveraging digital communication tools. These technologies foster clear and interactive dialogue, enhancing employees'

understanding of their contributions and strengthening their commitment to the organization. This approach helps in cultivating both loyal customers and a stable workforce (Lee et al., 2022).

High turnover rates can erode employee loyalty, damage morale, and tarnish an organization's reputation. These challenges highlight the importance of adopting effective management practices to improve retention. Aligning organizational strategies with employees' core values—such as providing motivation, opportunities for promotion, fair compensation, and work-life balance is essential to fostering long-term commitment and reducing turnover (Xuecheng et al., 2022).

By addressing the factors that contribute to turnover and focusing on employee satisfaction, organizations can build a loyal and motivated workforce, ensuring sustained success and competitiveness in their respective industries.

As identified by (Raza et al., 2022), employee attrition can be categorized into:

- **Voluntary Attrition:** When employees leave by choice, often for better opportunities or personal reasons.
- **Involuntary Attrition:** When the organization terminates the employment relationship due to performance or restructuring.
- **External Attrition:** Employees departing to work for other organizations.
- **Internal Attrition:** Employees transitioning to other roles or departments within the same organization.

Each type of attrition has unique implications for organizational strategy and highlights the importance of tailoring retention efforts to address specific challenges.

Employee attrition affects organizations on multiple levels, including financial costs and operational efficiency. According to (Fallucchi et al., 2020), the impacts include:

- **Investment in Employees:** Recruiting and training employees require significant time and resources, making employee departures a costly loss.
- **Loss of Resources:** Departures result in the loss of the investment made in hiring and training individuals.
- **Continuous Investment:** Replacing employees necessitates ongoing expenditure on recruitment and onboarding processes.
- **Cost of Training:** Training new hires is both expensive and time-intensive.
- **Core Stability:** Retaining motivated, satisfied employees is critical to maintaining organizational productivity and innovation.
- **Employee Creativity and Productivity:** Loyal employees contribute more effectively through their experience and engagement.

Additionally, turnover negatively impacts firm performance by eroding institutional knowledge and disrupting team dynamics. High attrition rates also damage employer reputation, reducing the organization's ability to attract top talent.

Effective retention strategies are essential for minimizing the costs and impacts of attrition. Organizations must prioritize:

- **Career Development:** Providing growth opportunities to encourage employee commitment.
- **Fair Compensation:** Ensuring pay structures reflect employees' contributions and market standards.
- **Work-Life Balance:** Offering flexible policies to support employees' personal and professional lives.
- **Supportive Leadership:** Fostering trust and collaboration through effective management.

- **Positive Work Environment:** Building a culture of inclusivity and recognition to enhance employee engagement.

Employee attrition poses a specific challenge in the IT industry in India, where high turnover disrupts productivity and competitiveness. Factors such as pay disparities, excessive workloads, and limited development opportunities contribute to dissatisfaction and turnover. By addressing these issues and creating targeted retention strategies, organizations can mitigate attrition and retain top IT talent.

High retention rates are essential for reducing costs, maintaining institutional knowledge, and enhancing organizational performance. By understanding the causes and impacts of attrition, organizations can develop effective strategies to foster employee satisfaction, motivation, and loyalty. Investing in retention not only strengthens the organization's workforce but also drives sustainable success in competitive markets.

2.6. Employer Branding on Retention

Employer branding plays a pivotal role in shaping strategies for employee retention within Human Resource Management (HRM). It encompasses how an organization is viewed as an employer by both its current workforce and prospective employees, as well as its reputation in the market. The importance of employer branding can be observed in several key areas:

- **Attracting Top Talent:** An impactful employer brand serves as a magnet for exceptional talent. It articulates the organization's principles, culture, and mission, resonating with job seekers whose values align with those of the company (Ahmad et al., 2020).
- **Fostering Employee Engagement:** By treating existing employees as valuable internal stakeholders, employer branding strengthens loyalty. This, in turn, drives better performance, enabling organizations to excel in customer satisfaction and gain a competitive advantage. As a result, the significance of employees in

amplifying the organization's brand has gained increased attention in recent years (Staniec and Kalińska-Kula, 2021).

- **Promoting Retention:** A well-executed employer branding strategy helps retain top performers by fostering a culture where employees feel connected to the brand. Providing avenues for personal and professional growth further strengthens their commitment. When employees see consistency between the employer's promises and actions, their loyalty and tenure increase (Chopra et al., 2024).
- **Lowering Turnover Costs:** Strong employer branding enhances trust in leadership and unity between staff and management. This reduces attrition rates and recruitment costs while fostering a positive company culture that attracts and retains skilled workers (Monteiro et al., 2020).
- **Building a Robust Company Culture:** Establishing and maintaining a positive company culture is a core aspect of employer branding. When employees feel proud of their workplace culture, they are more likely to remain with the organization over the long term (Pandita, 2022).

In a dynamic and competitive job market, the demand for highly skilled employees has made employer branding an indispensable element for organizations aiming to stay ahead. A strong employer brand not only attracts new talent but also ensures current employees find alignment between their values and the organization's mission (Azam and Qureshi, 2021). In essence, employer branding goes beyond recruitment and it creates an environment that nurtures employee satisfaction and commitment. HRM strategies that prioritize employer branding contribute to a workforce that is engaged, loyal, and invested in the organization's success. By aligning personal and professional aspirations with organizational goals, companies can achieve sustainable growth and stability over time.

2.7. Employee Retention for Gen X, Gen Y and Gen Z

Modern workplaces consist of employees from multiple generations, leading to generational gaps that influence business performance. These gaps often manifest as strong biases and conflicting assumptions between generations, which can result in workplace disputes. Such conflicts are particularly common when younger employees report to older managers, or vice versa. Bridging these generational divides is essential for achieving positive and productive business results. Most employers hire individuals from Generations X, Y, and Z, with a smaller representation of Baby Boomers. Researchers have highlighted the importance of analysing Generation X and Millennials (Generation Y) to identify their key differences, which can guide tailored organizational strategies and leadership practices.

Generation X typically includes individuals born between 1960 and 1975, though some classifications extend the range to 1982. This generation forms the backbone of upper and middle management in many organizations. Gen X employees highly value hard work, education, and financial independence. Unlike their predecessors, they prioritize work-life balance over traditional notions of career prestige or upward mobility, often choosing not to remain in one role solely for advancement.

On the other hand, Millennials, or Generation Y, comprise individuals born between 1980 and 1995. They represent a large pool of highly skilled young professionals in their twenties and thirties. Millennials are recognized for being self-reliant, ambitious, and confident. Compared to Generation X, Millennials are exceptionally goal-driven, placing significant emphasis on success and career growth. Their proactive approach to work and eagerness to embrace new challenges have made them highly sought-after in the job market. Exploring what distinguishes Millennials from Generation X is crucial to understanding their workplace behaviours and the factors that influence their retention.

The generational divide is a common concern in workplaces worldwide, impacting productivity and the ability to sustain a positive work environment. Research consistently shows that Millennials experience significantly higher turnover rates compared to Generation X. Consequently, businesses must address this challenge by developing strategies to reduce attrition, especially among Generation Y employees.

According to (Kaushik and Gaur, 2023), the annual report of ABC Private Limited for 2018–2019 evaluated resignation rates for Millennials using an age range of 26–40 and for Generation X employees using an age range of 41–65. The findings revealed that Millennials had a considerably higher resignation rate during this period compared to Generation X workers, reinforcing the urgency of addressing this trend.

(Kaushik and Gaur, 2023) outlined the following lifestyle and workplace characteristics for Generations X and Y:

- **Generation X:**
 - Prioritizes family and personal well-being over career ambitions.
 - Uses pragmatic and effective methods to address workplace challenges.
 - Prefers companies with flat organizational structures, which encourage long-term commitment and reduce turnover related to stagnation in career growth.
- **Generation Y (Millennials):**
 - Often blends work and personal life, emphasizing continuous learning and professional development.
 - Holds higher levels of formal education, with many possessing advanced degrees or certifications.
 - Thrives on opportunities to apply modern technologies and innovative methods in tackling workplace challenges.
- **Generation Z:**

- Shares a high degree of technological fluency with Millennials, leveraging digital tools for personal and professional growth.
- Displays adaptability and creativity, often distinguishing these younger cohorts from older generations.

Retention dynamics vary significantly between Generation X and Millennials. Gen X employees are more likely to remain with an organization if they find the work engaging and have control over their pace of work. In contrast, Millennials tend to prioritize external rewards, such as competitive salaries and material benefits, as their primary motivation to stay with an employer. Offering these incentives is common strategy businesses use to retain Generation Y employees.

To further improve retention, organizations can implement programs such as career counselling and professional development opportunities tailored to Millennials. These efforts not only address their need for growth and recognition but also foster stronger loyalty to the organization.

Generational differences play a crucial role in workplace dynamics, affecting productivity, employee satisfaction, and retention. By understanding the distinct preferences and behaviours of Generations X and Y, organizations can design strategies to bridge generational gaps, reduce turnover, and create a more cohesive work environment. Targeted initiatives, such as fostering work-life balance for Gen X and offering extrinsic rewards and career development for Millennials, can significantly enhance organizational performance and employee retention.

2.8. Effect Of Data Driven Employee Retention Strategy in India

Organizations increasingly rely on data-driven strategies to develop tailored approaches that reduce employee turnover. By harnessing the power of data analytics, companies can design precise, organization-specific retention strategies that address key factors influencing attrition.

Advanced tools like Dataiku enable businesses to analyse and refine their retention methods by examining variables that drive employee turnover. This data-centric approach helps organizations detect patterns, predict potential attrition risks, and assess the success of implemented strategies. As a result, they can craft retention solutions tailored to boost employee satisfaction and long-term commitment.

Through analytics, companies can experiment with factors like engagement levels, salary structures, work-life balance policies, and career development opportunities. Such analyses yield actionable insights, often surpassing the depth of traditional methods. This empowers HR teams to make more informed decisions, fostering retention while simultaneously enhancing overall organizational performance.

- **Data-Driven Retention Strategies in India**

The impact of data-driven employee retention strategies is becoming increasingly significant in India as companies embrace analytics to optimize HR functions. In a competitive market with a vast talent pool yet high turnover rates, leveraging data to retain employees has become essential for organizations.

High attrition rates in sectors like IT, BPO, and e-commerce are among the primary reasons driving the adoption of data-driven approaches. Factors such as inadequate engagement, poor management practices, and limited growth opportunities lead to significant talent loss. Companies using analytics are better equipped to identify risks of employee churn by evaluating metrics like satisfaction scores, engagement trends, performance reviews, and attendance data.

Additionally, advancements in technology, such as AI, predictive analytics, and machine learning, empower HR teams to uncover valuable insights from large datasets. These tools enhance decision-making and enable organizations to address retention challenges more effectively. As globalization heightens competition, Indian businesses increasingly recognize the need to retain skilled talent, with data-driven approaches offering tailored solutions to meet individual employee needs.

Positive Impacts of Data-Driven Retention Strategies

- **Accurate Identification of At-Risk Employees**

Predictive analytics allow organizations to flag employees likely to leave based on factors such as dissatisfaction, lack of promotions, or negative experiences. This enables proactive interventions, including personalized development opportunities, improved work-life balance, or adjusted compensation packages, to enhance satisfaction and retention.

- **Targeted Employee Engagement Initiatives**

By analysing feedback, behavioural patterns, and interaction data, companies can create customized engagement programs. For instance, younger employees may prioritize growth and mentorship opportunities, while senior employees may value flexibility and recognition. Tailored approaches improve the overall employee experience, fostering loyalty and reducing attrition.

- **Improved Organizational Culture**

Data insights help HR teams measure the effectiveness of workplace policies on morale and productivity. This enables continuous refinement of organizational culture, creating a supportive, inclusive, and motivating environment that fosters employee loyalty and improves retention rates.

- **Cost Savings**

High employee turnover incurs significant costs in recruitment, onboarding, and training. Data-driven strategies help companies address attrition causes, such as inadequate compensation, limited career growth, or poor leadership—before employees decide to leave. This proactive approach reduces operational costs associated with frequent turnover.

- **Enhanced Employee Performance**

Matching employees to suitable roles, providing targeted training, and aligning personal goals with organizational objectives are easier with data-driven insights. This boosts engagement, productivity, and retention, particularly among high performers, significantly enhancing overall business outcomes.

The relationship between data-driven retention strategies and their positive effects on employee engagement, turnover, and costs is evident. In India, organizations leveraging analytics are better positioned to tackle attrition, implement tailored interventions, and create a supportive workplace. By adopting predictive tools and data-focused approaches, businesses can retain top talent, foster long-term loyalty, and strengthen their competitive edge. This shift towards data-centric HR practices is reshaping workforce management in India, ensuring sustainable success in a competitive environment.

2.9. Significance of Data-Driven Employee Retention Strategies

Enterprises are increasingly embracing Big Data Analytics as a means to enhance decision-making processes (Batko and Ślęzak, 2022). This shift encourages decision-makers to rely on data-driven insights and technological tools rather than their instincts and subjective judgment (Gul et al., 2023). In essence, organizations adopting a data-centric approach to value creation prioritize decisions derived from analytical insights rather than assumptions. By analyzing and integrating data from diverse sources, Big Data Analytics transforms large volumes of continuous data into actionable intelligence (Berros et al., 2023), which is critical for improving organizational efficiency and performance (Mahmood et al., 2023).

The benefits of analytics are extensive, including expedited task completion, handling of complex operations, and simultaneous performance of multiple functions with a higher success rate and fewer errors. Artificial Intelligence (AI), as a part of these technologies, excels in managing intricate scenarios, performing advanced calculations, and even venturing into uncharted domains such as space exploration (Khanzode and Sarode, 2020).

Effective decision-making requires selecting the best options to achieve specific objectives, a process that increasingly depends on the ability to understand and apply data effectively. Data-Driven Decision-Making (DDDM), which relies on data rather than subjective assumptions, has emerged as a cornerstone in modern decision-making practices. It integrates fields such as business intelligence, machine learning, and decision support systems, representing the convergence of data science, engineering, and management efforts (Roes, 2022).

As the volume of available data expands and analytical techniques evolve, businesses encounter fresh opportunities to innovate. Leveraging these opportunities primarily involves adopting a DDDM approach, which emphasizes data over instinctive or experience-based decision-making. Investing in advanced technologies fosters a data-driven culture across organizations, encouraging both leaders and employees to shift from intuition to evidence-based practices (Gul and Al-Faryan, 2023).

DDDM is founded on the principle that data represents a strategic asset, offering insights that surpass those derived from intuition and historical experiences. This methodology requires leaders to actively cultivate a culture that promotes innovation while managing data rigorously throughout the decision-making process (Troisi et al., 2020). When handled appropriately, data can reveal patterns and insights that are not immediately evident through subjective methods.

In Human Resource Analytics (HRA), data serves as a valuable tool for identifying trends, patterns, and correlations, facilitating more precise and effective decision-making. HR professionals with expertise in data processing play a crucial role in ensuring accurate analytics outcomes and avoiding misinterpretation of data. Although analytics provide valuable insights, HR managers must be prepared to validate the reliability of big data findings in the face of traditional managerial instincts (Shet et al., 2021). Data analysis in HR processes helps identify inefficiencies, enabling targeted improvements that optimize time and resources. Understanding the

interplay of organizational structures, IT systems, and external partnerships is vital for enhancing the adoption and effectiveness of HRA practices (Margherita, 2022).

In the rapidly evolving business landscape, HR management must integrate data analytics to align HR strategies with organizational goals and adopt a forward-looking approach to talent management (Lee et al., 2019).

Technological advancements such as cloud computing, AI, and big data have transformed lifestyles and become integral to navigating contemporary challenges (Shet et al., 2021). In decision-making, historical data often provides a foundation of accumulated knowledge and insights. However, the human capacity to process vast datasets is inherently limited, necessitating efficient tools to support decision-making. Machine learning, a core component of AI, is designed to extract valuable insights from data and enhance outcomes across diverse applications. ML algorithms, by learning from historical data, play a pivotal role in optimizing decision-making processes (Fu et al., 2021).

2.10. Impact of Data Driven employee retention strategy in India

Despite challenges in data collection, storage, and analysis, organizations are optimistic about the potential of analytics to provide actionable insights into past, present, and future business scenarios. These insights enable evidence-based decision-making, which has a significant impact on business outcomes. One critical area where data analytics proves invaluable is addressing employee attrition—a persistent issue that adversely affects productivity and growth. Retaining employees is essential, as attrition results in the loss of critical skills, talent, and opportunities, ultimately undermining long-term business sustainability (Ravesangar and Narayanan, 2024).

In today's highly competitive business environment, talent retention is vital, particularly in diverse markets like India. The integration of technology and data analytics into HR practices has transformed retention efforts, leading to the development of data-driven strategies. These strategies not only reduce employee

turnover but also provide a competitive advantage by fostering a positive workplace culture, increasing employee satisfaction, and reducing recruitment costs. In India, where success is often built on a balance between traditional values and modern practices, data-driven approaches have proven highly effective.

- **HR Retention Strategies and Employer Branding**

Retention strategies play a crucial role in enhancing employer branding. In competitive markets like India, where companies vie for the best talent, a robust retention strategy can significantly elevate an organization's reputation. By focusing on understanding employee needs, offering career development opportunities, and nurturing a positive work environment, companies can position themselves as employers of choice.

Data-driven tools enable HR teams to analyze metrics such as employee feedback, engagement levels, and workplace sentiment. This allows for the creation of tailored strategies that meet diverse employee needs. For example, data might highlight the importance of flexible schedules, career advancement, or work-life balance. Addressing these factors not only aids retention but also enhances the company's image, attracting new talent and solidifying existing employee loyalty.

In a country like India, where cultural diversity and regional variations significantly influence employee expectations, personalized retention strategies are critical. Data analytics helps HR departments craft localized solutions, ensuring inclusivity and recognition of individual contributions. This not only strengthens employer branding but also bolsters the organization's competitive advantage.

- **Impact of Retention Strategies on Employee Satisfaction and Well-Being**

Retention strategies that prioritize employee satisfaction and well-being can transform workplace dynamics. By using data-driven approaches, organizations can create environments that make employees feel valued, engaged, and motivated. This

leads to improved satisfaction and a better balance between personal and professional life, often referred to as the “happiness index.”

Modern HR systems utilize analytics to monitor engagement levels, absenteeism, and even employee health metrics. For example, if data reveals heightened stress levels within a team, HR can proactively implement wellness programs, mental health support, or workload adjustments. Such interventions not only enhance retention but also contribute to employees’ overall well-being.

In India, where achieving a work-life balance is becoming increasingly important, companies that prioritize employee well-being stand out. Employees who feel supported in their personal lives and health are more likely to remain loyal, leading to greater productivity, creativity, and resilience in tackling workplace challenges.

- **Cost Savings through Effective Retention Strategies**

Retention strategies significantly reduce costs associated with recruitment and training. High turnover rates burden organizations with repetitive hiring processes, onboarding expenses, and productivity losses. Data-driven retention approaches minimize these costs by identifying at-risk employees early and implementing customized interventions to retain them.

In India’s growing market, where the demand for skilled professionals is high, attrition can be financially draining. Recruitment efforts, training initiatives, and workflow disruptions due to turnover are costly. By analyzing patterns such as tenure-based attrition, HR teams can implement measures to address dissatisfaction at critical junctures, reducing turnover rates.

Retention strategies that promote career growth, recognize achievements, and foster a sense of belonging cultivate employee loyalty. This, in turn, translates into cost savings and long-term stability for the organization.

- **Data-Driven Decisions and Employee Advocacy**

Data-driven retention strategies not only improve employee satisfaction but also transform employees into advocates for their organization. When employees feel supported in their growth, well-being, and professional development, they are more inclined to share positive experiences about their workplace.

In India, where platforms like LinkedIn and Glassdoor influence job seekers, positive employee reviews significantly enhance an organization's reputation. Data-driven retention strategies equip HR teams with insights from surveys, feedback, and performance metrics, enabling them to address potential issues preemptively. A supportive work environment encourages employees to promote their organization within their networks.

Employee advocacy helps build a robust organizational culture that attracts top talent. Employees who share their positive workplace experiences create authentic, organic promotion that strengthens the organization's employer brand more effectively than traditional marketing efforts.

Data-driven retention strategies extend beyond mitigating attrition; they focus on creating a workplace where employees feel valued, engaged, and motivated. For India's diverse workforce, tailored retention strategies powered by analytics are essential to addressing unique employee needs. By emphasizing employer branding, well-being, cost savings, and advocacy, these strategies provide organizations with a competitive advantage in attracting and retaining talent.

By utilizing platforms like Dataiku and other analytics tools, companies gain valuable insights into employee behavior and sentiment, enabling informed decisions to enhance retention. As India continues to grow as a global economic force, organizations that prioritize data-driven retention strategies will secure their workforce's loyalty, build resilience, and drive sustainable success.

CHAPTER 3: RESEARCH METHODOLOGY

3.1. Research Design

This research aims to formulate data-driven employee retention strategies utilizing the CRISP-DM (Cross-Industry Standard Process for Data Mining) framework. The focus is to analyze patterns, trends, and key factors influencing employee retention through data visualization and descriptive analytics rather than leveraging machine learning models. The CRISP-DM framework serves as the guiding methodology, starting with the **business understanding phase**, which will define employee retention challenges across different organizational levels, including new hires, mid-senior employees, and senior professionals.

In the data preparation phase, relevant organizational data will be collected. This includes information on aspects such as job involvement, recognition programs, rewards systems, supervision quality, and mentoring initiatives. The aim is to ensure comprehensive coverage of the factors influencing employee retention for effective analysis.

The next step involves conducting **exploratory data analysis (EDA)** using plotting techniques to uncover key trends and patterns related to employee attrition. Visual tools such as histograms, bar charts, and scatter plots will be employed to answer critical research questions. These questions pertain to identifying the factors affecting retention, understanding how these factors vary among different employee groups, and evaluating which strategies have the most substantial impact. Machine learning models will be intentionally excluded to maintain a focus on deriving insights through visual and descriptive means.

The research findings will include clear visual depictions of critical retention drivers, offering organizations actionable insights. The study will conclude by assessing the effectiveness of retention strategies through visual comparisons of pre-

and post-strategy implementation data. This approach aims to deliver practical and targeted recommendations for organizations to minimize employee turnover through evidence-based interventions.

3.1.1. CRISP-DM Framework

The CRISP-DM framework is a universal process model for data mining. It provides benefits in data preparation, modeling, and evaluation steps. The process involves six iterative stages, from understanding the business context to implementation (Brzozowska et al., 2023).

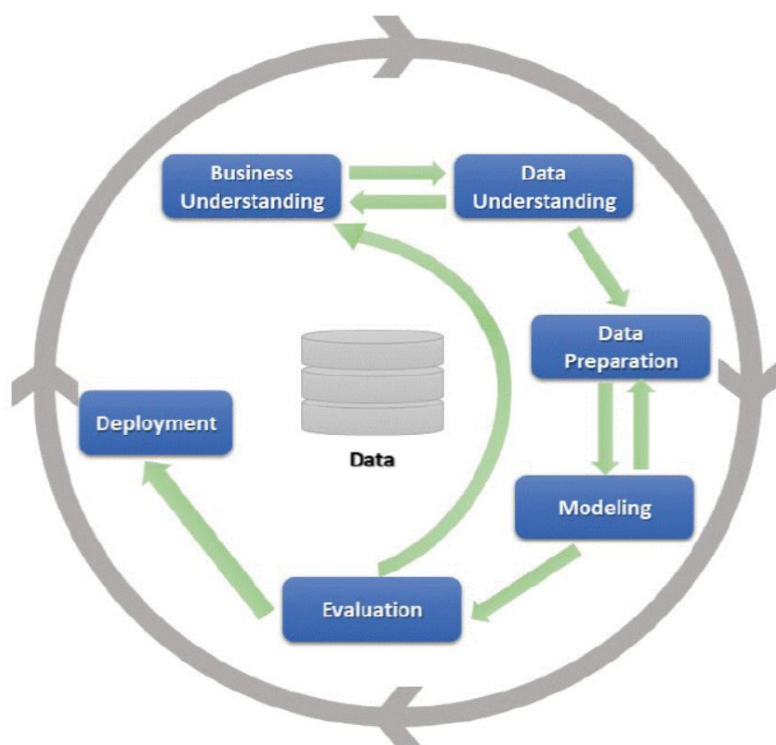


Figure-1: CRISP-DM Methodology (Márquez-Hermosillo et al., 2023).

Phase	Description
Business Understanding	The evaluation of the business situation is crucial to identifying the resources that are both available and required for the project.

	<p>A significant focus during this stage is the determination of the data mining objective. This process includes outlining the type of data mining techniques to be employed, such as classification, and defining success criteria, such as achieving a specified level of precision. Furthermore, creating a comprehensive project plan is a key component of this phase.</p>
Data Understanding	<p>This stage involves a series of essential tasks, including gathering data from diverse sources, conducting an exploration to describe the data, and evaluating its quality. This phase typically requires statistical analyses to identify attributes and their interconnections.</p>
Data Preparation	<p>In the step of data selection, clear inclusion and exclusion criteria must be established to guide the choice of data. Addressing poor-quality data through rigorous data cleaning is an integral part of this process. Depending on the model selected during the initial phase, it may also be necessary to generate new attributes. The techniques applied during this phase are contingent upon the model requirements and objectives.</p>
Modeling	<p>The data modeling stage centers around selecting an appropriate modeling technique, developing a corresponding test</p>

	<p>case, and ultimately constructing the model. A variety of data mining methods can be utilized, but the choice is typically influenced by the specific business problem and the nature of the data involved. It is critical to provide a clear explanation for the selection of a particular method. The process of model construction involves defining detailed parameters, while model evaluation entails comparing the model against predefined evaluation criteria to identify the most effective option.</p>
Evaluation	<p>During the evaluation phase, the generated results are assessed in relation to the predetermined business objectives. This step involves analyzing the outcomes and determining the next steps. Moreover, a comprehensive review of the entire process is conducted to ensure consistency and identify potential improvements.</p>
Deployment	<p>The deployment phase is typically detailed in the user guide, which outlines the steps required for implementation. This phase may include generating a final report or creating a software application. The user guide also emphasizes the importance of planning for deployment, alongside establishing mechanisms for continuous monitoring and maintenance.</p>

Table-7: CRISP-DM process model description (Schröer et al., 2021)

The CRISP-DM methodology is a versatile and iterative framework that balances structure with flexibility, making it well-suited for the dynamic nature of data mining projects. Unlike strictly linear or purely cyclic processes, CRISP-DM allows for movement between its phases, ensuring the methodology adapts to evolving project needs and emerging insights.

A notable feature of CRISP-DM's flexibility is its capacity for revisiting the Business Understanding phase from subsequent stages. For instance, during the Data Understanding phase, analysts may uncover previously unrecognized patterns or data limitations that necessitate revisiting and refining the original business objectives. This feedback loop ensures the project remains aligned with its core goals and adjusts to incorporate new findings effectively.

The framework also supports backward transitions from the Modelling phase to the Data Preparation phase. As models are developed, it may become evident that additional preprocessing is required or that new features must be created to improve the model's performance. This iterative process guarantees that the data used is both high-quality and relevant, enhancing the accuracy and reliability of the models.

Similarly, during the Evaluation phase, if the analysis does not sufficiently address the business goals, it may be necessary to return to the Business Understanding phase. This step allows for refining business questions, adjusting evaluation metrics, or redefining project objectives based on the insights gained thus far.

The iterative design of the CRISP-DM framework, with its ability to move backward between phases, provides a robust approach to managing the complexities of data mining projects. This adaptability ensures continuous alignment with business priorities while allowing the framework to respond to new information and challenges throughout the project lifecycle.

- **Developing Business Understanding: First Step in CRISP-DM**

This research focuses on identifying the factors that influence employees' decisions to remain with an organization, utilizing data-driven methods. By examining both internal and external datasets, the study aims to uncover patterns and relationships that impact employee sentiment. Key factors such as workload, compensation, work-life balance, and leadership effectiveness are explored. Using statistical modelling and machine learning techniques, the research seeks not only to identify critical retention drivers but also to predict employees who may be at a higher risk of leaving. These insights enable organizations to design targeted strategies and interventions to enhance employee engagement and productivity.

In the Data Understanding phase of the CRISP-DM framework, two distinct data sources are utilized. The first is a primary dataset, derived from surveys conducted among employees across various IT sectors. This dataset captures perspectives directly from employees, offering valuable information on factors like satisfaction with workload, opportunities for career advancement, and the organization's culture.

The second source involves publicly available data, which may include industry benchmarks, government reports, or academic studies on employee turnover. This external dataset provides a broader context and helps validate or complement the findings from the internal survey data.

By integrating these two datasets, the study achieves a comprehensive understanding of the drivers behind employee retention. The survey data delivers detailed insights specific to the IT industry, while the public dataset contributes a wider perspective on the influencing factors. This combined approach ensures a well-rounded analysis, enabling the development of predictive models to assess flight risk among employees with greater accuracy.

- **Data Understanding:**

In the realm of data analysis, survey data emerges as a primary source. This type of data is gathered directly from individuals through questionnaires or interviews,

providing insights into behaviours, preferences, and opinions. It's highly valuable for understanding the human elements behind the numbers, offering a snapshot of attitudes and experiences at a particular point in time. Schema for survey data is defined at [Appendix A - Survey data](#).

On the other hand, public Kaggle data represents a treasure trove of datasets made available by the global community of data scientists. These datasets, which span various industries and topics, are a rich resource for anyone looking to perform comprehensive data analysis, test hypotheses, or develop machine learning models. Kaggle's collaborative environment also encourages the sharing of knowledge and techniques among data enthusiasts. Schema for public data is provided at [Appendix B – Public Data](#).

- **Data Preparation:**

Survey data typically requires no extensive preparation since it is collected in a structured format, designed specifically for analysis. This makes it ready for immediate use. In contrast, public datasets often demand significant preparation due to their unstructured and heterogeneous nature. Steps such as cleaning, formatting, and anonymizing the data are essential to ensure its usability for machine learning applications. These processes address inconsistencies, fill or handle missing values, and standardize the dataset. Proper preparation of public data enhances the accuracy, reliability, and overall effectiveness of machine learning models in generating actionable insights.

When analysing public data, the 'Attrition' feature is identified as the target variable, or dependent variable, representing the outcome to be predicted. The remaining features in the dataset act as independent variables, which provide the basis for predicting the target. By employing machine learning models, patterns and relationships among these variables can be analysed to determine which factors have the greatest impact on attrition rates. This analysis also enables the prediction of attrition likelihood based on the given independent variables.

The dataset is split into two subsets: a training set and a test set, following a 70-30 ratio. This means 70% of the data is used to train the machine learning algorithms, while the remaining 30% is reserved for evaluating the models. During training, the algorithms learn patterns and relationships between the independent variables and the target variable, 'Attrition.' Once trained, the models are applied to the test dataset, which was not used during training. This step assesses the models' ability to generalize their predictions to unseen data, ensuring predictive accuracy and reliability.

Standardization, a crucial step in data preparation, involves rescaling features so that they have a mean of zero and a standard deviation of one. This process ensures that all features contribute equally to the model, avoiding disproportionate influence from features with larger scales. The formula for standardization is:

$$Z = \frac{X - \mu}{\sigma}$$

where Z is the standardized value, X is the original data value under the data column, μ is the mean of the feature, and σ is the standard deviation of the feature. All the numerical features (refer [public data schema](#) for numerical features) are scaled using this mathematical formula.

Dummy encoding, also known as one-hot encoding, is a technique used to convert categorical variables (refer [public data schema](#) for categorical features) into a format that can be provided to machine learning algorithms. Many algorithms cannot handle categorical data directly, so dummy encoding transforms these categories into a set of binaries (0 or 1) variables (also called as dummy variables).

Dummy variables are used to convert categorical data into a numerical format suitable for machine learning algorithms. For a gender feature column containing the categories "male" and "female," dummy encoding would create two new binary variables to represent these categories. Consider the original gender feature:

Gender
Male
Female
Male
Male
Female

Table-8: Sample table for illustration pertaining gender values

Dummy encoding for this feature would create two new columns, Gender_Male and Gender_Female. Each new column will contain binary values (0 or 1) indicating the presence of each category. The encoded data would look like this:

Gender	Gender_Male	Gender_Female
Male	1	0
Female	0	1
Male	1	0
Male	1	0
Female	0	1

Table-9: Data after dummy transformation

In this representation:

- Gender_Male is 1 if the original gender is "Male" and 0 otherwise.
- Gender_Female is 1 if the original gender is "Female" and 0 otherwise.

Alternatively, to avoid multicollinearity (where one dummy variable can be perfectly predicted from others), one category is often dropped. This results in:

Gender	Gender_Male
Male	1
Female	0
Male	1
Male	1
Female	0

Table-10: Dropped 'Gender_Female' to avoid duplication data

In this case, "Female" is the baseline category. Here, "Gender_Male" is 1 for "Male" and 0 for "Female," and the information about the "Female" category can be inferred when "Gender_Male" is 0. This approach reduces redundancy and simplifies the model.

- **Model Creation & Hyper parameter optimization:**

(Yu and Zhu, 2020) explore hyperparameter tuning, emphasizing its importance in optimizing neural network structures and enhancing machine learning model training. Hyperparameters differ from model parameters in that they cannot be adjusted during the training process. They influence architectural elements, such as the number of hidden layers and activation functions, and training dynamics, such as learning rate (LR) in stochastic gradient descent (SGD), batch size, and the choice of optimizer. Hyperparameter optimization (HPO), a practice dating back to the early 1990s, is particularly significant for neural networks as machine learning grows increasingly mainstream. Serving as both the final stage of model design and the preparatory step for training, HPO ensures that hyperparameters are fine-tuned before training begins. This process reduces manual involvement by automating

hyperparameter selection but requires substantial computational resources, particularly when multiple hyperparameters need optimization simultaneously. (Yu and Zhu, 2020) further investigate strategies for efficient use of computational resources and effective design of the search space in HPO. Their research highlights HPO's role in minimizing repetitive tasks for AI experts, enhancing training accuracy and efficiency, and improving robustness and reproducibility in hyperparameter choices.

One popular method for hyperparameter tuning is grid search, which systematically explores a predefined parameter grid to evaluate all possible hyperparameter combinations. By doing so, grid search identifies the optimal set of hyperparameters for improved model performance. This exhaustive search ensures a comprehensive exploration of the hyperparameter space, yielding models that are both accurate and robust. Key parameters optimized using grid search include learning rate, the number of layers, and regularization terms—each of which critically impacts a model's ability to generalize to new data. While grid search is computationally demanding, it is indispensable for developing high-performing and reliable machine learning models.

This research utilizes three machine learning models: decision tree, logistic regression, and random forest. Each model belongs to a distinct category of machine learning algorithms, offering unique strengths and analytical capabilities:

- Decision Tree (Tree-Based Model):

A decision tree is a versatile model that makes decisions based on hierarchical splits of the data. It works by recursively partitioning the dataset into subsets based on the most significant attribute at each node, forming a tree-like structure. This model is intuitive and easy to interpret, making it useful for understanding the decision-making process.

Decision Tree

ON

Decision Tree is a simple non-parametric algorithm. It creates a model that predicts the value of the target by learning simple decision rules inferred from the data features.

[Show more...](#)

Maximum depth Min Max Values count

The maximum depth of the tree.

Criterion Try Gini
 Try Entropy

The function to measure the quality of a split. Supported criteria are "gini" for the Gini impurity and "entropy" for the information gain.

Min. samples per leaf Min Max Values count

Minimum number of samples required to be at a leaf node.

Split strategy Try Best
 Try Random

The strategy used to choose the split at each node. Supported strategies are "best" to choose the best split and "random" to choose the best random split.

Figure-2: Hyperparameter Range - Decision Tree

○ **Logistic Regression (Linear Model):**

Logistic regression is a linear model used for binary classification problems. It estimates the probability that a given input belongs to a particular class by applying a logistic function to a linear combination of input features. This model is particularly effective for datasets where the relationship between the features and the target variable is linear. It provides insights into the influence of each feature on the outcome.

Logistic Regression

ON

Logistic Regression is a classification algorithm, using a linear model (i.e., it computes the target feature as a linear combination of input features).

[Show more...](#)

Regularization Try with L1 regularization
 Try with L2 regularization

C Min Max Values count

Penalty parameter C of the error term.
 A low value of C will generate a smoother decision boundary (higher bias) while a high value aims at correctly classifying all training examples, at the risk of overfitting (high variance).
 (C corresponds to the inverse of a regularization parameter).

Figure-3: Hyperparameter Range - Logistic Regression

- Random Forest (Ensemble Model):

Random forest is an ensemble learning method that builds multiple decision trees and merges their outputs to improve predictive accuracy and control overfitting. By combining the results of many trees, random forests enhance robustness and generalization. This model is powerful for handling large datasets with high dimensionality and complex interactions among features.

The image shows a user interface for configuring a Random Forest model. At the top, there is a title "Random Forest" and a toggle switch set to "ON". Below the title is a brief description: "A Random Forest is made of many decision trees. Each tree in the forest predicts a record, and each tree 'votes' for the final answer of the forest." A "Show more..." link is provided. The configuration options are as follows:

- Number of trees:** Min 80, Max 200, Values count 3. Description: "Number of trees in the forest."
- Feature sampling strategy:** Default. Description: "Adjusts the number of features to sample at each split."
- Maximum depth of tree:** Min 6, Max 20, Values count 3. Description: "Maximum depth of each tree in the forest. Higher values generally increase the quality of the prediction, but can lead to overfitting. High values also increase the training and prediction time."
- Minimum samples per leaf:** Min 1, Max 20, Values count 3. Description: "Minimum number of samples required in a single tree node to split this node. Lower values increase the quality of the prediction (by splitting the tree mode), but can lead to overfitting and increased training and prediction time."
- Parallelism:** 4. Description: "Number of cores used for parallel training. Using more cores leads to faster training but at the expense of more memory consumption, especially for large training datasets."

Figure-4: Hyperparameter Range - Random Forest

By employing three distinct machine learning models—decision tree (a tree-based algorithm), logistic regression (a linear model), and random forest (an ensemble approach)—we can evaluate their performance and determine the most effective model for our dataset. This comparative analysis provides insights into the strengths and limitations of each model under different conditions, enabling us to make accurate and reliable predictions tailored to specific scenarios.

Evaluating machine learning models is a crucial step to ensure their performance, robustness, and reliability. This process involves the use of key metrics such as accuracy, precision, recall, and the F1-score. These metrics help determine

how well the models make predictions and generalize to unseen data. Model evaluation plays a pivotal role in guiding refinements and enhancing predictive capabilities. The following section elaborates on the various techniques and considerations involved in the evaluation process.

		Actual	
		Positive	Negative
Predicted	Positive	True Positive (TP)	False Positive (FP)
	Negative	False Negative (FN)	True Negative (TN)

Table-11: Confusion Matrix (Amin, 2022)

(Alhothali et al., 2022) highlight the value of the confusion matrix in providing a detailed summary of prediction outcomes. It categorizes predictions into four key metrics: true positives (TP), true negatives (TN), false positives (FP), and false negatives (FN). True positives represent instances where positive examples are accurately classified, while true negatives refer to correct classification of negative examples. Conversely, false positives occur when negative instances are mistakenly classified as positive, and false negatives arise when positive examples are misclassified as negative.

(Alhothali et al., 2022) also identify several metrics for evaluating machine learning models, including accuracy (acc.), sensitivity, specificity, precision, recall, F1-score (f1), and the area under the ROC curve (AUC). Among these, accuracy is a fundamental metric calculated by dividing the sum of true positive (TP) and true negative (TN) predictions by the total number of examples in the dataset (P + N). As noted by (Vujovic, 2021), accuracy values range from 0.00 (lowest) to 1.0 (highest) and are computed using the following formula:

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN}$$

Accuracy is a widely used metric in the evaluation of machine learning models, valued for its simplicity and ease of interpretation. It works particularly well in scenarios where datasets have a balanced distribution of positive and negative examples. In such cases, accuracy effectively reflects the model's overall ability to correctly classify instances. For example, in tasks like image classification or handwriting recognition, where the class distributions are generally balanced, accuracy serves as a dependable measure of the model's performance. Furthermore, during the early stages of model development, accuracy is often used as a quick indicator to assess whether the model is learning effectively from the data.

However, accuracy has limitations, especially when dealing with imbalanced datasets. For instance, in an employee attrition scenario, the number of employees who leave (positive class) might be significantly smaller compared to those who stay (negative class). In such cases, a model could predominantly predict the majority class (employees staying) and achieve high accuracy, while failing to address the core problem—identifying employees at risk of leaving. For example, if only 5% of employees leave, a model predicting "stay" for every instance would yield a 95% accuracy rate, which obscures the model's inability to identify the critical positive cases.

Sensitivity, also referred to as recall or true positive rate (TPR), measures the proportion of actual positive cases accurately predicted by the model (Salih and Abdulazeez, 2021). This metric is particularly valuable in situations where identifying all positive instances is essential. It is calculated using the formula:

$$\text{Sensitivity} = \frac{TP}{TP + FN}$$

Sensitivity is a valuable metric for evaluating machine learning models, particularly in scenarios where correctly identifying positive cases is of utmost importance. It quantifies the proportion of actual positive instances that the model accurately detects. Sensitivity plays a critical role in areas such as healthcare, fraud

detection, and safety-critical systems, where missing a positive instance (false negatives) can lead to severe consequences. For example, in medical diagnostics, failing to identify a disease may have far more serious implications than issuing false alarms. Optimizing for high sensitivity in these contexts ensures that as many true positives as possible are captured, even if it results in a higher number of false positives.

However, sensitivity is not always the optimal metric to prioritize. In cases where false positives carry significant costs, such as spam detection systems or loan approval processes, focusing exclusively on sensitivity can be problematic. For instance, in spam detection, maximizing sensitivity might incorrectly label a large number of legitimate emails as spam, frustrating users. Similarly, in financial contexts, excessive approval of fraudulent loan applications could lead to substantial financial losses. In such situations, it is crucial to balance sensitivity with metrics like specificity or precision, which focus on minimizing false positives and ensuring a more balanced approach to model evaluation.

Specificity, also known as the true negative rate (TNR), measures the proportion of actual negative instances that are correctly classified as negative (Handelman et al., 2019). This metric is essential in scenarios where accurately identifying negative cases is critical to avoiding false positives. Specificity is computed using the formula:

$$\text{Specificity} = \frac{TN}{TN + FP}$$

Specificity is a key evaluation metric that determines the proportion of actual negative instances a model correctly identifies. It is especially valuable in situations where false positives can lead to significant consequences. For example, in fraud detection, incorrectly flagging a legitimate transaction as fraudulent can result in dissatisfied customers and potential financial losses, making high specificity crucial. Similarly, in medical diagnostics, avoiding the misclassification of healthy individuals

as having a disease can prevent unnecessary stress, additional testing, and unwarranted treatments. High specificity ensures the model effectively rules out negative cases, thereby enhancing reliability and maintaining operational efficiency.

However, specificity is not always the ideal metric to prioritize, particularly in cases where false negatives carry greater risks than false positives. In disease screening, for instance, failing to detect an actual case of illness (a false negative) could delay critical treatment and endanger the patient's health. In such scenarios, sensitivity, which measures the proportion of actual positives accurately identified, becomes a more critical metric. Furthermore, in datasets with a high imbalance between positive and negative instances, relying solely on specificity may not provide a complete picture of the model's effectiveness. To ensure balanced evaluation, combining specificity with metrics like sensitivity, precision, and the F1 score is recommended, as this approach accounts for both false positives and false negatives.

Precision, on the other hand, calculates the proportion of correctly predicted positive instances out of all instances classified as positive by the model and is defined as follows (Vishwakarma et al., 2021):

$$Precision = \frac{TP}{TP + FP}$$

Precision is an essential evaluation metric in situations where the cost of false positives is particularly high. It is calculated as the ratio of correctly predicted positive instances to the total instances predicted as positive, making it a valuable measure for reducing the false positive rate. Precision is especially important in fields such as medical diagnostics, where false positives can lead to unnecessary stress, invasive follow-up tests, or treatments for patients. Similarly, in spam detection systems, precision is critical because incorrectly labelling legitimate emails as spam could result in missed important communications, leading to user frustration. Therefore, precision is favoured in applications where the impact of false positives outweighs that of false negatives.

However, precision alone may not be appropriate for scenarios where false negatives pose a greater risk than false positives. In such cases, recall or sensitivity becomes more critical. For example, in credit card fraud detection or intrusion detection systems, failing to identify fraudulent transactions or security breaches (false negatives) can lead to significant financial losses or compromised security. Even with high precision, a model might be inadequate if it overlooks a large number of actual fraudulent or malicious activities. Additionally, in datasets with a significant imbalance between positive and negative samples, precision may not fully capture the model's performance, as it does not account for the true negative rate. This can create an overly optimistic impression of the model's ability to identify positive instances accurately.

To address such limitations, combining precision and recall is recommended, particularly through the F1-score. The F1-score, also known as the F1-measure, provides a weighted average of precision and recall, accounting for both false positives and false negatives. It is particularly effective for evaluating models on imbalanced datasets, as it balances the trade-off between precision and recall.

The F1-score is calculated as follows (Humphrey et al., 2022):

$$F1_measure = \frac{TP}{TP + 0.5(FP + FN)}$$

The F1-measure, or F1-score, is an essential metric for evaluating the performance of machine learning models, particularly in classification tasks. It is defined as the harmonic mean of precision and recall, combining these two metrics into a single score that reflects their balance. The F1-measure is especially useful in scenarios with class imbalances, where the distribution of classes is uneven, and both false positives and false negatives carry significant consequences. This metric helps strike a balance between precision (the proportion of correctly identified positive predictions) and recall (the proportion of actual positive instances correctly identified).

Unlike other metrics, the F1-score offers a more balanced evaluation of a model's performance. While accuracy is simple to compute, it can be misleading when class distributions are imbalanced. For example, a model that predominantly predicts the majority class may achieve high accuracy while neglecting the minority class, thus failing to capture its performance comprehensively. Precision and recall, though individually important, focus on specific aspects of the model's capability. Precision is critical when false positives are costly, while recall is prioritized when false negatives carry severe implications. However, relying solely on one without the other can lead to an incomplete understanding of a model's effectiveness. The F1-score addresses this by harmonizing precision and recall, rewarding models that perform well on both metrics and penalizing those that exhibit imbalance.

The F1-score is particularly valuable in real-world applications involving imbalanced datasets. For instance, in medical diagnostics, fraud detection, or similar domains, the cost of false positives and false negatives can be significant. A model with high precision but low recall, or vice versa, may not effectively meet practical requirements. The F1-score ensures that models achieve a balanced trade-off, making it especially relevant for applications where adjustments to classification thresholds are needed to optimize performance.

Another critical evaluation metric is the Area Under the ROC Curve (AUC), which measures overall model performance by plotting the true positive rate (TPR) against the false positive rate (FPR) (Niroomand et al., 2022). A higher AUC value signifies better discrimination ability, indicating a model's effectiveness across different thresholds.

While accuracy is often the default metric for model evaluation, it is inadequate for highly imbalanced datasets, as it fails to reflect the true predictive capability in such scenarios. Metrics like sensitivity, specificity, precision, recall, F1-score, and AUC provide a more nuanced and reliable evaluation, ensuring that both positive and negative classes are appropriately accounted for in the assessment of model

performance.

- **Deployment:**

The objective of model deployment is to make the predictions generated by a trained machine learning model accessible for use by various stakeholders, including end-users, management, or integrated systems (Halawi et al., 2022). This step involves embedding the model into a production environment where it can process new data to deliver predictions or classifications. Deployment is geared toward addressing specific problems by leveraging the model's predictive capabilities efficiently and effectively.

Deployment is a crucial stage in the machine learning workflow. Without it, the insights and predictions generated by the model cannot contribute to decision-making or add tangible value. Proper deployment ensures that the model functions seamlessly in real-time environments, delivering consistent and accurate outputs. Achieving this requires meticulous planning and execution, aligning the model's operation with existing technological frameworks and infrastructure.

The CRISP-DM framework's iterative nature allows movement between phases to refine the data mining process as needed. For instance, the Data Understanding phase often loops back to the Business Understanding phase under the following circumstances:

- **Insufficient Data:** If data exploration reveals inadequate variables, low data volume, or poor quality, it may necessitate revisiting business goals to refine objectives or acquire additional data.
- **Misalignment with Business Goals:** During data exploration, inconsistencies between the available data and initial business objectives might surface. This requires adjusting project goals or redefining the scope in the Business Understanding phase to better align with the data.
- **Emerging Insights or Patterns:** Unexpected patterns or insights discovered in the data may prompt a reassessment of business objectives to incorporate these

findings.

- **Clarification of Business Requirements:** Gaps in understanding initial business requirements may arise during data exploration, leading to discussions with stakeholders and a return to the Business Understanding phase.
- **Data Quality Concerns:** Significant quality issues may necessitate re-evaluating whether the available data can be improved or if alternative sources should be sought. This reassessment typically occurs in the Business Understanding phase.

Similarly, the Modelling phase may require a return to the Data Preparation phase without passing through the Evaluation phase for the following reasons:

- **Improper Data Formatting:** Issues such as unencoded categorical variables or unstandardized numerical variables might arise, requiring additional preparation.
- **Inadequate Feature Engineering:** Initial feature engineering efforts might be insufficient, prompting further transformation or the creation of new features to enhance model performance.
- **Unaddressed Data Quality Issues:** Problems such as outliers or missing values, overlooked during Data Preparation, might be identified during modelling and require rectification.
- **Algorithm-Specific Requirements:** Certain algorithms may demand specific data preparation steps, such as normalization or handling missing data differently.
- **Feature Selection Challenges:** Some features might negatively impact model performance or prove irrelevant. This discovery may necessitate refining the feature set by removing or adding features.
- **Sampling Errors:** Inappropriate data sampling during preparation might require adjustments to the training, test, or validation sets to ensure the model is trained and evaluated correctly.
- **Insights from Early Models:** Initial modelling iterations might reveal

transformations or adjustments that could improve performance, prompting a return to Data Preparation for more thorough implementation.

Through these iterative refinements, the CRISP-DM framework supports continuous improvement of the machine learning process, ensuring models are well-aligned with business objectives and capable of delivering actionable insights in practical applications.

- **Evaluation:**

The Evaluation phase in the CRISP-DM framework often necessitates revisiting the Business Understanding phase to ensure alignment and refine objectives. This backward iteration occurs in several scenarios, as outlined below:

- **Misalignment with Business Objectives:** During the Evaluation phase, the performance of the data mining models is assessed against the business objectives defined earlier. If the models fail to meet these objectives or produce unsatisfactory results, revisiting the Business Understanding phase may be required to redefine or refine the goals and ensure they are achievable.
- **New Insights or Business Opportunities:** The Evaluation phase can reveal unexpected findings or highlight business opportunities that were not initially considered. These new insights may lead to the formulation of additional business questions or expanded project goals, necessitating a return to the Business Understanding phase.
- **Stakeholder Feedback:** Results from the Evaluation phase are often reviewed by stakeholders to confirm their alignment with business expectations. If stakeholders find the outcomes insufficient or propose new requirements, the Business Understanding phase may need to be revisited to incorporate their feedback and refine the project objectives.
- **Model Performance Issues:** Poor performance of the models during the Evaluation phase might indicate deeper issues with the original problem definition

or business context. Revisiting the Business Understanding phase can help clarify the problem and provide a better foundation for future iterations.

- **Adjustment of Evaluation Criteria:** The criteria used to evaluate the models—such as accuracy, recall, precision, or business relevance—might need refinement if they are found to be inadequate during the Evaluation phase. This requires reexamining the business objectives to ensure that evaluation metrics are properly aligned with the intended outcomes.
- **Integration and Implementation Considerations:** Practical challenges in integrating the model's results into business workflows may surface during the Evaluation phase. Addressing these challenges might require revisiting the Business Understanding phase to reassess goals and ensure that the model's outputs can be seamlessly applied within the business environment.
- **Reassessment of Data Issues:** Data-related problems, such as poor quality, incomplete datasets, or irrelevant information, may become apparent during the Evaluation phase. Revisiting the Business Understanding phase can help reassess data requirements and address any gaps to improve future model performance.

These scenarios highlight the iterative nature of the CRISP-DM framework, where continuous refinement across phases ensures that the project remains aligned with business objectives and produces actionable, high-quality results.

3.2.1. Exploratory Data Analysis

Exploratory Data Analysis (EDA) is a crucial step in the data analysis process, aimed at detecting errors, exploring data relevance, verifying assumptions, and analyzing relationships between variables (Indrakumari et al., 2020). Unlike statistical modeling or inferential techniques, EDA emphasizes understanding the data through exploration. Moreover, data analytics, including EDA, is regarded as a cost-effective technology that supports informed decision-making.

As noted by (Indrakumari et al., 2020), EDA is classified into graphical and non-graphical methods and can be further divided into univariate and multivariate analyses. Univariate analysis focuses on examining individual variables independently, offering insights into their distribution and characteristics. On the other hand, multivariate analysis explores two or more variables simultaneously, enabling a deeper understanding of complex relationships within the dataset. This comprehensive exploration facilitates better data comprehension, ensuring decisions are backed by thorough analysis.

Type of Data	Preferable EDA Techniques	Purpose
Categorical	Descriptive statistics, Histogram	Distribution of a variable
Continuous Univariate	Histograms, Line plot, Scatter plots, Box-and-whisker plots	Outlier detection
Continuous Bivariate	Heatmap, 2D arrays, Scatter plots, Covariance, Correlation	Quantify the relationship between two variables
Trivariate	3D Scatter plot, Heatmap	Visualize the relationship between two exposure variables
Multiple Groups	Side-by-side Box plot, 2D or 3D Scatter plot	Visualizing high-dimensional data

Table-12: EDA techniques based on data and purpose (Banu et al., 2022)

3.2. Population Of the Study

This study focuses on IT employees from leading firms such as TCS, Wipro, Tech Mahindra, Capgemini, and Accenture. It aims to gain a comprehensive understanding of employee retention strategies by examining perspectives across diverse experience levels. The research targets employees based in Bangalore and

Hyderabad, two major IT hubs in India, which host a significant portion of the country's IT workforce and provide valuable insights into industry practices and employee expectations.

The research population spans various career stages, including newly hired employees with minimal experience, mid-level employees with approximately 5 to 6 years of experience, and senior employees with over 15 years in the field. This diversity ensures a broad view of retention strategies and their effectiveness across different professional phases.

Newly recruited employees, for instance, often prioritize learning opportunities, career advancement, and job security. Mid-level professionals might focus more on achieving work-life balance, job satisfaction, and fair compensation. Senior employees, in contrast, may value leadership opportunities, career stability, and long-term financial planning. By incorporating these distinct perspectives, the study seeks to highlight how retention strategies can be tailored to meet the unique needs of employees at different career stages.

Bangalore and Hyderabad were selected for their prominence as IT industry hubs in India. These cities are home to a vast number of IT professionals and reflect the competitive pressures, working conditions, and cultural nuances of the sector. Analyzing employee feedback from these locations provides a realistic and comprehensive understanding of the challenges and opportunities in employee retention.

The data collected from this diverse group will be analyzed to identify key factors influencing employee retention and attrition within Indian IT companies. By examining trends across different experience levels, the research aims to help organizations design targeted strategies that cater to the specific needs of their workforce. This approach is expected to enhance employee satisfaction, reduce turnover rates, and strengthen organizational stability.

Ultimately, the study's findings will support HR departments in creating more effective, personalized retention policies. By aligning these policies with the distinct motivations and expectations of employees at various career stages, companies can foster a more engaged and committed workforce. This research population, representing a range of experience levels and key IT hubs, provides a strong foundation for evaluating data-driven retention strategies in India's IT industry and contributes to the development of solutions that promote long-term organizational success.

3.3. Sample Technique and Size

In the "Selection of Sample" process, the study randomly selected fresh recruits, mid-level employees, and senior employees from five leading national multinational corporations (NMCs). Equal proportions were maintained among these three groups, forming a sample of 100 employees from each NMC, resulting in a total of 500 participants. After thoroughly filtering out invalid data and null responses from the initial pool, a refined dataset of 108 valid records was chosen for this research. This carefully selected sample ensures balanced representation across various experience levels, enhancing the study's relevance and the reliability of its findings.

3.4. Instruments Of Data Collection

This research utilizes a dual approach for data collection to gain insights into employee attrition trends and develop data-driven HR retention strategies. A survey was conducted to gather firsthand information from employees across IT firms in India, while a publicly available dataset from Kaggle was used to complement the findings. The combination of primary survey data and secondary public data enables a comprehensive analysis, ensuring both qualitative and quantitative perspectives are addressed in this study. The following sections outline the specific instruments and methods employed in this data collection process

3.4.1. Survey Design for Employee Attrition Factors

A questionnaire is a popular and effective tool for data collection, consisting of a structured set of questions designed to gather specific information from a targeted group of respondents. This method is particularly advantageous for studies involving large populations, as it enables the efficient collection of standardized data. Questionnaires are instrumental in aligning collected information with the research objectives, making them a widely preferred approach for studies requiring input from extensive participant groups. They provide a secure and organized framework for respondents to share their answers, ensuring reliable data for analysis.

In this study, data was collected through a questionnaire that combined two response formats: free text entries and predefined dropdown selections. This dual approach facilitated a more comprehensive data collection process. Predefined dropdown options ensured uniformity and simplicity, streamlining data processing, while the free text responses allowed participants to share detailed, open-ended insights. This combination enabled the capture of both structured quantitative data and rich qualitative perspectives, offering a well-rounded view of employee opinions and experiences. Additional specifics on the questionnaire structure can be found in Appendix – A.

3.4.2. Public Dataset from Kaggle

In addition to survey data, this research incorporates a public dataset on employee attrition from Kaggle, focusing on the IT sector. This dataset includes key variables such as job satisfaction, work-life balance, and career growth. Machine learning models will be used to analyze this data, helping to predict attrition trends and develop data-driven retention strategies.

3.4.3. Data Validity and Reliability

Before conducting Exploratory Data Analysis (EDA) on the survey data, several validation steps were performed to ensure the quality and relevance of the data:

- **Free-text Answer Validation:** Responses to questions that required free-text input were carefully reviewed to ensure they were coherent, relevant, and properly formatted for analysis. Any ambiguous or incomplete answers were flagged or filtered out.
- **Personal Data Filtering:** Any personal identifiers or confidential information from the survey participants were removed to maintain anonymity and comply with privacy standards.
- **Generic Response Verification:** The data was checked to ensure that responses were generic and not tied to specific instances or organizations, as the focus of the research was on broader patterns related to employee attrition, not individual cases or companies. Any responses containing organization-specific or incident-specific information were excluded as they fell outside the scope of the research.

3.5. Justification For the Instruments Used

The instruments selected for this research were carefully chosen to ensure robust data collection and analysis, addressing the study's objectives effectively.

- A questionnaire administered through Google Forms served as the primary tool for gathering responses from a large sample of IT employees across various cities. This method allowed for efficient data collection, ensuring broad accessibility to participants and achieving a high response rate.
- Survey responses from IT professionals in Bangalore and Hyderabad were collected, offering valuable region-specific insights into employee retention trends in India. These responses were subjected to Exploratory Data Analysis (EDA), which helped uncover key patterns and trends relevant to the study's research questions.
- Additionally, a public dataset from Kaggle was utilized to capture general employee behavior patterns in a broader context. This dataset played a vital role in supporting the application of machine learning models, enabling the

development of data-driven strategies to enhance employee retention.

By combining region-specific survey data with the generalized patterns provided by the Kaggle dataset, this approach ensured a balanced analysis. The integration of these two data sources facilitated the identification of trends unique to specific regions while also highlighting broader, industry-wide behaviors, providing a strong foundation for actionable retention strategies.

3.6.Method Of Data Collection

Data collection is the organized process of obtaining, assessing, and interpreting information to extract insights for research purposes. This process employs validated techniques to ensure accuracy and relevance. Researchers use the gathered data to test hypotheses and make informed conclusions. The methods of data collection differ across fields, customized to meet the specific objectives of each study. A key objective is to gather data that is comprehensive, dependable, and suitable for statistical evaluation. This facilitates informed decision-making and enhances the reliability of research findings (Mazhar et al., 2021).

Data collection generally falls into two categories: primary and secondary. In behavioral sciences, primary data is often acquired through methods like direct observation, interviews, surveys, and structured databases. Conversely, secondary data is sourced from existing materials, such as published books, academic journals, magazines, and unpublished documents like autobiographies and biographies. The selection of a data collection method is guided by the study's aims and the suitability of the chosen method for the research type. This ensures alignment with the study's objectives and methodology.

3.6.1. Methods Of Collection of Primary Data

In experimental research, primary data is obtained through the process of conducting experiments. In contrast, descriptive research and surveys, such as sample or census-based studies, typically involve collecting primary data via observation or

direct interaction with participants through various communication methods. This approach provides original information specifically tailored to meet the objectives of the study.

The use of questionnaires is a prevalent method for data collection, particularly in large-scale surveys conducted by researchers, institutions, and governments. This technique involves distributing a set of pre-arranged questions, either printed or typed, to respondents and requesting their input. The questions are organized in a specific sequence, and participants are required to answer independently by filling in the designated spaces. Respondents review and complete the questionnaire before submitting it. This self-completed method is especially effective for collecting data from a broad population.

3.6.2. Sources Of Secondary Data Collection

In some scenarios, researchers may rely on data already stored within databases, bypassing the need for new data collection. Databases consist of systematically organized information, which can be in the form of digital systems, books, or physical filing systems. One significant benefit of utilizing existing databases is the structured and easily accessible nature of the information. The choice of whether to use pre-existing data or gather new information depends on the specific goals of the research. Leveraging such resources can simplify the research process and offer an efficient foundation for analysis.

Kaggle is a widely recognized platform in data science and analytics, known for its extensive collection of datasets. It serves as a dependable source of secondary data, particularly valuable in areas like human resources. The platform's repository includes datasets contributed by organizations and researchers, covering topics such as employee behavior, attrition trends, and retention strategies. These datasets are often well-organized and validated, ensuring their quality and applicability. By using Kaggle's resources, HR professionals can craft data-informed strategies to improve

employee retention, aligning their initiatives with current trends and actionable insights.

CHAPTER 4: RESULTS AND DISCUSSION

4.1. Exploring Data

To achieve detailed outcomes and support meaningful discussions, the data utilized in this research holds significant importance. This section outlines the primary and secondary data sources that serve as the foundation for the analysis. The primary data was gathered through a customized survey aimed at identifying factors contributing to employee attrition, retention issues, and variations across departments. This survey collected responses from participants of diverse demographics, departmental roles, levels of experience, and satisfaction metrics, providing direct insights into the workforce's perspectives and opinions.

In addition to the primary survey data, secondary data was acquired from Kaggle, a renowned platform offering datasets for data science and machine learning. This secondary source complements the primary findings by providing industry benchmarks, historical patterns in attrition, and additional variables that might not have been covered in the survey. Utilizing Kaggle's data enables comparisons with broader industry trends, helping to contextualize the study's results and assess whether the observed trends align with or deviate from common industry practices.

The analysis begins with an examination of the survey data. This involves conducting a correlation analysis to uncover relationships between critical variables, which helps identify factors significantly impacting employee attrition. By exploring these correlations, insights are gained into the influence of elements such as workplace environment, pay structures, and opportunities for career progression. These findings guide the development of specific strategies to improve employee retention. Furthermore, the participant distribution within the survey sample is analyzed, focusing on characteristics like age, department, and tenure. This breakdown ensures the sample is representative, reinforcing the credibility and applicability of the study's conclusions.

4.1.1. Primary Data:

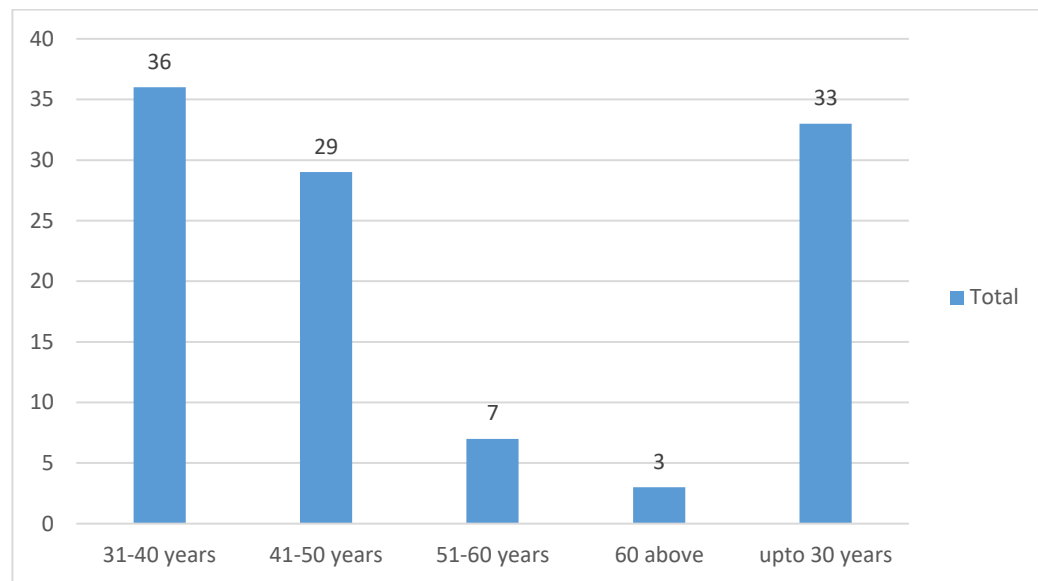


Figure-5: Age Distribution of The Sample Considered

Figure-5 presents key insights into the age distribution of employees based on the survey data. This information is instrumental in identifying patterns and trends related to age-specific attrition and retention requirements. Below is an analysis of the various age groups represented in the survey, along with potential implications for developing HR retention strategies:

- Up to 30:

The youngest age group, consisting of employees up to age 30, represents early-career professionals. High attrition rates here are often related to career exploration, professional growth opportunities, and competitive compensation. Retention efforts for this group should focus on training, skill development, and clear career paths. Providing mentorship and fostering a dynamic, inclusive culture can also help retain younger employees who are still forming long-term career connections.

- Age 31-40:

This age category represents the largest proportion of the workforce surveyed, indicating its critical importance in understanding overall workforce dynamics. Individuals in this group are generally at a mid-career stage, where they balance professional growth with personal and family commitments. Elevated attrition rates within this demographic may stem from aspirations for career progression, the pursuit of competitive remuneration, and the need for a healthy work-life balance. Effective retention strategies for this group could include implementing career advancement initiatives, providing leadership training opportunities, and offering family-friendly benefits such as flexible schedules and comprehensive health coverage.

- Age 41-50:

The 41-50 age group constitutes an essential segment of the workforce, often including seasoned professionals and senior leaders. Individuals in this demographic typically value job security, engaging work, and acknowledgment of their efforts and achievements. Losing employees in this group can be particularly detrimental due to the loss of their specialized skills and leadership capabilities. To retain these employees, organizations could focus on initiatives like succession planning, mentorship programs, and positions that provide a strong sense of purpose and recognition. Additionally, offering customized retirement plans and reinforcing job stability can serve as effective strategies to support and retain this valuable age group.

- Age 51-60:

This group has a smaller presence in the survey, likely indicating a nearing-retirement stage for many. Employees here might be focused on retirement planning and job satisfaction rather than aggressive career growth. Retention strategies could include phased retirement plans, flexible work arrangements, and opportunities for legacy-building within the organization, such as mentoring younger employees. Keeping this group engaged is crucial as they bring vast knowledge and experience that can benefit the organization.

- Above 60:

Employees over 60 are few but highly valuable, often possessing deep institutional knowledge. Retention for this age group may focus on offering part-time or consulting roles post-retirement, allowing them to contribute to the organization in a way that accommodates their needs. Ensuring a smooth transition for knowledge transfer from this group is also essential to maintain organizational continuity.

Each age group within the workforce comes with its own set of retention challenges and priorities. Recognizing these differences enables HR teams to design tailored strategies that align with the distinct needs and driving factors of each demographic. This approach helps create a more committed, satisfied, and resilient workforce.

To categorize these departments into broader categories, we can create general groupings based on function. Here's a possible breakdown:

- Human Resources and Training
 - Human Resources: Includes Human Resources (HR) and the Talent Strategy Center of Excellence, focusing on strategic initiatives within the HR domain.
 - Training and Development: Covers HR Training, Organizational Development (OD), Training & Development, and Learning and Development, emphasizing employee skill enhancement and organizational growth.
 - Recruitment and Talent Management: Encompasses Talent Strategy Center of Excellence, HR functions, and Client Relationship management, highlighting strategic recruitment and effective talent management practices.
- Sales, Marketing, and Business Development:
 - Sales: Sales, Client Relationship, Business Development
 - Business Administration and Management: Business Administration,

Commerce and Management, Branch Manager, Business Excellence, Corporate Actions, Digital Lab

- Manufacturing and Production:
 - Manufacturing: Manufacturing, CNC Manufacturing, Automobile, Production, Quality Assurance, Supply Chain, Supply Chain Management, Supply Chain Operations, Procurement, Operations
- Information Technology and Engineering:
 - Information Technology: Information Technology, IT, Software, Software Engineer, Digital Experience, Data Science/Analytics, Security and Fraud Control, VLSI Physical Design, Computer Science and Engineering, ECE, BPM Sector
 - Engineering and Technical Roles: Naval Projects, DRDO, APGENCO, Public Transport Management
- Academic and Education:
 - Education: Education, Academic, Certification
 - Specialized Training and Research Institutions: Employees Provident Fund Organization, Public Transport Management
- Finance and Administration:
 - Finance: Finance, Finance Management, Financial Services, Corporate Actions
 - Commerce and Business Support: Commerce, Business Administration, Commerce and Management
- Quality and Compliance:
 - Quality Assurance and Control: Quality Assurance, Security and Fraud Control
 - Regulatory and Compliance: Certification, Employees Provident Fund Organization
- Other Departments:
 - Secretarial and Support Roles: Secretarial Department, Support Executive

- Miscellaneous Roles: Others, Retired, Digital Experience

These broader categories can help to structure the analysis or report, allowing for a clearer picture of the distribution of survey respondents and potential patterns by functional areas. Additionally, grouping departments by function may make it easier to analyze HR challenges and attrition causes within similar roles and identify trends relevant to specific areas.

The survey columns can be grouped into categories that focus on employee demographics and work environment, attrition causes and impacts, retention policies, and pandemic-related factors. The demographics and work environment section, including columns on age, department, length of service, dependents, work hours, and compensation, aims to understand how background factors and job conditions influence attrition. This category captures a snapshot of the employee profile and working environment, offering insight into how personal circumstances, workload, and perceived value from compensation affect satisfaction and retention.

The next category focuses on attrition causes, impacts, and organizational responses. Questions on HR challenges, major reasons for attrition, experience levels most susceptible to attrition, and specific roles highlight underlying factors that lead to turnover and which employees are most vulnerable. The survey also inquires about the organizational consequences of attrition - whether it's loss of productivity, increased recruitment costs, or morale issues - providing a basis for prioritizing retention efforts. Another crucial category addresses retention policies and organizational support, with questions about exit interviews, retention offers for resigning employees, career growth, training, and work culture alignment. This section aims to gauge if the organization is actively fostering a supportive environment and if policies are in place to retain valuable talent.

Pandemic-related questions focus on understanding employee expectations for support during challenging times, addressing aspects such as financial aid, remote work opportunities, health and safety protocols, and flexible arrangements. This

evaluation sheds light on how the pandemic has influenced employee satisfaction and work-life balance, highlighting the critical role of responsive and adaptive policies in maintaining employee retention during periods of uncertainty. Combined, these insights offer a holistic perspective on the factors driving attrition and help HR teams develop more precise and effective retention strategies.

In the sphere of data analysis, survey data serves as an essential and direct source of information. Gathered firsthand from individuals through structured questionnaires or interviews, this data offers valuable insights into human behaviors, preferences, and perceptions. Unlike purely quantitative data, survey responses provide a nuanced view of attitudes and personal experiences at a specific moment, capturing the human dimension behind the numbers. The schema for survey data is presented in [Appendix A - Survey data](#).

4.1.2. Secondary Data:

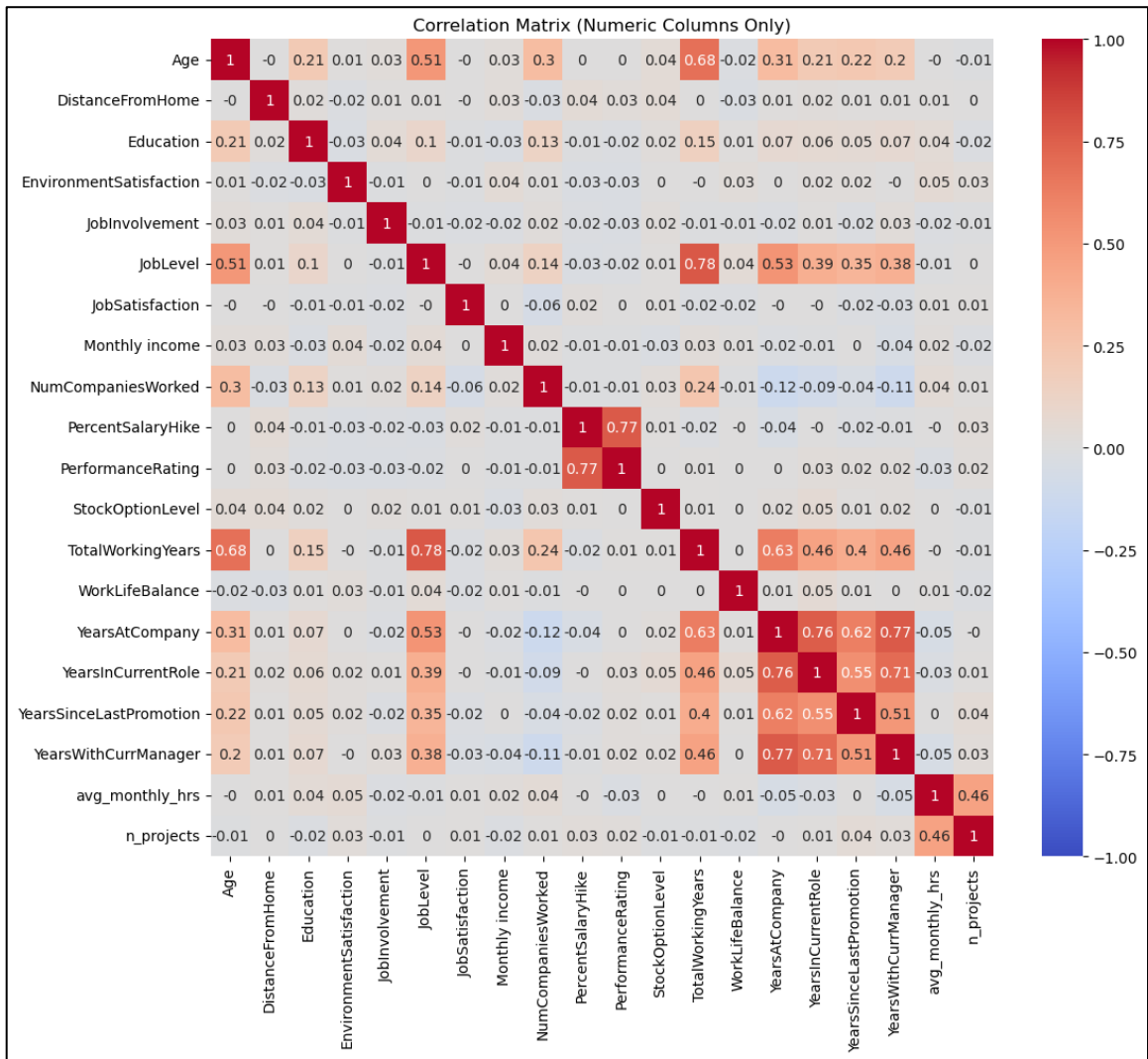


Figure-6: Correlation Matrix of Numerical Data of The Public Data.

Based on the correlation matrix provided in figure-6, a sophisticated analysis of the relationships between variables can be obtained using dataset. Insights drawn from the correlation plot:

- Strong Positive Correlations:
 - There's a remarkably strong positive correlation (0.95) between "TotalWorkingYears" and "Age," indicating that as employees age, their total

working experience increases proportionally. This relationship is intuitive but confirms the dataset's internal consistency.

- "Monthly income" shows strong positive correlations with several variables, highlighting key factors associated with employee compensation. There is a notably high correlation with "JobLevel" (0.95), suggesting a clear hierarchical pay structure where higher job levels are consistently associated with higher salaries. Additionally, the correlation with "TotalWorkingYears" (0.78) and "Age" (0.70) indicates that compensation tends to increase with both experience and age, reflecting an incremental reward system that values tenure and expertise. The "YearsAtCompany" (0.62) correlation further implies that employees who remain loyal to the company are likely to see financial rewards over time, reinforcing a compensation model that incentivizes long-term commitment.
- Moderate Positive Correlations:
 - "YearsAtCompany" correlates positively with "YearsInCurrentRole" (0.78), "YearsSinceLastPromotion" (0.72), and "YearsWithCurrManager" (0.71). This cluster of correlations suggests that as employees stay longer with the company, they tend to remain in their roles longer, experience longer intervals between promotions, and maintain longer relationships with their current managers.
- Weak to Moderate Correlations:
 - "JobSatisfaction" shows weak positive correlations with "JobInvolvement" (0.31) and "EnvironmentSatisfaction" (0.29), suggesting that while these factors contribute to job satisfaction, other unmeasured variables likely play significant roles.
- Negligible or Weak Correlations:
 - Interestingly, "PerformanceRating" shows very weak correlations with most variables, including "Monthly income" (0.01) and "JobLevel" (0.01). This could indicate that performance ratings may not be strongly tied to traditional

career progression metrics or compensation in this organization.

- Negative Correlations:
 - There are no strong negative correlations in the matrix, which is noteworthy. The strongest negative correlation is between "Age" and "PercentSalaryHike" (-0.19), suggesting a slight tendency for younger employees to receive higher percentage salary increases.
- Multicollinearity Concerns:
 - The strong correlations between "TotalWorkingYears," "Age," "JobLevel," and "Monthly income" suggest potential multicollinearity. This could be problematic for certain types of predictive modeling and may require careful consideration in feature selection for machine learning applications.

The analysis of observed correlations provides valuable insights into the factors that influence employee compensation and retention. These findings illuminate the connections between various demographic and job-related characteristics, offering a comprehensive perspective on how an organization's pay policies and work environment affect employee satisfaction and turnover.

One notable observation is the significant positive correlation between Monthly Income and Job Level, which reflects a systematic approach to compensation. This pattern suggests that salary increases are closely tied to career advancements, with promotions bringing notable pay enhancements. Such a structure likely motivates employees to pursue career growth within the organization.

Another key insight arises from the positive relationship between Monthly Income and Total Working Years, indicating that compensation generally rises with an employee's accumulated experience. This trend aligns with standard industry practices, where seasoned professionals are often rewarded with higher pay due to their developed expertise and skills. Additionally, the correlation between Monthly Income and Age shows that salaries tend to grow as employees age. This highlights the organization's recognition of the value that experience and maturity bring to the

workplace, potentially contributing to lower turnover rates among older, more highly compensated employees.

The correlation between Monthly Income and Years at Company suggests that loyalty and tenure within the organization are financially rewarded. Employees who have invested more years with the company are likely to earn higher salaries, which could foster a culture of loyalty and reduce turnover rates among long-term employees. This insight can be especially valuable for retention strategies, as it indicates that consistent recognition of employee tenure through pay raises can help retain experienced employees.

- Career Progression:
 - The moderate correlations between "YearsAtCompany," "YearsInCurrentRole," "YearsSinceLastPromotion," and "YearsWithCurrManager" paint a picture of career stability and potentially slow progression within the organization.
- Work-Life Balance:
 - "WorkLifeBalance" shows very weak correlations with most other variables, including "JobSatisfaction" (0.10) and "EnvironmentSatisfaction" (0.10). This suggests that work-life balance might be perceived independently of other job-related factors in this organization.
- Employee Engagement:
 - The variable "JobInvolvement" exhibits a weak to moderate positive correlation with "JobSatisfaction" (0.31) and "EnvironmentSatisfaction" (0.24). This suggests that employees who are more engaged in their roles tend to show a slightly higher level of satisfaction with both their jobs and their work environment.
- Compensation Structure:
 - The strong correlation between "JobLevel" and "Monthly income" (0.95), coupled with their similar correlation patterns to other variables, suggests a

structured compensation system closely tied to job levels rather than individual performance metrics.

The insights offer a detailed perspective on the connections between various elements in the employee dataset. They emphasize key areas for HR initiatives, such as tackling the limited association between performance ratings and career advancement, as well as identifying strategies to improve job satisfaction and work-life balance. Additionally, these correlations serve as a basis for conducting more sophisticated analyses, including predictive modeling focused on employee retention or satisfaction. At the same time, they highlight potential challenges like multicollinearity, which must be addressed in these analyses.

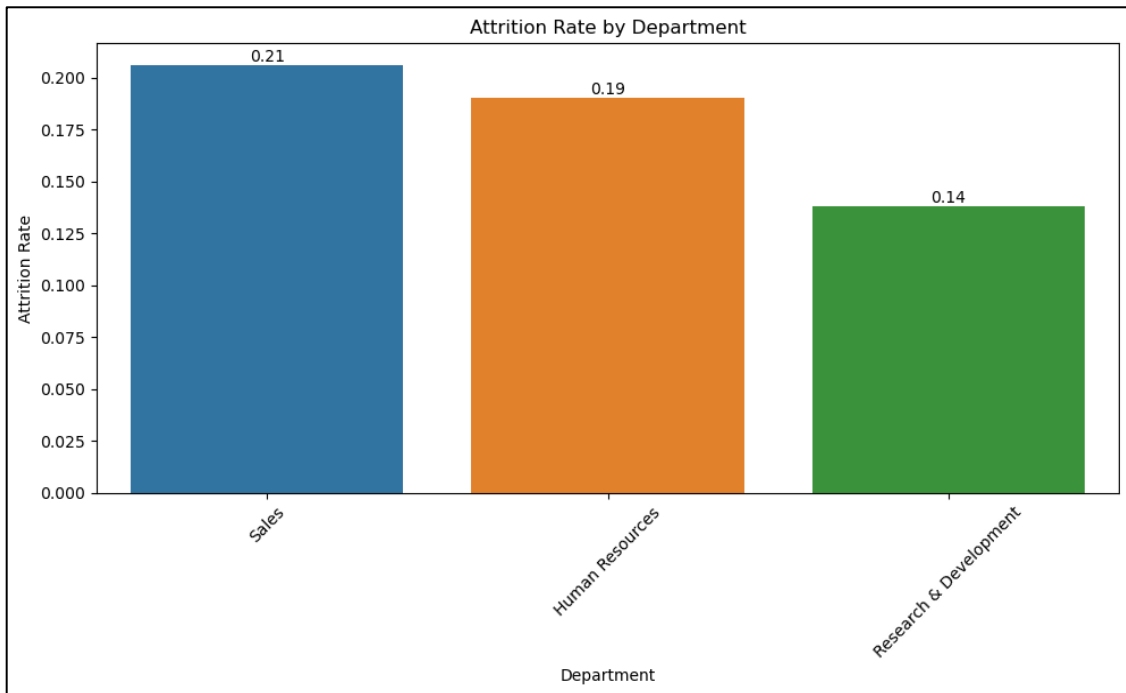


Figure-7: Attrition Rate Captured for Each Department.

Figure-7 shows the attrition rate by department, highlighting differences across Sales, Human Resources, and Research & Development. Here are some insights from this data:

- Sales Department: The attrition rate in the Sales department is the highest at

21%. This suggests that employees in Sales may face factors like high performance pressure, targets, or job dissatisfaction that contribute to a higher turnover.

- **Human Resources:** The attrition rate in the HR department is 19%, slightly lower than Sales but still significant. This could indicate challenges related to HR roles, such as handling sensitive employee matters, which may impact job satisfaction and lead to turnover.
- **Research & Development:** The R&D department has the lowest attrition rate at 14%. This might imply that employees in R&D have more stable roles, potentially due to higher job satisfaction, growth opportunities, or engagement in projects that are challenging but rewarding.

Overall, the Sales and HR departments have notably higher attrition rates compared to R&D, indicating a need for targeted retention strategies in these areas, such as enhancing job satisfaction, offering better support, and potentially adjusting workload and incentives.

Public data on Kaggle represents an extraordinary reservoir of datasets contributed by a global community of data scientists. Spanning diverse industries and topics, these datasets are an invaluable resource for those aiming to perform thorough analyses, explore hypotheses, or build machine learning models. Kaggle's collaborative ecosystem further enhances this by fostering a vibrant exchange of expertise and techniques among data enthusiasts worldwide. The schema for this public data can be found in [Appendix B – Public Data](#).

4.2. Solving Research Questions

This section of the research delves into addressing the posed research questions by employing data visualization techniques to discern patterns within the data. Machine learning (ML) methods excel at analysing large, complex datasets, as substantial data is necessary for robust learning. Small sample sizes can undermine the

stability and reliability of ML models. The primary strength of ML techniques lies in delivering highly accurate results, significantly benefiting precision medicine principles (Cilluffo et al., 2021).

Data visualization is a vital tool for both data exploration and presentation. During the exploration phase, researchers utilize visual representations to investigate potential patterns that are suspected but not yet confirmed. This method offers a broad perspective, aiding in the identification of significant trends. On the other hand, the presentation of data focuses on showcasing established features and emphasizing notable structures that have already been discovered. Therefore, data visualization serves as a critical component in both uncovering insights and effectively communicating them (Shoresh and Wong, 2011).

Furthermore, the research leverages machine learning models to pinpoint the most influential factors that contribute to the outcomes being studied. These models are adept at sifting through large datasets to identify which attributes are most significant in predicting or affecting the target variable. Once these key attributes are identified, the research proposes data-driven retention strategies, which are formulated based on the insights gleaned from the data. These strategies are aimed at retaining valuable elements, such as employees or customers, by addressing the factors that the data has shown to be most impactful in influencing retention. The approach is systematic and grounded in empirical evidence, ensuring that the strategies are not only relevant but also effective in achieving the desired retention outcomes.

Logistic Regression is a statistical model that breaks down the relations between more than one independent variable and a dependent variable that holds categorical value. This method operates to provide a linear model, assuming that a linear relationship exists between the log-odds of the dependent variable and the predictor variables. Being a generalized linear model, logistic regression extends the ordinary methods of linear regression to take in dependent variables that have non-normal distributions. As a result, it is highly regarded in predictive analysis, especially

in tasks that deal with discrete dependent variables. In fact, logistic regression results are very effective at estimating the probability of binary outcomes using one or more independent variables. Common contexts of its application include binary classification tasks, where it is used to predict the probability of an event. In this respect, the model outputs probabilities, whereby a class is assigned a label. A common threshold for this is 0.5. Due to its simplicity and interpretability of coefficients, it fares well in business applications, providing concrete insight into how each predictor affects the outcome.

Contrarily, a decision tree is a model of machine learning that is, by nature, tree-like. It graphically portrays decisions along with their probable results. It contains nodes and edges; the nodes are the decisions or events, while the edges are the criteria or rules guiding such decisions. Each branch represents a possible value of an attribute, thus allowing the model to classify groups of data based on their features. The logic evident in the flow and clarity of this approach facilitates decision-making processes and classifications (Mahesh, 2020).

According to (Mahesh, 2020), the Random Forest was developed by Breiman as an ensemble learning method for the classification and regression problems; such a technique leverages multiple models to strengthen their predictive nature. Random Forest combines multiple decision trees on predictions that are stronger and more reliable than any single tree. This technique is very efficient for variance reduction, which might become especially important for cases when the models considered are individually unstable. Random Forest very frequently incorporates a voting mechanism; typically, majority voting manufactures the most frequently chosen class label for every instance. At once simple and powerful, it finds its application for a wide array of tasks (Sheykhmousa et al., 2020).

In the research methodology, logistic regression (a linear model), decision trees (a foundational tree-based model), and random forest (a tree-based ensemble model) were chosen as the machine learning models due to their interpretability and suitability

for business contexts. These models are widely recognized for their ability to provide actionable insights and are frequently used to address classification and regression challenges.

4.2.1. Which employee factors influence employee retention?

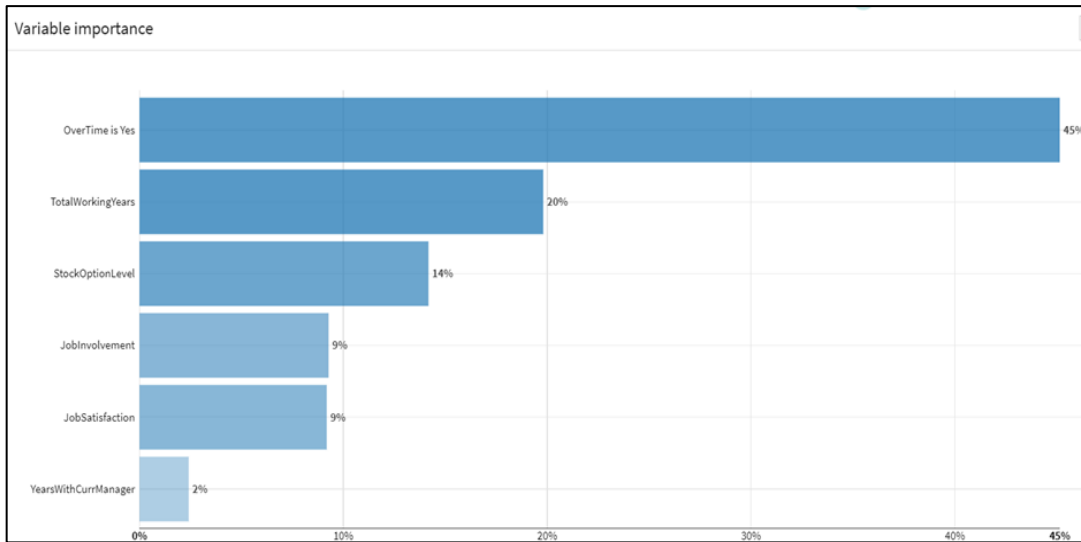


Figure-8: Plot of Feature Importance Obtained from Decision Tree

Based on the feature significance from figure-8, derived from the decision tree, here are the key inferences:

- **OverTime is Yes:**
This feature has the highest significance, influencing the model by 45%. Employees working overtime are likely to impact retention significantly.
- **TotalWorkingYears:**
With a significance of 20%, this feature plays a moderate role. Longer total working years may affect employee retention.
- **StockOptionLevel:**
This feature has 14% of significance. Slightly influence employee's intention to stay.

- **JobInvolvement, and JobSatisfaction:**
These features have lower significance of 9%. While they still matter, they don't strongly influence retention.
- **YearsWithCurrManager:**
Has least significant at 2%.

In summary, understanding these features can guide retention strategies, emphasizing overtime management, career longevity, and manager relationships.

Let's further analyse the significant variables among employee demographic factors to better understand their impact on various outcomes. Demographic variables such as 'Age', 'Gender', 'Distance from Home', 'Education', 'Total Working Years', and 'Number of Companies Worked' play crucial roles in shaping an employee's experience and performance within an organization. By exploring these key factors, we can gain insights into how different demographics influence job satisfaction, retention, productivity, and overall workplace dynamics. For instance, understanding the age distribution within the workforce can help in designing age-appropriate training programs and career development opportunities. Similarly, examining gender differences can shed light on diversity and inclusion efforts, helping to create a more equitable workplace.

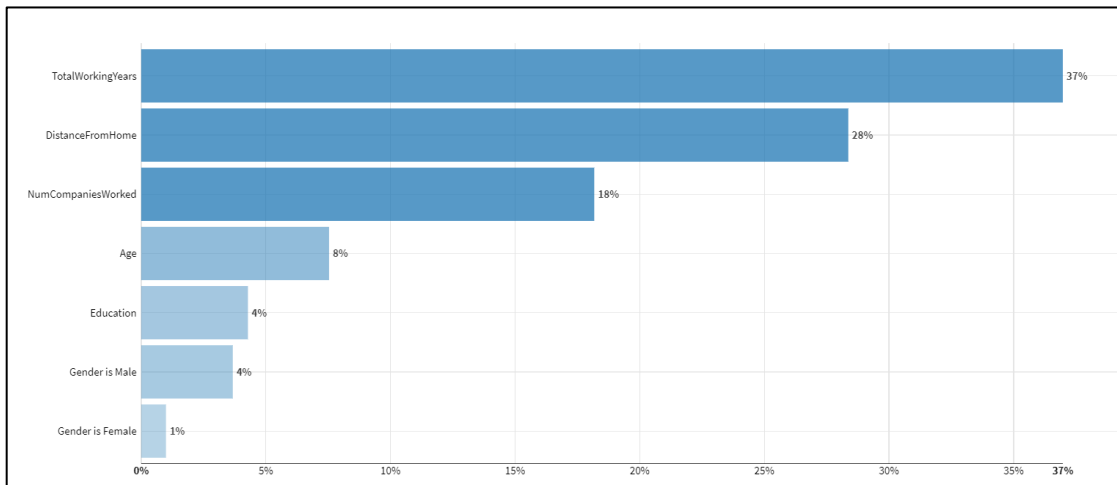


Figure-9: Significant Demographic Variables

Figure 9 shows that factors such as 'Distance from Home' relate to commute time and work-life balance, which may have a bearing on job satisfaction and, hence, state intention to leave. 'Education' generally is related to the type of role an employee may fit and also to their growth within the company. 'Total Working Years' and 'Number of Companies Worked' provide insights into an employee's career stability and experience. Analysing these variables can help identify trends and patterns that inform strategic HR decisions, such as targeted retention strategies, personalized career development plans, and effective diversity and inclusion initiatives. By delving into these demographic factors, organizations can better understand their workforce and create tailored interventions to enhance employee engagement and performance.

Let's further analyse the significant variables related to organizational attributes to better understand their impact on employee performance and satisfaction. Key factors such as 'Business Travel', 'Department', 'Number of Projects', 'Environment Satisfaction', 'Job Level', 'Job Satisfaction', 'Monthly Income', 'Over Time', 'Percentage Salary Hike', 'Performance Rating', 'Stock Option Level', and 'Average Monthly Hours' provide valuable insights into how various organizational aspects influence employee behaviour and outcomes. For instance, the frequency of 'Business Travel' can affect work-life balance and job stress levels, which in turn impact job performance and satisfaction. The 'Department' an employee belongs to can reveal differences in departmental cultures and resources, affecting overall productivity and morale.

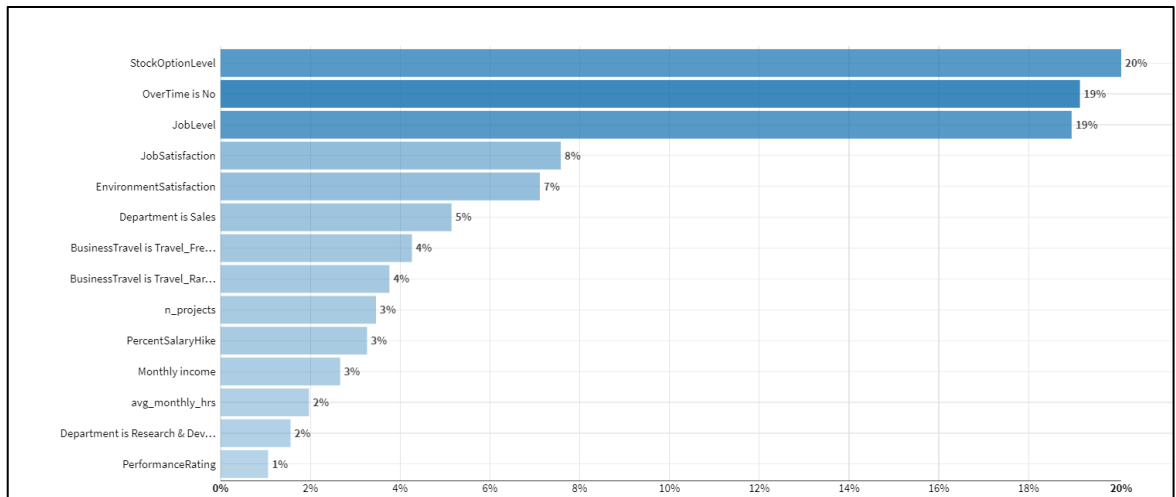


Figure-10: Significance Of Organization Related Factors

From figure-10, we can deduce that the ‘Number of Projects’ an employee handles can help gauge workload and its correlation with stress and job satisfaction. ‘Environment Satisfaction’ and ‘Job Satisfaction’ are critical indicators of how content employees are with their workplace conditions and roles, directly influencing retention rates and productivity. ‘Monthly Income’ and ‘Percentage Salary Hike’ are vital in assessing financial incentives and their role in employee motivation. ‘Over Time’ and ‘Average Monthly Hours’ can indicate potential burnout issues, affecting long-term performance and health. ‘Performance Rating’ and ‘Stock Option Level’ reflect how employees perceive their growth and rewards within the company, impacting their engagement and loyalty. These organizational attributes, when looked into, can further help organizations in knowing which areas to improve upon and come up with strategies to improve employee satisfaction, performance, and retention, and hence a more productive and motivated workforce could be attained.

Let's further analyse the significant variables related to leadership attributes to get a more complete understanding of their effects on employee engagement and employee performance. Variables of importance that will be discussed in this section—i.e., 'Job Involvement', 'Work-Life Balance', 'Years at Company', 'Years in Current Role', 'Years Since Last Promotion', 'Years with Current Manager', and

'Decision Skill Process'—all have been presented as supporting critical variables in determining what occurs in leading an individual employee's work life.

'Job Involvement' refers to the extent to which an employee is engaged in the job. To a large extent, this can be aided by the leadership and managerial support given. Generally speaking, the higher the job involvement, the higher the performance and job satisfaction. The same applies to 'Work-Life Balance', which is important because it relates to well-being and productivity. Leaders encouraging work-life balance will, therefore, tend to develop a more motivated and dedicated workforce.

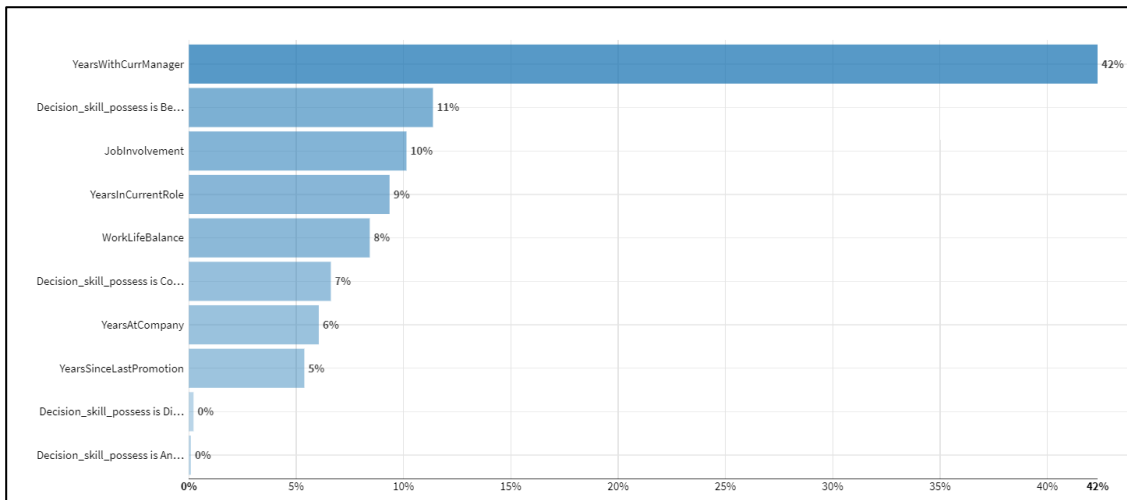


Figure-11: Significance Of Leadership Related Attributes

From figure-11, the impact of tenure-related variables such as 'Years at Company', 'Years in Current Role', and 'Years with Current Manager' is essential. These factors can indicate an employee's stability and experience within the organization, which are often influenced by leadership practices. Longer tenure with a supportive manager typically leads to higher job satisfaction and loyalty. 'Years Since Last Promotion' can reveal how leadership affects career advancement opportunities, which is crucial for employee motivation and retention. Furthermore, 'Decision Skill Process' evaluates how effectively employees are involved in decision-making, which is a key leadership trait. Leaders who empower their employees to make decisions can

enhance their engagement and ownership of work. By exploring these leadership-related attributes, organizations can identify strengths and areas for improvement in their leadership practices, ultimately aiming to create a more supportive and effective leadership culture that enhances employee satisfaction and performance.

4.2.2. Which Employee Retention Factors Are Important to an Emerging Economy Like India?

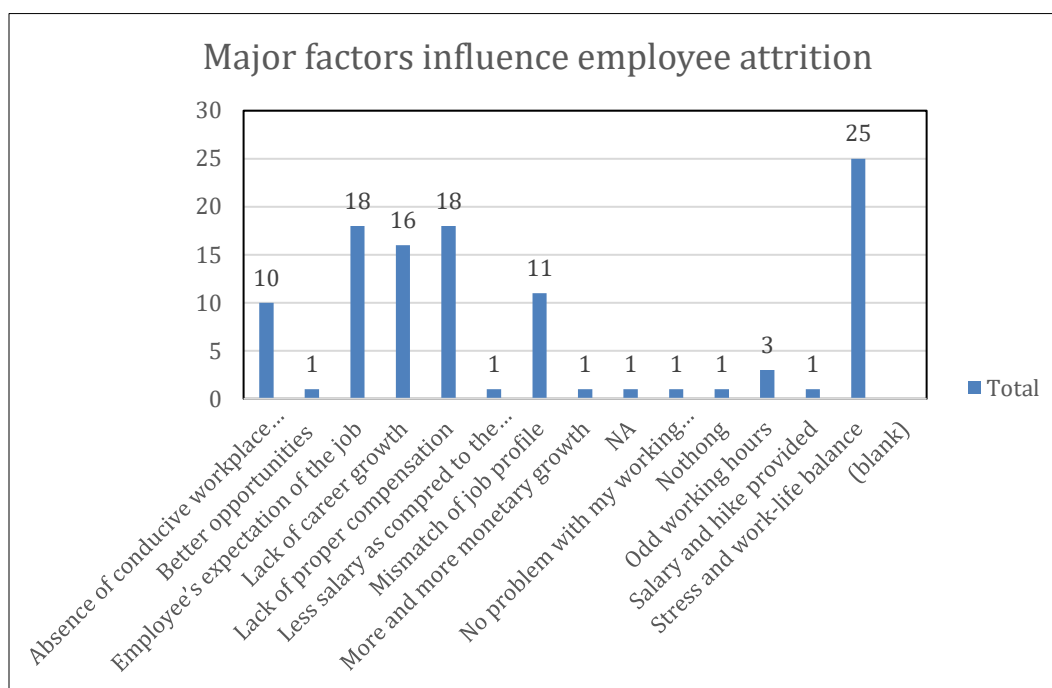


Figure-12: Attrition Factors - Employee View

Inference:

Figure-12 confirms, "Stress and work-life balance" emerged as the top concern with 25 votes. Following closely, "Lack of proper compensation" and "Employee expectations from the job," which tied for the second highest number of votes. "Lack of career growth" was the third most significant concern.

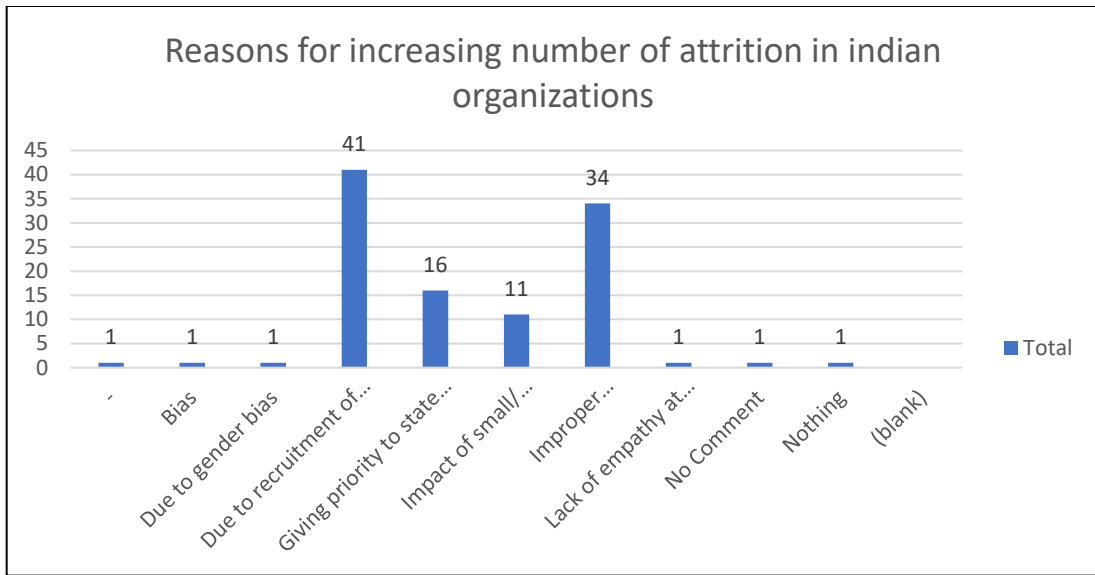


Figure-13: Attrition Factors - Organization View

Inference:

Figure-13 reveal that the primary concern is the "Recruitment of highly educated or highly qualified individuals at non-competitive prices," which ranked first. Following closely, the "Improper implementation of organizational policies" emerged as the second most significant issue, highlighting key areas requiring attention for organizational improvement.

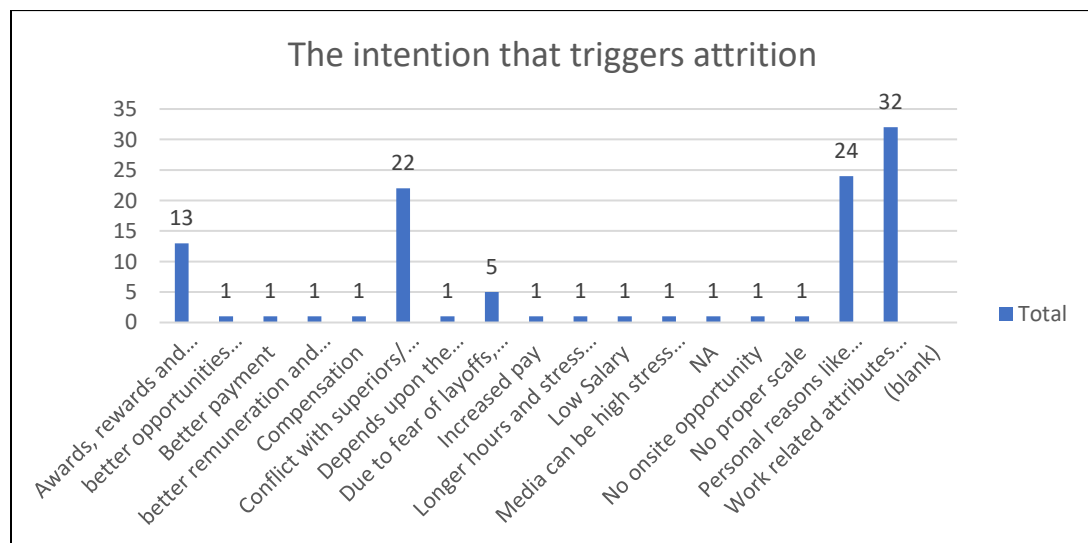


Figure-14: Triggering Intent to Leave the organization

Inference:

As per figure-14, “Work related attributes like no job satisfaction, frequent traveling, no clarity on role and responsibilities” has higher significance. “Personal reasons like family, dependents, health & social status” and “Conflict with superiors/ subordinates, resistant to change of product / process/ technology” has the second highest significance.

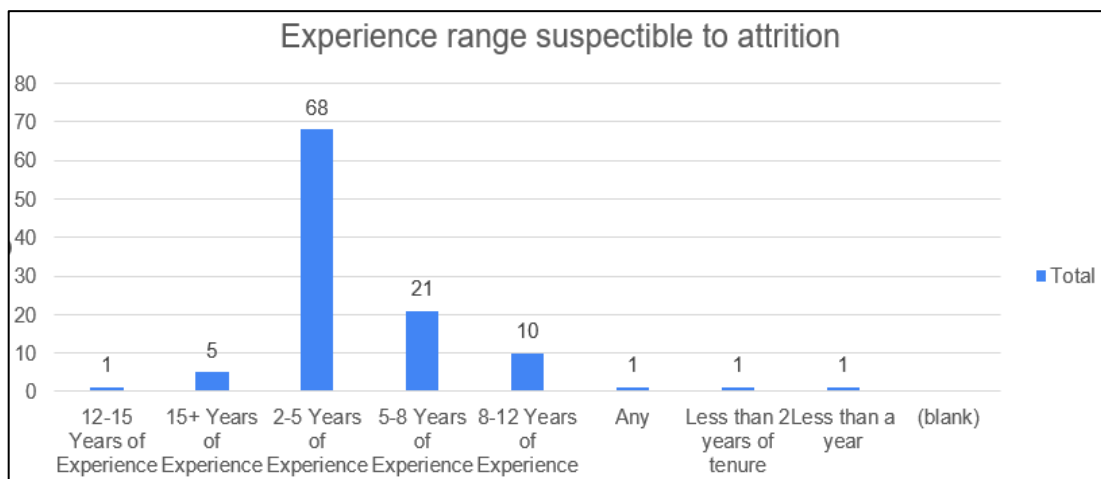


Figure-15: Employee Experience Range More Susceptible To Attrition

Inference:

Figure 15 above depicts that employees with experience between 2-5 years are most likely to quit the organization and have the highest tendency to leave the circle; similarly, employees with 5-8 years of experience stand as the second most inclined, and employees falling in the category of 8-12 years of experience stand third in consideration for attrition tendency.

4.2.3. What Is the Best Fit Model for Employee Retention?

Classification has been viewed as one of the supervised machine learning tasks, which is crucial in Human Resource Management. Several classification algorithms

classify employees into two classes. The task of creating efficient models is the complication because of the large volumes of data. Preprocessing is a necessary procedure that, especially with high-dimensional data, needs to be considered. Performance metrics, such as confusion matrix and accuracy, allow finding the best classification algorithm.

In trying to deter employee attrition, one has to withhold that minimum amount of False Negatives is essential. False Negatives are such some actual cases of leaving the organization getting misclassified as staying. Misclassifications are much worse since they avoid an organization from taking previous positive steps to amend the issues and problems of at-risk employees. Every company that misses the opportunity to identify and take care of its employees before they quit the company misses the opportunity to develop certain retention strategies, such as career development, improvement of working conditions, and offering other types of incentives. These employees will feel ignored and not taken care of and, over time, quit their jobs.

Reducing False Negatives demands a strong and precise predictive model in which employees who are likely to quit can be correctly identified. This can be done through regular employee surveys, performance appraisals, and monitoring of trends in employees' behavior and engagement. If the organization identifies such at-risk employees correctly, it could intervene early, listen to them, and make the work environment more supportive and satisfying. Reducing False Negatives not only helps retain valuable talent but also enhances overall employee morale and loyalty, leading to a more stable and productive workforce.

In the HRM systems, the efficiency of machine learning models depends on reducing 'false negatives' (FN), which means correctly predicting those 'employees' who intend to leave the organization. We will focus on model performance evaluation based on false negatives.

	Predicted Yes	Predicted No	Total
Actually Yes	27	43	70
Actually No	29	334	363
Total	56	377	433

Figure-16: Confusion Matrix Obtained From Decision Tree

	Predicted Yes	Predicted No	Total
Actually Yes	46	28	74
Actually No	23	340	363
Total	69	368	437

Figure-17: Confusion Matrix Obtained From Logistic Regression

	Predicted Yes	Predicted No	Total
Actually Yes	55	10	65
Actually No	4	381	385
Total	59	391	450

Figure-18: Confusion Matrix Obtained From Random Forest

Now we can clearly say that, out of Logistic regression, Decision Tree, and Random Forest, the random forest performed better. Hence, the random forest is the best-fit model for this dataset.

4.2.4. What Are Some Data-Driven Retention Strategies for Competitive HR?

We test several hypotheses, along with the corresponding change in probability for an employee's intention to stay with the organization by changing independent variables, in order to develop effective retention strategies. That way, we can point out factors that create a high impact on retention and consider those facts in formulating specific strategies based upon those facts. Our hypotheses consider total working years, experience with the current manager, job satisfaction level, overtime, stock level options, and incorporation of job involvement.

In the light of identified factors that impact retention, we propose various hypotheses that could address employee attrition effectively. We will use the best-obtained model to do predictions, supplying different values to the independent variables under consideration in order to test the proposed hypotheses. For instance, suppose we formulate a hypothesis that employee attrition decreases with increases in age. We will test for the veracity of this hypothesis by running tests that study the impact of varying age on probability of attrition. In other words, varying age will be keeping rest of other independent variables constant and observing changes in attrition probability. Tests shall be conducted multiple times to have results which are robust.

These tests are done using Dataiku DSS via what-if analysis, whereby the best predictive model is used to make predictions in different scenarios of inputs. This way, we are able to systematically observe how changes in certain variables—for example, age—increase in employee attrition and therefore feed data-driven insights into the various hypotheses proposed for effective ways of ensuring staff retention. Such tests and analyses will provide a greater understanding of the factors affecting employee attrition and, in turn, permit focused measures for addressing those causes or inhibiting factors.

By analyzing the results of these tests, we can draw some inferences correctly that enable us to observe correlations among different variables affecting employee retention. From those inferences, a specific, highly effective retention plan will be developed which would help address particular issues that we will find. This structured approach has ensured that our strategies, so far, are data-driven, evidence-based, and tailored toward providing the best possible outcomes in minimizing attrition.

Analysis of total working years will indicate whether the long-serving members are more interested in staying on, and what compensating factors can further retain them. Looking at experience with current manager provides insights into the impacts of relationships with managers on retention. Job satisfaction is critical, as satisfied employees are much more likely to stay longer. Overtime may be an indication of potential burnout and thus is important for workload and retention. Stock level options can be potent incentives, such as stock ownership plans, where employees' interests are aligned with the successes of the company. Finally, job involvement reflects how engaging and committed employees feel in their role, thus being a strong predictor of their stay intention.

By systematically assessing these factors, nuanced effective retention strategies can be designed to meet the specific needs and motivations of our workforce. Only the significant features are trained to answer this research question using the obtained best model. It will explore the use of what-if analysis under Dataiku for a better understanding of how intent to attrition changes based on various important features.

Hypothesis-1: Mentoring programs are expected to significantly decrease employee attrition rates.

This hypothesis states that the researcher will be testing on employees who have joined within one year and have experience of less than a year. It is an estimate of new employees to stay with the company by changing different factors that may affect their decision to stay. This study analysed the changes in various factors, such

as satisfaction with the job, opportunities for career development, and work environment, to draw useful inferences for strategizing retention policies for fresh recruits.

Test 1: This test calculates the probability that a new joiner will remain with the organization, considering other factors influencing attrition.

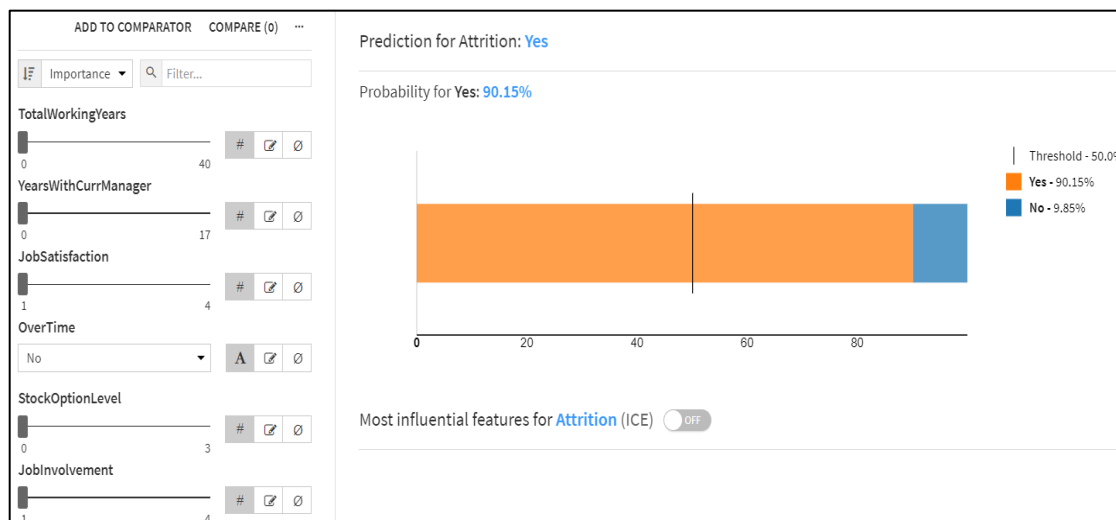


Figure-19: Intent to Stay - New Joiners

The above test was done without changing any of the independent variables; hence, this can be termed as the baseline of our analysis. This resulted in a probability of 90% that this employee will leave the organization given the prevailing conditions. This high level of probable attrition calls for finding out what the key factors are which influence retaining the employee. This base case helps in deriving an appropriate perspective on the effects of potential changes in the independent variables and in developing methods of improvement in employee retention rates. The initial finding has been a critical reference point for further testing of hypotheses and strategy development.

Test 2:

Whereas a new joiner with one year of experience without mentoring is likely to have a higher risk of attrition, providing guidance and support early in tenure may make a case for improving retention.

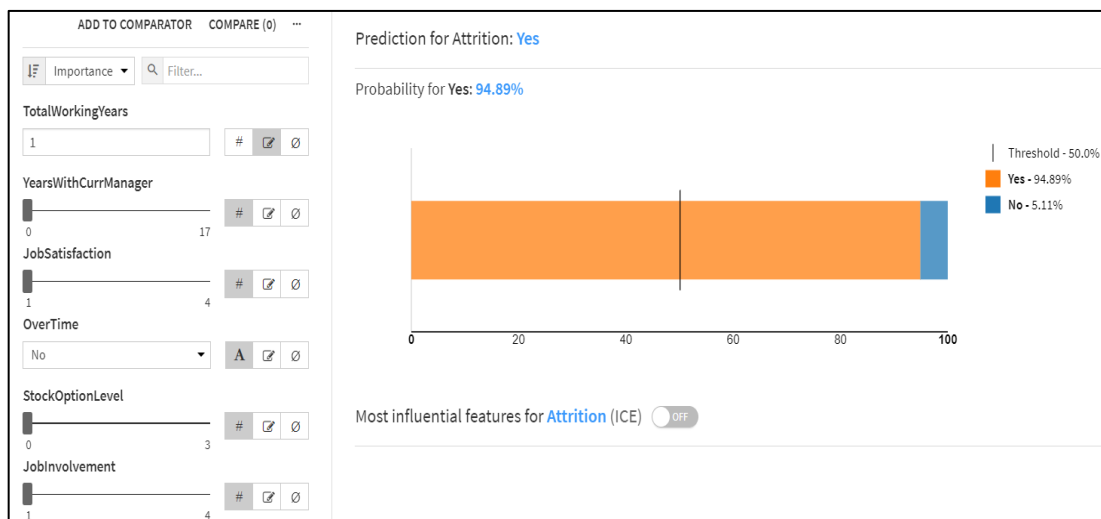


Figure-20: Assessing 1-Year Employee Retention Intent

Figure-19 shows that the employee intends to leave the company by 90% nowadays. If the employee continues for the same period, then after a year, under the same circumstances, this intention to leave will increase to about 95%, as given under figure-16. This upward graph itself shows how urgent is the need to look into the reasons for dissatisfaction and leaving on the part of the employee. This therefore calls for proactive measures to ensure improved job satisfaction, provision of better career development opportunities, and managerial support that will help buck this trend and achieve a more positive and stable work environment for the employee.

Test 3:

This test determines the probability that a new joiner will spend one year in the same company when provided with one year of mentoring or supervision.

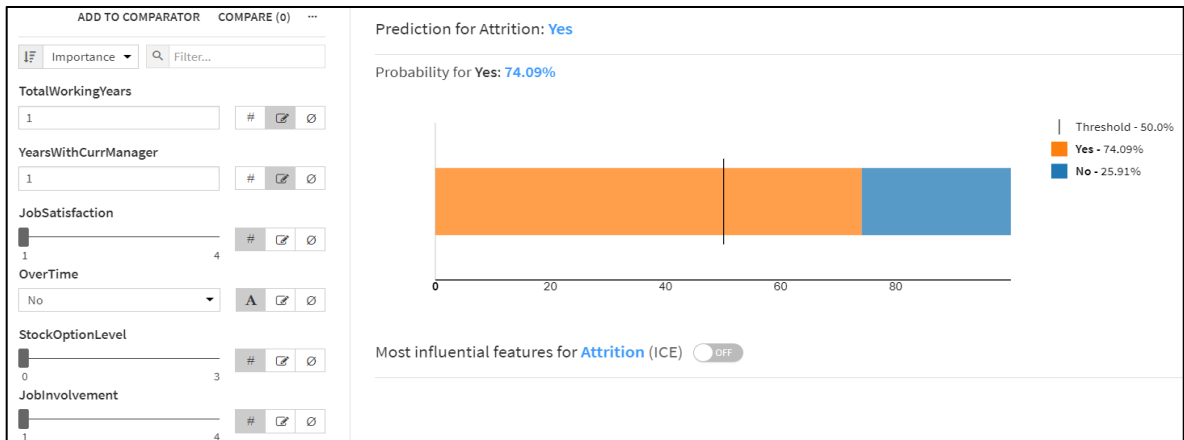


Figure-21: Retention Intent of 1-Year Employees with Mentorship

From Figure 20, it can be seen that without any mentoring or supervision for a period of one year, the intention to leave the organization goes as high as 95%. This means that the risk of attrition in case of no guidance or support is very high. However, with proper mentoring or supervision of the employees, the leaves are reduced by as much as 74%, according to Figure 21. Therefore, a critical implication of this is the impact that mentoring and supervision have on employee retention; thus, more investments in these practices are warranted to reduce the intensity of turnover and enhance organizational stability.

Inference:

- **Initial Onboarding Support:** When a new employee joins the organization, the probability of them leaving within the first year is significantly high, at 90%. To counter this, it's crucial to implement a strong onboarding process that includes clear communication of job roles, company culture, and available resources. Additionally, establishing a supportive environment through peer mentoring or buddy systems can help in reducing the initial uncertainty and stress that new employees often experience.
- **Early Intervention and Monitoring:** If an employee continues in the same situation for one year without adequate support, the likelihood of them leaving increases to

95%. To prevent this, regular check-ins and feedback sessions should be conducted throughout the first year to monitor the employee's experience, identify potential issues early, and provide timely intervention. This proactive approach can help in addressing concerns before they escalate into reasons for attrition.

- Appropriate supervision or mentoring reduces the employee's chances of leaving the company to 74%. An indication that good mentoring and supervision programs will work includes the fact that more experienced persons are allowed to mentor those that are new and inexperienced in workplaces. Proper practice of mentoring activities can then help people assist each other by helping them develop their skills as well as make them develop a sense of belonging and engagement, which are very important during employee retention. This mentoring process should include regular performance reviews and career development discussions to align the goals of the employee with those of the organization.

Hypothesis 2: Work-Life Balance and Job Satisfaction Enhancements:

Under this hypothesis, tests on mid-senior level employees who have approximately 6 years of experience with the company will be conducted. In this connection, an estimate of the probability that these workers stay with the company will be done through an analysis of the impact of various factors on retention: job satisfaction, opportunities for career advancement, work-life balance, compensation, and organizational culture. It also aims at presenting the relationship between the modifications of factors identified and whether changes in these factors influence the decision to remain with the company, aiming to inform and improve retention strategies for mid-senior employees.

Test 1:

This test calculates the probability of an employee with 6 years of experience staying with the organization, considering all other factors that significantly influence employee attrition

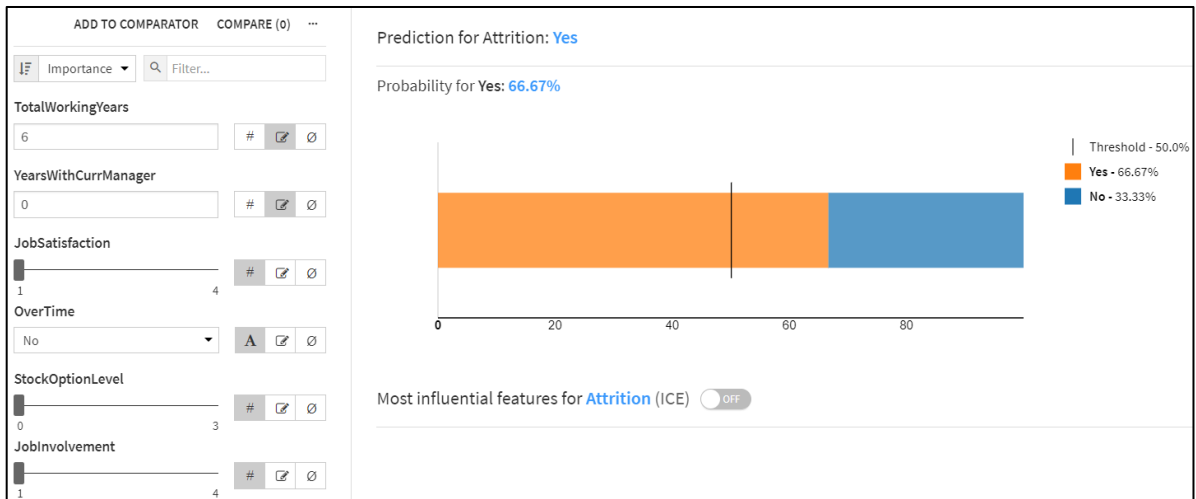


Figure-22: Attrition Probability - Mid-Senior (Default Factors)

Assuming other factors are kept constant, it can be seen from figure-22 that the probability of attrition of an employee with 6 years of experience is 66%. As can be seen, at this stage, this is a hugely high risk, and policies should be implemented to retain interest in and avoid the likelihood of quitting.

Test 2:

This test estimates the probability of an employee leaving/churning after working for 6 years. In an attempt to capture how changing the levels of job involvement and stock options might affect an employee's intent to stay or leave the

organization.

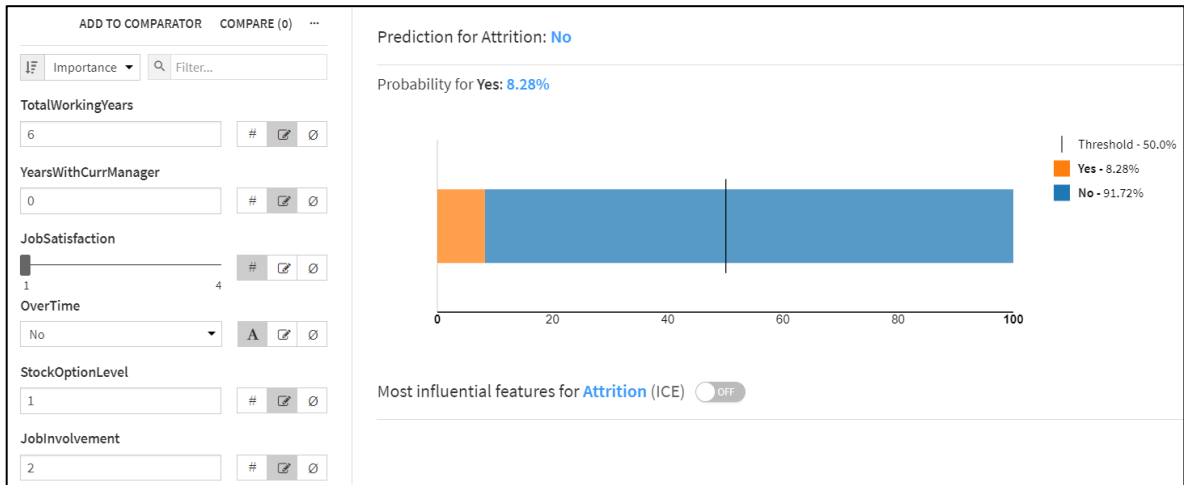


Figure-23: Retention Probability - Mid-Senior (Rewards & Involvement)

Figure 23: From the above figure, it can be observed that an employee with 6 years in service, when given less reward and recognition and involved at the second level of job involvement, has shown a drastic decline in the probability of attrition to merely 8% with a significant difference. This shows the effect of basic recognition and involvement on employee retention.

Test 3:

This test calculates the attrition probability for a mid-senior employee with 6 years of experience, focusing on the impact of overtime, while other factors remain at default. This analysis helps identify the likelihood of employee turnover based on workload, offering insights for retention strategies.

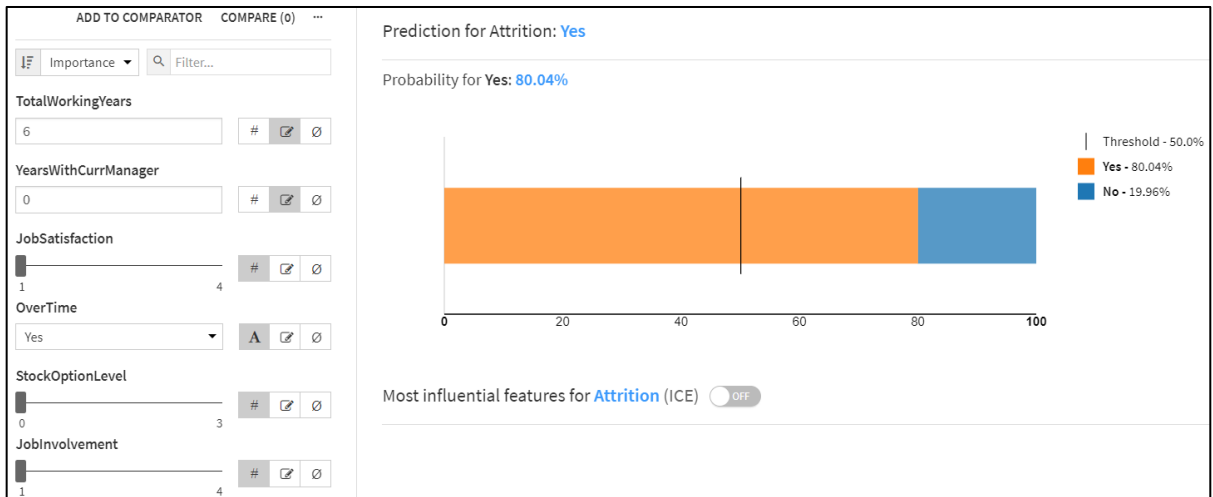


Figure-24: Attrition Probability - Mid-Senior (Overtime)

Figure-22 shows that the probability of an employee leaving is 66%. However, when overtime is added, the probability of attrition increases to 80% illustrated in figure-24, indicating that excessive overtime may negatively impact employee retention.

Test 4:

This test calculates the probability of attrition for mid-senior employees with experience of 6 years. Factors such as overtime and improvement in job satisfaction are considered to reach a decision on the likelihood of leaving the company. This helps in understanding and addressing the attrition risks in this critical employee segment.

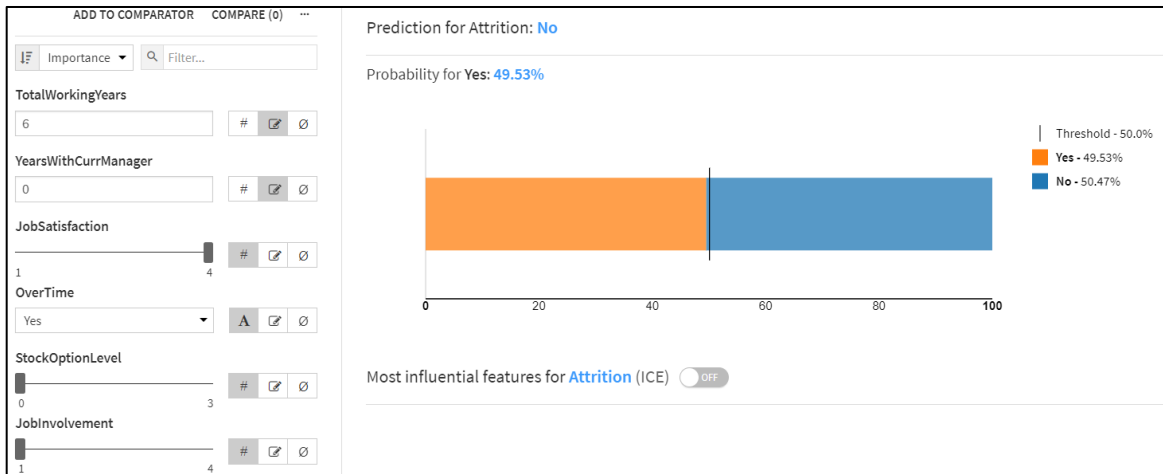


Figure-25: Retention - Satisfied Mid-Seniors (Overtime)

Figure 24 reveals an 80% intention to leave the organization. Even with an extreme level of job satisfaction, the probability of attrition only reduces to 50% from figure 25, indicating that this reduction is less effective than the results observed in Test-2, where increasing job involvement along with rewards and recognition led to a more significant decrease in attrition.

Inference:

To address the high risk of attrition among employees with six years of experience, a comprehensive strategy should be implemented. Initially, the focus should be on providing basic rewards and recognition, which, as shown in Figure-19, can significantly lower attrition probability from 66% to just 8%. This demonstrates that even minimal recognition can substantially enhance retention. Furthermore, excessive overtime, which increases attrition risk to 80% as seen in figure-20 and figure-21, should be carefully managed. Instead of relying on overtime, the strategy should prioritize job involvement and adequate rewards, as Test-2 indicates these factors are more effective in reducing turnover. Lastly, while job satisfaction is important, it alone only reduces attrition probability to 50%, underscoring the need for a balanced approach that includes recognition, involvement, and manageable workloads to ensure long-term employee retention.

Hypothesis 3: Work-Life Balance and Adaptable Work Schedules

This hypothesis is proposed to confirm the probability that employees who have completed already 15 years of service will continue their services in the same organization. The estimation probability would be done based on various influence factors which will determine whether they will continue with a particular organization or not. Factors such as job satisfaction and recognition, growth opportunity in career, and maintenance of appropriate work-life balance are the major factors that will be evaluated in this research which influences retention. Accordingly, by manipulating these variables, the hypothesis purports to provide an insight into the motivating factors that constitute long-term employee loyalty and find accordingly ways of improving retention among experienced professionals.

Test 1:

This test aims to calculate the attrition probability for senior employees with 15 years of experience, while keeping other features at default values. This analysis helps in understanding the specific risk of turnover among long-tenured employees, enabling targeted retention strategies to reduce potential attrition.

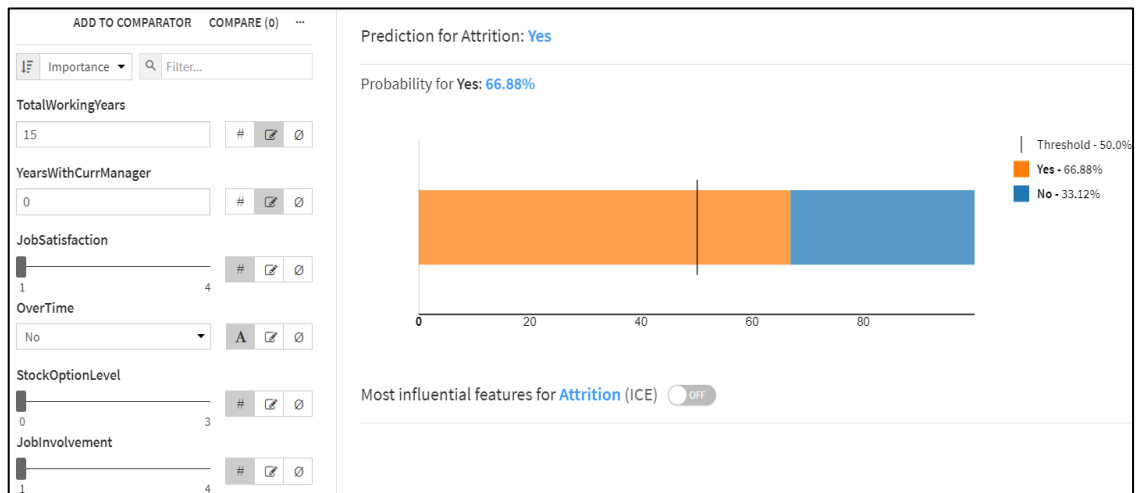


Figure-26: Attrition Probability - Senior (Default Factors)

Figure 26 indicates that the probability of attrition for senior employees with more than 15 years is 66%, assuming all other factors remain unchanged.

Test 2:

This test aims to calculate the attrition probability of senior employees with 15 years of experience. It focuses on understanding the impact of mentoring, assessing how effective guidance can influence their decision to stay or leave, ultimately aiding in the development of retention strategies for experienced personnel.

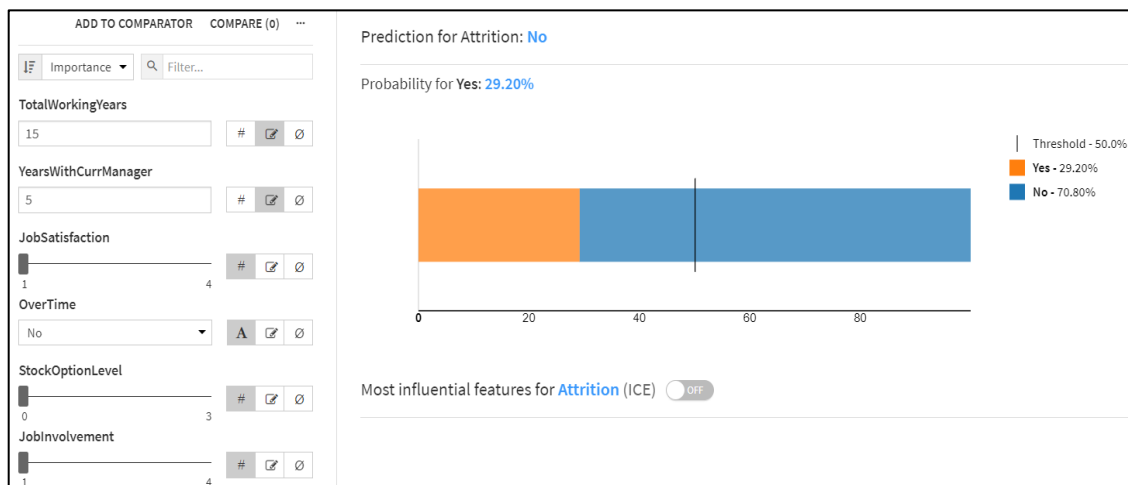


Figure-27: Attrition Probability - Senior (Mentoring/Supervision).

Figure 26 shows a 66% attrition probability when other factors are constant. However, with significant mentoring or supervision, figure-27 illustrates a substantial reduction in attrition probability to 29%.

Test 3:

This test evaluates the attrition probability of senior employees with over 15 years of experience by incorporating rewards, recognition, and enhanced supervision. The focus is on understanding how these factors influence retention rates, providing insights into effective strategies to reduce turnover among seasoned employees.

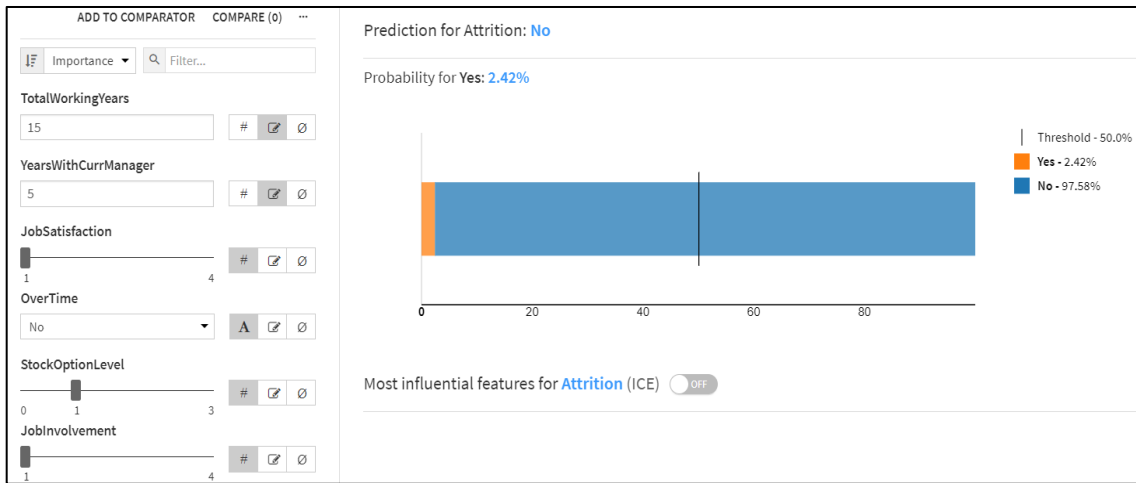


Figure-28: Reduced Attrition - Senior (Perks & Supervision)

From the above figure-28, it is clear that addition of rewards and recognition along with mentoring/supervision for a senior employee will reduce the rate of attrition significantly to 2% from 29%.

Test 4:

This test evaluates the attrition probability of senior employees with 15 years of experience by analyzing the impact of rewards and recognition. Additionally, it considers the effect of eliminating supervision, focusing on whether these factors contribute to retaining or losing experienced talent within the organization.

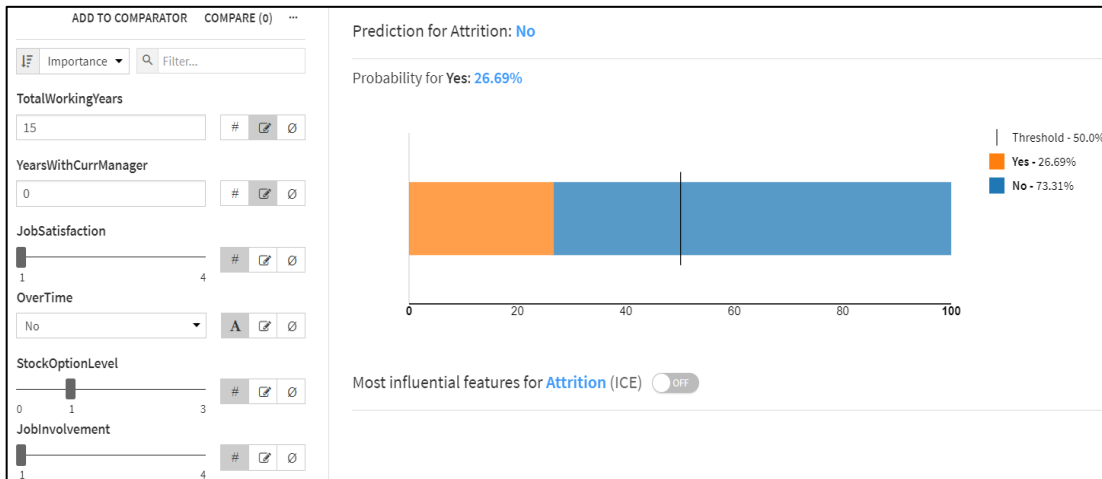


Figure-29: Reduced Attrition - Senior (Perks)

From figure-29, it is clear that, even under no supervision or mentoring given minimal level of rewards and recognition the percentage of intention to leave is reduced to 26% from 66% illustrated under figure-26.

Test 5:

This test calculates the attrition probability of senior employees with over 15 years of experience, focusing on the impact of job involvement, rewards, and recognition. By assessing these factors, the test aims to identify key areas that influence retention, helping to tailor strategies for retaining experienced professionals.

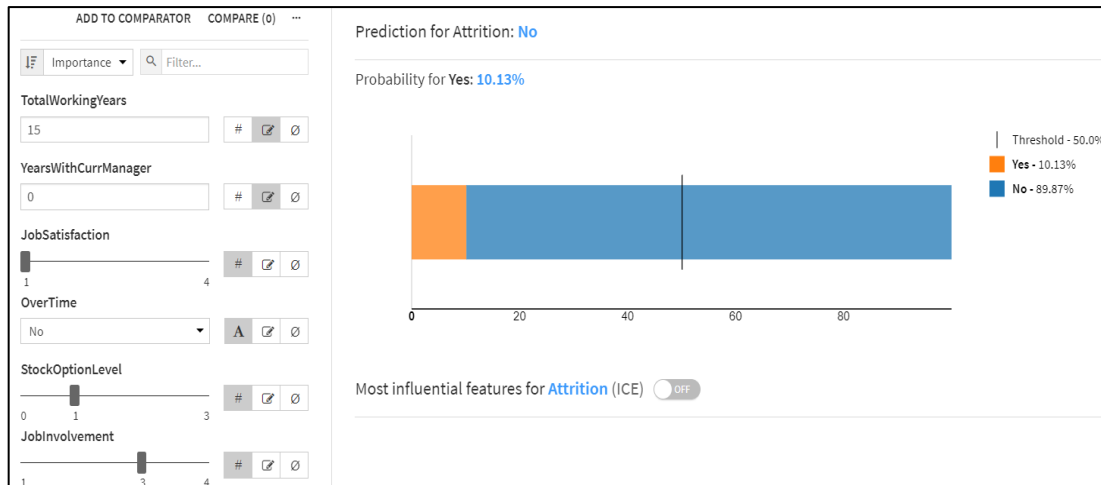


Figure-30: Reduced Attrition - Rewards & Involvement

From above figure-30, it is clear that, intention to stay in same organization is increased by improving job-involvement and minimal level of rewards and recognition made the attrition to 10% from 26% illustrated under figure-29.

Inference:

To address the high attrition rate among senior employees with over 15 years of experience, a targeted retention strategy is essential. Initially, the attrition probability stands at 66%, as shown in Figure 26. Implementing significant mentoring

or supervision reduces this risk to 29%, as demonstrated in Figure 27. Further integrating rewards and recognition into the strategy brings the attrition rate down to a remarkable 2%, as highlighted in figure-28. Even without supervision, minimal rewards and recognition reduce the likelihood of leaving to 26%, per figure-29. Enhancing job involvement alongside basic rewards can further reduce attrition to 10%, as depicted in figure-30.

4.3. Tailored Retention Strategies: Across All Employee Levels

New Joiner Retention Strategies:

New employees are particularly vulnerable to attrition as they adjust to the organization, its culture, and their new roles. During this critical phase, they may experience uncertainty, disengagement, and challenges adapting to their environment, which could lead to early departures. To address this, a customized retention strategy should include comprehensive onboarding programs that not only introduce new hires to the company's values, mission, and expectations but also equip them with the necessary training to succeed. Assigning mentors or buddies to guide them through the initial stages can create a sense of belonging and support. Regular check-ins and feedback sessions during the first few months are essential for addressing concerns and making new employees feel valued. These strategies mitigate the risk of early attrition by fostering connection and commitment from the outset.

Mid-Senior Employee Retention Strategies:

Mid-senior employees, typically those with substantial experience, are a vital segment of the workforce, holding extensive knowledge and expertise. However, they may encounter feelings of stagnation or underappreciation, which can increase turnover risk. Retention efforts for this group should prioritize career development and progression opportunities. Clearly defined paths for promotion or lateral moves within the organization can reignite their motivation. Additionally, offering skill development programs or educational support underscores the organization's investment in their growth. Consistent recognition of their contributions, whether through formal rewards

or informal acknowledgments—boosts job satisfaction. Keeping mid-senior employees engaged and valued is essential for retaining their talent and preventing them from seeking opportunities elsewhere.

Retention Strategies for Senior Employees:

Senior employees, particularly those with over 15 years of experience, play a crucial role in ensuring organizational stability and passing on their knowledge to younger colleagues. However, they may face challenges such as burnout, health concerns, or a sense of diminished relevance in an evolving workplace. Retention strategies for this group should emphasize flexibility and recognition of their contributions. Options like reduced work hours or remote work arrangements can alleviate the physical and mental demands of long-term employment. Encouraging their participation in mentoring or leadership roles can renew their sense of purpose. Tailored rewards and recognition programs that honour their service and expertise can further strengthen their loyalty. By meeting the unique needs of senior employees, companies can ensure they remain engaged and committed, reducing attrition risks.

CHAPTER 5: CONCLUSION

The study aims to tackle various challenges in human resource management (HRM), especially the pressing issue of employee turnover or attrition. It highlights the importance of addressing this issue due to its significant impact on organizational performance, financial stability, and overall employee morale. High attrition rates result in increased recruitment and training costs, disruption of team dynamics, and potential harm to the company's reputation and employer branding. Therefore, implementing measures to reduce turnover is essential for maintaining a competitive and successful business environment.

The research examines the limitations of conventional HRM methods, which are often based on theoretical frameworks and intuition. While valuable, these approaches may not possess the accuracy and predictive capabilities needed to manage complex HR challenges effectively. This study advocates for the adoption of data-driven decision-making in designing employee retention strategies. By employing data analytics, organizations can gain a deeper understanding of the root causes of employee turnover and develop targeted, effective strategies to address them.

To achieve this, the research introduces three types of machine learning models: linear models, tree-based models, and ensemble-based models. Linear models, such as logistic regression, explore relationships between variables. Tree-based models, like decision trees, provide flexibility and can capture non-linear patterns in the data. Ensemble-based models, such as random forests, combine the strengths of multiple models to enhance predictive accuracy and robustness.

Each model was rigorously evaluated using performance metrics, with the confusion matrix serving as a key tool. The confusion matrix provides detailed insights into the model's accuracy by categorizing predictions into true positives, false positives, true negatives, and false negatives. This evaluation approach also measures precision, recall, and the F1-score, offering a nuanced assessment of the models' predictive capabilities. Following this comprehensive evaluation, the best-performing

model was identified and utilized to formulate data-driven employee retention strategies.

These strategies, based on model insights, allow organizations to implement specific interventions tailored to the unique needs of their workforce. This ensures that the strategies address the underlying causes of turnover effectively and efficiently. Additionally, the research emphasizes the broader implications of employee attrition on employer branding. High turnover rates can tarnish a company's reputation, making it less appealing to potential hires and stakeholders. Conversely, effective retention strategies enhance employer branding by demonstrating a commitment to employee well-being and professional growth, creating a positive work environment that attracts and retains top talent.

In conclusion, the study presents a comprehensive framework for addressing HRM challenges through data-driven decision-making. Integrating advanced machine learning models into HR practices enables organizations to move beyond traditional methods and develop more effective employee retention strategies. The findings highlight the importance of using data analytics to generate actionable insights and informed decisions that benefit both employees and the organization.

Successful implementation of these strategies can result in a more stable and motivated workforce, improved organizational performance, and a stronger employer brand. Future research could explore additional machine learning techniques, expand datasets with diverse variables, and examine the long-term effects of data-driven retention strategies on organizational success. Continued innovation and the application of data analytics in HRM will help organizations navigate the complexities of employee retention and create sustainable, thriving work environments.

The subsequent section outlines findings derived from data-driven analyses and proposes tailored retention strategies for three key employee groups: new joiners, mid-senior employees, and senior employees. Each group faces unique retention challenges that require distinct approaches to ensure sustained engagement and

satisfaction. Recommendations include structured onboarding and early support for new joiners, career advancement opportunities and recognition for mid-senior employees, and flexible work arrangements and leadership roles for senior employees. These targeted, data-driven strategies aim to optimize retention across all levels of experience.

5.1. New Joiners

- **Vulnerability to Attrition:** New employees are particularly susceptible to turnover as they adjust to the organization, often experiencing uncertainties, lack of engagement, and adaptation challenges.
- **Tailored Onboarding:** Comprehensive onboarding programs are essential, emphasizing the organization's values, mission, and expectations while providing job-specific training.
- **Mentorship Support:** Assigning mentors or "buddies" offers guidance through initial employment stages, fostering a sense of support and belonging.
- **Regular Feedback and Engagement:** Frequent check-ins and feedback sessions within the first few months help address concerns and build early commitment, reducing the risk of attrition.

5.2. Mid-Senior Employees

- **Risk of Stagnation:** Mid-senior employees with years of experience may feel stagnated or underappreciated, leading to potential turnover.
- **Career Development and Growth Opportunities:** Clear advancement pathways, such as promotions or lateral moves, reinvigorate motivation and organizational commitment.
- **Skill Development and Training:** Providing training programs and educational assistance shows the company's dedication to their growth and professional development.

- **Recognition and Appreciation:** Regular acknowledgment of their contributions, whether through rewards or appreciation gestures, enhances job satisfaction and retention among this group.

5.3. Senior Employees

- **Challenges with Longevity:** Senior employees with over 15 years of experience may face burnout, health concerns, or a perceived decline in relevance due to rapid workplace changes.
- **Flexible Work Arrangements:** Options like reduced hours or remote work can help alleviate physical and mental strain, addressing the needs of long-serving employees.
- **Mentoring and Leadership Roles:** Engaging senior employees in mentorship or leadership responsibilities provides a renewed sense of purpose and maintains relevance.
- **Tailored Recognition:** Rewards and acknowledgment programs that highlight their years of service and unique contributions encourage loyalty and long-term commitment, effectively reducing attrition rates among this critical segment.

These findings outline how retention strategies tailored to each employee level help address their specific needs and foster greater commitment, ultimately lowering attrition rates across all experience levels.

5.4. Recommendations:

This thesis recommends a set of targeted retention strategies for three key employee segments - new joiners, mid-senior employees, and senior employees and proposes retention strategies based on data-driven insights into their unique retention challenges and needs. Each segment requires tailored approaches to maintain sustained engagement, foster satisfaction, and reduce turnover rates effectively. By addressing the specific factors contributing to attrition within each group, Organizations can cultivate a more supportive atmosphere that fosters enduring engagement at all levels.

- Retention Strategies for New Joiners:

New employees are particularly vulnerable to early attrition as they adjust to the organization, its culture, and their roles. A structured onboarding program is critical to easing this transition, as it familiarizes them with the company's values, mission, and performance expectations while equipping them with essential skills. This program should extend beyond administrative onboarding to include personalized introductions to team dynamics and an understanding of how their roles contribute to organizational goals.

It is recommended to provide early-stage support through a mentorship or "buddy system" to help new employees feel integrated and reduce the sense of isolation often experienced in the initial months. Mentors or buddies can assist with day-to-day tasks, introduce new hires to key contacts, and explain the informal aspects of the organizational culture. Additionally, conducting regular feedback sessions during the first few months helps identify initial challenges, reinforce strengths, and highlight areas for growth. This approach ensures that new employees feel valued and supported from the outset, significantly reducing the risk of early turnover.

- Retention Strategies for Mid-Senior Employees:

Mid-senior employees, typically with several years of experience, represent a critical talent segment as they hold specialized skills and knowledge accumulated over time. However, they often face the challenge of stagnation, particularly when career advancement opportunities are unclear or insufficient. For this group, it is essential to provide clear and accessible pathways for career growth, whether through promotions or lateral moves that allow them to expand their skill sets and explore new responsibilities. Structured career development programs that include regular check-ins on career goals and available opportunities can be effective in preventing dissatisfaction.

Offering continuous learning opportunities and upskilling initiatives, such as technical training or educational support, highlights the organization's dedication to

fostering both personal and professional development. Consistent recognition of their efforts, whether through formal awards or casual appreciation, further boosts job satisfaction and strengthens commitment. Mid-senior employees who feel appreciated and challenged are more inclined to remain with the organization and contribute to its success, thereby lowering the risk of attrition.

- Retention Strategies for Senior Employees:

Senior employees, particularly those with over 15 years of experience, are crucial for ensuring organizational stability and transferring knowledge to younger employees. However, they may face challenges such as burnout, health concerns, and a sense of diminished relevance due to fast-paced changes in technology and workplace practices. To address these issues, implementing flexible work options, including part-time schedules, telecommuting, or reduced working hours, is advisable. These arrangements can cater to their specific needs while alleviating the physical and mental strain associated with prolonged employment.

In addition, engaging senior employees in mentorship roles or advisory positions allows them to leverage their expertise in ways that benefit both themselves and the organization. This sense of continued purpose and relevance can bolster their engagement and commitment. Recognizing senior employees through tailored rewards that honour their years of service and unique contributions reinforces their loyalty and dedication to the organization.

By adopting these customized, data-informed strategies, organizations can foster an inclusive work environment that resonates with each experience level. Such an approach not only strengthens workforce stability but also ensures that each employee feels valued and aligned with the organization's goals, ultimately enhancing overall productivity and morale. This structured, targeted retention framework equips HR leaders with the insights and tools needed to develop effective, long-term retention practices across the entire employee lifecycle.

5.5. Suggestions for Future Research

Although this research offers valuable insights into addressing the issue of employee attrition, it is essential to acknowledge certain limitations to gain a complete understanding of its scope and areas for future study. The primary focus of this study is the employee attrition problem, a crucial aspect of Human Resource Management (HRM). However, it provides only limited exploration of other emerging challenges and opportunities, particularly those driven by recent advancements in artificial intelligence (AI), such as generative AI (GenAI).

Generative AI is expected to significantly influence various organizational functions, especially in areas requiring interaction with human stakeholders. HRM, in particular, holds immense potential for generative AI applications. Despite this promise, the adoption of generative AI within HRM has been slower compared to other organizational functions (Ooi et al., 2023). Future research could explore how these AI advancements can be incorporated into HR practices to enhance overall organizational effectiveness.

Secondly, the research approaches employee retention strategies by analyzing data holistically rather than segmenting it into specific attributes such as demographic, organizational, and leadership-related factors. While this broad approach provides valuable general insights, it may overlook the nuanced retention factors unique to different employee segments. A more segmented analysis could yield more targeted and effective retention strategies, addressing specific needs and characteristics within the workforce. This clustering approach provides effectiveness in grouping employees with similar characteristics, enabling more targeted and impactful interventions (Yanamala, 2024). For example, understanding the distinct retention drivers for different demographic groups or organizational roles could enhance the precision of retention initiatives.

The research does not provide a comprehensive exploration of the ways employee attrition impacts employer branding or how data-driven HRM practices can

measure and enhance employer branding. Employer branding is a complex and multidimensional concept that is pivotal for attracting and retaining top talent (Vieira et al., 2024). A detailed analysis of methods to evaluate employer branding can significantly improve organizational performance by bolstering recruitment, retention, and employee engagement (Hein et al., 2024).

This process includes evaluating metrics related to brand perception, conducting employee satisfaction surveys, assessing external reputation, and implementing branding initiatives that align with the organization's values and culture.

REFERENCES

- Aburub, B.S.H., others, 2020. Employee retention & engagement solution. *Open Journal of Business and Management* 8, 2805.
- Ahmad, A., Khan, M.N., Haque, M.A., 2020. Employer branding aids in enhancing employee attraction and retention. *Journal of Asia-Pacific Business* 21, 27–38.
- Albarqi, H., 2022. Strategic HRM Preparedness for Healthcare Crisis Management. *International Journal Of Medical Science And Clinical Research Studies*.
- Alhothali, A., Albsisi, M., Assalahi, H., Aldosemani, T., 2022. Predicting student outcomes in online courses using machine learning techniques: A review. *Sustainability* 14, 6199.
- Alsayegh, M.F., Abdul Rahman, R., Homayoun, S., 2020. Corporate economic, environmental, and social sustainability performance transformation through ESG disclosure. *Sustainability* 12, 3910.
- Amin, M.F., 2022. Confusion Matrix in Binary Classification Problems: A Step-by-Step Tutorial. *Journal of Engineering Research*.
- Azam, M., Qureshi, J.A., 2021. Building employer brand image for accumulating intellectual Capital. *Studies of Applied Economics* 39.
- Bangsu, M., Darmawan, D., Hardyansah, R., Suwito, S., Mujito, M., 2023. The Implications of Remuneration, Procedural Justice Principles, and Work Environment Factors on Employee Retention Rate. *International Journal of Service Science, Management, Engineering, and Technology* 3, 26–32.
- Banu, A., Reddy, S., Rama, M., 2022. Graphical Exploratory Data Analysis (GEDA): A Case Study on Employee Attrition. *Journal of Science & Technology (JST)* 7, 1–11.
- Bargavi, N., Shrivastava, A., Mahapatra, R., Gupta, R., Deepti, G, S.M., 2023. Exploring the Factors Affecting Employee Retention in the Information Technology Sector: Demographic Perspective. *Proceedings of the 1st Pamir Transboundary Conference for Sustainable Societies*.
- Batko, K., Ślęzak, A., 2022. The use of Big Data Analytics in healthcare. *Journal of big Data* 9, 3.
- Berros, N., El Mendili, F., Filaly, Y., El Bouzekri El Idrissi, Y., 2023. Enhancing digital health services with big data analytics. *Big data and cognitive computing* 7, 64.
- Brzozowska, J., Pizoń, J., Baytikenova, G., Gola, A., Zakimova, A.M., Piotrowska, K., 2023. DATA ENGINEERING IN CRISP-DM PROCESS PRODUCTION DATA – CASE STUDY. *Applied Computer Science*.
- Budrienė, D., Diskienė, D., 2020. Employee engagement: Types, levels and relationship with practice of HRM. *Malaysian e commerce journal* 4, 42–47.
- Cachón-Rodríguez, G., Blanco-González, A., Prado-Román, C., Del-Castillo-Feito, C., 2022. How sustainable human resources management helps in the evaluation and planning of employee loyalty and retention: Can social capital make a difference? *Evaluation and program planning* 95, 102171.

- Chatzoudes, D., Chatzoglou, P., 2022. Factors affecting employee retention: Proposing an original conceptual framework. *International Journal of Economics and Business Administration* 10, 49–76.
- Chopra, A., Sahoo, C.K., Patel, G., 2024. Exploring the relationship between employer branding and talent retention: the mediation effect of employee engagement. *International Journal of Organizational Analysis* 32, 702–720.
- Chowdhury, S., Dey, P., Joel-Edgar, S., Bhattacharya, S., Rodriguez-Espindola, O., Abadie, A., Truong, L., 2023. Unlocking the value of artificial intelligence in human resource management through AI capability framework. *Human Resource Management Review* 33, 100899.
- Cilluffo, G., Fasola, S., Ferrante, G., Malizia, V., Montalbano, L., Grutta, S.L., 2021. Machine Learning: An Overview and Applications in Pharmacogenetics. *Genes* 12.
- Cvenkel, N., 2020. Historical and Theoretical Debates in Human Resources Management and High-Performing Organisations.
- Dhingra, N., Samo, A., Schaninger, B., Schrimper, M., 2021. Help your employees find purpose—or watch them leave. *McKinsey & Company* 31.
- Fallucchi, F., Coladangelo, M., Giuliano, R., William De Luca, E., 2020. Predicting Employee Attrition Using Machine Learning Techniques. *Computers* 9. <https://doi.org/10.3390/computers9040086>
- Fu, C., Xu, C., Xue, M., Liu, W., Yang, S., 2021. Data-driven decision making based on evidential reasoning approach and machine learning algorithms. *Applied Soft Computing* 110, 107622. <https://doi.org/10.1016/j.asoc.2021.107622>
- Gul, R., Al-Faryan, M.A.S., 2023. From insights to impact: leveraging data analytics for data-driven decision-making and productivity in banking sector. *Humanities and Social Sciences Communications* 10, 660. <https://doi.org/10.1057/s41599-023-02122-x>
- Gul, R., Leong, K., Mubashar, A., Al-Faryan, M.A.S., Sung, A., 2023. The empirical nexus between data-driven decision-making and productivity: Evidence from Pakistan’s Banking Sector. *Cogent Business & Management* 10, 2178290.
- Halawi, L.A., Clarke, A.S., George, K., 2022. Model Deployment. *Harnessing the Power of Analytics*.
- Handelman, G.S., Kok, H.K., Chandra, R.V., Razavi, A.H., Huang, S., Brooks, M., Lee, M.J., Asadi, H., 2019. Peering into the black box of artificial intelligence: evaluation metrics of machine learning methods. *American Journal of Roentgenology* 212, 38–43.
- Haque, F., 2024. Retention of tech employees in India: lessons from the extant literature. *The Learning Organization*.
- Hein, A.Z., Elving, W.J., Koster, S., Edzes, A., 2024. Is your employer branding strategy effective? The role of employee predisposition in achieving employer attractiveness. *Corporate Communications: An International Journal* 29, 1–20.
- Humphrey, A., Kuberski, W., Bialek, J.J., Perrakis, N., Cools, W., Nuyttens, N., Elakhrass, H., Cunha, P.A.C., 2022. Machine-learning classification of

- astronomical sources: estimating F1-score in the absence of ground truth. *Monthly Notices of the Royal Astronomical Society: Letters*.
- Indrakumari, R., Poongodi, T., Jena, S.R., 2020. Heart Disease Prediction using Exploratory Data Analysis. *Procedia Computer Science* 173, 130–139. <https://doi.org/10.1016/j.procs.2020.06.017>
- Kamalaveni, M., Ramesh, S., Vetrivel, T., 2019. A review of literature on employee retention. *International Journal of Innovative Research in Management Studies (IJIRMS)* 4, 1–10.
- Kaushik, S., Gaur, D.M., 2023. Employee Retention Factors Affecting Generation X And Y Personnel In The IT Sector. *Journal of Survey in Fisheries Sciences*.
- Kess-Momoh, A.J., Tula, S.T., Bello, B.G., Omotoye, G.B., Daraojimba, A.I., 2024. Strategic human resource management in the 21st century: A review of trends and innovations. *World Journal of Advanced Research and Reviews* 21, 746–757.
- Khan, M.A., Farooqi, M.R., Ahmad, M.F., Haque, S., Alkhuraydili, A., 2024. Influence of Compensation, Performance Feedback on Employee Retention in Indian Retail Sector. *SAGE Open* 14.
- Khanzode, K.C.A., Sarode, R.D., 2020. Advantages and disadvantages of artificial intelligence and machine learning: A literature review. *International Journal of Library & Information Science (IJLIS)* 9, 3.
- Lahti, H., Kulmala, M., Lyyra, N., Mietola, V., Paakkari, L., 2024. Problematic situations related to social media use and competencies to prevent them: results of a Delphi study. *Scientific Reports* 14, 1–11.
- Lazzari, M., Alvarez, J.M., Ruggieri, S., 2022. Predicting and explaining employee turnover intention. *International Journal of Data Science and Analytics* 14, 279–292.
- Lee, C.C., Lim, H.S., Seo, D.J., Kwak, D.-H.A., 2022. Examining employee retention and motivation: the moderating effect of employee generation. *Evidence-based HRM: a Global Forum for Empirical Scholarship* 10, 385–402.
- Lee, H.W., Pak, J., Kim, S., Li, L.-Z., 2019. Effects of human resource management systems on employee proactivity and group innovation. *Journal of management* 45, 819–846.
- Lee, J.Y.L., Yunsoo, 2023. Integrative Literature Review on People Analytics and Implications From the Perspective of Human Resource Development. *Human Resource Development Review* 0, 1–30.
- Lisa Marie Giermindl, U.L.-D., Franz Strich, Oliver Christ, Redzepi, A., 2022. The dark sides of people analytics: reviewing the perils for organisations and employees. *European Journal of Information Systems* 31, 410–435. <https://doi.org/10.1080/0960085X.2021.1927213>
- Macaraig, R., Hong, S., Lay, S., 2024. FACTORS AFFECTING EMPLOYEE RETENTION OF PRIVATE COMPANIES IN CAMBODIA BY QUALITATIVE AND QUANTITATIVE APPROACH. *British Journal of Management and Marketing Studies* 7, 78–102.
- Mahesh, B., 2020. Machine learning algorithms-a review. *International Journal of Science and Research (IJSR).[Internet]* 9, 381–386.

- Mahmood, Q.-U.-A., Ahmed, R., Philbin, S.P., 2023. The moderating effect of big data analytics on green human resource management and organizational performance. *International Journal of Management Science and Engineering Management* 18, 177–189.
- Malik, E., Baig, S.A., Manzoor, U., 2020. Effect of HR practices on employee retention: The role of perceived supervisor support. *Journal of Public Value and Administrative Insight* 3, 1–7.
- Margherita, A., 2022. Human resources analytics: A systematization of research topics and directions for future research. *Human Resource Management Review* 32, 100795.
- Márquez-Hermosillo, A., Rodríguez, L.F., Salazar-Lugo, G., Borrego, G., 2023. Employee profile and labor turnover in outsourcing companies: A data mining approach. *Ingeniería, investigación y tecnología* 24.
- Mazhar, S.A., Anjum, R., Anwar, A.I., Khan, A.A., 2021. Methods of data collection: A fundamental tool of research. *Journal of Integrated Community Health (ISSN 2319-9113)* 10, 6–10.
- Monteiro, B., Santos, V., Reis, I., Sampaio, M.C., Sousa, B., Martinho, F., José Sousa, M., Au-Yong-Oliveira, M., 2020. Employer branding applied to SMEs: A pioneering model proposal for attracting and retaining talent. *Information* 11, 574.
- Niroomand, M.P., Cafolla, C.T., Morgan, J.W.R., Wales, D.J., 2022. Characterising the area under the curve loss function landscape. *Machine Learning: Science and Technology* 3.
- Nocker, M., Sena, V., 2019. Big data and human resources management: The rise of talent analytics. *Social Sciences* 8, 273.
- Ochieng, E.M., 2023. A Study of the History, Functions, Roles, and Challenges of Human Resources Management. *Journal of Enterprise and Business Intelligence* 3, 054–064.
- Okolie, U.C., Omole, O.G., Yakubu, A.-R., 2021. Leadership and Effective Human Resource Management in Organization. *RUDN Journal of Public Administration*.
- Omar, K.M., 2021. Key Elements of the HRM Challenges in the Technology Era 21st Century. *Open Journal of Business and Management*.
- Ooi, K.-B., Tan, G.W.-H., Al-Emran, M., Al-Sharafi, M.A., Capatina, A., Chakraborty, A., Dwivedi, Y.K., Huang, T.-L., Kar, A.K., Lee, V.-H., Loh, X.-M., Micu, A., Mikalef, P., Mogaji, E., Pandey, N., Raman, R., Rana, N.P., Sarker, P., Sharma, A., Teng, C.-I., Wamba, S.F., Wong, L.-W., 2023. The Potential of Generative Artificial Intelligence Across Disciplines: Perspectives and Future Directions. *Journal of Computer Information Systems* 1–32.
<https://doi.org/10.1080/08874417.2023.2261010>
- Otoo, F.N.K., 2019. Human resource management (HRM) practices and organizational performance: The mediating role of employee competencies. *Employee Relations: The International Journal* 41, 949–970.
- Pandita, D., 2022. Innovation in talent management practices: creating an innovative employer branding strategy to attract generation Z. *International Journal of Innovation Science* 14, 556–569.

- Park, J., Feng, Y., Jeong, S.-P., 2024. Developing an advanced prediction model for new employee turnover intention utilizing machine learning techniques. *Scientific Reports* 14, 2045–2322.
- Pawar, N., Saraf, N., Pradhan, T., 2023. Role of analytics in HR-Attrition for effective decision making. *International Research Journal of Modernization in Engineering Technology and Science* 5, 185–188.
- Ravesangar, K., Narayanan, S., 2024. Adoption of HR analytics to enhance employee retention in the workplace: A review. *Human Resources Management and Services* 6, 3481–3481.
- Raza, A., Munir, K., Almutairi, M., Younas, F., Fareed, M.M.S., 2022. Predicting Employee Attrition Using Machine Learning Approaches. *Applied Sciences* 12.
- Roes, J., 2022. Beyond data: people. Lessons from a data-driven decision making adoption process (Master's Thesis). University of Twente.
- Salih, A.A., Abdulazeez, A.M., 2021. Evaluation of classification algorithms for intrusion detection system: A review. *Journal of Soft Computing and Data Mining* 2, 31–40.
- Saudin, L., 2024. Ethical Leadership in HRM: A Critical Analysis of the Role of HRM Practices in Promoting Ethical Behavior and Corporate Social Responsibility. *Management Studies and Business Journal (PRODUCTIVITY)*.
- Schröer, C., Kruse, F., Gómez, J.M., 2021. A Systematic Literature Review on Applying CRISP-DM Process Model. *Procedia Computer Science* 181, 526–534.
<https://doi.org/10.1016/j.procs.2021.01.199>
- Shet, S.V., Poddar, T., Samuel, F.W., Dwivedi, Y.K., 2021. Examining the determinants of successful adoption of data analytics in human resource management—A framework for implications. *Journal of Business Research* 131, 311–326.
- Sheykhmousa, M., Mahdianpari, M., Ghanbari, H., Mohammadimanesh, F., Ghamisi, P., Homayouni, S., 2020. Support vector machine versus random forest for remote sensing image classification: A meta-analysis and systematic review. *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* 13, 6308–6325.
- Shoresh, N., Wong, B., 2011. Points of view: Data exploration. *Nature Methods* 9, 5–5.
- Singh, R., Ramdeo, S., 2023. Alternative perspectives in employee turnover. *Contemporary Perspectives in Human Resource Management and Organizational Behavior: Research Overviews and Gaps to Advance Interrelated Fields* 137–154.
- Staniec, I., Kalińska-Kula, M., 2021. Internal employer branding as a way to improve employee engagement. *Problems and perspectives in management* 19, 33.
- Stojanović, N., Bernik, M., 2022. Strategic Human Resources Management: Challenges and Opportunities. 41 st International Conference on Organizational Science Development.
- Susanto, P.C., Sawitri, N.N., 2023. Coaching, Mentoring, Leadership Transformation and Employee Engagement: A Review of the Literature. *Dinasti International Journal of Education Management And Social Science*.
- Sutrisno, S., Suherlan, Rijal, S., 2024. The Role of ChatGPT in Enhancing the Quality of Human Resource Team Communication: An Innovative Approach in Human

- Resource Management. *Journal of Contemporary Administration and Management (ADMAN)*.
- Taj, M., Hajira, M.B., 2022. An Empirical Study On Factors Affecting Employee Retention In Selected It Companies In Bangalore City.
- Thilaka, B. a, Sivasankaran, J., Udayabaskaran, S., 2020. Optimal time for withdrawal of voluntary retirement scheme with a probability of acceptance of retirement request. *Journal of Information Technology* 2, 201–206.
- Troisi, O., Maione, G., Grimaldi, M., Loia, F., 2020. Growth hacking: Insights on data-driven decision-making from three firms. *Industrial Marketing Management* 90, 538–557.
- Tseng, S.T., Levy, P.E., 2019. A multilevel leadership process framework of performance management. *Human Resource Management Review* 29, 100668.
- Vieira, J., Gomes da Costa, C., Santos, V., 2024. Talent Management and Generation Z: A Systematic Literature Review through the Lens of Employer Branding. *Administrative Sciences* 14, 49.
- Vishwakarma, G., Sonpal, A., Hachmann, J., 2021. Metrics for benchmarking and uncertainty quantification: Quality, applicability, and best practices for machine learning in chemistry. *Trends in Chemistry* 3, 146–156.
- Vujovic, Ž.Đ., 2021. Classification Model Evaluation Metrics. *International Journal of Advanced Computer Science and Applications* 12.
- Xuecheng, W., Iqbal, Q., Saina, B., 2022. Factors Affecting Employee’s Retention: Integration of Situational Leadership with Social Exchange Theory. *Frontiers in psychology* 13, 872105.
- Yanamala, K.K.R., 2024. Artificial Intelligence in talent development for proactive retention strategies. *Journal of Advanced Computing Systems* 4, 13–21.
- Yusriadi, Y., 2020. Human Resource Management in an Organization. *Proceeding of International Conference on Engineering, Technology, and Social Sciences (ICONETOS)*.

APPENDIX A - SURVEY DATA

The table below outlines the population selected for the survey. It details the various demographics and employee groups, highlighting the diversity and representation included in the study. This population was carefully chosen to ensure that the survey results reflect a comprehensive view of the workforce, encompassing different experience levels, departments, and job roles. By targeting a broad and representative sample, the survey aims to gather insights that are relevant across the organizations, enabling the development of effective strategies to address employee needs and challenges.

Demographic Factor	Groups
Age Group	This is divided into below categories, <ul style="list-style-type: none"> • less than 30 • 31-40 • 41-50 • 51-60 • 60 and above
Department	Contains details of various departments under Indian IT firms such as <ul style="list-style-type: none"> • Human Resource Management • IT • Product Management • Supply Chain Management • Sales • Quality Assurance • Procurement
Length Of Service	This is divided into below categories, <ul style="list-style-type: none"> • 10 - 12 years • 13 and above • 1 - 3 years • 4 - 6 years • 7 – 9 years

Table-13: Employee demographic category and groups under each category

The following section presents the research questions identified for this study, along with detailed explanations of the significance and purpose of each question. These questions were carefully formulated to address key aspects of employee retention and attrition. By exploring these topics, the research aims to uncover the underlying factors influencing employee decisions to stay or leave, assess the effectiveness of current HR practices, and identify areas for improvement. Each question is designed to contribute to a deeper understanding of workforce dynamics, helping to shape targeted strategies for enhancing employee satisfaction and reducing turnover.

Question	Significance	Purpose
1. Which of the greatest HRM challenges faced by your organization?	Identifies the key HR challenges that need attention.	To prioritize HR issues and focus on strategies that address the most significant challenges.
2. State the major reasons for attrition in your company.	Pinpoints the primary causes of employee turnover.	To develop targeted interventions to reduce attrition.
3. Which of the following employees in the experience range are most susceptible to attrition?	Determines which experience levels are most at risk of leaving.	To tailor retention strategies for employees at specific experience levels.
4. Which level of employees in your organization is most susceptible to attrition?	Identifies the organizational levels where attrition is highest.	To focus retention efforts on specific employee levels, such as entry-level or senior management.
5. Which of the following would you enlist as the consequence of attrition for your organization?	Highlights the impact of attrition on the organization.	To understand and quantify the consequences of attrition, such as financial loss or reduced morale.
6. Do employees feel less career growth with overwork and micro-management?	Assesses the impact of workload and management style on career satisfaction.	To identify if overwork and micro-management are contributing to attrition and reduce these factors.
7. State the major reasons for increasing attrition in your company, especially due to industry trends.	Evaluates how external industry factors affect employee retention.	To adapt retention strategies based on industry-specific challenges.

8. How many hours do you work per week?	Measures workload and potential burnout risks.	To ensure employees have a manageable workload and to address work-life balance concerns.
9. Are employees compensated sufficiently for their job role, with enough benefits to keep them motivated?	Gauges satisfaction with compensation and benefits.	To assess if compensation and benefits are adequate to retain employees.
10. Do you have dependents living with you?	Understands the personal responsibilities that might influence job stability.	To consider personal circumstances in retention strategies, such as offering flexible working arrangements.
11. Does the company work culture align with the employee's values, and does the boss give them room to grow?	Assesses alignment between company culture and employee values, along with leadership support.	To improve cultural alignment and leadership practices to retain employees.
12. What kind of benefits does your organization offer to resigning employees if they consent to continue their services?	Identifies retention incentives offered to resigning employees.	To evaluate and possibly enhance retention packages to keep valuable employees.
13. Do you conduct exit interviews for employees who resign from your organization?	Determines if the organization gathers insights from exiting employees.	To improve retention by understanding why employees leave and addressing those issues.
14. Does your organization have a policy to attempt to retain resigning employees by offering increased benefits?	Assesses if retention policies are in place for resigning employees.	To evaluate the effectiveness of retention offers in reducing turnover.
15. What is the common triggering attribute for an employee to leave the organization?	Identifies the primary reasons why employees decide to leave.	To target and mitigate key factors that trigger employee turnover.
16. Do employees receive good training to guide them through their job, opening up new opportunities and growth prospects within the company?	Evaluates the adequacy of training and development opportunities.	To improve training programs that enhance employee growth and retention.

17. What kind of support do employees expect from employers during this pandemic time? [Financial, Hygienic conditions, Work From Home]	Understands employee expectations during the pandemic.	To tailor support measures that address employee concerns during crises like the pandemic.
18. How has the pandemic affected employee satisfaction, and are the company working hours flexible enough to accommodate their needs?	Assesses the impact of the pandemic on employee satisfaction and work flexibility.	To adapt work policies to improve satisfaction and retention during and after the pandemic.
19. Please explain how employee attrition is ultimately impacting your organization.	Evaluates the broader impact of turnover on the organization.	To quantify and address the negative effects of attrition, such as loss of knowledge or productivity.
20. Please suggest ways that you may think can help to counter the HR challenge of employee attrition.	Gathers suggestions for improving retention strategies.	To involve employees in creating effective retention strategies by leveraging their insights.

Table-14: Research question with significance and purpose

APPENDIX B – PUBLIC DATA

The IBM HR Analytics Attrition dataset from Kaggle is a public dataset that contains detailed HR information for 1,470 employees, specifically aimed at analyzing employee attrition. The dataset includes 35 attributes such as age, job role, salary, distance from home, years at the company, and performance rating, among others. These variables can help identify factors contributing to employee turnover. Key fields include "Attrition" (indicating if an employee has left the company), "JobSatisfaction," "WorkLifeBalance," and "OverTime," which provide insight into employees' work experience and well-being. This dataset is widely used for building predictive models to analyze retention and turnover in organizations.

Feature	Data Type
Age	Numeric
Attrition	Categorical
BusinessTravel	Categorical

DailyRate	Numeric
Department	Categorical
DistanceFromHome	Numeric
Education	Numeric
EducationField	Categorical
EmployeeCount	Numeric
EmployeeNumber	Numeric
EnvironmentSatisfaction	Numeric
Gender	Categorical
HourlyRate	Numeric
JobInvolvement	Numeric
JobLevel	Numeric
JobRole	Categorical
JobSatisfaction	Numeric
MaritalStatus	Categorical
MonthlyIncome	Numeric
MonthlyRate	Numeric
NumCompaniesWorked	Numeric
Over18	Categorical
OverTime	Categorical
PercentSalaryHike	Numeric
PerformanceRating	Numeric
RelationshipSatisfaction	Numeric
StandardHours	Numeric
StockOptionLevel	Numeric
TotalWorkingYears	Numeric
TrainingTimesLastYear	Numeric
WorkLifeBalance	Numeric
YearsAtCompany	Numeric
YearsInCurrentRole	Numeric
YearsSinceLastPromotion	Numeric
YearsWithCurrManager	Numeric

Table-15: Research question with significance and purpose