INTRODUCTION

Traditional workforce management techniques in organisations across all sectors are causing challenges in monitoring and controlling crucial workforce trends. High employee turnover remains a financial concern, as it takes a lot of time to train and onboard new hires, and losing experienced staff can reduce output and profitability (Raja et al., 2024). Exit interviews that are commonly conducted are inadequate as they rely on the Manager's intuition rather than predictive analytics. Yet another concern is performance management. According to most of the HR leaders, the existing review systems are dissatisfactory (Gartner, 2019). Some comprehensive analytics solutions are needed in HR approaches.

In this report, we investigated the employee attrition issue using the IBM HR Analytics Employee Attrition & Performance dataset, publicly accessible via Kaggle. This dataset is a record of 1470 employees covering 35 attributes. It was created by IBM data scientists as a fictitious corporate HR database. This data set is an example of how corporations can use structured employee data to solve basic HR challenges.

A case study of Alpha AI, an imaginary tech company, was taken in this analysis. An interactive Tableau dashboard to provide an in-depth analysis of attrition trends was used. Along with understanding demographic patterns, it seeks to identify the primary factors of employee departure and tries to offer data-driven insights for strategic workforce planning and talent retention. The dashboard visualization can be accessed at: HR Attrition Dashboard for Alpha AI.

The study looks at multiple aspects of employee attrition, such as job-related trades, salary structures, employee satisfaction scores, and demographic factors. By closely examining these variables, the report aims to provide answers to the questions about the causes of attrition and its patterns.

CHAPTER 1: DATA COLLECTION AND CLEANING METHODOLOGY

1.1 Data Collection Process

The HR dataset used here has employee information from 2010 to 2025. The data collection process captured both historical data and real-time workforce metrics. The dataset contains various employee life-cycle stages, from recruitment to employment duration, performance evaluation to compensation and separation records.

Data Sources:

- Demographic records
- Performance data
- Payroll and Salary information
- Training and development records
- Exit interview summaries
- Employee satisfaction scores

1.2 Dataset Description

There are 1,470 employee records across 35 variables in the dataset, covering multiple dimensions of employee information. Key attributes include:

Demographic variables:

- Age
- Gender
- Marital Status (single, married, divorced)
- Education level (High school to Doctoral degree)
- Education field

Employment Characteristics:

- Employee No. (unique identifier)
- Department (Research & Development, Sales, Human Resources)
- Job Role
- Job level (1 - 5 Hierarchical levels)
- Years at company (0 to 40 years tenure)
- Years in current role
- Years with current Manager
- Years since last promotion

Compensation and Benefits:

- Monthly income (ranging from $1K to $20K)
- Salary Hike (11-25% range)
- Monthly rate (compensation frequency metrics)
- Stock Options

Work environment factors:

- Distance from home
- Overtime requirements
- Training times last year
- Business Travel

Satisfaction Metrics:

- Job satisfaction
- Environment satisfaction
- Work-Life balance
- Relationship satisfaction
- Job involvement

Target Variable:

- Attrition status (Current employee/ Ex-employee)
- Exit date

1.3 Data Quality Assessment

There are very few missing values for any of the key variables in the data set, indicating its high quality. Complete demographic data, employment history and satisfaction scores are all included in the employee records. Data integrity is validated by compensation data, which shows total coverage with suitable ranges.

1.4 Data Pre-Processing and Preparation

Data cleaning procedures

Missing value:

- Less than 1% missing values were identified in non-critical fields
- Missing satisfaction ratings were handled through median imputation based on department and job level
- Incomplete compensation records for ex-employees were excluded from the salary analysis

Data type conversion:

- Date fields standardised to YYYY-MM-DD format
- Categorical variables are coded for proper visualisation
- Numerical satisfaction skills validated for 1-4 range consistency

Feature engineering:

- Age groups: categorical age bands (18-25, 26-35, 36-45, 46-55, 56+)
- Income Bins: developed income ranges ($0-5K, $5-10K, $10-15K, $15K+) for compensation analysis
- Tenure categories: classified employees by years of service (0-2, 3-5, 6-10, 11+ years)
- Attrition rate calculations: computed, and role-specific attrition percentages
- Risk scoring: developed composite risk indicators based on satisfaction metrics and tenure

Data validation:

- Cross-referencing employment dates with system records
- Verification of department-roll alignment, consistency
- Outlier detection for compensation and satisfaction metrics
- Business rule validation (e.g., promotion dates vs hire dates)

Calculated Fields for Tableau:

- Overall Attrition Rate: SUM(Attrition Count) / SUM(Total Employees)
- Department Attrition Percentage:
  SUM(Attrition Count) / TOTAL(SUM(Employee Count))
- Average Risk Rating: Weighted average of satisfaction metrics
- Monthly Attrition Trend: Time series aggregation by exit date

Interactive Filters Created:

- Department selector (Research & Development, Sales, HR)
- Job Role filter (9 role categories)
- Gender filter (Male/Female)
- Age Group selector (5 age categories)
- Year of Exit Date range filter (2010-2025)

The preprocessing phase resulted in a clean, analysis-ready dataset enabling comprehensive visualization and reliable insights generation.

CHAPTER 2: OVERVIEW DASHBOARD ANALYSIS

The Overview Dashboard display important workforce metrics and high-level trends, acting as the centre of Alpha AI's attrition monitoring. This dashboard helps in the swift evaluation of the company's retention health and identifies the areas that need urgent attention.

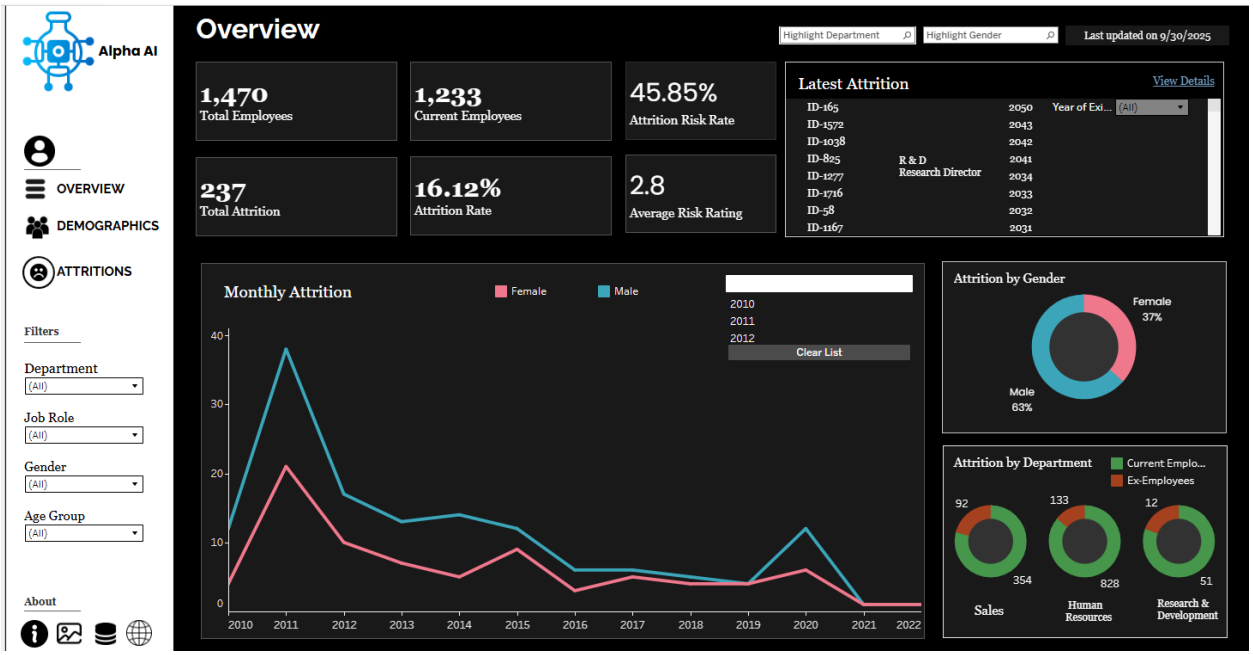

Fig 1: Attrition Overview Dashboard

Key Performance Indicators

Primary Metrics Display:

- **Total Employees**: 1,470 (workforce count)
- **Current Employees**: Active employees count
- **Overall Attrition Rate**
- **Attrition Count**: Total number of employees who have left
- **Average Risk Rating**: Composite Employee Satisfaction Indicator
- **Last Updated**: Real-Time Data Currency

Latest Attrition Analysis: The section provides real-time visibility into recent departures, displaying:

- Employee ID of recent departures
- Job Roles of Departing Employees
- Year of Exit

Attrition Patterns based on Gender: The gender distribution pie chart shows uneven distribution in attrition among males and females. The attrition in females is about 37%, while that in males is almost double, i.e., 63%.

Monthly Attrition Trends: Major trends can be noticed in the time series chart:

- Higher attrition rates are observed in some years like 2011, 2015 and 2020. This shows high organisational or market influence.
- Male and female attrition patterns show different timing preferences.

Attrition Patterns based on Departments: The analysis of departmental pie chart shows that the Sales department is moderate in size with notable turnover rate. The largest department, Research & Development, has the lowest attrition volume. However, the human resources department, which is the smallest in size, needs close attention as it has the highest attrition rate.

CHAPTER 3: DEMOGRAPHICS DASHBOARD ANALYSIS

Information about how personal trades affected attrition at Alpha AI can be found in this dashboard. The dashboard reveals important relationships between employee demographics and departure, which can be used for targeted retention strategies.

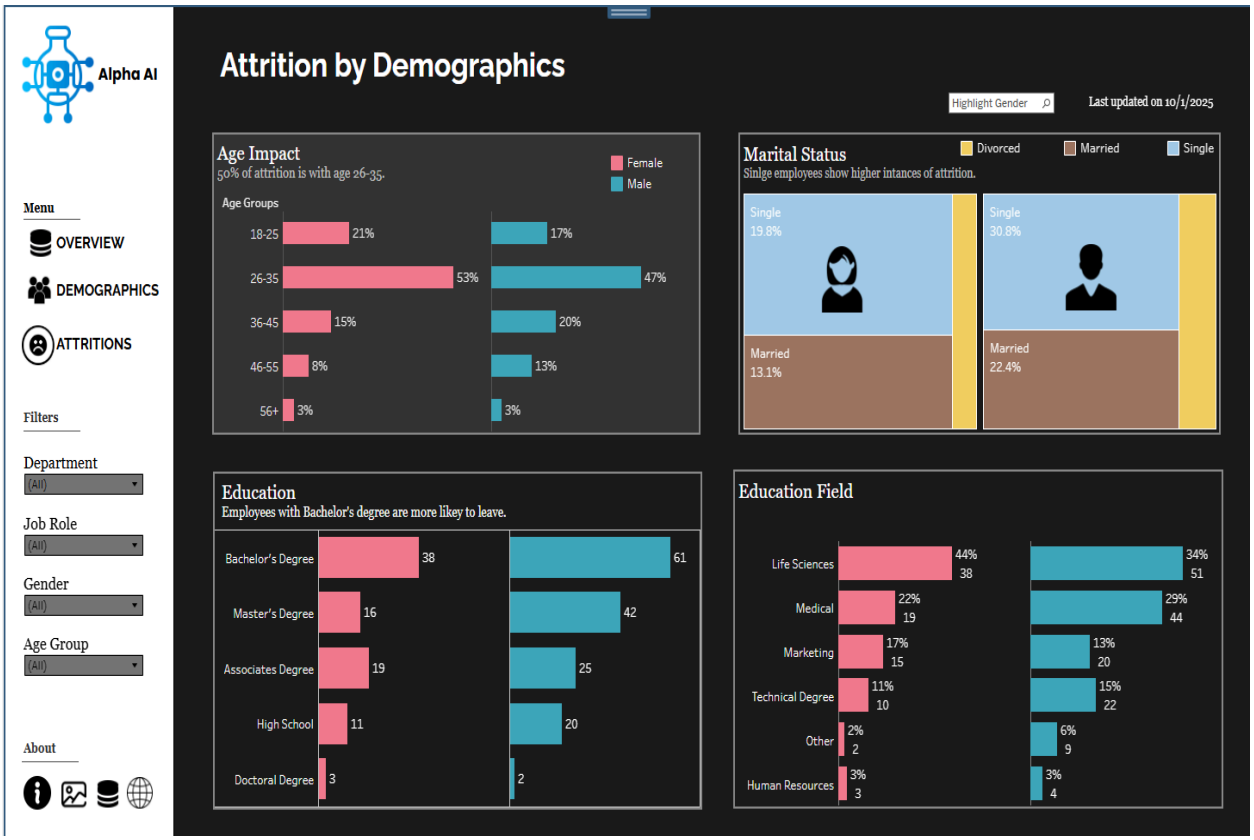

Fig 2: Attrition by Demographics

Attrition Analysis on Age Groups: During the analysis, one important finding came to light. The age group of 26 to 35 accounts for 50% of all attrition. The trend suggested that the mid-carrier professionals with significant experience are looking for better opportunities, making this the biggest retention challenge for Alpha AI.

Marital Status Correlation with Attrition: Single Employees have much higher attrition rates compared to those who are married or divorced. The tree map visualisation shows that single professionals of both genders contribute greatly to overall attrition.

Attrition by Education Level: According to the graph, employees with bachelor's degrees are most likely to leave. People with an Associate's and high school degree have a lower departure rate; the attrition rate is lowest in doctoral degree holders.

Attrition by Education Field: A particular academic background that is most vulnerable to attrition came to light. The highest attrition volume was found in the Life Science graduates. Additionally, a significant departure was seen amongst Medical graduates. Marketing and technical degree holders have moderate attrition levels. While professionals coming from an HR background have lower attrition rates.

CHAPTER 4: FINANCIAL DASHBOARD ANALYSIS

In the financial dashboard, we took a glance at how the compensation factor is affecting Alpha AI's employee attrition. This analysis provided a fresh perspective on how different wage structures influence employee resignation/layoffs.

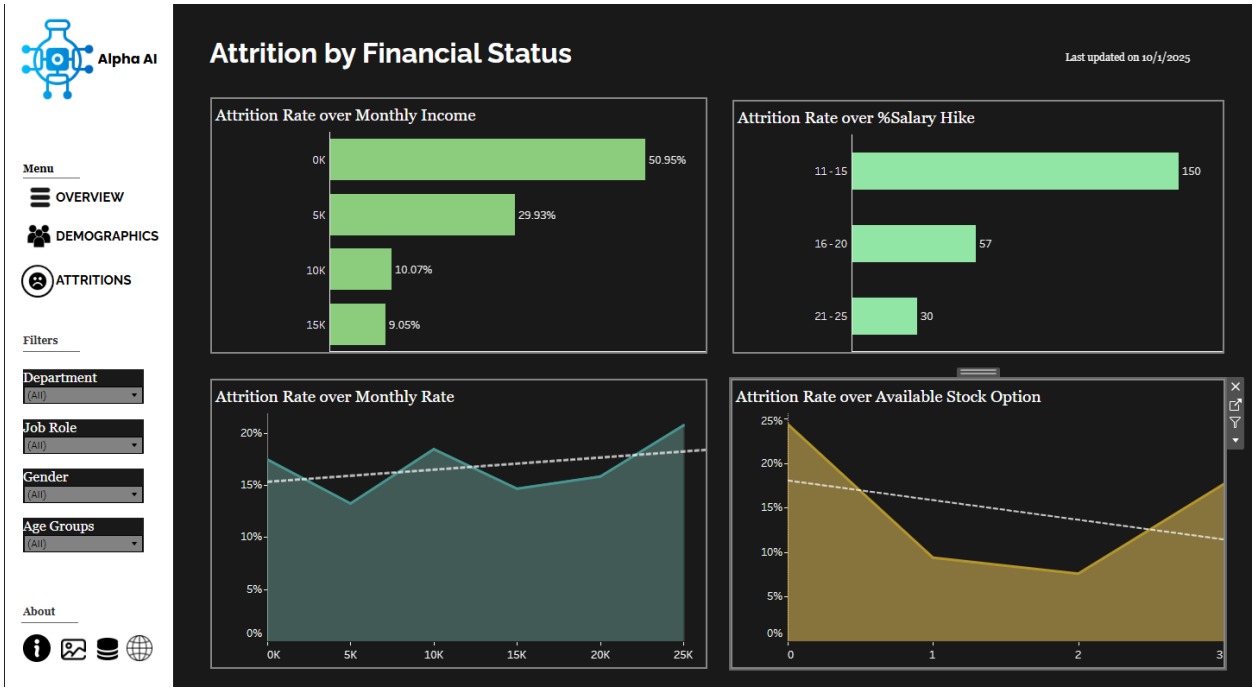

Fig 3: Attrition Over Financial Status

Income Distribution Patterns: Employee concentration is highest under $5K salary range. There is a significant workforce in $5-10 K income range. $10-15K range has a moderate number of employees, while $15K+ range has the smallest population. The distribution is in line with expected organisational hierarchy patterns. However, if employees look for better-paying opportunities, this might be a factor in attrition.

Salary Hike % Analysis: The largest group of people received 11-15% compensation hike. 16-20% increase was given to moderate population, while a small number of professionals received increase of 21-25%. Employees with low pay exhibit higher attrition rates, which suggests insufficient compensation growth.

Monthly Rate Analysis: This analysis explored patterns of compensation, frequency, and a connection to attrition. Lower monthly rates displayed high attrition rates (~20%). The attrition rate decreased with increase in monthly rates. This inverse relationship could be one of the main reasons why employees leave.

Attrition Over Stock: The numbers in this analysis showed that equity compensation is a retention tool. Highest attrition rate was seen in the group with no stock option, while folks with premium stock options exhibited significantly lower turnover.

CHAPTER 5: JOB ROLE DASHBOARD ANALYSIS

This dashboard examined work-related factors leading to employee attrition. In this analysis, we shed some light on how different organisational tiers and functions affect retention in relation to job characteristics and work environment.

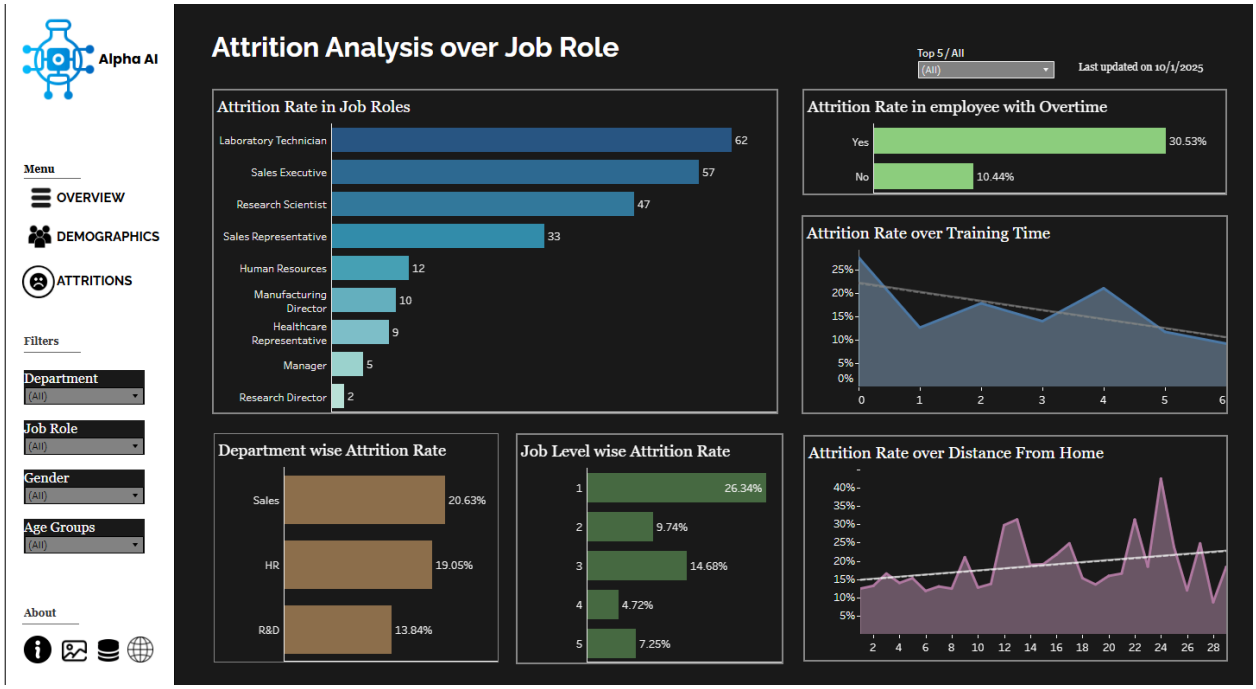

Fig 4: Attrition Analysis over Job Role

Job Role Attrition Patterns: According to the analysis, the laboratory technician role is at the highest risk of attrition. Other roles at high stake are Sales executive and representatives, Research Scientist, and HR. Some roles at lower risk are Healthcare representative, managerial roles, directorial roles, etc.

Overtime Impact Analysis: Overtime and attrition are dramatically correlated. Attrition rates are higher among employees who put in extra hours.

Training time effectiveness: The graph shows an inverse relation between training sessions and attrition rate.

Department-Specific Patterns: Sales department has the highest attrition rate, while, despite being high-volume, R&D has least attrition rate.

Hierarchical Attrition Patterns: Attrition rates are highest at entry and Junior level. The rate declines with advancement in hierarchical ladder.

Distance-Attrition Correlation: The geographical analysis reveals that employees who commute distance of 8-14 miles have the highest chances of attrition. Employees living either very near or very far from the office have lowest attrition rate.

CHAPTER 6: COMPANY HISTORY DASHBOARD ANALYSIS

The dashboard looked at the historical aspects of employee retention. It examined the effects of tenure-related factors, offering information on career progression and organisational loyalty.

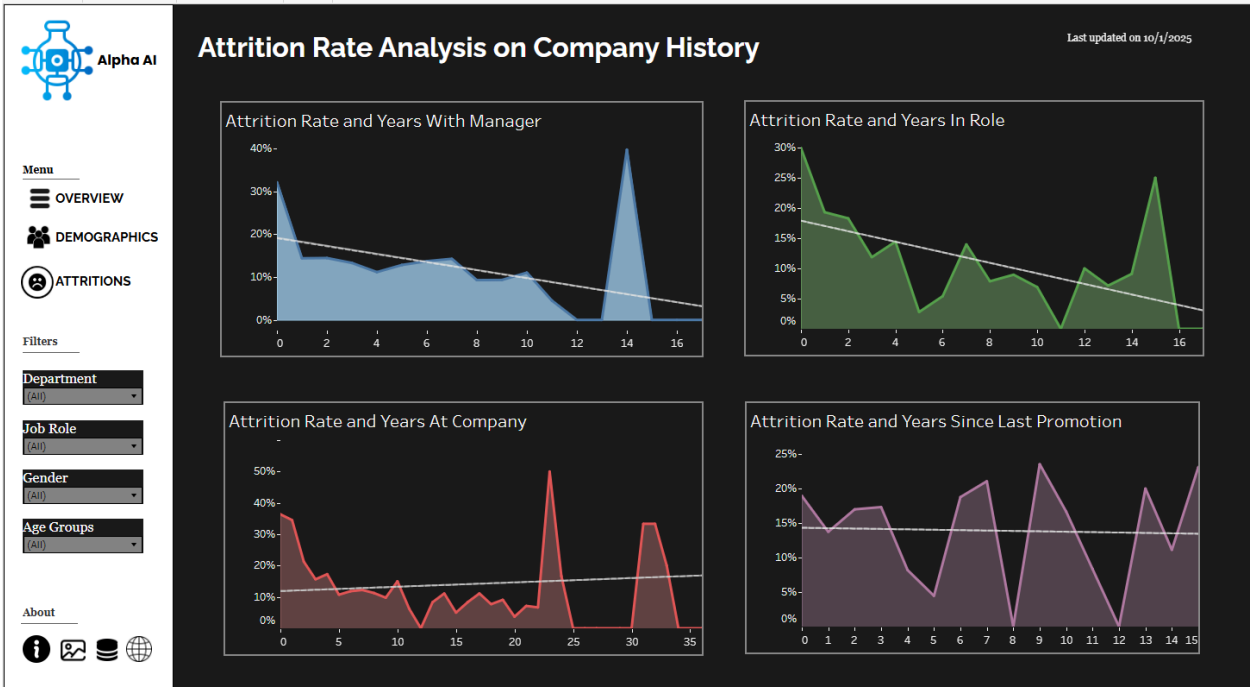

Fig 5: Attrition Rate Analysis on Time spent in the organization

Role Tenure Attrition Curve: According to the data, employees are most likely to leave a position between 2-4 years into it. The rate gradually decreases if employee spends five years in a position.

Manager Tenure Correlation: Highest attrition rate, over 35%, occurs in the first two years with the Manager. From the graph, it can be concluded that initial Manager-employee relationships contribute to departure decisions, but strong managerial relationships grow over time.

Company Tenure Insights: During 0-5 years at the company, the attrition rates are extremely high. Significantly lower rates are seen in the following years due to organisational loyalty.

Promotion Timing Patterns: According to the data, employees are more likely to quit after 3-4 years without being promoted.

CHAPTER 7: EMPLOYEE SATISFACTION DASHBOARD ANALYSIS

The dashboard evaluated individual workplace experience factors affecting attrition. Analysis brings some exposure to workplace culture and employee experience quality.

Fig 6: Attrition Rates based on Employee Satisfaction Scores

Satisfaction-Attrition Correlation: This linear relationship confirms satisfaction serves as reliable marker of attrition risk by showing a direct correlation between employee satisfaction and retention.

Previous Employment Impact: Attrition risk is higher for individuals with multiple job-hopping histories, indicating that past employment patterns predict future retention behaviour.

Engagement-Retention Patterns: Attrition is much higher among employees with low job involvement.

Balance-Attrition Relationship: This data proves to be one of the best indicators of attrition. A lack of work-life balance can increase the risk of departure immensely.

Environmental Aspects: Across all employee categories and departments, the physical and cultural workplace and environment have a big impact on attrition decisions, evident from the linear relationship between them.

Job Contentment Impact: The value of job satisfaction is also a crucial indicator, which is confirmed by its direct correlation with retention.

Relationship Quality Impact: According to the graph, strong working relationships are important retention factors that reinforce the value of team dynamics.

CONCLUDING REMARKS

A thorough examination of Alpha AI's employee attrition trends uncovers a challenging but manageable retention issue. The insights gathered from this analysis require prompt organisational response and executive attention.

Five fundamental categories of risk factors were identified in the study. First issue being the departure of about 50% employees in the age group of 26-35. Secondly, single employees have much greater attrition rates than married/divorced employees. Additionally, professionals making <$10K per month have much higher turnover rates, suggesting a relationship between adequate compensation and retention. Factors related to workplace, quality and environment raise the risk of attrition for all employee categories. Lastly, satisfaction statistics and retention show a direct linear relationship, serving as one of the most accurate predictors of attrition.

Although substantial, the attrition issues are neither impractical nor unsolvable. The dashboard analysis provides data-driven insights for clear patterns, recognisable risk factors, and possible intervention opportunities that, if addressed in time, can significantly enhance the retention success story. But sustained success and retention will require leadership, commitment, adequate resource allocation and continuous progress tracking through the dashboard framework. Successful implementation will transform the challenges into competitive advantages, supporting sustainable growth and leadership.

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APPENDIX

GitHub Repo for the analysis: Attrition Analysis and Retention Solutions Using Tableau

Future Work and Enhancement Opportunities

In the future, organisational scalability and advanced analytics can help in retention tactics. Future developments might focus on optimising the dashboard and incorporating predictive modeling along with real-time, performance and feedback tracking. This may enable early detection of attrition risk and help in the implementation of cost-effective data-driven decisions. Additionally, sentiment analysis of qualitative employee data may offer a deeper understanding of the emotional perspective of the workforce. Moreover, enabling machine learning can also help reveal intricate attrition patterns. Lastly, the dashboard should be modified to handle upscaling across various locations and business units with features for recruitment analytics and industry benchmarking.