Journal of Mathematics and Computing Science, 10 (2). 138-153, 2024

eISSN: 0128-0767

Leveraging Interactive Visualisation Using Tableau for Effective Human Resources Management

Siti Nur Atiqah Mohd Shafie[1], Mohd Noor Azam Nafi[2*], Siti Nurhafizah Mohd Shafie[3] , Nasuhar Ab. Aziz[4] , Akmal Shafiq Badarul Azam[5] and Puteri Faida Alya Zainuddin[6]

[1,5,6]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Mukah, Sarawak, Malaysia
[2,3,4]Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Kelantan, Bukit Ilmu, Machang, Kelantan, Malaysia

Authors' email: sitinuratiqahms@uitm.edu.my, norazam05@uitm.edu.my*, sitinurhafizah@uitm.edu.my, nasuha978@uitm.edu.my, akmalshafiq@uitm.edu.my and puterifaida@uitm.edu.my

*Corresponding author

Received 19 November 2024; Received in revised 22 December 2024; Accepted 29 December 2024
Available online 31 December 2024
DOI: https://doi.org/10.24191/jmcs.v10i2.7393

Abstract: Interactive visualisation tools like Tableau have revolutionised human resources data analysis, moving beyond static reports to dynamic dashboards that reveal meaningful information and enhance decision-making through clear and engaging manner. This paper aims to deliver insightful and interactive visualisations on the curiosities of employee profiling, factors influencing employee turnover, and effective recruitment sources. A sample of 113 employees was analysed, incorporating various demographic variables such as gender, marital status, citizenship status, race, and state, along with position, salary, employment status, department, tenure, hire and termination years, special projects received, recruitment sources, reasons for termination, employee satisfaction, performance scores, lateness, and absences. Kirk's framework was applied, and Tableau Software was utilised to create visualisations that offer deeper insights and address key areas of interest regarding curiosities. The findings reveal that the majority of employees are active, single, employed in the production department, and hold United States (US) citizenship. Additionally, factors such as employee satisfaction, performance, absenteeism, and tardiness contribute to employee turnover. Finally, it emerged as the leading platform for recruitment sources.

Keywords: Employee profiling, Employee turnover, Interactive visualisation, Recruitment sources, Tableau software

1 Introduction

In the modern business landscape, data-driven decision-making has become the cornerstone of effective management practices [1], including in the domain of human resource management. Organisations generate vast amounts of human resources data, ranging from employee performance metrics and recruitment statistics to attrition trends and workforce diversity. Hence, the robust tools are required to analyse and present information in a clear, meaningful, and interactive manner. Rajeswari et al. [2] mentioned that Tableau is a leading data visualisation platform for handling big data analytics. The ability to transform raw human resource data into interactive visualisations and dashboards provides organisations with intuitive, user-friendly tools that seamlessly integrate advanced analytical capabilities [3]. Thus, Tableau could provide human resource professionals with a dynamic platform to analyse, visualise, and communicate complex data trends, enabling data-driven decision-making that improves organisational performance and employee well-being.

The integration of interactive visualisation into human resource management processes offers numerous advantages, as it goes beyond merely presenting data in charts and graphs. It involves developing tools that enable in-depth exploration, foster a deeper understanding of data, and support

informed decision-making. Traditional approaches to analysing human resources data, such as spreadsheets or static reports, often fall short in capturing the complexity and interconnections within human resources metrics. In contrast, interactive visualisations enable users to integrate diverse datasets, uncover meaningful correlations, and extract actionable insights with greater clarity and precision [4]. For instance, consider workforce diversity metrics. Instead of reviewing lengthy tables of demographic data, Tableau allows human resources management to create dynamic dashboards that visualise representation across gender, ethnicity, and age groups. Users can filter by department or role, enabling a granular view of diversity at every organisational level [5]. This not only improves understanding but also helps organisations monitor progress toward inclusivity goals in real time.

Demographic analysis is a key focus of data analysis using Tableau, making it an essential component of human resource management research. As Margherita [6] highlights, descriptive studies in human resource management facilitate benchmarking and the development of impactful tools such as dashboards and reports. These tools are critical for understanding workforce dynamics and aligning organisational strategies to optimise performance. Descriptive statistics on demographic variables such as gender, age, and education offer profound insights into employee performance, enabling organisations to identify trends and areas for improvement [7]. Incorporating employees' demographic characteristics into research not only fosters healthier interpersonal relationships and reduces counterproductive behaviours but also drives enhanced organisational productivity [8].

Besides studying the demographic characteristics, Gao et al. [9] highlight that employee turnover can create significant challenges for organisations. Employee turnover is described as the movement of employees either within or out of a company [10]. Demographic characteristics, such as age, gender, educational background, and tenure, can significantly influence turnover rates, as different groups may exhibit varying tendencies to stay or leave. Organisations may face financial instability when employee departures, particularly from key demographic segments, exceed sustainable levels [11]. Furthermore, prolonged vacancies resulting from unfilled positions can disrupt organisational workflows. Consequently, research on employee turnover is crucial to identify employees at risk of leaving and to assess turnover rates, ensuring an organisation maintains an efficient recruitment process [12].

Apart from that, a study on the proper employment recruitment sources has become an important criterion for the human resource department, enabling organisations to identify and attract loyal and high-performing employees. Recruitment encompasses activities designed to influence the quantity and quality of applicants who submit applications, remain in the candidate pool, and ultimately accept job offers [13]. Human resources departments traditionally relied on methods such as advertisements, referrals from employees or acquaintances, employment agencies, internal postings, walk-ins, campus recruitment, and job fairs [14]. However, as Acikgoz and Bergman [15] note, online recruitment has become a widespread practice. Organisations increasingly leverage digital platforms, including corporate websites, online job boards, and social networking sites, to reach a broader and more diverse pool of candidates. Platforms like LinkedIn, a professional networking site, are frequently utilised by human resources to identify and engage individuals with the required qualifications for open positions [16]. These recruitment strategies also allow organisations to target specific demographic groups, ensuring a diverse and inclusive workforce.

To date, several researchers [17, 18, 19] have conducted studies on human resources management using dashboard analytics. However, noticeably, the implementation of the interactive dashboard using Tableau software on human resources management is still lacking. Thus, this deficiency requires further attention to be explored, especially stress on the certain characteristics of demographic variables such as gender, marital status, citizenship status, race, and state, along with position, salary, employment status, department, tenure, hire and termination years, special projects received, recruitment sources, reasons for termination, employee satisfaction, performance scores, lateness, and absences.

Heer and Shneiderman [20] describe the taxonomy of interactive dynamics that contribute to successful analytic dialogues in Tableau Software. The integration of Tableau Software could create dynamic and interactive dashboards, enhancing the accessibility and comprehension of complex human

resource data while supporting better decision-making. Additionally, it utilises a comprehensive dataset that includes a wide range of variables, such as demographic characteristics, employment details, performance metrics, and recruitment sources, enabling a multifaceted understanding of employee profiling and turnover factors. On top of that, the application of Kirk's visualisation framework ensures methodological rigour, while the focus on critical human resource management challenges, such as employee turnover and recruitment effectiveness, provides actionable insights.

Eventually, to address this gap, this study investigates the use of interactive visualisation through Tableau to enhance the effectiveness of human resources management. In addition, the study results could support department heads by providing detailed visualisations of employee profiles, the factors contributing to employee turnover, and the most effective recruitment platforms. Furthermore, Tableau can be highly beneficial in enhancing decision-making processes within organisations [21]. By enabling exploratory analysis of statistical data, it provides individuals, organisations, and related fields with valuable insights, supporting the development of informed strategies and achieving improved outcomes.

2 Methodology

Visualisation is the process of representing data graphically, transforming raw information into charts, graphs, or maps to make complex datasets easier to understand and analyse [22]. This could provide the users insights into important business metrics and facilitate better decision-making. Nonetheless, interactive visualisation extends the capability of static charts by allowing users to explore data dynamically through filtering, drilling down, and customising views. A hands-on approach could enable the users to understand data, uncover insights in real time, and tailor the analysis to specific questions or needs. According to Murphy [23], Tableau software is an effective tool for creating interactive visualisations, particularly with large datasets. The ability to facilitate seamless interaction with data makes this highly efficient for exploring and analysing complex datasets.

Hence, this study is applying the interactive visualisation on the human resource management using the Tableau software to create interactive dashboards and visualisations for tracking and monitoring the human resource metrics, including employee profiling, employee turnover, and recruitment sources. Nevertheless, prior to conducting this study, the five key steps of Kirk's [24] visualisation approach have been implemented, comprising formulating the brief, data acquisition, pre-processing, and developing data visualisations.

A Formulating Brief

In the process of formulating the brief, it is crucial to establish the project context by identifying the key areas of curiosity within human resource management. This study aims to explore the factors influencing employee turnover in human resource management. From the given scenario, the researcher will define a specific curiosity to guide the investigation and provide an explanation for the situation presented. The curiosity is outlined below:

i. What are the profiles of the employees within the organisation?
ii. What are the profiles and factors contributing to employee turnover based on turnover status (voluntary termination vs. termination for cause)?
iii. What are the most effective recruitment sources or platforms based on the profiles of active employees?

Hence, the purpose of the study, according to the research questions constructed are:

i. To visualise the profiles of the employees within the organisation.
ii. To visualise the profiles and factors contributing to employee turnover based on turnover status (voluntary termination vs. termination for cause).
iii. To visualise the most effective recruitment sources or platforms based on profiles of active employees.

The purpose map was constructed in alignment with the research's vision to describe various types of visualisations and intended applications. This map categorises visualisations based on two key factors that are reading and feeling, which aim to enhance users' understanding of the data and support informed decision-making. The purpose map depicted in Table 1 determined that this study involves the reading-based explanatory visualisation with annotation or description of the data. This indicates that this study used the interactive visualisation to help in explaining data in a sequential manner with the particular process or flow. Besides, the reading-based exhibitory on display defined that this study uses visualisations designed to display data clearly and efficiently based on charts or graphs that allow users to view data in a straightforward manner. This was focusing on presenting key metrics without additional complexity, emphasising clarity. Then, the reading-based exploratory visualisation with efficient manipulation, which means it incorporates visualisations that provide descriptions or annotations that help to clarify the meaning behind data points. These are used for precise, detailed explanations of specific elements in the dataset.

Table 1: The Purpose Map

		Explanatory		Exhibitory	Exploratory	
		Sequence/ Drama	Annotate/ Describe	Display	Manipulate/ Interrogate	Participate/ Contribute
Reading	Efficient/ Precision		×	×	×	
Feeling	Emotive/ big picture					

B Data Acquisition and Pre-processing

During the data acquisition and pre-processing phase, several steps were undertaken to ensure seamless use in subsequent stages. These steps included data acquisition, manipulation, and exploration. Data was sourced from the Kaggle website, specifically the human resources dataset simulated by Dr. Rich Huebner and Carla Patalano [25]. This dataset comprised 311 observations across 36 variables. Following a thorough exploration and refinement of the dataset, the researcher opted to focus on 20 key variables while retaining the full set of 311 observations. The description of each variable is shown in Table 2.

Table 2: Variable Descriptions

Variable	Description
Absences	The number of times the employee was absent from work
Citizen Status	US Citizen, Eligible Non-Citizen, Non-Citizen
Days of late	The number of times the employee was late
Department	Name of the department that person works in
Employee Name	Employee's full name
Employee Status	Active, non-active
Gender	Male, Female
Marital Status	Single, Married, Divorced, Separated, Widowed
Performance score	Fully meet, exceeds, need improvement, performance improvement plan (PIP)
Employee Satisfaction	5 Likert scale of the performance score
Position	Title of the position the person has
Race	The race of the employee
Reasons of termination	The reasons of person were terminated
Recruitment Source	Sources where the employee was recruited
Salary	Salary of each employee
Special Project Received	The number of special projects that the employee worked on

Variable	Description
State	The state of a person lives in
Tenure Duration	The duration of employee work in a company
Year of Hired	The year of person was hired
Year of Termination	The year of person was terminated

C Interactive Visualisation Development

Human resource departments handle vast amounts of data, ranging from employee demographics and job roles to performance ratings and turnover rates. Making sense of this data requires robust analytical tools, and Tableau excels in this domain by providing a platform for interactive and shareable dashboards. Tableau flexibility enables researchers and managers to combine datasets, build relationships between variables, and visualise key metrics that inform human resource strategies.

Tableau is a powerful and user-friendly data visualisation tool widely used for transforming raw data into insightful visual narratives. Its applications span various fields, including human resources management, where it aids in exploring workforce analytics, identifying trends, and making informed decisions. The interactive features, such as quickly adding or removing variables, segmenting, sorting, and highlighting data, greatly improve the ability to analyse vast amounts of information. The drag-and-drop functionality allows for seamless transitions between different types of visualisations, making it easier to shift perspectives. Additionally, Tableau's built-in tools streamline the analysis process, simultaneously integrating data from multiple sources and combining the information to deliver precise and reliable results [26]. There are several processes involved in using Tableau visualisation for human resources management.

i. Preparing the Data

The human resources data were downloaded in Excel format with unclean or unstructured information. Therefore, the data was cleaned and formatted for seamless integration with Tableau software, where we ensured all variables have consistent naming conventions, no missing values or outliers, and structured the data into rows (observations) and columns (variables).

ii. Connecting Tableau to the Data

Tableau software supports various types of data connections, including file-based formats (e.g., Excel, CSV), server-based systems (e.g., SQL, Oracle), and cloud-based platforms (e.g., Google Sheets, Salesforce). For this study, however, Tableau was connected to human resources data in the Excel file format. Upon connection, Tableau automatically identifies dimensions (qualitative variables) and measures (quantitative variables) within the dataset, organising them in the Data Pane for seamless access and use during visualisation.

iii. Exploring the Data

Before creating visualisations, researchers explored the dataset using Tableau's interface to review the imported data and ensure all fields were loaded correctly. This step did not involve the use of multiple datasets, as the study relied solely on a single human resources dataset extracted in Excel format. This ensures that the data is ready for insightful analysis.

iv. Creating Visualisations

Visualising data in Tableau involves dragging and dropping fields into the worksheet. A worksheet in Tableau is a single workspace to create visualisations, for instance, charts, graphs, or maps, based on the data provided. The worksheet is the building block of Tableau's interactive dashboards and storyboards. Each worksheet is dedicated to a specific visualisation, allowing you to focus on a particular aspect of the data. The components of a Tableau worksheet include the data pane, rows and

columns shelf, filter shelf, pages shelf, and marks card (for adjusting colour, size, label, shape, and detail). Besides, the visualisation area is provided as a central space to display the chart or graph constructed. There is a component, namely the Show Me panel, that acts as an expert assistant, guiding you to build the appropriate chart to use and explaining its purpose [27]. This component also simplifies the process of creating complex visualisations, making it quicker and easier [28]. Then, the toolbar component is available at the top of the worksheet for saving, undoing actions, refreshing data, and adjusting visualisation options. Hence, this study applies various types of charts in different worksheets, such as pie charts, bar charts, line charts, packed bubble charts, tree maps, map charts, lollipop charts, and funnel charts, using a human resources dataset. The interface of the worksheet is depicted in Figure 1.

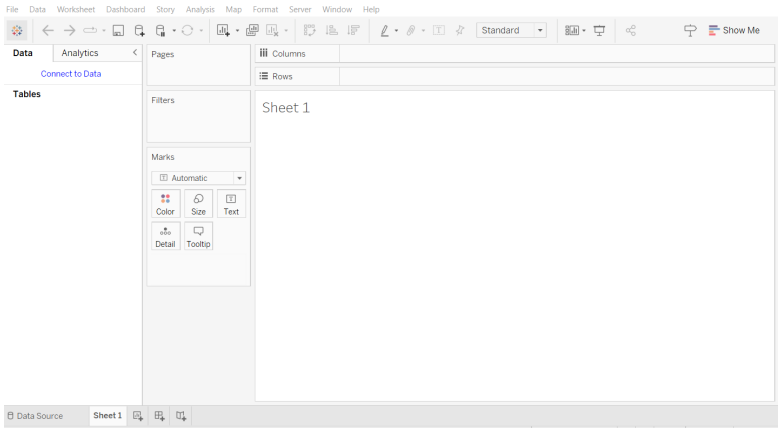

Figure 1: Interface of Worksheet in Tableau Dekstop

v. Creating Dashboards

A Tableau Dashboard is a consolidated workspace where multiple visualisations from several worksheets, such as charts, graphs, and maps, are compiled together in a dashboard to provide a comprehensive and interactive view of data. It allows users to combine various data insights into a single, unified interface, making the visualisation easy to use and interpret complex datasets [29]. Dashboards are commonly used for reporting, decision-making, and sharing insights across teams or organisations.

vi. Adding Interactivity

There are specific key features provided in the Tableau dashboard, for instance, multi-visualisation integration, which combines different types of visualisations from different worksheets within the same Tableau workbook into one layout. Then, there are the interactive elements based on the dashboards that support interactivity, such as filters, drilldowns, and clickable actions, allowing users to explore the data dynamically. For example, selecting a region on a map can update related charts with data specific to that region. Next, the customisable layouts act as the content organisation since the dashboard can be tailored to fit specific screens or devices, such as desktops, tablets, or mobile phones, effectively. The features of filters and parameters enable dynamic inputs to adjust data or visualisations based on user preferences. Besides, the understanding of data could be enhanced using the text, titles, legends, and image features such as company logos, annotations, or contextual descriptions. Features in the dashboard offer the actions to connect visualisations within the dashboard or link to external resources, such as web pages or other dashboards.

vii. Publishing and Sharing

Tableau offers several sharing options. Researchers use Tableau Public for free access (with data made public) or Tableau Server/Online for secure organisational sharing. Dashboards can also be exported as PDFs or images for offline sharing, ensuring flexibility in how insights are communicated.

3 Results and Discussion

This section presents the detailed findings and results of the study, addressing the three curiosities through interactive visualisations created using Tableau Software. Each curiosity is explored through separate dashboards, each featuring distinct colour themes. The results are further elaborated in the subsections below.

A First Curiosity: What are the profiles of the employees within the organisation?

Figure 1 illustrates the first dashboard, which visualises comprehensive employee details, offering valuable insights into the organisation's human resource management practices. The dashboard employs a purple colour theme, incorporating various shades from light to dark purple, symbolising creativity and extravagance. This creative visualisation is achieved using a variety of chart types, including maps, icons, bar charts, pie charts, funnel charts, and tree map charts, all effectively depicted in the dashboard. The variables included in this dashboard were total number of employees, employee status, gender, marital status, state, citizen status, race status, position, department, and recruitment sources. The gender filter in the worksheet has been utilised to analyse the distribution of various attributes, including marital status, state, citizenship status, race, position, department, and recruitment sources, categorised by gender.

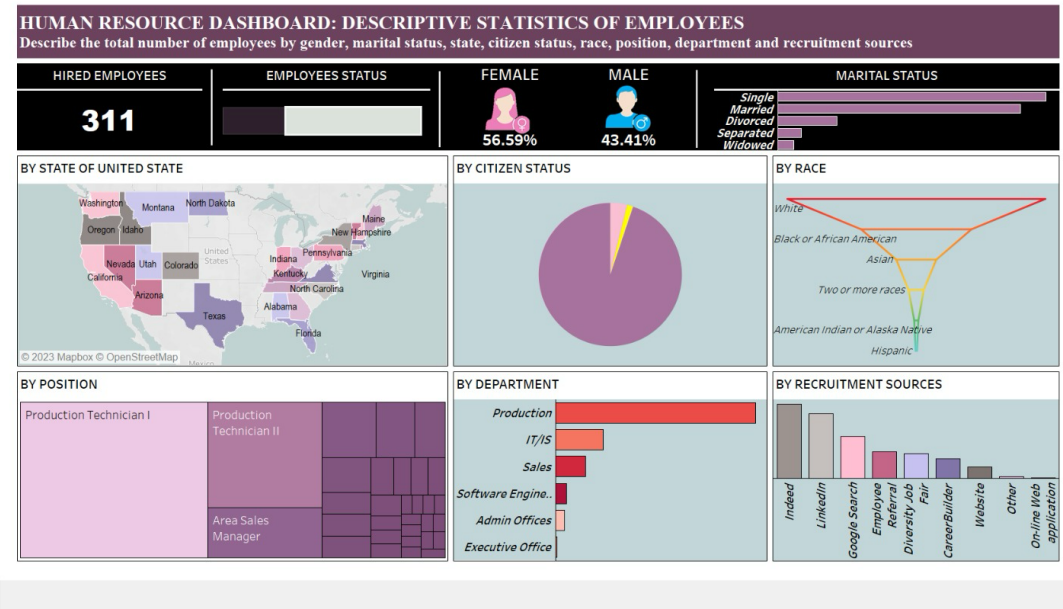

Figure 1: The first curiosity dashboard

The results presented in Figure 2 reveal detailed employee profiling. The results obtained based on the visualisation dashboard are that the total number of employees was 311, with 66.56% of employees still active. This indicates a relatively stable workforce, but with over one-third of employees who are inactive, there may be concerns about turnover or underutilisation of talent. Understanding the reasons for inactivity could help the organisation implement measures to improve employee retention and engagement. For instance, conducting exit interviews or satisfaction surveys could shed light on the underlying issues.

While gender distribution is proportional, females slightly outnumbered males at 56.59% as compared to males with 43.41%. This distribution indicates a diverse workforce that could benefit from specific diversity programs. However, it is important to understand whether this gender balance matches industry standards or if there are any gender-based issues related to opportunities or job satisfaction. For instance, the organisation could investigate whether there are challenges in recruiting or retaining men in certain roles. This would allow the organisation to ensure its recruitment and retention strategies are effective and offer equal opportunities to all employees.

The marital status data indicates that 44.05% of employees are single. This information is providing valuable insight into the needs and preferences of single employees, helping the organisation tailor its policies to improve employee satisfaction and retention. Single employees are likely to place a high value on career development opportunities, flexible work arrangements, and a strong sense of belonging within the organisation. By strategically addressing these needs, the organisation can significantly enhance employee engagement, reduce turnover, and foster a more supportive and productive work environment, ultimately driving long-term success.

Apart from that, visualisation discovered the highest state of employee recorded in Massachusetts by 276 employees; most of them had US citizen identity with 94.86% and had the white race with 60.13%. This highlights the potential gaps in diversity. Expanding recruitment outreach and fostering an inclusive workplace environment could help the organisation attract and retain a more diverse workforce.

The dominance of the Production Technician I position, representing 44.05% of employees and aligning with the production department's 67.20%, underscores the department's critical role in operations. Ensuring proper training, career progression, and job satisfaction in this department is crucial for maintaining operational efficiency. Meanwhile, the recruitment sources analysis reveals that Indeed is the most utilised platform, contributing 27.97% of hires. While this highlights the platform's effectiveness, exploring additional channels such as employee referrals and targeted social media campaigns could help diversify and optimise recruitment efforts.

These findings emphasise the importance of addressing turnover through strategies such as mentorship programs, career development initiatives, and tailored benefits. Additionally, focusing on diversity, recruitment optimisation, and employee engagement can further strengthen the organisation's workforce. By leveraging these insights, the organisation can implement strategies that not only improve retention but also build a more inclusive and high-performing team.

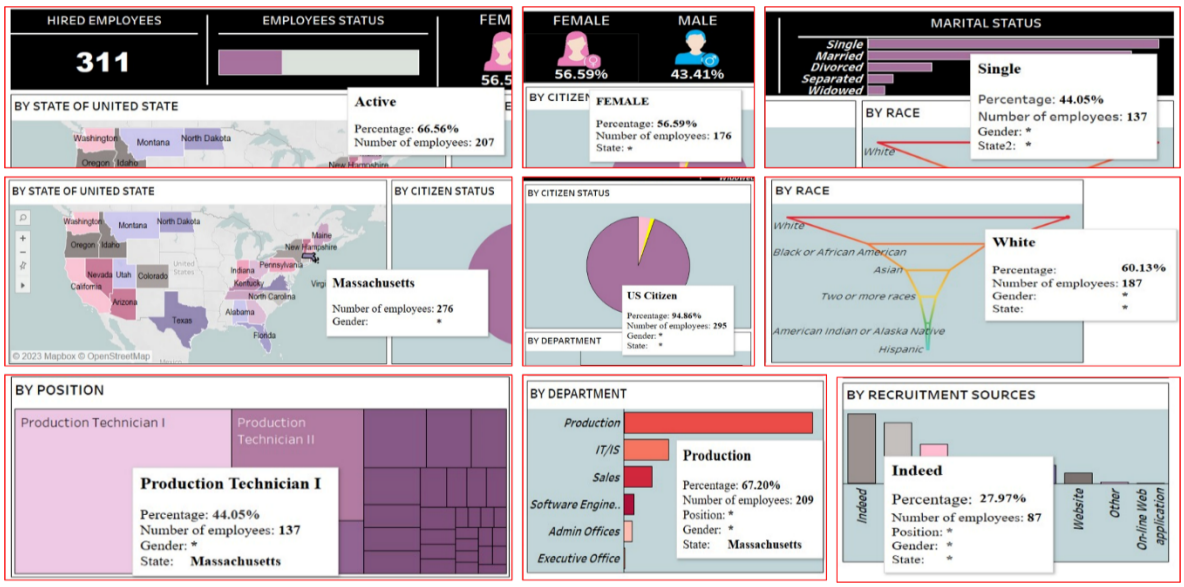

Figure 2: The record and percentage of employees for each variable in first curiosity

B Second Curiosity: What are the profiles and factors contributing to employee turnover based on turnover status (voluntary termination vs. termination for cause)?

Figure 3 presents the dashboard designed to address the second curiosity. The chosen red theme, symbolising urgency, effectively highlights the critical factors that may contribute to employee turnover, emphasising the importance of these issues for the organisation.

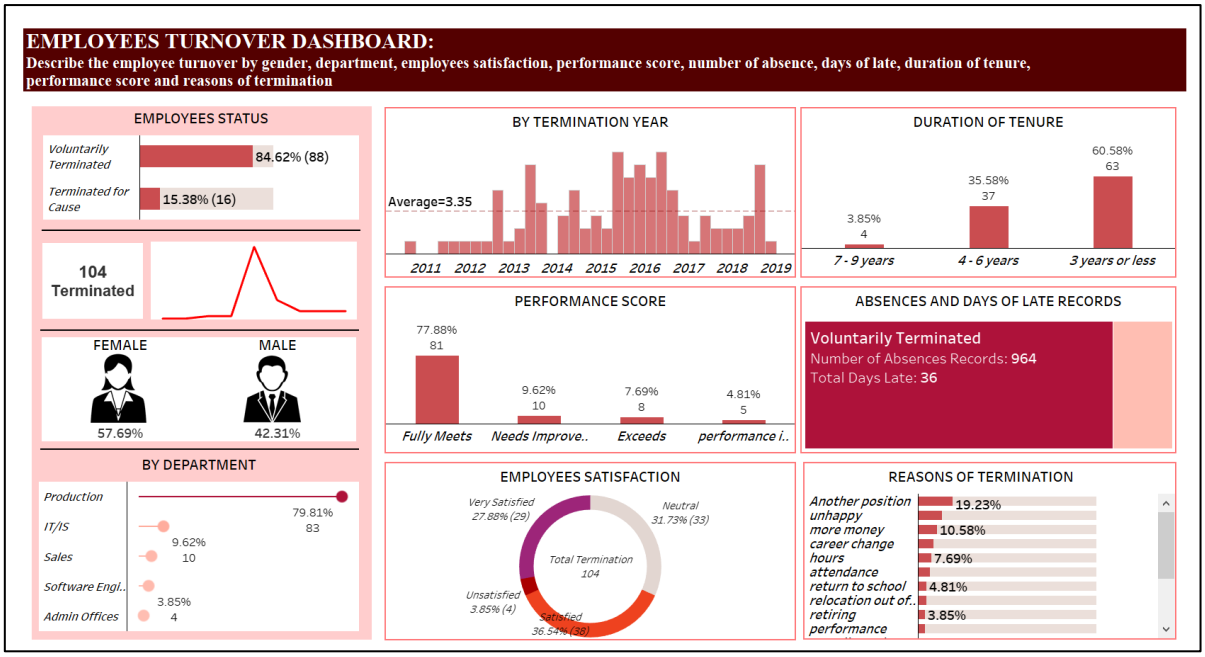

Figure 3: The second curiosity dashboard

The dashboard includes variables such as employee status, a line graph showing the year of hire, department, average termination rate by year, tenure duration, performance score, absences, and days late to work within a 30-day period, employee satisfaction, and reasons for termination. A filter on employee status was applied to examine the details and factors contributing to employee turnover. As shown in Figure 4, employee turnover is categorised into two types: voluntary termination and termination for cause. The dashboard reveals that most employee terminations (84.62%) are voluntary, meaning most employees choose to leave the company. High voluntary turnover often signals dissatisfaction with the current work environment, which could be due to various factors such as career opportunities, job satisfaction, or compensation. Since the majority of employees are voluntarily terminating their employment, this suggests that the organisation needs to investigate the underlying causes of employee dissatisfaction. These factors could range from lack of growth opportunities to poor work-life balance, and identifying these issues is critical in reducing voluntary turnover.

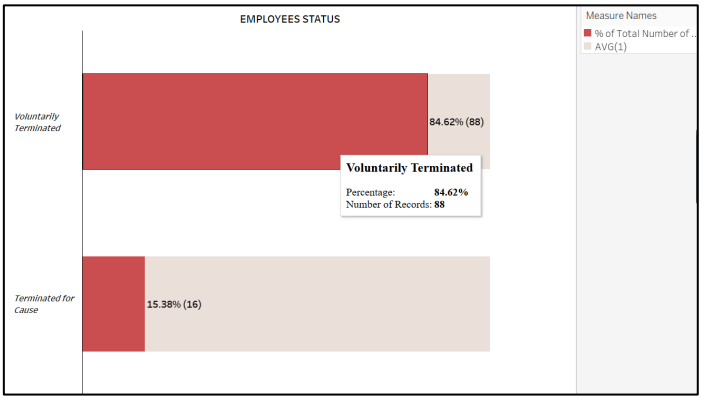

Figure 4: The percentage of employee status

Figure 5 presents the dashboard filtered for employees who voluntarily terminated their employment. It shows that the majority of these employees were female, hired in 2011, and worked in the production department. Meanwhile, the average annual termination rate for voluntarily terminated employees is 3.03, with a tenure duration of 3 years or less. This trend could indicate that employees with relatively short tenure in specific roles are more likely to leave. It may suggest a gap in engagement or career development opportunities, particularly in the production department. The relatively higher turnover in this department could be indicative of specific challenges faced by employees, such as job

monotony, lack of advancement opportunities, or insufficient compensation. The organisation may want to explore whether job enrichment strategies, career development programs, or incentives are needed to retain employees in this department.

In addition, over the past 30 days, voluntarily terminated employees showed high absenteeism (964 absences, 36 days late) while still maintaining satisfactory performance scores since most employees reported high satisfaction and met or exceeded their performance scores. Although these employees had satisfactory performance, their absenteeism suggests disengagement or external issues affecting attendance. The organisation may need to address potential causes such as burnout, personal or family issues, or dissatisfaction with workplace conditions. High absenteeism often correlates with a lack of commitment or engagement, which is a critical factor in turnover. Implementing programs that focus on employee well-being, mental health support, and flexible work arrangements could help address these challenges and improve attendance.

On the other hand, the primary reasons for voluntary termination recorded were pursuing another job, higher salary offers, and dissatisfaction with the current position. These reasons point to issues related to employee compensation and career growth. Offering competitive salaries, bonuses, and clear pathways for advancement could help reduce voluntary turnover. Additionally, providing regular performance reviews and feedback could help employees feel more engaged and valued, reducing the likelihood that they will leave for better opportunities elsewhere.

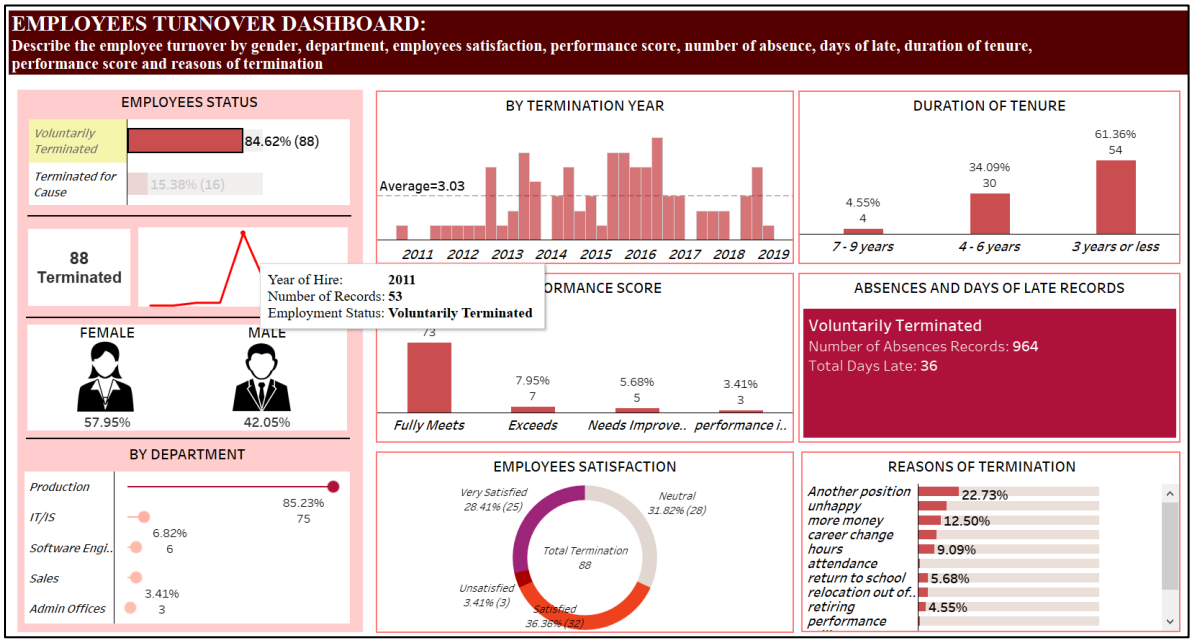

Figure 5: The dashboard of voluntarily terminated employee status

Next, when filtering for employees terminated for cause in Figure 6, the majority are still from the Production Department, female, and hired in 2011 or 2014. The main reasons for termination are attendance problems, no-call-no-show incidents, and poor performance. Terminations for cause indicate more severe issues, such as attendance problems and performance deficiencies. Employees in this group tend to have short tenures (3 years or less), suggesting that issues may arise early in employment. The organisation should consider implementing stricter performance management policies and clearer expectations regarding attendance. Providing early intervention and coaching for employees who exhibit attendance issues could prevent these problems from escalating to termination.

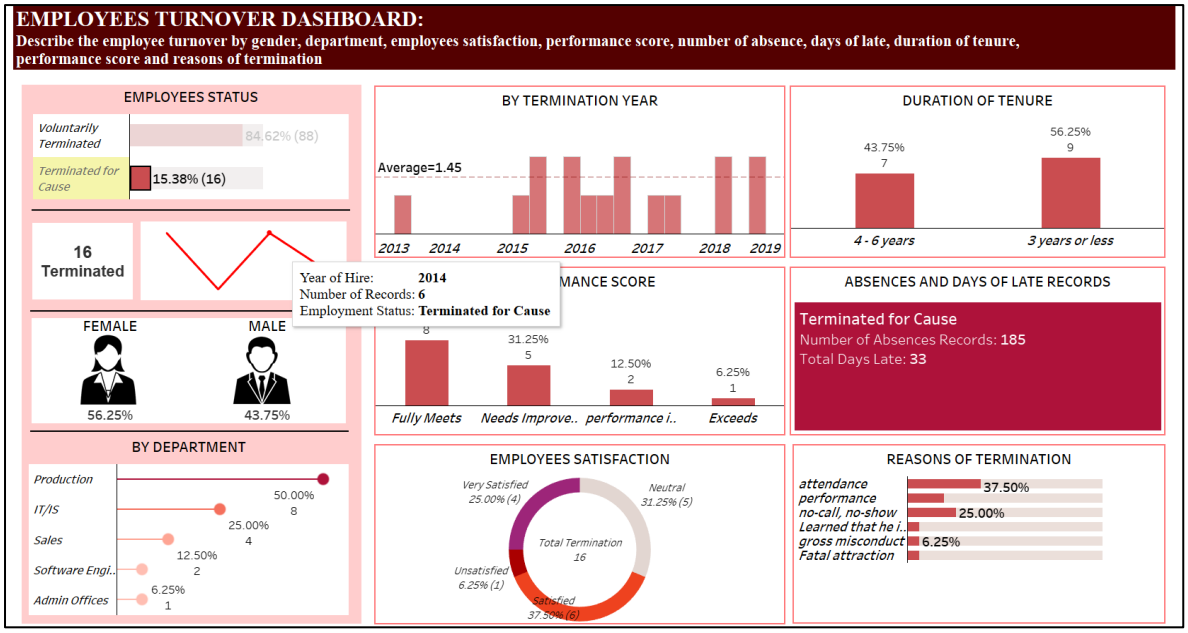

Figure 6: The dashboard of terminated for cause employee status

In consequence, the high rate of voluntary termination, especially in the Production Department, suggests that the organisation may need to evaluate its compensation packages, career development opportunities, and job satisfaction levels. The organisation should conduct employee surveys to gather feedback on what factors contribute to turnover, such as job satisfaction, career growth opportunities, and compensation. Based on this feedback, the organisation can develop targeted retention strategies, such as providing more competitive benefits or increasing employee recognition programs.

Besides, the relationship between absenteeism and turnover indicates that absenteeism may be a warning sign of disengagement. Hence, the organisation could implement employee wellness programs, mental health support, and more flexible work arrangements to address absenteeism and improve overall employee engagement. In addition, the employees terminated for cause due to attendance and performance issues present an opportunity for the organisation to improve its performance management practices. Therefore, the organisation should establish clear attendance policies and provide training for managers to address performance issues early on. Implementing mentorship or coaching programs may help employees improve performance before it results in termination. Meanwhile, given the high turnover in the Production Department, the organisation might consider department-specific strategies, such as job rotation, skills development programs, and team-building activities to increase job satisfaction and reduce turnover.

C Third Curiosity: What are the most effective recruitment sources or platforms based on the profiles of active employees?

The third analysis focuses on identifying the best recruitment sources for active employees to enhance retention, considering both department and performance score. In Figure 7, the dashboard is color-coded in blue to signify employee loyalty and their likelihood of remaining active within the organisation.

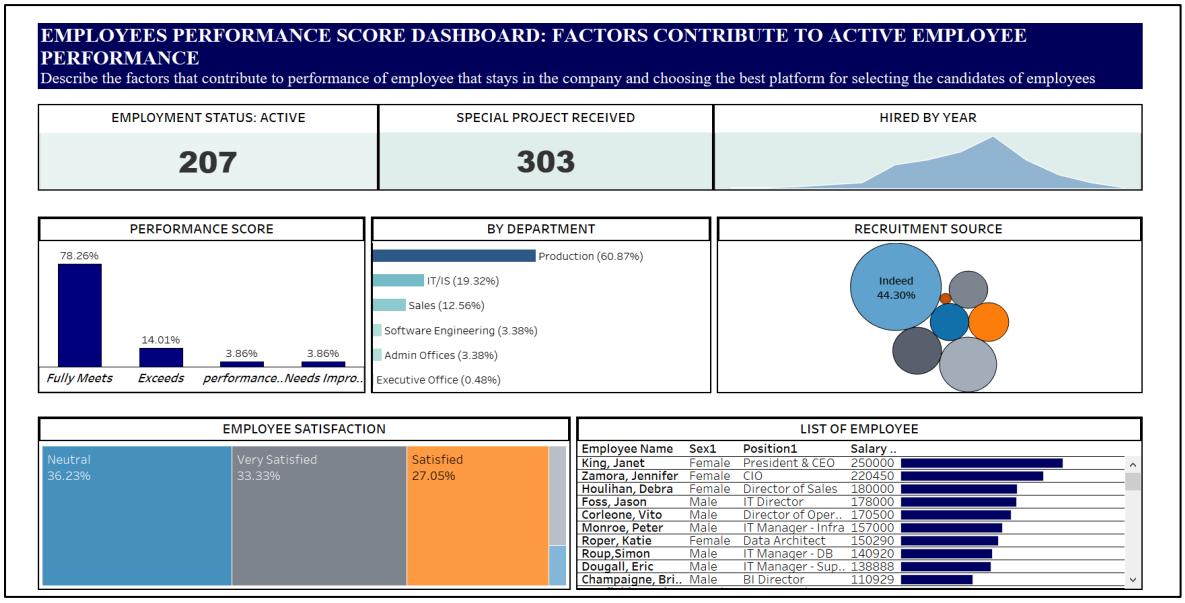

Figure 7: The dashboard for third curiosity

Additional information on employee retention is provided in the dashboard, including employment status, special projects assigned, year of hire, performance score, departments, recruitment source, employee satisfaction, and detailed employee information. The dashboard provides valuable insights into recruitment sources by focusing on active employees specifically highlighted in Figure 8. The head of the human resource department can hover over the dashboard to see which recruitment sources have the fewest or the most active employees, allowing for a clear understanding of the distribution across sources. This information is crucial for assessing the effectiveness of various recruitment channels. By understanding which sources provide the most active employees, the organisation can optimise the recruitment efforts, focusing more on successful platforms and refining strategies for less effective sources. For example, if certain platforms consistently lead to more engaged employees, the organisation can allocate more resources to those channels, ensuring a steady flow of qualified candidates. Conversely, sources that result in lower engagement could be reconsidered or improved.

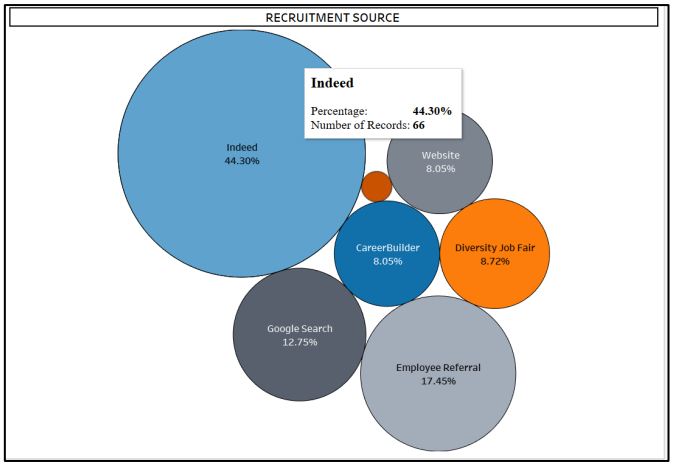

Figure 8: The percentage of recruitment source

Figure 8 presents a dashboard allowing filtering by department and performance score, which helps pinpoint the most effective recruitment sources for employees in different departments and performance categories, as shown in Figure 9. Using this feature, the head of the department can filter the data by clicking on specific departments and performance scores. For instance, when filtering by the “fully met” performance score and the production department, Indeed emerged as the best recruitment source. This suggests that Indeed is particularly effective for sourcing high-performing

employees in this department. The ability to segment recruitment data based on both department and performance scores enables organisations to tailor recruitment strategies for specific needs. If a department requires higher-performing employees, organisations can focus on channels like Indeed, which appear to yield candidates that meet or exceed expectations.

The data also includes employee satisfaction levels, and the number of special projects employees have been involved in. For instance, the production department, where Indeed is the leading recruitment source, has a majority of employees with neutral satisfaction levels and only a few special projects assigned to them, as the result reveals that there are 96 active employees, the majority of whom have a neutral satisfaction rating. These employees have been assigned an average of 3 special projects. Eventually, employee satisfaction is a key factor in retention, and the fact that most employees in the production department report neutral satisfaction could indicate a gap in engagement or opportunities for professional development. The low number of special projects (only 3) might suggest a lack of variety or challenge in their roles, which could lead to disengagement and eventual turnover. To improve retention in this department, the organisation could consider assigning more complex and varied tasks or offering additional training opportunities. By linking employee satisfaction and special project involvement to retention, organisations can target strategies to improve engagement, such as introducing more career development opportunities and recognition programs.

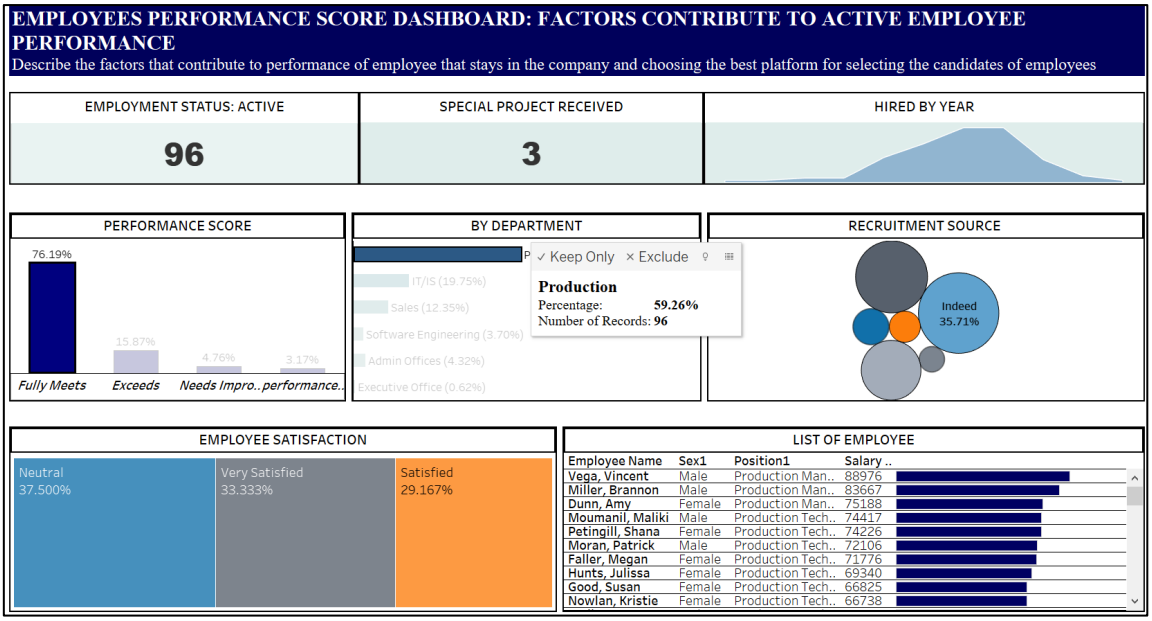

Figure 9: The dashboard filtered by production department with fully meet performance score

Figure 10 shows the filtering of recruitment sources for the production department, focusing on employees with a performance improvement plan. The dashboard also reveals that even employees in performance improvement plans (PIPs) were largely recruited through Indeed since most of the employees were recruited through this app. This finding is significant because it indicates that Indeed not only brings in employees who are highly engaged and perform well but also attracts those who may require additional support to meet performance standards. The fact that Indeed continues to be the leading recruitment platform even for employees in PIPs suggests that recruitment sources can attract a wide range of candidates, including those who might initially struggle. This can help human resource management create more supportive onboarding processes and provide tailored development plans for new hires who might need performance improvement. It also indicates that recruitment strategies should not only focus on high performers but also consider how to support and develop employees who may need additional training or guidance.

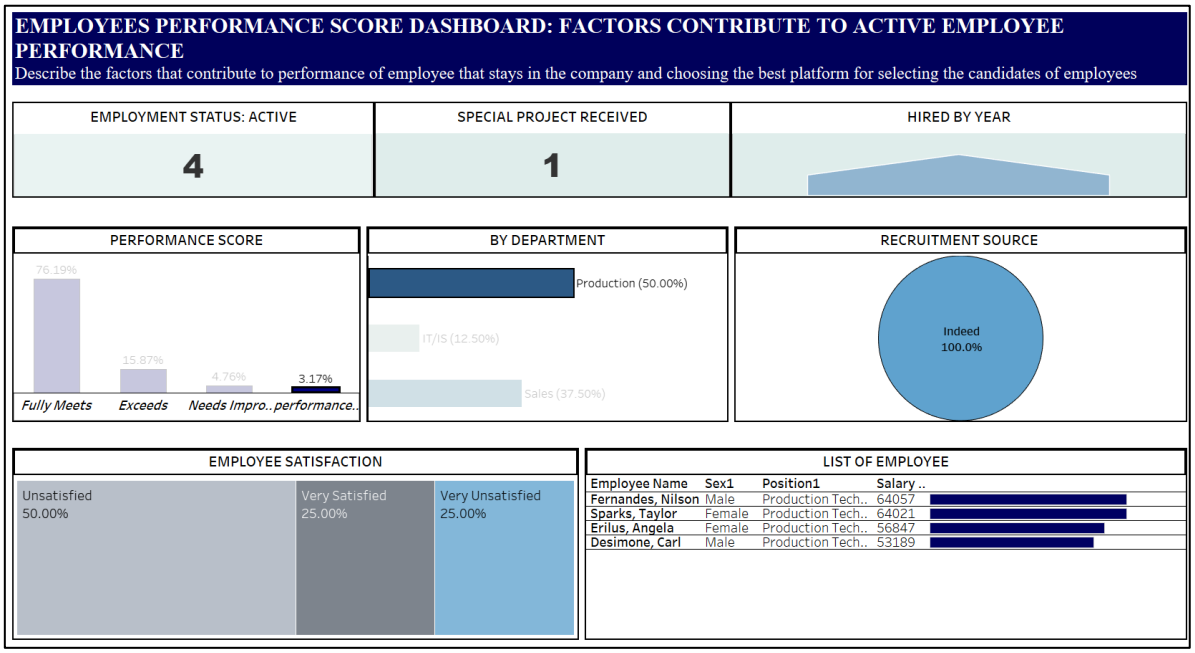

Figure 10: The dashboard filtered by production department with performance improvement plan performance score

Nonetheless, understanding which recruitment sources bring in the most active employees allows the organisation to refine its recruitment approach. Indeed, as the leading platform for the production department, could become a primary focus for recruiting candidates in similar roles. The organisation can allocate more resources to these successful recruitment channels while experimenting with new platforms for other departments to diversify the talent pool. Besides, the neutral satisfaction levels in the production department highlight a potential area of concern. Neutral satisfaction could signal disengagement or lack of challenge. Human resource management should investigate the underlying causes of neutral satisfaction, possibly through employee surveys, and address issues such as career progression, job variety, and work-life balance. Offering more opportunities for special projects or leadership roles could help improve engagement and retention. The organisation could also explore developing a more rigorous recruitment process to ensure that even employees who need performance improvement can be supported and developed after hire. The organisation should ensure that employees recruited from Indeed who are placed on performance improvement plans receive the necessary support, such as mentorship or additional training, to help them succeed.

4 Conclusion

The findings from the first survey offer valuable insights into workforce composition and recruitment dynamics, providing critical implications for human resource management and strategic planning. The results of the second curiosity highlight that both voluntary and involuntary turnover are driven by factors such as job satisfaction, compensation, performance, and attendance. Addressing these issues through targeted retention strategies, enhanced performance management, and a strong emphasis on employee engagement can significantly reduce turnover and boost overall productivity. Leveraging data-driven insights to understand the underlying causes of employee turnover empowers the organisation to foster a more supportive, satisfying, and sustainable work environment for its workforce. Besides, the analysis of recruitment sources, employee satisfaction, performance, and special project involvement provides valuable insights for refining recruitment and retention strategies. By focusing on the most effective recruitment platforms like Indeed, addressing gaps in employee satisfaction, and supporting performance improvement efforts, the organisation can create a more engaged and high-performing workforce. Through these data-driven insights, human resource management can implement targeted strategies to optimise recruitment, improve employee satisfaction, and reduce turnover.

In conclusion, the interactive visualisation offers significant value to the target audience, particularly human resources management, by providing actionable insights into employee demographics, turnover patterns, and recruitment sources. The design process utilised techniques from Andy Kirk's renowned guide on data visualisation, ensuring a structured and effective approach to creating impactful visual representations. These insights empower human resource management professionals to make informed decisions, ensuring efficient workforce management. Moreover, the organisation can leverage this tool to monitor employee turnover trends, enabling swift action to fill vacant positions and maintain uninterrupted operations, thereby safeguarding financial performance. The visualisation's interactive features enhance the depth and clarity of the insights, making complex data easier to comprehend for decision-makers. Ultimately, this tool supports human resource teams in identifying critical areas requiring attention, aligning workforce strategies with organisational goals, and fostering improved management practices to ensure the company operates seamlessly and achieves its objectives.

To further enhance the effectiveness of such tools, future research could explore advanced visualisation techniques, such as dynamic heatmaps or network diagrams, to uncover complex relationships between employee attributes, turnover rates, and recruitment success. Integrating predictive visualisations, such as time-series projections, could help forecast employee turnover and identify potential risk factors proactively. Additionally, creating department-specific dashboards with comparative visualisations might enable better benchmarking and targeted strategies. Exploring the use of 3D visualisations or augmented reality to represent workforce data in an immersive format could also open new possibilities for engaging stakeholders. These visualisation-based approaches would further enrich the analytical capabilities of human resources management tools, aiding in the development of more effective management strategies aligned with organisational goals.

Acknowledgements

This research received no specific grant from any funding agency in the public, commercial, or private sectors.

Conflict of Interest Statement

The authors agree that this research was conducted in the absence of any self-benefits, commercial or financial conflicts and declare the absence of conflicting interests with the funders.

References

[1] O. Sarioguz, and E. Miser, "Data-Driven Decision-Making: Revolutionizing Management in the Information Era". *Journal of Artificial Intelligence General science (JAIGS)*, ISSN: 3006-4023, 4(1), 179-194, 2024.

[2] C. Rajeswari, D. Basu, and N. Maurya, "Comparative study of big data analytics tools: R and tableau". *In IOP Conference Series: Materials Science and Engineering*, vol. 263, No. 4, p. 042052. IOP Publishing, 2017, November.

[3] O. Kharakhash, "Data visualization: transforming complex data into actionable insights". *Automation of technological and business processes*, 15(2), 4-12, 2023.

[4] S. Kumari, G. K. Pandey, and S. Tiwari, "Data Visualization Techniques in Smart Agriculture Implementation". *In AI Applications for Business, Medical, and Agricultural Sustainability*, pp. 122-159, IGI Global, 2024.

[5] N. Akhtar, N. Tabassum, A. Perwej, and Y. Perwej, "Data analytics and visualization using Tableau utilitarian for COVID-19 (Coronavirus)". *Global Journal of Engineering and Technology Advances*, 2020.

[6] A. Margherita, "Human resources analytics: A systematization of research topics and directions for future research". *Human Resource Management Review*, 32(2), 100795, 2022.

[7] R. Kanfer, C. R. Wanberg, and T. M. Kantrowitz, "Job search and employment: A personality–motivational analysis and meta-analytic review". *Journal of Applied psychology*, 86(5), 837, 2001.

[8] D. Szostek, "Innovations in human resource management: impact of demographic characteristics, quality of interpersonal relationships on counterproductive work behaviours". *Marketing imenedžment innovacij*, (1), 11-20, 2021.

[9] X. Gao, J. Wen, and C. Zhang, "An improved random forest algorithm for predicting employee turnover". *Mathematical Problems in Engineering*, 2019.

[10] M. Ameer, S. P. Rahul, and S. Manne, "Human resource analytics using power bi visualization tool". *In 2020 4th International Conference on Intelligent Computing and Control Systems* (ICICCS) (pp. 1184-1189). IEEE, 2020.

[11] D.A.B.A. Alao, and A.B. Adeyemo, "Analyzing employee attrition using decision tree algorithms". *Computing, Information Systems, Development Informatics and Allied Research Journal*, 4(1), 17-28, 2013.

[12] S.N. Mishra, and D.R. Lama, "A decision making model for human resource management in organizations using data mining and predictive analytics". *International Journal of Computer Science and Information Security* (IJCSIS), 14(5), 217-221, 2016.

[13] J.A. Breaugh, "Employee recruitment: Current knowledge and important areas for future research". *Human Resource Management Review*, 18(3), 103-118, 2008.

[14] M.A., Zottoli, and J.P. Wanous, "Recruitment source research: Current status and future directions". *Human Resource Management Review*, 10(4), 353-382, , 2000.

[15] Y. Acikgoz, and S.M. Bergman, "Social media and employee recruitment: Chasing the runaway bandwagon". *Social media in employee selection and recruitment: Theory, practice, and current challenges*, 175-195, 2016.

[16] Jobvite, Jobvite recruiter nation report. 2016. Available from: https://www.jobvite.com/wpcontent/uploads/2016/09/RecruiterNation2016.pdf , 2016.

[17] S.S.A. Chandra and P. Malathi, "HR Metrics and Decision-Making using Tableau", 2023.

[18] A.M. Simanjuntak, S. Thamrin, and S. Sundari, "The Influence Of Big Data Analytics On Human Resource Management Strategies For Company Sustainability". *Shaping the Sustainable Future: Trends and Insights in Economics, Business, Management, and Information Technology*, 25, 2023.

[19] A. Gupta, F. Ali, B.K. Singh, and S. Janarthanan, "HR Dashboard Analytics". *In 2023 5th International Conference on Advances in Computing, Communication Control and Networking* (ICAC3N) (pp. 17-21). IEEE, 2023, December.

[20] J. Heer, and B. Shneiderman, "Interactive dynamics for visual analysis". *Communications of the ACM*, 55(4), 45-54, 2012.

[21] J. Hoelscher, and A. Mortimer, "Using Tableau to visualize data and drive decision making". *Journal of Accounting Education*, 44, 49-59, 2018.

[22] S. G. Archambault, J. Helouvry, B. Strohl, and G. Williams, "Data visualization as a communication tool". *Library Hi Tech News*, *32*(2), 1-9, 2015.

[23] S. A. Murphy, "Data visualization and rapid analytics: Applying tableau desktop to support library decision-making". *Journal of Web Librarianship*, *7*(4), 465-476, 2013.

[24] A. Kirk, *Data visualisation: A handbook for data driven design*, 2019.

[25] R. Huebner, 2021, "Human Resources Data Set," Kaggle. [Online]. Available: https://www.kaggle.com/datasets/rhuebner/human-resources-data-set

[26] N. Akhtar, N. Tabassum, A. Perwe, and Y. Perwej, "Data analytics and visualization using Tableau utilitarian for COVID-19 (Coronavirus)". *Global Journal of Engineering and Technology Advances*, 2020.

[27] N. Akhtar, N. Tabassum, A. Perwej, & Y. Perwej (2020). "Data analytics and visualization using Tableau utilitarian for COVID-19 (Coronavirus)". *Global Journal of Engineering and Technology Advances*, 2020.

[28] F. B. Viegas, M. Wattenberg, F. van Ham, J. Kriss and M. McKeon. "ManyEyes: a Site for Visualization at Internet Scale", *IEEE Transactions on Visualization and Computer Graphics*, 13(6), 1121-1128, 2007.

[29] A. Patel. "Data Visualization Using Tableau", *Metropolia University of Applied Sciences Master of Engineering Information Technology, Master's Thesis*, 2021.