

# Singapore's Employment Landscape

CS5346 Project - April 2024

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## 1. Introduction

Understanding Singapore's employment market dynamics is crucial for assessing economic health and individual career prospects. However, the complexity of Singapore's employment data poses challenges for stakeholders like job seekers, employers, and policymakers. Traditional static data formats hinder in-depth analysis and trend identification. This project addresses this limitation by developing an interactive data visualisation tool leveraging Ministry of Manpower (MOM) data to provide insightful exploration of Singapore's employment landscape. Employment levels are essential indicators of job creation capacity and labour market health, reflecting economic shifts. Analysis of employment distribution across industries reveals trends like industry growth or decline, aiding policymakers, businesses, and researchers in informed decision-making. Data on employment, unemployment, labour turnover, and retrenchment from MOM's repository form the foundation for this study.

Link to our Visualisation can be found here: [Tableau Viz](#)

### 1.1 Author's Contributions

All the authors have contributed equally towards the fulfilment of this report. Table 1 provides a breakdown of each author's contributions.

Name	Contributions
Lalitha Ravi	Data Preprocessing and Transformation, Design, Viz for Employment
SreeLakshmi Edakulathil Chellappan	Data Preprocessing and Transformation, Design, Viz for Unemployment
Nishtha Malhotra	Data Preprocessing, and Transformation, Design, Viz for Labour Turnover and Retrenchment

## 2. Dataset

We intend to use the below-mentioned datasets made available by the Ministry of Manpower (MOM) to understand various employment aspects in Singapore.

### 2.1 Employment

- **Overview:** These datasets cover various aspects of employment in Singapore from 1991 to 2023, employment changes by industry, employment levels based on residential status, number of employed persons aged fifteen years and over, labour force participation statistics by age and sex, employment status, highest qualification attained, occupation, detailed occupation, and resident employment rate by age and sex. They offer valuable insights into the dynamics of the Singaporean labour market and are sourced from reliable administrative records and labour surveys.
- **Source:** <https://stats.mom.gov.sg/Pages/EmploymentTimeSeries.aspx>
- **Format ( Files) - CSV**
- **Original Number Of Files -** Comprised of Total - 27 files ( Admin - 3 , Labour Force - 25 )
- **Original Combined File Size - 734 KB**
- **Data Cleaning and Preprocessing Steps:**
  - a. Converted the 'year', 'employment\_change', 'employed', 'retrenched' column to integer type
  - b. Replaced 'paper products and publishing^' with 'paper products and printing' in the 'industry 3' column of the annual dataset
  - c. Clean columns industry 1, industry 2 and industry 3 by removing leading and trailing spaces, additional spaces, non alphanumeric characters and converting to lower
  - d. Convert non-numeric values in the 'employment\_change' column to NaN
  - e. To maintain consistency - replaced with \_ for nominal columns
  - f. Check for non numeric values in the employed columns.
- **Data Transformation:**
  - a. Performed Union of datasets.
  - b. Merged datasets from different years, encompassing broader and more granular occupational categories.
  - c. Processed and cleaned numerous datasets to ensure data quality and consistency, resulting in a substantial number of refined datasets ready for analysis.
- **Number Of Files After Preprocessing:** 17 Files including Admin and Labour Force Data
- **Preprocessed Combined File Size - 675 KB**

<b>Data</b>	<b>Data Type</b>	<b>Range of Values</b>	<b>Additional Information</b>
<b>year</b>	Interval, Discrete, Quantitative	Min - 1991 Max - 2023	Years
<b>quarter</b>	Interval, Discrete, Quantitative	Min - Q1 Max - Q4	Quarters in each Year
<b>industry1</b>	Qualitative, Categorical, nominal	services, manufacturing, construction, others	Broader Industry categories
<b>industry2</b>	Qualitative, Categorical, nominal	More detailed categories. Ex: wholesale and retail trade	1st Level of detailed categories
<b>industry3</b>	Qualitative, Categorical, nominal	More granular categories. Ex:wholesale trade	2nd Level of detailed categories
<b>employment_change</b>	Quantitative, ratio	Min: Max:	Employment change measures the difference in employed individuals between two periods, where a positive change indicates an increase and a negative change denotes a decrease, typically expressed in thousands of persons
<b>sex</b>	Qualitative, Categorical, nominal	Male , female	
<b>age</b>	Qualitative, Categorical, ordinal	15_19, 20_24,25_29, 30_34 and so on	Different categorical aggregations of age distribution.
<b>Labour force</b>	Quantitative, ratio	Min - 67000 Max - 306100	Number of available Labour Force(residents) in Singapore
<b>employed</b>	Quantitative, ratio	Min: 63800 Max: 295600	Number of residents employed in the labour force
<b>unemployed</b>	Quantitative, ratio	Min: 100 Max: 19800	Number of residents unemployed in the labour force
<b>Outside labour force</b>	Quantitative, ratio	Min: 19300 Max: 355800	Number of foreign labour force
<b>Employment status</b>	Qualitative, Categorical, nominal	Employers, Employees, own account workers, contributing family workers	Indicates if a person is an employer or employee or is an own account worker or contributing family worker

<b>number_of_employed</b>	Quantitative, ratio	Min:5400 Max:2064900	Indicates number of employer employees, own account workers and family business contributors
<b>edu1</b>	Qualitative, Categorical, ordinal	Degree, Diploma and professional qualification, Post secondary, Secondary, Lower secondary, Primary and below	Levels of education
<b>Employment rate</b>	Quantitative, ratio	Min:4 Max: 95.7	Rate of employment
<b>occupation</b>	Qualitative, Categorical, nominal	Professionals, managers, executives, technicians, Clerical, sales, services, manual labourers	Occupation categories
<b>total_employed</b>	Quantitative, ratio	Min:1645000 Max:3840300	Total people employed in a year
<b>employed_residents</b>	Quantitative, ratio	Min:1345000 Max: 2352300	Number of employed residents in a year
<b>broad_occupation</b>	Qualitative, Categorical, nominal	pmets, non- pmets	Professionals and non professionals

## 2.2 Unemployment

- **Overview:** This project leverages a rich dataset on Singaporean unemployment, encompassing various aspects. It provides monthly unemployment rates and the corresponding number of unemployed individuals from 2020 to 2023. Beyond overall figures, it delves deeper with breakdowns for resident, non-resident, youth, and long-term unemployment rates. Analysing demographics, the data offers insights by age, gender, education level, and industry. Furthermore, it explores the previous occupations and industries of unemployed residents, along with unemployment rates categorised by current occupation and industry. Specific attention is paid to PMETs (professionals, managers, etc.) and non-PMETs, with data showcasing the age distribution of unemployed individuals in these categories, as well as unemployment rates and long-term unemployment trends across different age groups. This comprehensive dataset allows for a nuanced understanding of unemployment patterns in Singapore.
- **Source:** <https://stats.mom.gov.sg/Pages/UnemploymentTimeSeries.aspx>
- **Format ( Files) - CSV**

- **Original Number Of Files** - Comprised of Total - 39 files
- **Original Combined File Size** - 156 KB
- **Data Cleaning and Preprocessing Steps:**
  - a. Checked Missing Values Checked erroneous values and column names and labels for consistency and clarity Removed a column whose values are NaN.
  - b. Removed erroneous values('2007a') year column as it was an anomaly in the dataset.
  - c. Renamed columns as it is needed for consistency and readability. Eg. The column name was changed from "Age" to "age" as part of the data analysis.
  - d. Capitalised column values in title case for occupation and industry category columns to ensure readability. Checked for duplicated records
- **Data Transformation:**
  - a. Performed union of datasets The datasets were consolidated by combining information from various years, residential status, and occupational categories. Consolidated datasets are as follows:
    - **combined\_annual\_average\_citizen\_overall\_resident\_U\_UR:** Provides distribution of unemployment across different residential categories (citizen, overall, resident) over the years(1992-2023).
    - **combined\_annual\_by age & occu\_U\_UR\_LTU\_LTUR :** Provides distribution of unemployment across different age groups and occupation(PMETS vs Non-PMETs) over the years(2001-2023).
    - **combined\_annual\_by age\_U\_UR\_LTUR:** Provides distribution of unemployment across different age groups over the years(1992-2022).
    - **combined\_annual\_by hqa\_U\_UR\_LTUR:** Provides distribution of unemployment across different education levels over the years(1992-2022).
    - **combined\_annual\_by sex\_U\_UR\_LTUR:** Provides distribution of unemployment across different gender categories over the years(1992-2022).
    - **combined\_annually\_by ind\_U\_UR:** Provides distribution of unemployment across different industries over the years(2001-2023). Processed and cleaned numerous datasets to ensure data quality and consistency, resulting in a substantial number of refined datasets ready for analysis.
- **Number Of Files After Preprocessing:** 15 files
- **Preprocessed Combined File Size:** 88 KB

<b>Data</b>	<b>Data Type</b>	<b>Range of Values</b>	<b>Additional Information</b>
<b>year</b>	<i>Interval, Discrete, Quantitative</i>	Min - 1998 Max - 2022	Years
<b>residential_status</b>	<i>Qualitative, nominal</i>	'overall', 'resident', 'citizen'	Represents different residential population categories .
<b>sex</b>	<i>Qualitative, Categorical, nominal</i>	sRepresents gender category	Represents gender category
<b>age</b>	<i>Qualitative, Categorical, nominal</i>	15_19, 20_24,25_29, 30_34 and so on	Represents different age groups
<b>high_qualification_attained</b>	<i>Qualitative, Categorical, ordinal</i>	Degree, Diploma and professional qualification, Post secondary, Secondary, Lower secondary, Primary and below	Levels of education
<b>previous_industry</b>	<i>Qualitative, Categorical, nominal</i>	services, manufacturing, construction, others	Industry categories
<b>previous_occupation</b>	<i>Qualitative, Categorical, nominal</i>	Professionals_managers_executives_technicians, Clerical_sales_services, manual_labourers	Occupation categories
<b>broad_occupdation</b>	<i>Qualitative, Categorical, nominal</i>	pmets, non- pmets	Professionals and non professionals
<b>month</b>	<i>Qualitative, Categorical, ordinal</i>	2020-01 to 2023-12	Represent the months for each year
<b>unemployed</b>	<i>Quantitative, discrete</i>		Represents the whole number of unemployed individual
<b>LT_unemployed</b>	<i>Quantitative, discrete</i>		Represents number of unemployed persons aged >=15 years for 25 weeks or more (approximately 6 months or more)
<b>unemployment_r</b>	<i>Quantitative, ratio, discrete</i>	Min: 1.4 Max: 4.0	Represent the % of unemployed persons to the labour force

ate			
LT_unemployment_rate	Quantitative, ratio, discrete		Represent the % of long-term unemployed persons to the labour force
seasonally_adjusted_unemployment_rate	Quantitative, ratio, discrete		Represent employment rate after adjusting for seasonal variations
non-seasonally_adjusted_unemployment_rate	Quantitative, ratio, discrete		Represent employment rate after adjusting for seasonal variations
seasonally_adjusted_LT_unemployment_rate	Quantitative, ratio, discrete		Represent long term employment rate after adjusting for seasonal variations

## 2.3 Retrenchment and Labour Turnover

- **Overview:** These datasets cover retrenchment, recruitment and resignation in Singapore from 1998 to 2022. Recruitment and Resignation Rates are measures of labour turnover. In good times when job openings are plentiful, recruitment and resignation rates tend to be high reflecting movement of workers between jobs.

The Resignation Rates by industry are valuable to employers for comparing their staff turnover against the industry norm. Low Resignation Rate in a company relative to the industry average is usually considered to be an indicator of good labour-management relations. Labour turnover also reflects the unique labour market dynamics of the various industries. For example, accommodation and food services typically have higher turnover rates because of their heavy reliance on temporary and part-time workers to cope with fluctuations in demand.

- **Source:**  
<https://stats.mom.gov.sg/Pages/RetrenchmentTimeSeries.aspx>  
<https://stats.mom.gov.sg/Pages/LabourTurnoverTimeSeries.aspx>
- **Format ( Files) - CSV**
- **Original Number Of Files -** Comprised of Total - 19 files ( Retrenchment - 19 , Labour Turnover - 8 )
- **Original Combined File Size -** 534 KB
- **Data Cleaning and Preprocessing Steps:**

- a. Handled invalid retrench values - Remove the rows with '-' retrench values
- b. Handle invalid industry types - Remove those rows
- c. Convert 'retrenched' from string to float
- d. Normalise #retrenched contractual and permanent employees to make comparable
- **Data Transformation:**
  - a. Performed Union of datasets.
  - b. Merged datasets from different years, encompassing broader and more granular occupational categories.
  - c. Processed and cleaned numerous datasets to ensure data quality and consistency, resulting in a substantial number of refined datasets ready for analysis.
- **Number Of Files After Preprocessing:** 20 Files
- **Preprocessed Combined File Size** - 421 KB

<i>Data</i>	<i>Data Type</i>	<i>Range of Values</i>	<i>Description</i>
<b>Year</b>	Interval, Discrete, Quantitative	1998-2022	No missing information
<b>Recruitment Rate</b>	Quantitative, Continuous	0-100 %	All are valid decimal values
<b>Resignation Rate</b>	Quantitative, Continuous	0-100 %	All are valid decimal values
<b>Industry1</b>	Qualitative, Categorical	services, manufacturing, construction, others	It represents the main industry sector according to SSIC. Some values are equal to 'total' which means all the industries are in consideration together.
<b>Industry2</b>	Qualitative, Categorical	"food, beverages and tobacco"  "textile and wearing apparel"	Comma separated list of industries showing specific sub categories within the main sector of industry1



<b>Industry3</b>	Qualitative, Categorical	<i>"Pension" under finance industry type 2</i>	<i>Provides further granularity within industry2, detailing specific sectors or specialties. While industry2 usually matches industry3, there are exceptions where more detailed classifications are necessary</i>
<b>Occupation</b>	Qualitative, Categorical	<i>"professionals, managers, executive and technicians" fall in one category</i>	<i>Comma separated list representing occupation for which the employees belonged. Some values are 'total'.</i>

### 3. Purpose Of Visualisation

The employment visualisations are crafted to provide valuable insights into Singapore's employment landscape for various audiences, including job seekers, employers, policymakers, and the general public. Each audience has specific needs and interests that the visualisations aim to address:

1. Job seekers who want to gain insights into industry trends, hiring patterns, and potential career paths to make informed decisions about their careers.
2. Employers aim to understand talent availability, identify emerging skills in demand, and make informed decisions about their workforce.
3. Policymakers need to analyse economic factors influencing employment, develop targeted interventions, and monitor the impact of policies on the labour market.
4. The general public seeks a deeper understanding of Singapore's evolving employment landscape and its impact on their lives.

## 4. Queries

1. What are the primary indicators shaping Singapore's employment landscape?
2. What is the labour force status for the year 2023?
3. How does the employment status in Singapore look for the year 2023?
4. What is the historical trend in the number of employed individuals in Singapore?
5. How has the trend in unemployment rates evolved over time in Singapore?
6. What is the historical trend in retrenchment and labour turnover rates in Singapore?
7. How has the employment rate changed over the years for males and females aged 25 to 64 in Singapore?
8. How has the unemployment rate changed over the years for males and females in Singapore?
9. How has the distribution of employment rates evolved over the years for professionals and non-professionals in Singapore?
10. How has the distribution of unemployment rates evolved over the years for professionals and non-professionals in Singapore?
11. Draw a comparison on the percentage of residents employed based on qualifications in Singapore in the years 2010 and 2023.
12. Draw a comparison on the percentage of unemployed residents based on qualification in the years 2010 and 2023.
13. Compare the percentage distribution of employed residents across occupations in Singapore in the years 2001 and 2023
14. Compare the percentage distribution of unemployed residents across occupations in Singapore in the years 2001 and 2023.
15. How has employment change evolved over the years in manufacturing, construction, and service-based industries in Singapore?
16. What impact do recession periods have on different sectors of industries in Singapore?
17. How has Labour Turnover (Recruitment and Resignation) changed over the years?
18. How has Labour Turnover changed been impacted by the recession for different occupations?
19. What is the forecast for Labour turnover for the next year?
20. What is the trend of Retrenchment over the last few years?
21. What are the top industries and sub-industries that are impacted the most by retrenchment?

## 5. Design Ideas

### 5.1 Colour Palette

Categories	Colours
<i>Male, Female</i>	<i>Blue, Pink</i>
<i>Employment, Unemployment, Retrenchment</i>	<i>Green, Orange, Red</i>
<i>PMET, Non- PMET</i>	<i>Royal Blue, Mustard Yellow</i>
<i>Construction, Manufacturing, Services</i>	<i>Brown, Grey, Purple</i>

### 5.2 Animations & Interactivity

We've incorporated dynamic animations into our graphs, enhancing visualisation by highlighting changes over time, such as trends across different years or periods. Improved the interactivity of visualisations using filters and tooltips.

## 6. Visualisations

### 6.1 Employment:

#### 6.1.1 Labour Force Status For The Year 2022

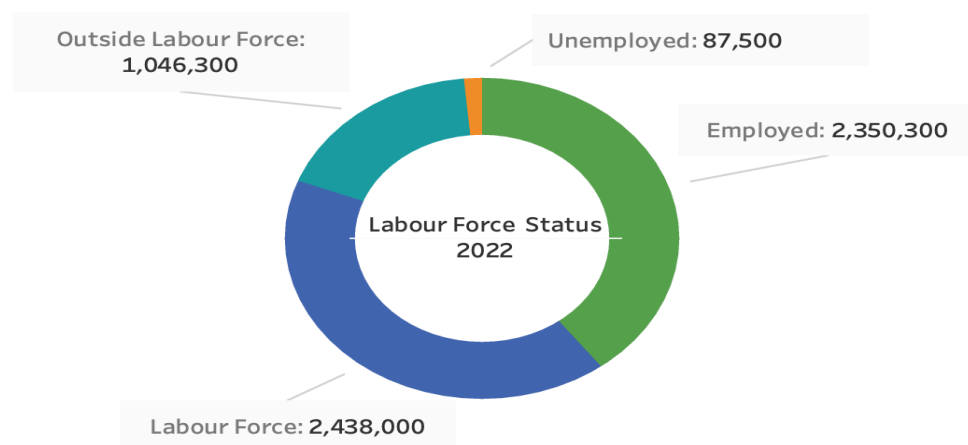


Fig1.1

Visual Encoding used in Figure 1.1

<i>Data</i>	<i>Data Type</i>	<i>Encoding</i>	<i>Description</i>
<b>Outside Labour Force</b>	Quantitative, Ratio	Channel: Colour: Hue Marks: Angle, Arc Length	Assigned Colour = Angle and Arc Length are determined by the number of outside labour force
<b>Labour Force</b>	Quantitative, Ratio	Channel: Colour: Hue Marks: Angle, Arc Length	Assigned Colour = Angle and Arc Length are determined by the number of labour force
<b>Employed</b>	Quantitative, Ratio	Channel: Colour: Hue Marks: Angle, Arc Length	Assigned Colour = Angle and Arc Length are determined by the number of employed residents
<b>Unemployed</b>	Quantitative, Ratio	Channel: Colour: Hue Marks: Angle, Arc Length	Assigned Colour = Angle and Arc Length are determined by the number of unemployed residents

**Insights:**

1. Within the labour force totaling 2,436,300 individuals, 2,352,300 are employed, comprising approximately 96.6% of the labour force, while 84,000 individuals are unemployed, accounting for about 3.4%.
2. Additionally, outside the labour force in Singapore for this year, there are 1,117,000 individuals, equivalent to 31.4% of the labour force in Singapore.

## 6.1.2 Employment Status For The Year 2022



Fig 1.2

Visual Encoding used in Figure 1.2

Data	Data Type	Encoding	Description
Employment Status	Qualitative, Categorical, nominal	Channel: Colour:Hue	Each employment status category is assigned a colour
Percentage Employed	Quantitative, Ratio	Marks: Arc Length	Length of each orbit depends upon the percentage of people under different employment status

#### Insights:

1. A mere 0.2% of residents are contributing family workers, indicating a small proportion engaged in family business activities.
2. The vast majority, accounting for 86.7% of residents, are employees, highlighting the significant reliance on wage-based employment.
3. Only 4.1% of residents are employers, suggesting a relatively low percentage of individuals who own or manage businesses.
4. Approximately 9.0% of residents are classified as own-account workers, implying a notable presence of self-employed individuals who manage their own businesses or freelance.

### 6.1.3 Historical Trend of Employed Individuals From 2010 to 2022

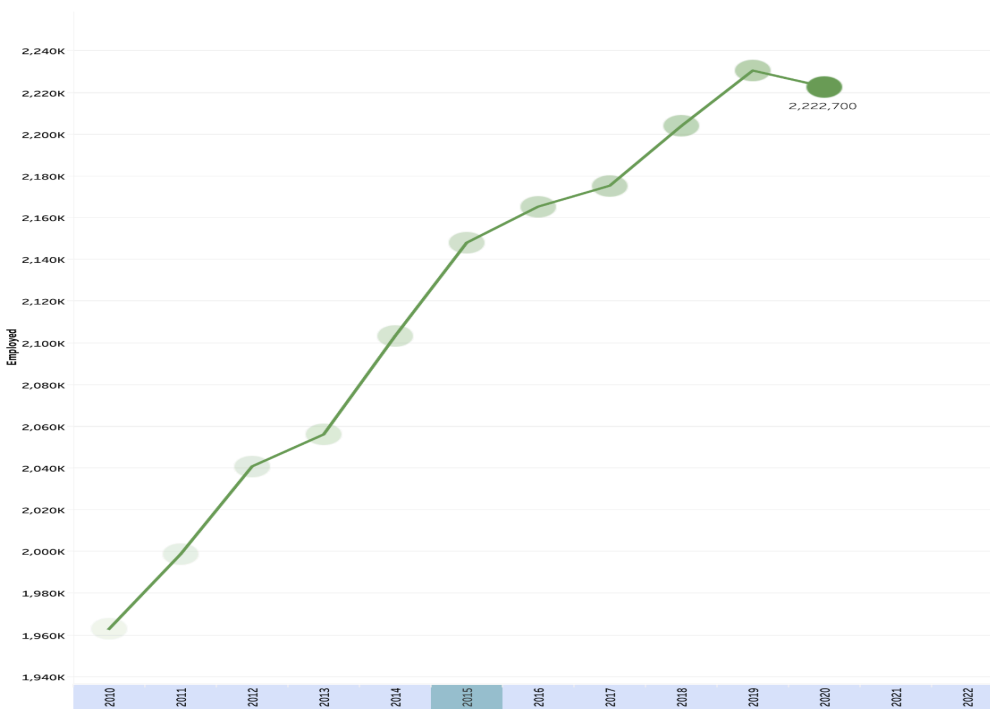


Fig 1.3

### Visual Encoding used in Figure 1.3

Data	Data Type	Encoding	Description
Year	<i>Interval, Discrete, Quantitative</i>	Channel: Horizontal Position	Temporal x-axis with equal intervals from 1992 to 2022
Employed	<i>Ratio, Continuous, Quantitative</i>	Channel: Vertical Position	Vertical Position shows the number of people employed.
		Marks - Points	Represents the number of people employed that year
		Marks - Line	Helps convey the trend in number of people employed over the years

#### Insights:

1. In 2010, the number of employed individuals stood at 1,962,900, while by 2022, it had increased to 2,350,000, indicating a consistent upward trend in employment over the years.
2. Despite this overall growth, there was a slight decline in employment in 2020, attributed to the impact of the COVID-19 pandemic, suggesting vulnerability to external economic shocks.
3. The steady upward trajectory in employment numbers underscores the resilience and stability of the labour market in Singapore, albeit with occasional fluctuations in response to external factors.

### 6.1.4 Evolution of Employment Rate Among Males and Females Aged 25 to 64 in Singapore

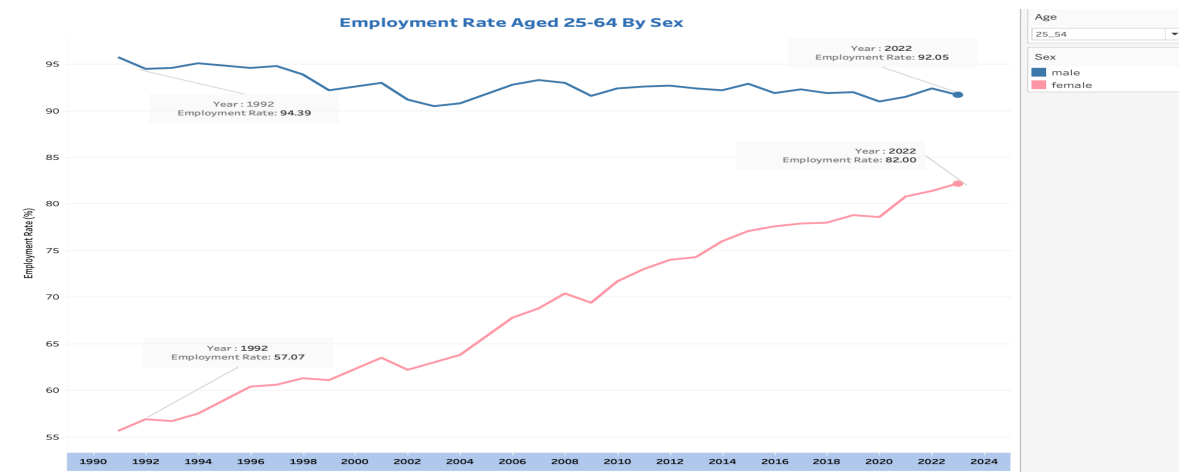


Fig 1.4

Visual Encoding used in Figure 1.4

Data	Data Type	Encoding	Description
Year	<i>Interval, Discrete, Quantitative</i>	Channel: Horizontal Position	Temporal x-axis with equal intervals from 1992 to 2022
Employment ratio	<i>Ratio, Continuous, Quantitative</i>	Channel: Vertical Position	Vertical Position shows the employment rate
Sex	<i>Qualitative, Categorical, nominal</i>	Channel: Colour Hue	Male Female are represented using different colors for differentiation
		Marks - Points	Represents the emp_rate of that year
		Marks - Line	Helps convey the trend in emp_rate over the years

Insights:

1. In 1992, the male employment rate was 89.97%, while the female employment rate stood at 52.19%. By 2022, these rates shifted to 89.41% for males and 76.12% for females.
2. The male employment rate has largely remained within the same range with fluctuations but consistently stayed above 85%, suggesting a stable trend in male employment.
3. On the other hand, the female employment rate has steadily increased over the years, indicating positive growth in female workforce participation. However, despite the upward trend in female employment rates over the years, they still lag behind male employment rates, suggesting ongoing disparities in employment opportunities between genders.

## 6.1.5 Evolution of Employment Rate Distribution for Professionals and Non-Professionals in Singapore Over Time

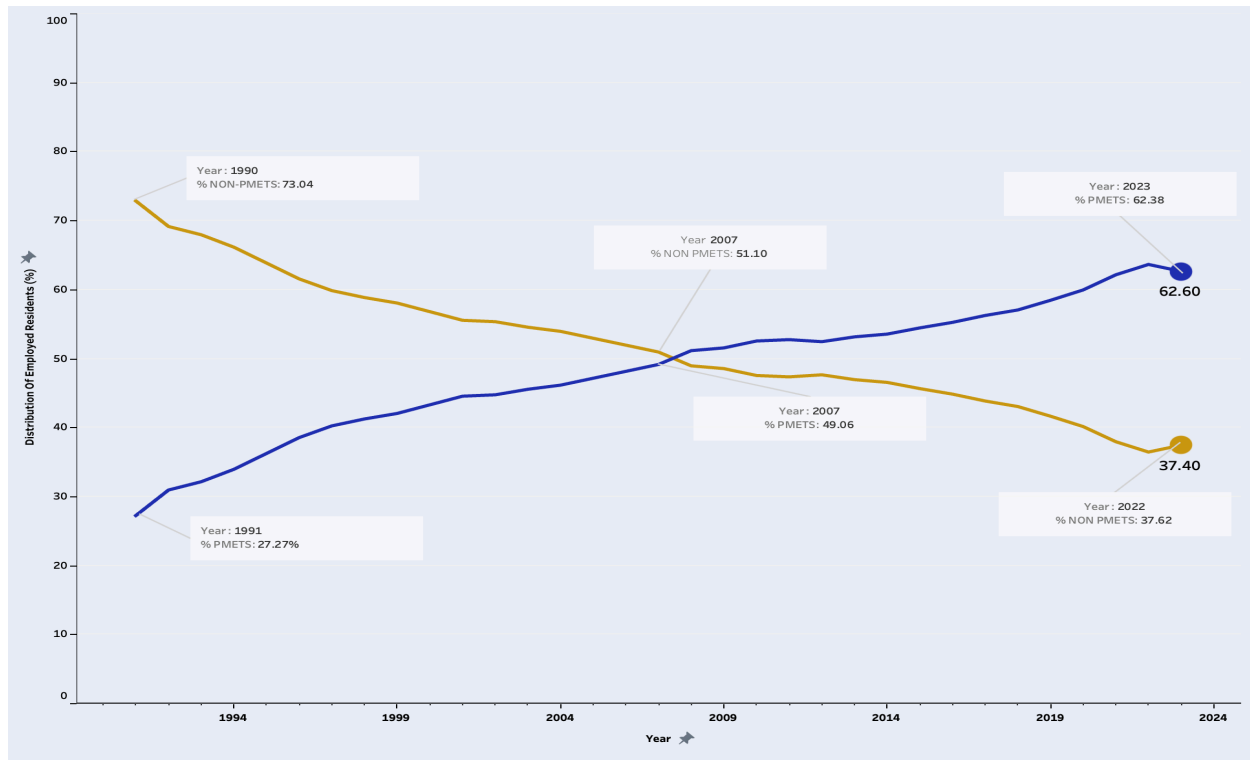


Fig 1.5

Visual Encoding used in Figure 1.5

Data	Data Type	Encoding	Description
Year	Interval, Discrete, Quantitative	Channel: Horizontal Position	Temporal x-axis with equal intervals from 1991 to 2022
Distribution Of Employed Residents %	Ratio, Continuous, Quantitative	Channel: Vertical Position	Vertical Position shows the % employed
Occupation	Qualitative, categorical, nominal	Channel: Colour: Hue	Represents Professional or Non-Professional Occupation
		Marks - Points	Represents the distribution % of pmetes and non-pemtes for that year based on hue colour
		Marks - Line	Helps convey the trend in % distribution of pmetes and non-pemtes employed over the years



Insights:

- 1. In 1991, non-PMETs comprised 72.80% of the workforce, with PMETs accounting for 27.20%. By 2007, there was a notable shift, with non-PMETs at 50.9% and PMETs at 49.0%.
- 2. The trend continued in 2022, with non-PMETs decreasing to 36.40%, while PMETs increased to 63.60% of the workforce.
- 3. This shift underscores a significant transformation in Singapore's workforce composition, with a gradual increase in the proportion of PMETs compared to non-PMETs over the years, reflecting a growing emphasis on professional occupations and skill-intensive industries in the economy.

6.1.6 Employment Percentage Distribution Based on Qualifications in Singapore: 2010 vs 2022

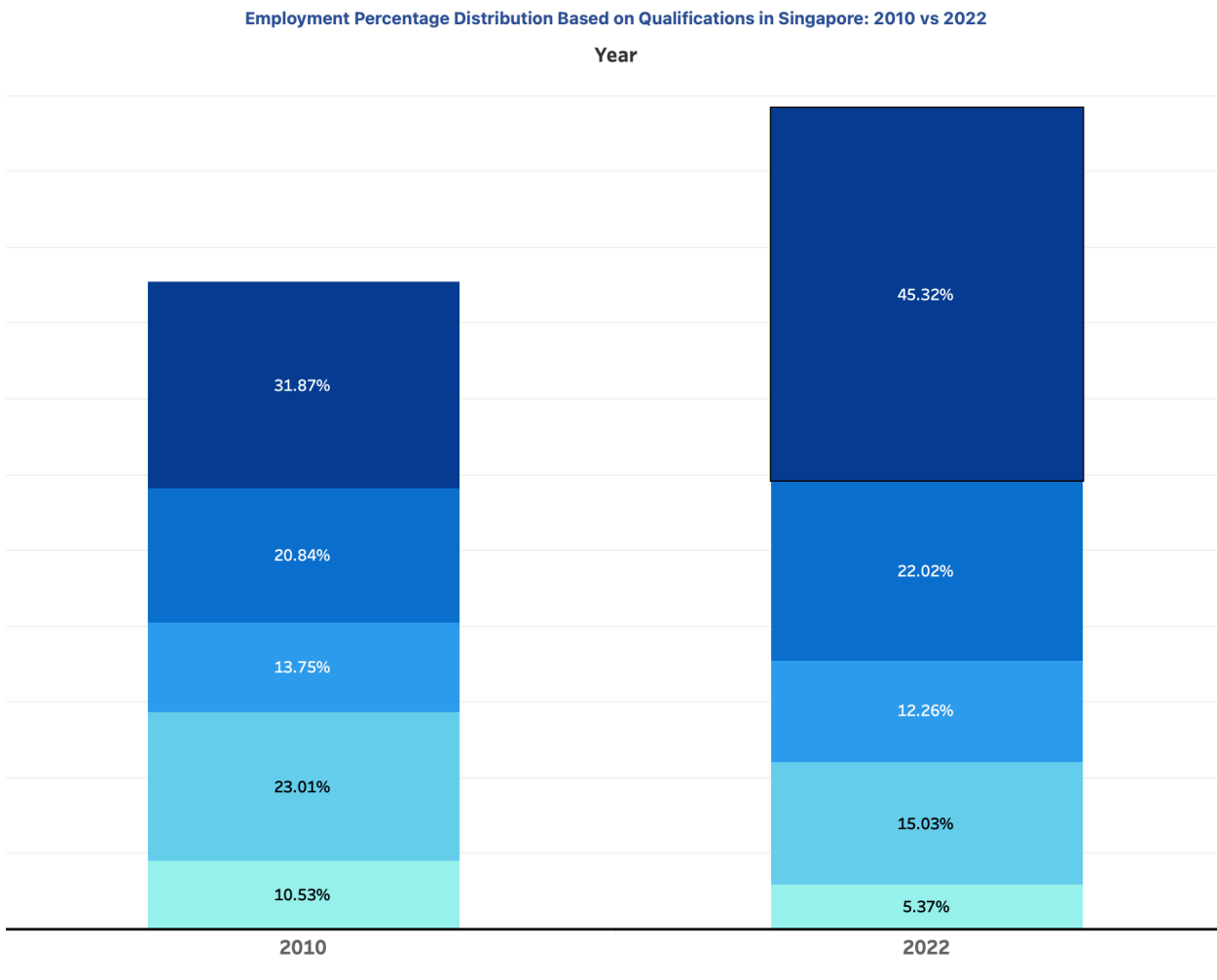


Fig 1.6

Visual Encoding used in Figure 1.6

Data	Data Type	Encoding	Description
Year	<i>Discrete, Quantitative</i>	Channel: Horizontal Position	Years 2010 and 2022
Education	Qualitative, categorical, ordinal	Channel: Vertical Position  Channel: Colour Saturation	Position of the stacked bar component depends upon the education order. (Highest education - Top of the Bar , Lowest Education - At the end)  Each Segment's colour saturation depends upon the level of education
Employed	<i>Ratio, Continuous, Quantitative</i>	Channel: Area  Marks: Area	The area under each stacked bar segment shows the percentage of people employed based on education

#### Insights

1. In 2010, 27.73% of employed individuals held degrees, 18.14% had diplomas, 11.96% possessed post-secondary qualifications, 20.02% had secondary education, 9.17% attained lower secondary education, and 12.99% had primary education or below.
2. By 2022, there was a notable shift towards higher education levels, with 41.79% holding degrees, 20.30% having diplomas, 11.30% possessing post-secondary qualifications, 13.86% with secondary education, 4.95% having lower secondary education, and 7.80% attaining primary education or below.
3. This trend indicates a significant increase in the proportion of tertiary-educated individuals in the workforce over the years, reflecting a shift towards a more educated workforce in Singapore.

### 6.1.7 Percentage Distribution of Employed Residents Across Occupations in Singapore: 2001 vs 2023

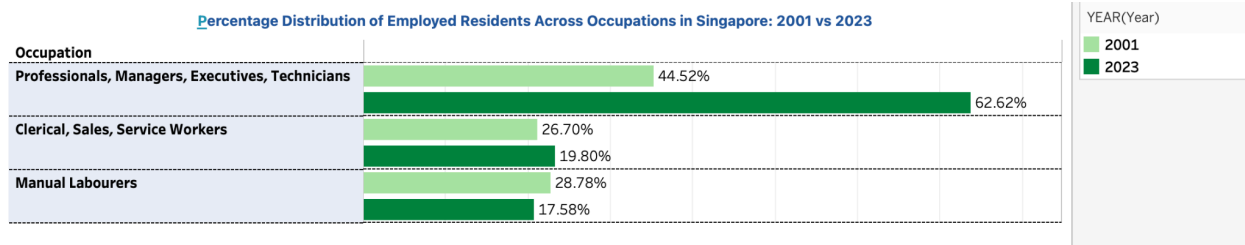


Fig 1.7

Visual Encoding used in Figure 1.7

Data	Data Type	Encoding	Description
Occupation	Qualitative, categorical, nominal	Channel: Vertical Position	The position of the grouped bar chart depends on the occupation in consideration
Year	Qualitative, Ordinal	Channel: Colour: Hue	The colour of each bar depends upon the year in consideration
% Employed	Quantitative, Ratio, Continuous	Channel: Horizontal Position Marks: Line/Bar	The horizontal length of the line or bar depends upon the distribution % of the occupation category.

Insights:

1. In 2001, professionals, managers, executives, and technicians (PMETs) constituted 44.52% of the workforce, a figure that surged to 63.57% by 2022, indicating a substantial increase in skilled and managerial roles over the years.
2. Conversely, clerical, sales, and service occupations saw a decline from 26.27% in 2001 to 19.27% in 2022, suggesting a relative decrease in administrative and customer service roles.
3. Similarly, manual labourers accounted for 28.78% of the workforce in 2001, which decreased to 17.15% by 2022, indicating a significant shift away from manual and labor-intensive occupations over time.
4. These trends highlight the evolving nature of the Singaporean workforce, with a notable increase in skilled and managerial positions and a corresponding decrease in manual and clerical roles, reflecting the ongoing transformation towards a knowledge-based economy.

## 6.1.8 Evolution of Employment Change in Manufacturing, Construction, and Service Industries in Singapore Over Time

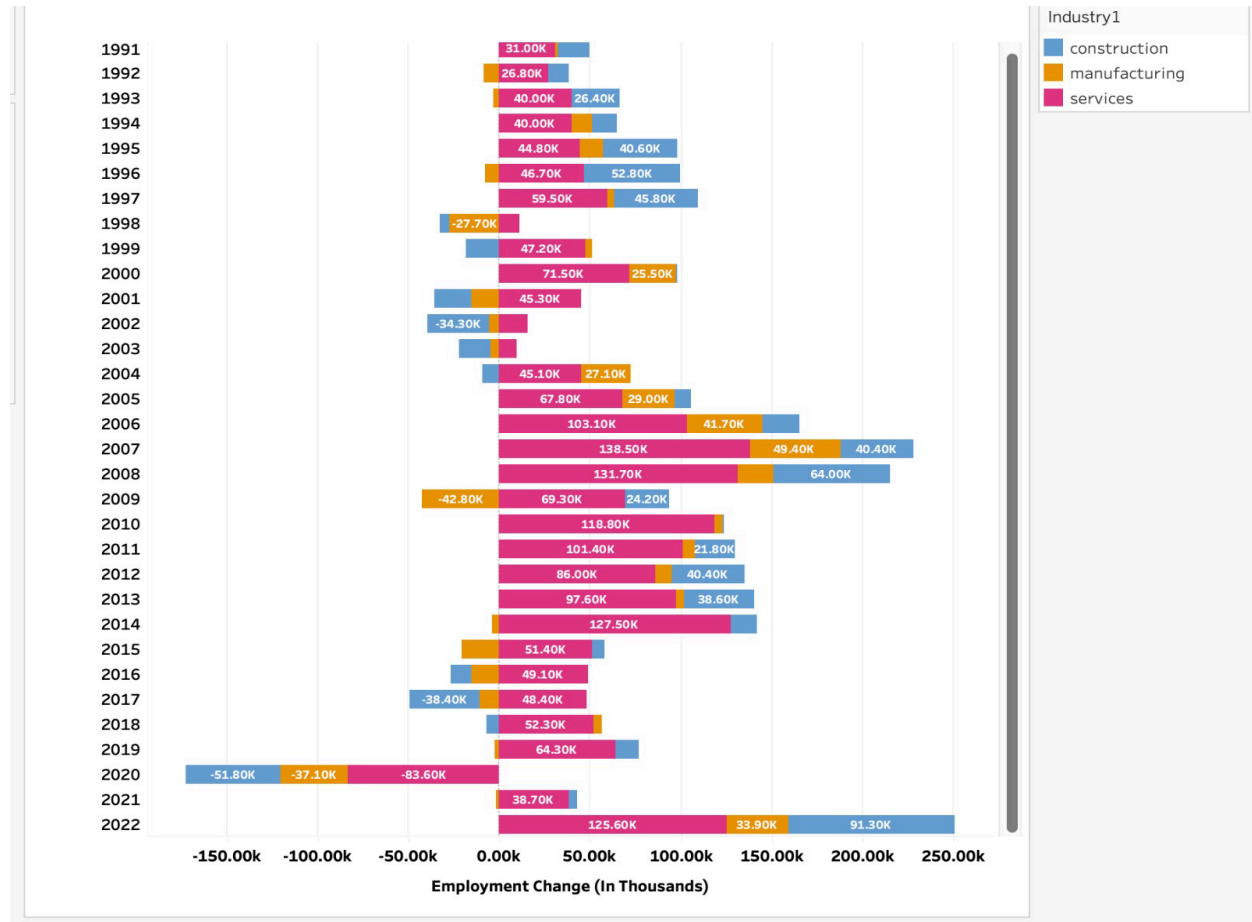


Fig 1.8

Visual Encoding used in Figure 1.8

Data	Data Type	Encoding	Description
Employment Change	Quantitative, Ratio, Continuous	Channel: Horizontal Position Marks: Line/Bar	Position to the right of the mid-section shows positive employment change ( increase ) whereas to the left indicates a negative change in employment
Year	Discrete, Interval, Quantitative	Channel: Vertical Position	Years ranging from 1991 to 2022
Industry1	Qualitative, categorical, nominal	Channel: Colour Hue	Different Colour for each industry

Insights:

1. Over the years, the service-based industry has experienced the highest level of positive employment change, indicating its resilience and adaptability in creating job opportunities.
2. In contrast, the manufacturing industry has seen more negative employment changes compared to service and construction sectors, suggesting greater volatility and susceptibility to economic fluctuations.
3. Both the manufacturing and construction industries exhibit slightly higher volatility in employment changes, underscoring the challenges and uncertainties faced within these sectors.
4. All the industries faced a downturn in 2020 due to the COVID-19 pandemic.
5. Asian Financial Crisis (July 1997 - Dec 1998): Impact on Construction and Manufacturing: Witnessed a notable exodus of workers from the construction and manufacturing sectors, while the services sector remained relatively stable. Limited insights are available for other sectors due to missing data.
6. Dot-com Bust (March 2001 - Nov 2001): High Departures from Construction and Manufacturing: A similar trend was observed with a notable decline in employment in construction and manufacturing industries. Limited insights from other sectors due to data gaps.
7. Global Financial Crisis (Dec 2007 - June 2009): Resilience of Construction and Services: Contrary to previous recessions, the construction and services sectors experienced an increase in employee inflow and remained resilient. However, manufacturing and other industries witnessed a downturn in employment during 2009.
8. COVID-19 Recession (Feb 2020 - Ongoing): Impact and Recovery: Manufacturing and construction sectors faced significant employment challenges during 2020 and the first three quarters of 2021. However, there was a notable rebound in employment after that.

## 6.2 Unemployment

### 6.2.1 Evolution of Unemployment Rates in Singapore (2000-2022)

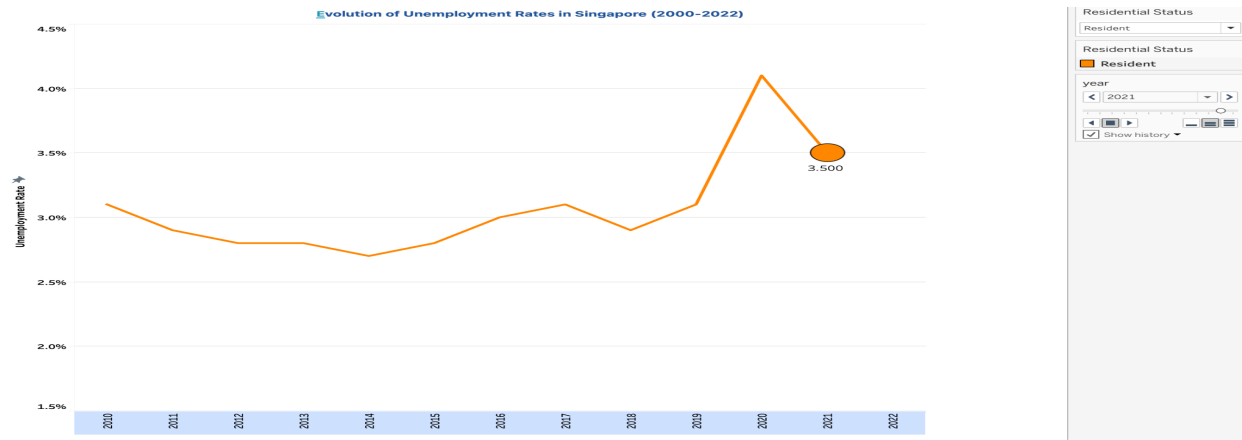


Fig 1.9

Visual Encoding used in Figure 1.9

Data	Data Type	Encoding	Description
Year	Interval, Discrete, Quantitative	Channel: Horizontal Position	Temporal x-axis with equal intervals from 2010 to 2022
Unemployment rate	Ratio, Continuous, Quantitative	Channel: Vertical Position	Vertical Position shows the unemployment rate
		Marks - Points	Represents the unemployment rate for that year
		Marks - Line	Helps convey the trend in the unemployment rate over the years

#### Insights:

1. The unemployment rate in Singapore has fluctuated within a range of 2.5% to 4.1% over the years, indicating moderate variability in job market conditions.
2. The highest unemployment rate occurred during the COVID-19 pandemic, reaching 4.1%, but gradually reduced to 3.5% by 2021-2022, reflecting the economy's resilience in recovering from the crisis.
3. In 2017, during the Global Financial Crisis, the unemployment rate stood at 3.1%, indicating the impact of external economic shocks on Singapore's labor market stability.
4. Overall, Singapore has maintained relatively low unemployment rates despite periodic economic challenges, showcasing its ability to adapt and recover from adverse situations.

### 6.2.2 Evolution of Unemployment Rates by Gender in Singapore (2000-2024)

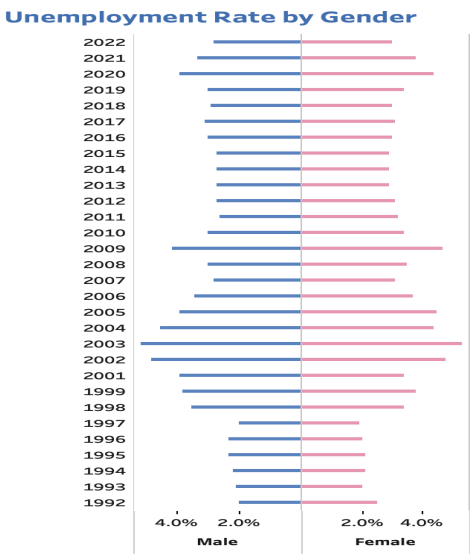


Fig 2.0

Visual Encoding used in Figure 2.0

Data	Data Type	Encoding	Description
Year	Interval, Discrete, Quantitative	Channel: Vertical Position	Temporal y-axis with equal intervals from 1992 to 2022
Unemployment rate	Ratio, Continuous, Quantitative	Channel: horizontal Position Marks - Lines/Bars	Horizontal Position shows the unemployment rate. Represents the unemp_rate of that year for both genders
Sex	Qualitative, Categorical, nominal	Channel: Colour Hue	Male Females are represented using different colours for differentiation

Insights:

1. Both men and women have unemployment rates below 5%, indicating a balanced distribution.
2. While women's unemployment rates are slightly higher than men's, the difference is minimal.
3. The symmetrical pattern in unemployment rates between genders suggests that gender discrimination is not a significant factor influencing overall unemployment.
4. Overall unemployment rates are likely driven by broader economic factors such as industry demand and market conditions, rather than gender-specific issues.

### 6.2.3 Unemployment Percentage Distribution Based on Qualifications in Singapore: 2010 vs 2022

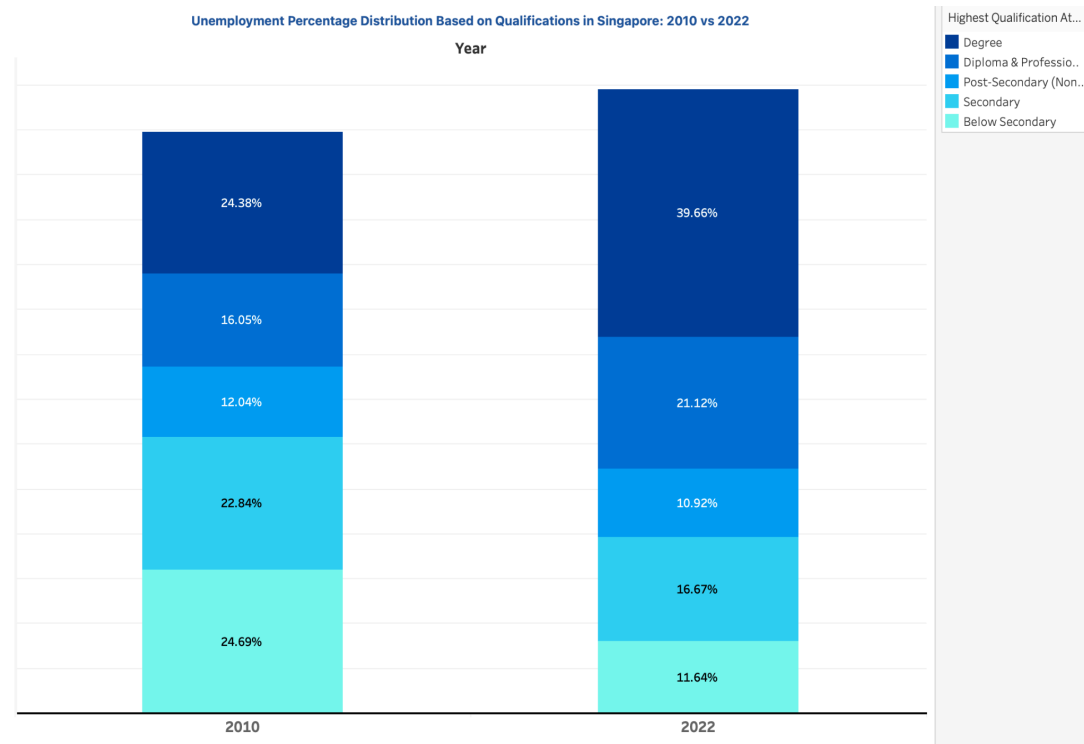


Fig 2.1

Visual Encoding used in Figure 2.1

Data	Data Type	Encoding	Description
Year	Discrete, Quantitative	Channel: Horizontal Position	Years 2010 and 2022
Education	Qualitative, categorical, ordinal	Channel: Vertical Position Channel: Colour Saturation	The position of the stacked bar component depends upon the education order. (Highest education - Top of the Bar, Lowest Education - At the end)  Each Segment's colour saturation depends upon the level of education
Unemployment Rate	Ratio, Continuous, Quantitative	Channel: Area Marks: Area	Area under each stacked bar segment shows unemployment rate on the education



#### Insights:

1. Rising Education Levels: The increase in unemployment rates across all education levels from 2010 to 2022 suggests a growing number of people pursuing higher education qualifications.
2. Skills Mismatch: Despite higher education attainment, individuals with degrees experienced the highest unemployment rates in both years, indicating a potential mismatch between education and job market demands.
3. Employment Opportunities: Lower unemployment rates among post-secondary educated individuals highlight the demand for vocational or technical skills, suggesting a need for more industry-aligned education and training programs.

### 6.2.4 Evolution of Unemployment Rate Distribution - PMETS and Non-PMETS

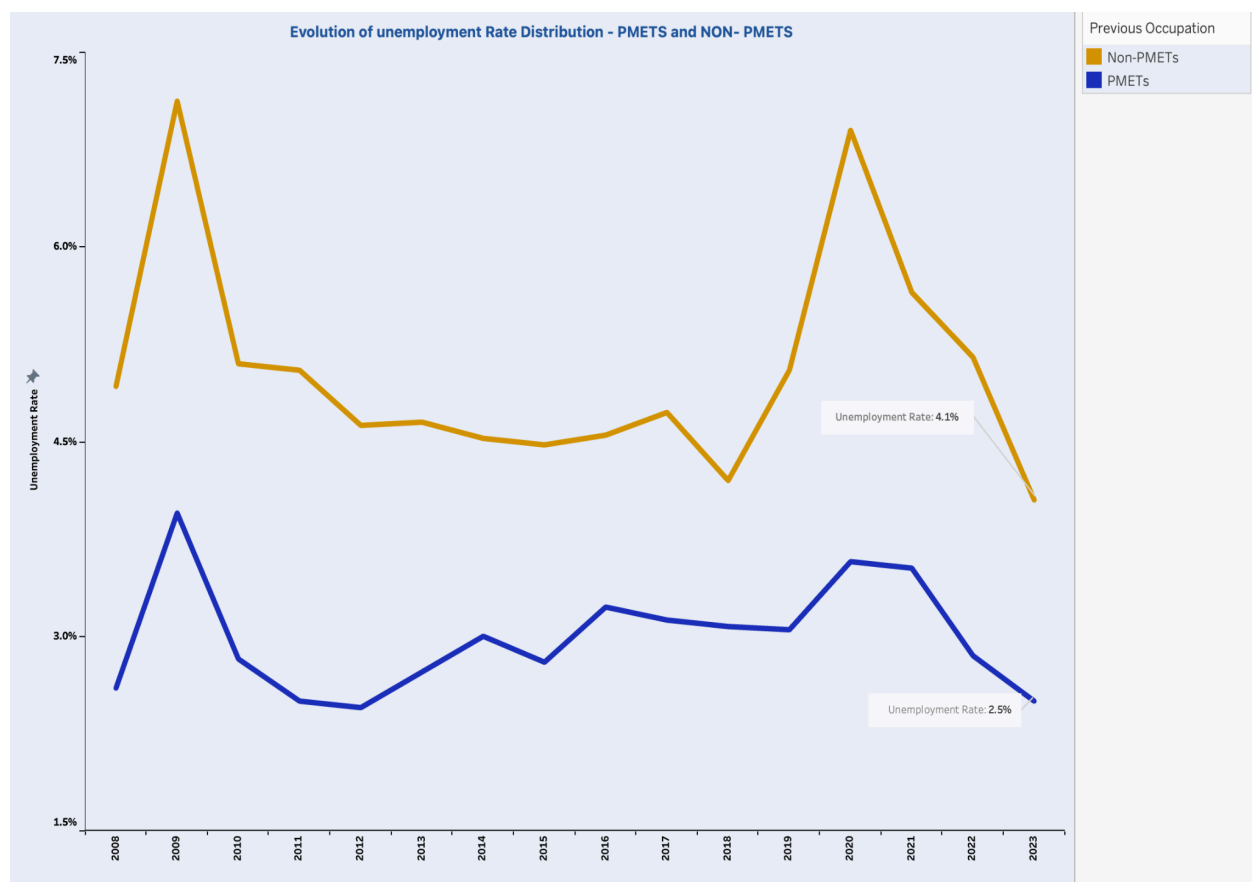


Fig 2.2

### Visual Encoding used in Figure 2.2

Data	Data Type	Encoding	Description
<b>Year</b>	<i>Interval, Discrete, Quantitative</i>	Channel: Horizontal Position	Temporal x-axis with equal intervals from 2008 to 2023
<b>Unemployment rate</b>	<i>Ratio, Continuous, Quantitative</i>	Channel: Vertical Position	Vertical Position shows the unemployment rate
<b>Occupation</b>	Qualitative, categorical, nominal	Channel: Colour: Hue	Represents Professional or Non-Professional Occupation
		Marks - Points	Represents the distribution % of pmet and non-pmet for that year based on hue colour
		Marks - Line	Helps convey the trend in % distribution of pmet and non-pmet Unemployment rate over the years

#### Insights:

1. Throughout the years, the unemployment rate has consistently remained higher for non-PMETs compared to PMETs, reflecting greater challenges for non-professional and non-managerial workers in finding employment.
2. The maximum unemployment rates occurred during times of economic downturn, such as 7.1% in 2009 and 6.9% in 2020 during the global financial crisis and the COVID-19 pandemic, respectively, with non-PMETs experiencing higher rates than PMETs.
3. Despite these challenges, both PMET and non-PMET unemployment rates decreased to 2.5% and 4.1% respectively in 2022, indicating a recovery in the labour market.
4. Reasons for the higher unemployment rates among non-PMETs may include the decline in demand for lower-skilled jobs, automation, and structural changes in the economy, while PMETs may benefit from their higher skill levels and adaptability to changing job market demands.

## 6.2.5 Long Term Unemployment Rate - PMETS and NON-PMETS

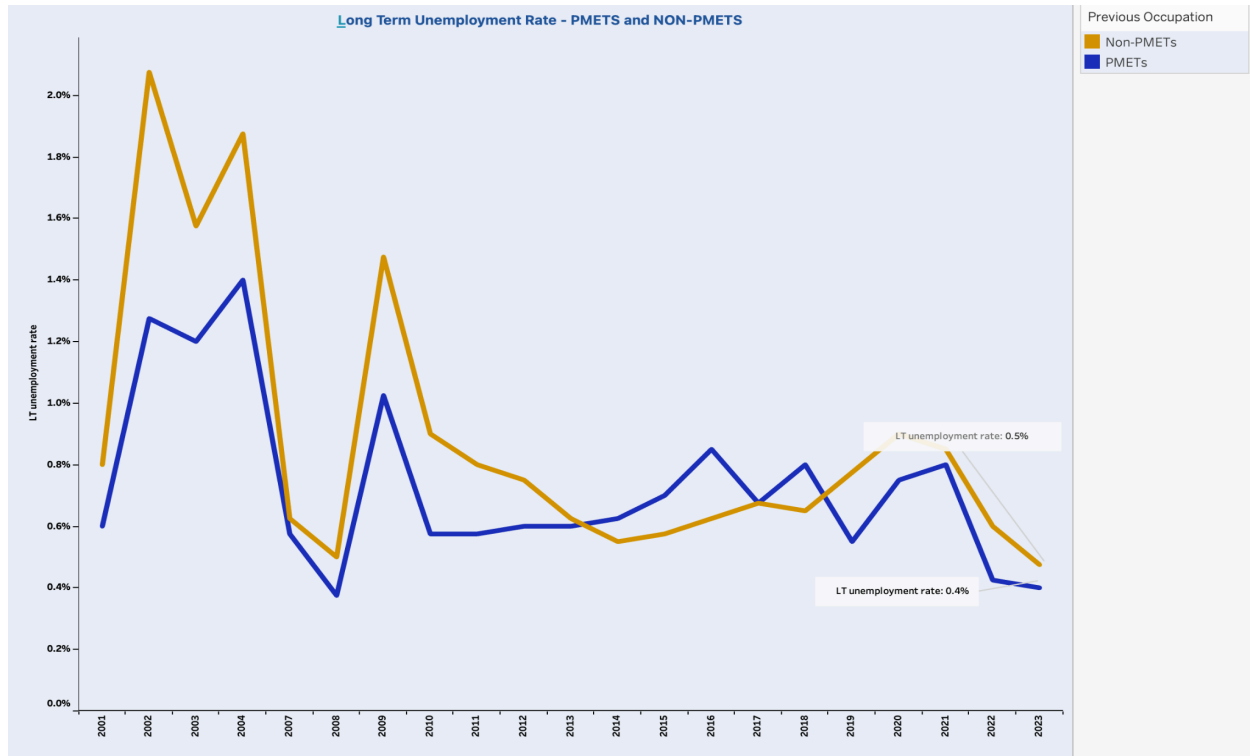


Fig 2.3

### Visual Encoding used in Figure

Data	Data Type	Encoding	Description
Year	Interval, Discrete, Quantitative	Channel: Horizontal Position	Temporal x-axis with equal intervals from 2008 to 2023
Long term Unemployment rate	Ratio, Continuous, Quantitative	Channel: Vertical Position	Vertical Position shows the long term unemployment rate
Occupation	Qualitative, categorical, nominal	Channel: Colour: Hue	Represents Professional or Non-Professional Occupation
		Marks - Points	Represents the distribution % of pmetes and non-pemts for that year based on hue colour
		Marks - Line	Helps convey the trend in % distribution of pmetes and non-pemts long term Unemployment rate over the years

#### Insights:

1. From 2008 to 2013, the long-term unemployment rate for non-PMETs exceeded that of PMETs, indicating higher challenges for non-professional and non-managerial workers in finding sustained employment during this period.
2. Conversely, from 2013 to 2018, the long-term unemployment rate for PMETs surpassed that of non-PMETs, signalling increased difficulties for professionals and managerial workers in securing long-term employment opportunities.
3. However, from 2018 to 2022, the long-term unemployment rate for non-PMETs slightly exceeded that of PMETs again, suggesting a fluctuating trend in unemployment dynamics between different occupational groups.
4. The maximum long-term unemployment rate occurred in 2009 at 1.5%, likely due to the global financial crisis, while the second-highest rate of 0.9% was observed in 2020 amidst the COVID-19 pandemic.
5. Despite fluctuations, the overall long-term unemployment rate tends to be slightly lower for PMETs compared to non-PMETs, indicating relatively better job prospects for professionals and managerial workers in Singapore.

## 6.3 Labour Turnover and Retrenchment

### 6.3.1 Evolution of Labour Turnover (Recruitment and Resignation) over time

Recruitment and Resignation Rates over the years

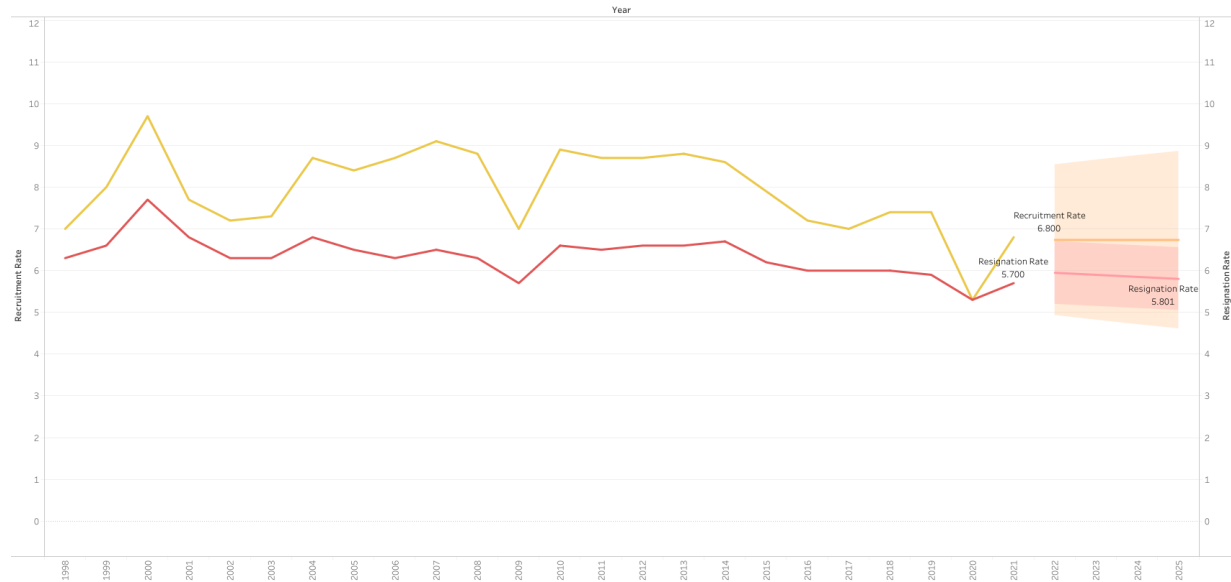


Fig 3.1

Visual Encoding used in Figure for 3.1

Data	Data Type	Encoding	Description
<b>Recruitment Rate</b>	Quantitative, Ratio, Continuous	Channel: Horizontal Position and Color Marks: Line	Dual axis, left axis is of recruitment rate and is represented by a yellow line chart
<b>Resignation Rate</b>	Quantitative, Ratio, Continuous	Channel: Horizontal Position and Color Marks: Line	Dual axis, right axis is of resignation rate and is represented by a red line chart
<b>Year</b>	Discrete, Interval, Quantitative	Channel: Vertical Position	Temporal x-axis with equal intervals from 1998 to 2022

#### Insights:

Recruitment and Resignation Rates are measures of labour turnover. In good times when job openings are plentiful, recruitment and resignation rates tend to be high reflecting movement of workers between jobs. In periods of economic downturn like 2008 and 2020, high layoffs are usually coupled with low resignation and recruitment rates.

## 6.3.2 Impact of recession on Labour Turnover for different occupations

Labour Turnover for different occupations saw a dip in 2009 and 2020 due to recession and covid

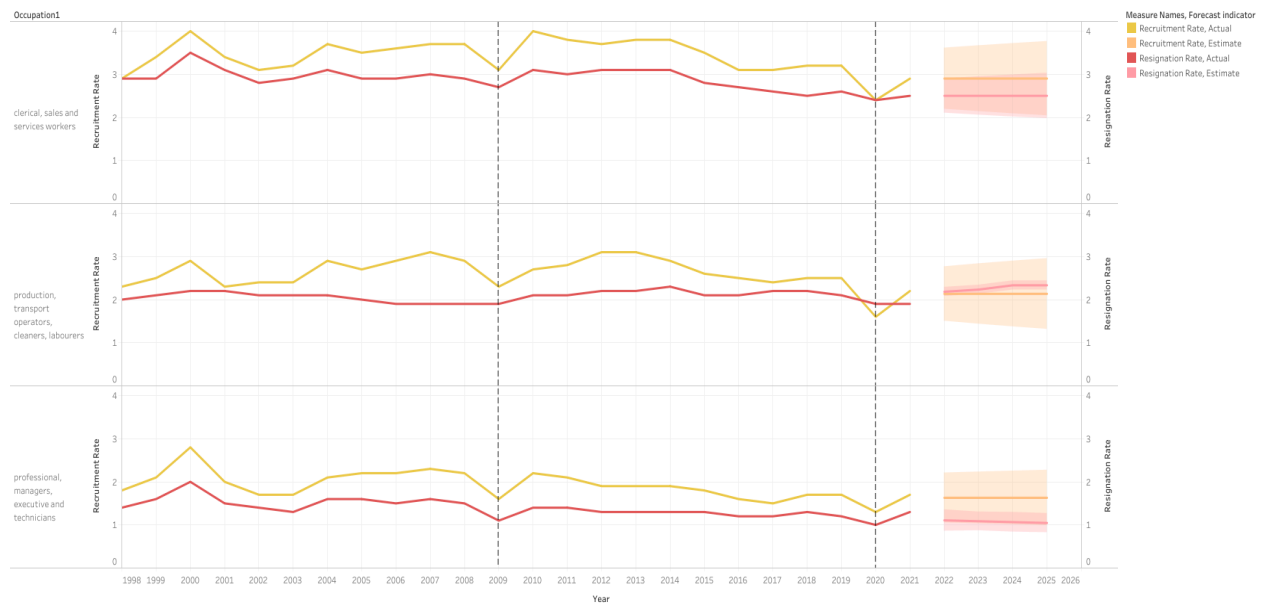


Fig 3.2

### Visual Encoding used in Figure 3.2

Data	Data Type	Encoding	Description
<b>Recruitment Rate</b>	Quantitative, Ratio, Continuous	Channel: Horizontal Position and Color Marks: Line	Dual axis, left axis is of recruitment rate and is represented by a yellow line chart
<b>Resignation Rate</b>	Quantitative, Ratio, Continuous	Channel: Horizontal Position and Color Marks: Line	Dual axis, right axis is of resignation rate and is represented by a red line chart
<b>Year</b>	Discrete, Interval, Quantitative	Channel: Vertical Position	Temporal x-axis with equal intervals from 1998 to 2022
<b>Occupation</b>	Categorical, Qualitative, Nominal	Channel: Horizontal Position	Each occupation has a row and is represented by a chart

Insights:

1. In periods of recession 2008 and 2020, production/transport operators/cleaners/labourers faced lower recruitment and higher resignation than the other occupations like professionals and clerical staff. This could have been due to immigrant control measures taken by the government.

2. Resignation of production/transport operators/cleaners/labourers is forecasted to increase from 2021 onwards.
3. Labour Turnover increased for professionals soon after 2020. Professionals' mobility increased, could have been due to more jobs and higher demand.

### 6.3.3 Comparison of Recruitment and Resignation over the last few years for different industries

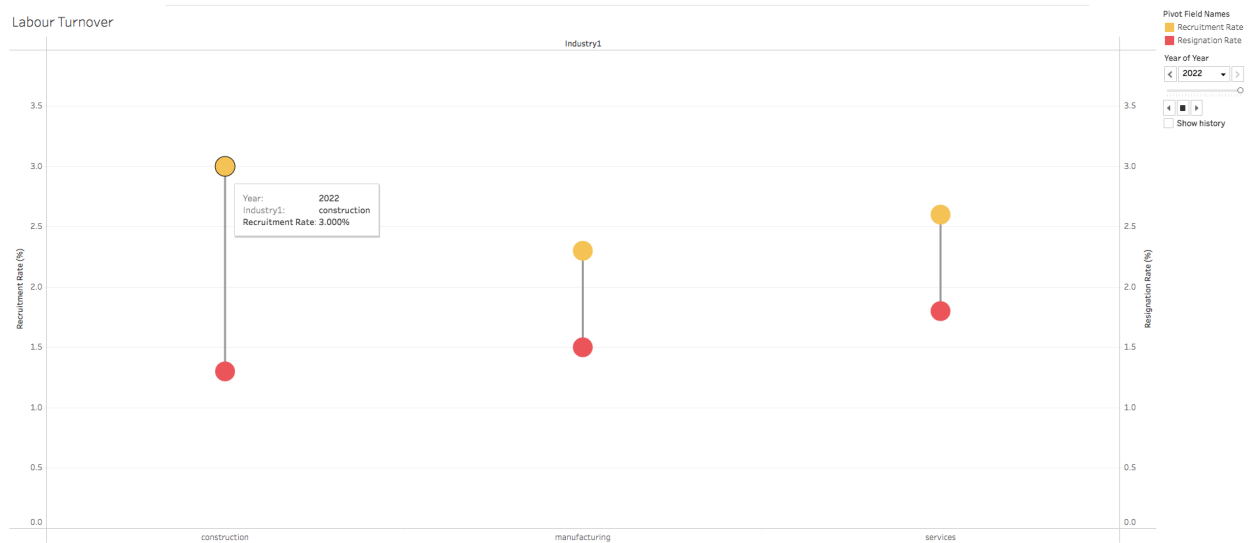


Fig 3.3

#### Visual Encoding used in Figure 3.3

Data	Data Type	Encoding	Description
<b>Recruitment Rate</b>	Quantitative, Ratio, Continuous	Channel: Vertical Position and Color Marks: Point	Dual axis, left axis is of recruitment rate and is represented by a yellow point chart
<b>Resignation Rate</b>	Quantitative, Ratio, Continuous	Channel: Vertical Position and Color Marks: Point	Dual axis, right axis is of resignation rate and is represented by a red point chart
<b>Year</b>	Discrete, Interval, Quantitative	Channel: Position	Animation is added per year from 1998-2022
<b>Industry1</b>	Categorical, Qualitative, Nominal	Channel: Vertical Position	Each industry is represented by a vertical line in each column

Insights:

1. In periods of recession 2008 and 2020, production/transport operators/cleaners/labourers faced lower recruitment and higher resignation than the other occupations like professionals and clerical staff. This could have been due to immigrant control measures taken by the government.
2. Resignation of production/transport operators/cleaners/labourers is forecasted to increase from 2021 onwards.
3. Labour Turnover increased for professionals soon after 2020. Professionals' mobility increased, could have been due to more jobs and higher demand.

### 6.3.4 What is the Retrenchment trend over the last few years

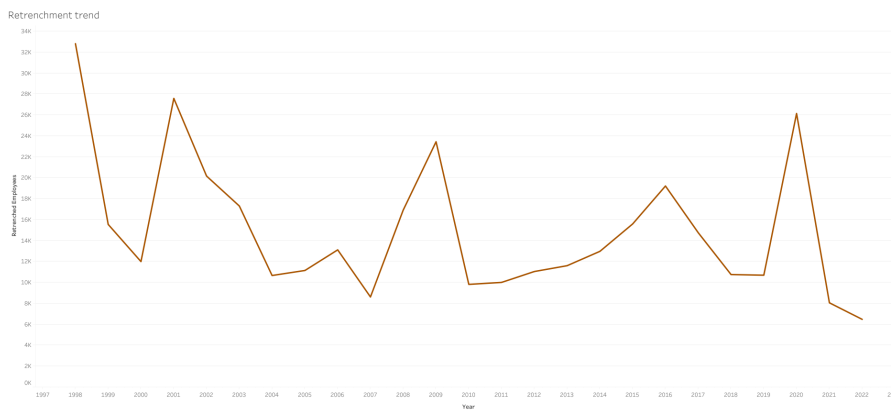


Fig 3.4

Visual Encoding used in Figure 3.4

Data	Data Type	Encoding	Description
<b>Retrenchment</b>	Quantitative, Ratio, Continuous	Channel: Position and Color Marks: Line	Y-axis representing number of employees retrenched. Red color line is used to denote the retrenchment.
<b>Year</b>	Discrete, Interval, Quantitative	Channel: Position	Temporal x-axis with equal intervals from 1998 to 2022

Insights:

1. Three major peaks observed during 2001, 2008 and 2020 possibly due to companies going bankrupt
2. Retrenchment came down from 27k to 6k within the covid year 2020 showing improvement in economies



## 6.3.5 What are the top industries and sub-industries that are impacted the most by retrenchment?

Retrenchment Across Industries

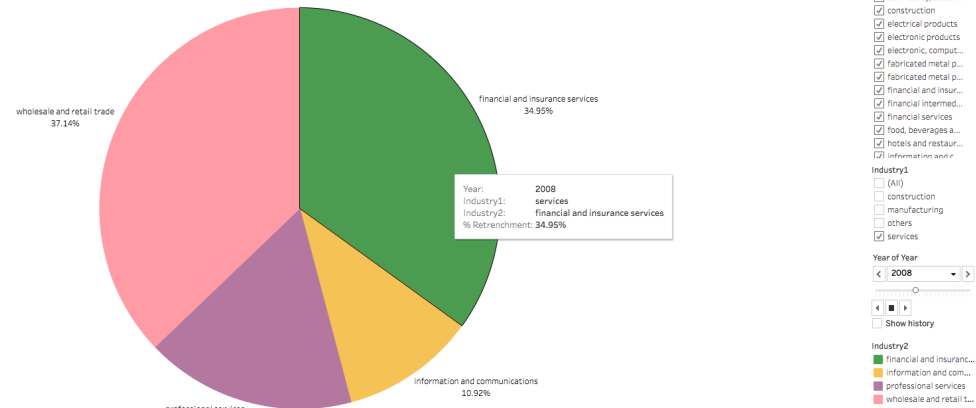


Fig 3.5

### Visual Encoding used in Figure 3.5

Data	Data Type	Encoding	Description
<b>Retrenchment</b>	Quantitative, Ratio, Continuous	Channel: Color, Angle	Each wedge is calculated based on the retrenchment value
<b>industry1</b>	Qualitative, Categorical, Nominal	Channel: Position	Industry1 is added a filter
<b>industry2</b>	Qualitative, Categorical, Nominal	Channel: Colour	Different colour represent different sub-industries
<b>Year</b>	Quantitative, Interval, Discrete	Channel: Position	Animation is added per year

Insights:

Information and Communication industry under services sector, electronic industry under manufacturing are the top industries affected by recession and saw a major retrenchment in 2020 - 2022.

## 7. Generation of key Visualisations

### 7.1 Labour Turnover

We can observe from Figure 4.1 and 4.2, that labour turnover (Recruitment and Resignation Rates) is high for Clerical, Sales and Service workers. This indicates that the job movement in such jobs is always higher as compared to other occupations irrespective of the times.

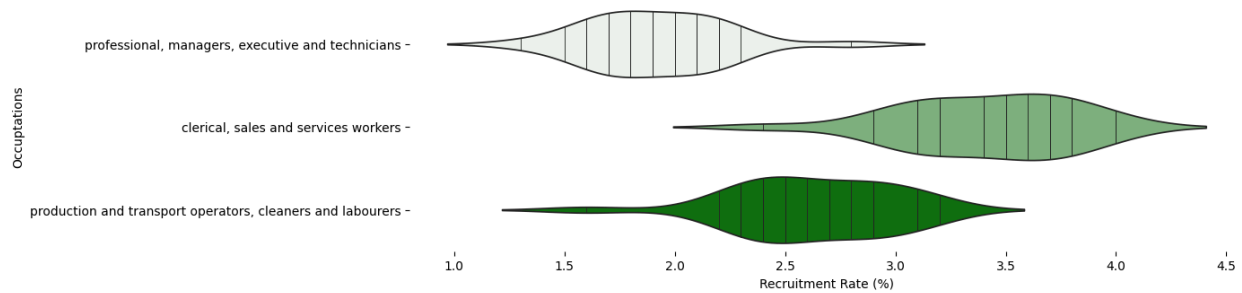


Figure 4.1: Violin Plot to show Recruitment Rates

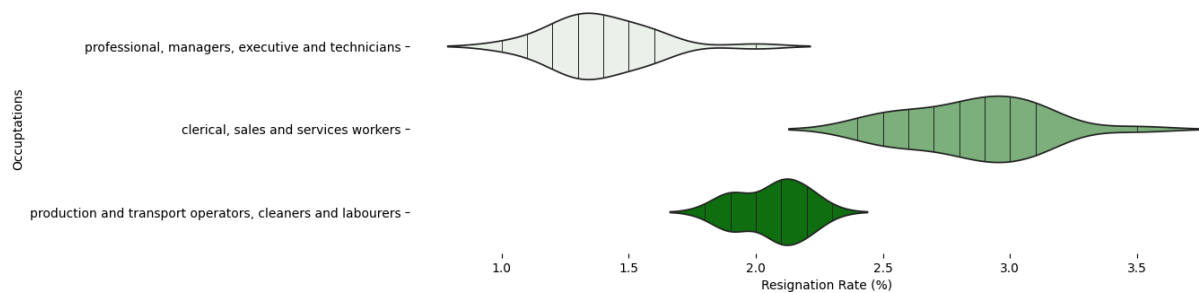


Figure 4.2: Violin Plot to show Resignation Rates

In Figure 4.3, we observed that construction and services industries experienced most labour turnover during recession periods. This could be due to movement of workers across countries for their livelihoods.

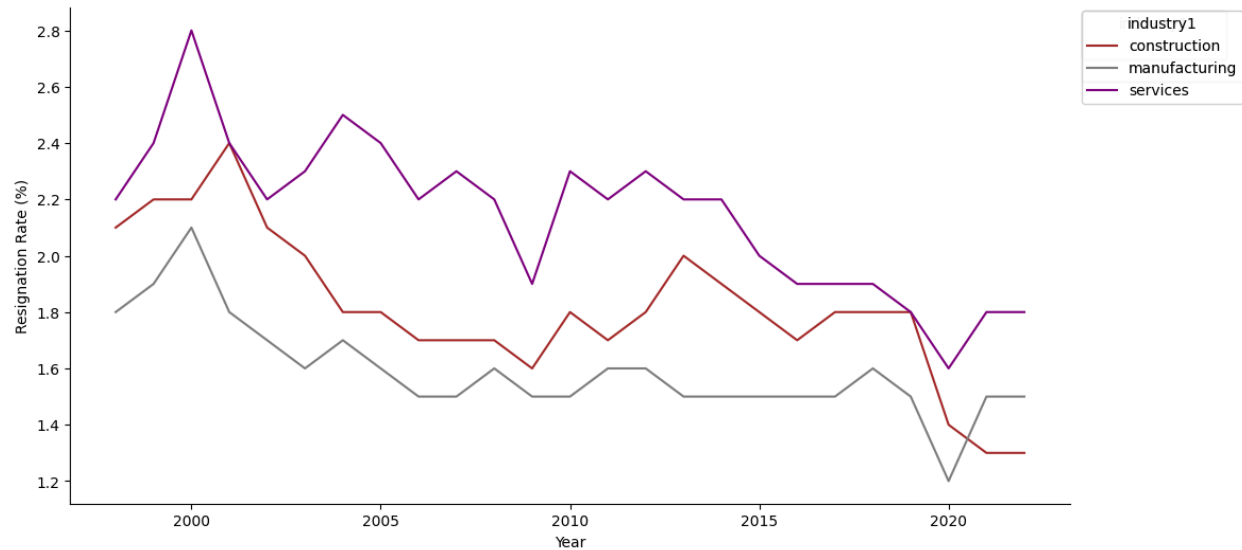


Figure 4.3: Line Chart to show Resignation Rate trends across industries

In this section we explain how we evolved from violin plot and line chart time series analysis to Connected Dot plot.

Violin plot is a distribution-focussed view and inorder to do labour turnover trend analysis we developed a trend-focussed view using Connected Dot Plot. Following steps were performed,

1. Violin Plot - Using recruitment rate and resignation rate for all the years, we plotted a distribution on violin plot
2. Transition - Next we shift the focus from distribution of rates to trends over time.
3. Connected Dot Plot
  - a. For each industry, a series of dots were plotted, where each dot represents the resignation or recruitment rate for a specific year.
  - b. We used a synchronised dual axis to plot both the continuous variables on the same plot.
  - c. Connected the dots within each industry using a line as a mark.
  - d. Added animation using year attribute to show changes over time.
  - e. Used red colour to denote resignation and yellow to denote recruitment. This colour scheme is common to all our graphs.
  - f. Initially the connected dot-plot was horizontal but we changed it to vertical with a recruitment dot on the top and resignation dot on the bottom. With a vertical view we showed the going up and down motion to denote the changes in recruitment-resignation per year.

- g. In the end we added interactivity using tooltips to allow users to explore the data more deeply.

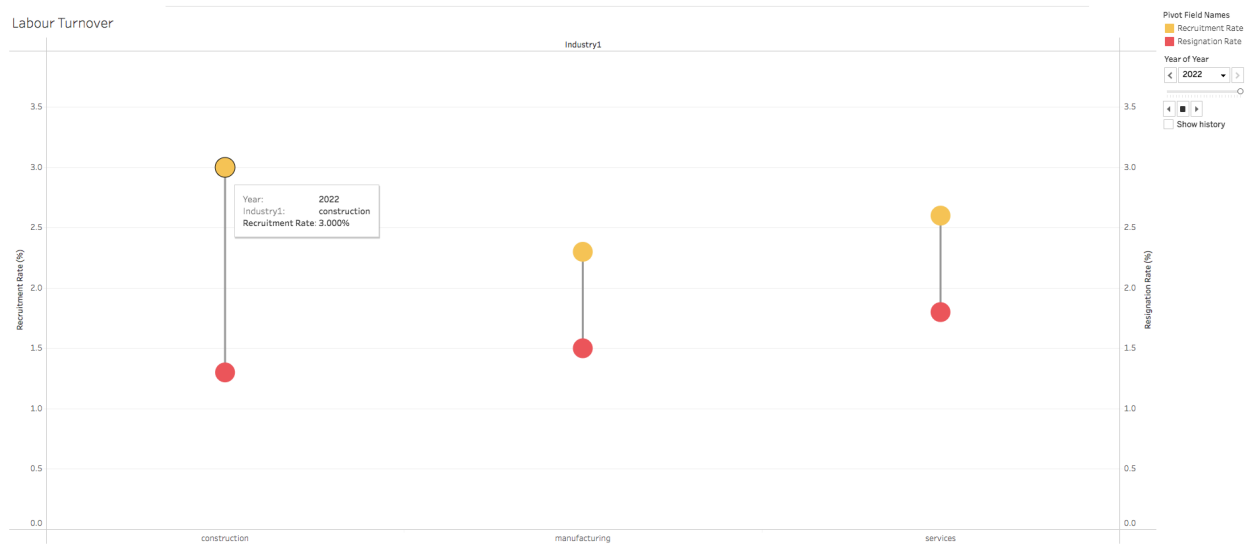


Figure 4.4: Connected-Dot Plot to show Recruitment-Resignation Rates

## 7.2 Retrenchment

Retrenchment refers to the termination of permanent employees or the early termination of term contract employees due to redundancy. Redundancy occurs when an employer no longer requires a particular job to be done by anyone, or when the employer becomes insolvent or bankrupt.

Data on retrenchment are valuable for monitoring the impact of economic downturns or restructuring on the workforce. High rates of retrenchment may indicate economic challenges or industries that are restructuring. This information can be used by policymakers, economists, and businesses to assess the health of the economy and make informed decisions.

The below line chart shows that Retrenchment had its peak during periods of recession esp during covid (2020). And then it quickly came down. This may be due to the cooling measures applied by the government.

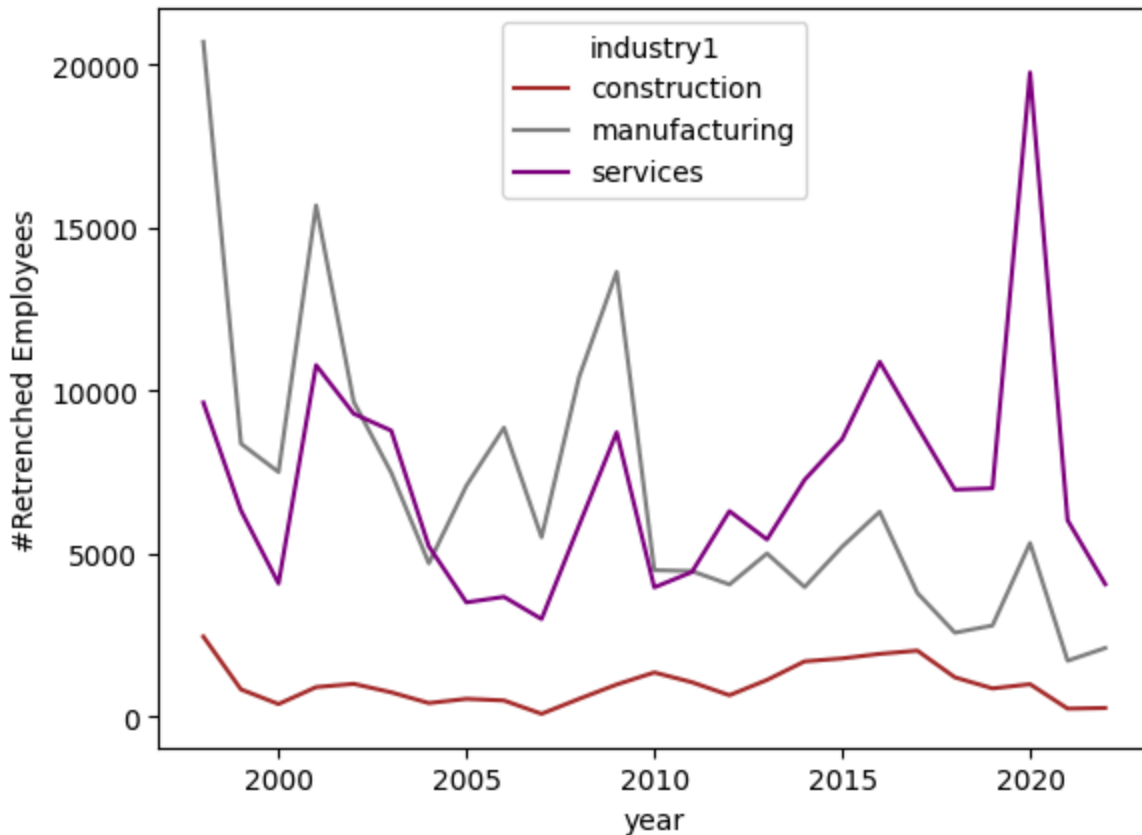


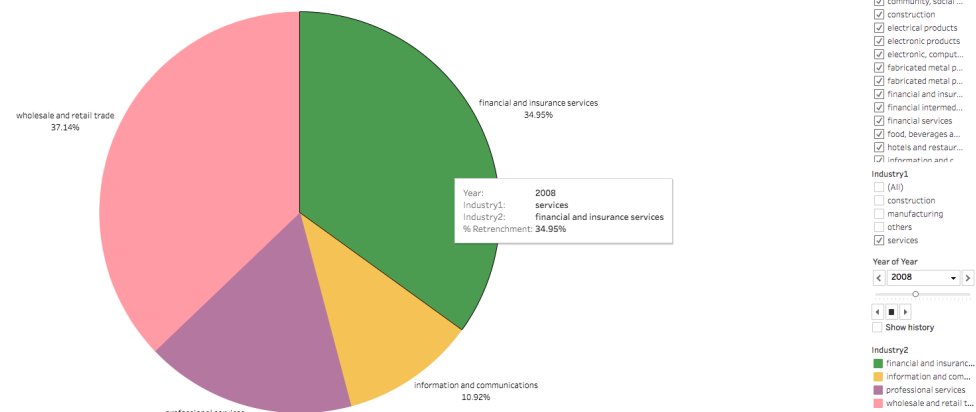
Figure 4.5: Line chart to show Retrenchment trend every 5 years

After having some idea of the trends we wanted to know how badly it affected each individual industry. We wanted to highlight the composition of retrenchment rates across different industries and sub-industries over the years, providing a different perspective on the data compared to the trend focused view of line charts. Hence we chose a pie chart to show the distribution of the retrenchment over the years. These were the steps performed,

1. Line Charts to display the trend in number of retrenchments over the years for each industry
2. Transition - Shifted the focus from the trends over time to the composition of retrenchment within each year.
3. Pie Chart - Created a pie for each year where each wedge represented the sub industry.
4. Filters - Added a filter for main industry1, so that the user can view the composition of sub industries over one particular industry.
5. Since there were a lot of sub industries within one industry, we added a filter to fetch only the ones whose retrenchment is beyond a certain retrenchment threshold (10k). This helped in reducing the noise in visualisation.

6. In order to show the changes over time, we added animation using year attribute
7. Used colours to show different sub-industries and labels to show the sub-industry name and retrenchment percentage.
8. In the end, we added interactivity using tooltips to allow users to explore the data more deeply and a filter for industry1.

Retrenchment Across Industries

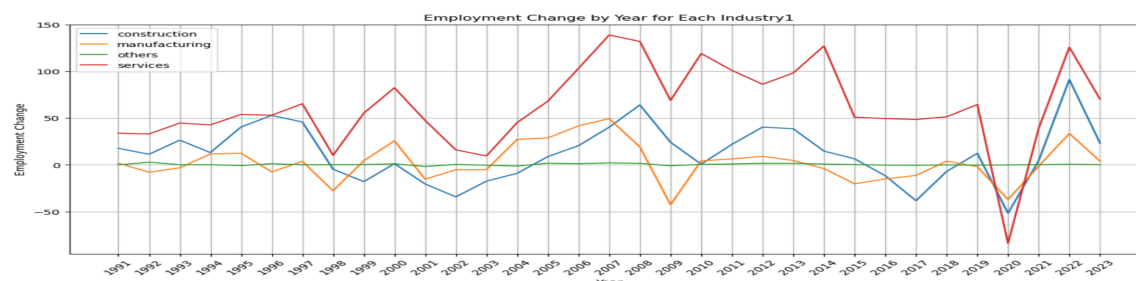


## 7.3 Employment Change

Employment change measures the difference in employed individuals between two periods, where a positive change indicates an increase and a negative change denotes a decrease, typically expressed in thousands of persons. We explore the employment change in industries over the years.

Evolution from a line chart to a pyramid chart for visualising employment changes in different sectors over the years involves a shift in the visualisation approach to better represent the data. Here's a conceptual evolution of the visualisation:

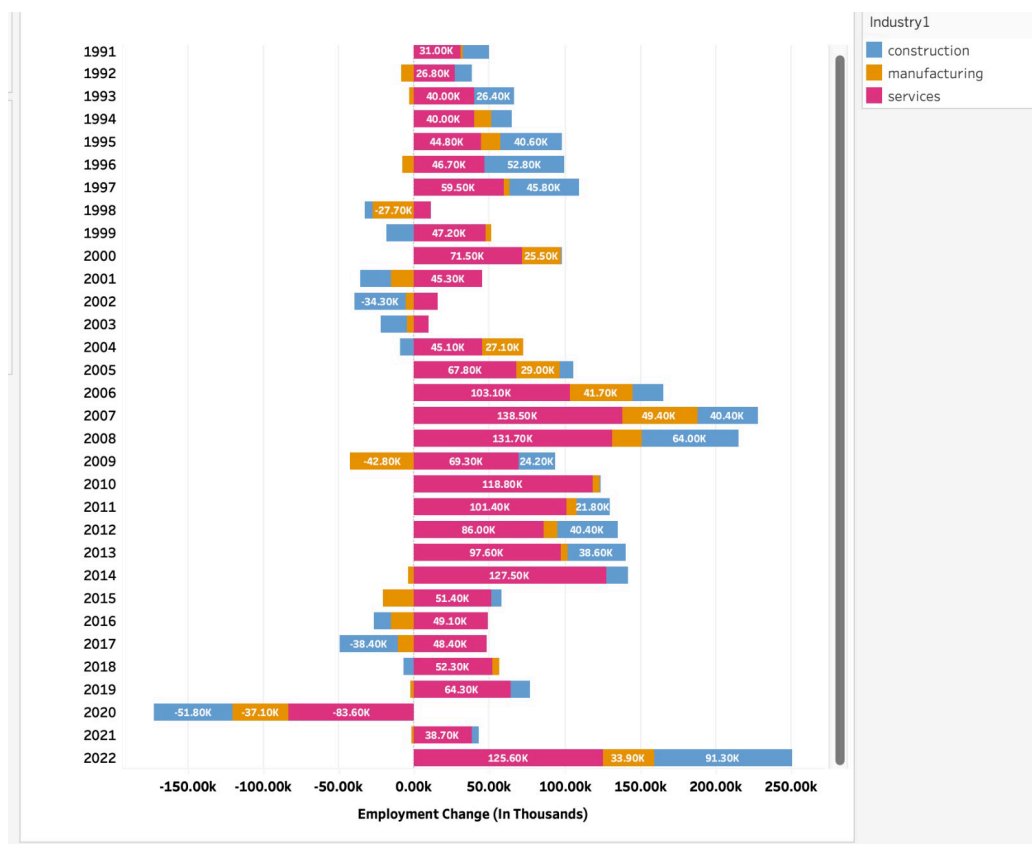
**Line Chart (Initial Visualisation):** The line chart is commonly used to show trends over time. In this context, you might have a line for each sector, showing the change in employment over the years.



**Pyramid Chart (Evolved Visualization):** A pyramid chart can be used to show the distribution of employment across sectors for a specific year. Each section of the pyramid represents a sector, and the width of each section corresponds to the proportion of employment in that sector. By arranging the pyramids side by side for different years, you can show how the distribution of employment across sectors has changed over time.

#### Steps Required to Create The Chart:

1. Drag years to rows.
2. Industries to Color Marks
3. Employment Change to the Columns Section
4. Filters:
  - a. Added a filter for year, allowing users to select a specific year and see the employment distribution for that year.
  - b. Added a filter for sectors, so that the user can view the composition of sectors over one particular year.
5. Color and Labels: Used colours to differentiate between sectors and labels to show the sector name and employment percentage.
6. Interactivity:
  - Added animation using year attribute to show changes over time.
  - Added interactivity using tooltips to allow users to explore the data more deeply.



## 8. Tableau Visualisation Story

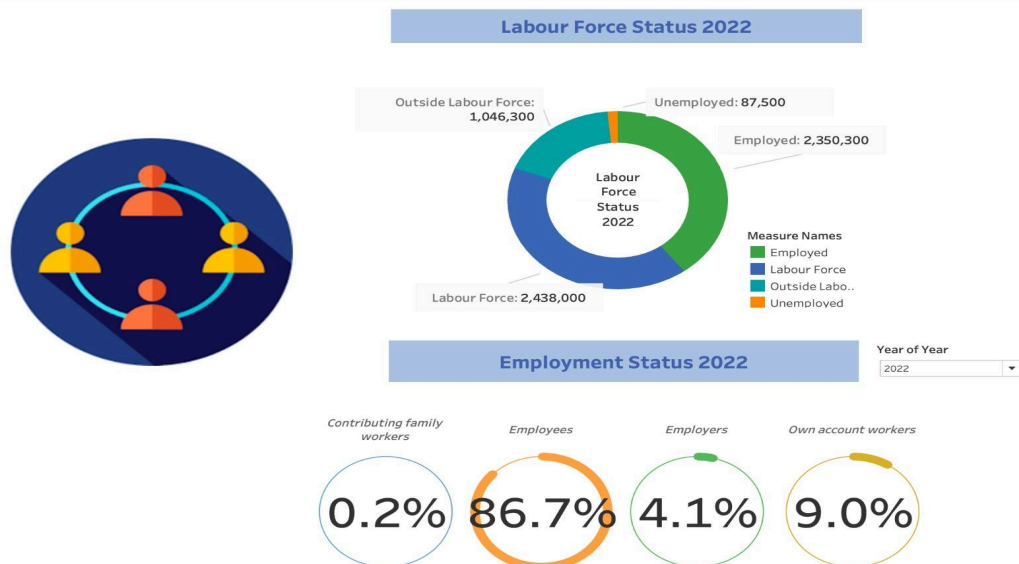
Through the integration of insightful analyses and interactive visualisations from the above discussion, our Tableau story provides a comprehensive narrative of Singapore's labour force dynamics. By combining key metrics, industry trends, and workforce insights, we offer a detailed exploration of Singapore's employment landscape. This interactive journey allows users to delve into the nuances of the data, gaining valuable insights into the distribution of employment rates, trends in unemployment, education-employment dynamics, occupation trends, and industry employment changes. Through this Tableau story, we aim to offer a compelling and informative overview that sheds light on Singapore's evolving labour market, catering to the diverse needs of job seekers, employers, policymakers, and the general public.

Here's an overview of each section in your Tableau story:

- **Singapore labour force:** The section of the Tableau Story provides a detailed analysis of Singapore's labour force status and employment status. These visualisations offer insights into the dynamics of Singapore's workforce, highlighting changes in labour force participation, employment trends, and unemployment count over the years. The section aims to provide a comprehensive overview of the labour market, helping stakeholders understand the current state of Singapore's employment landscape.

The following shows the screenprint of the section :

### Singapore's Labour force at a glance

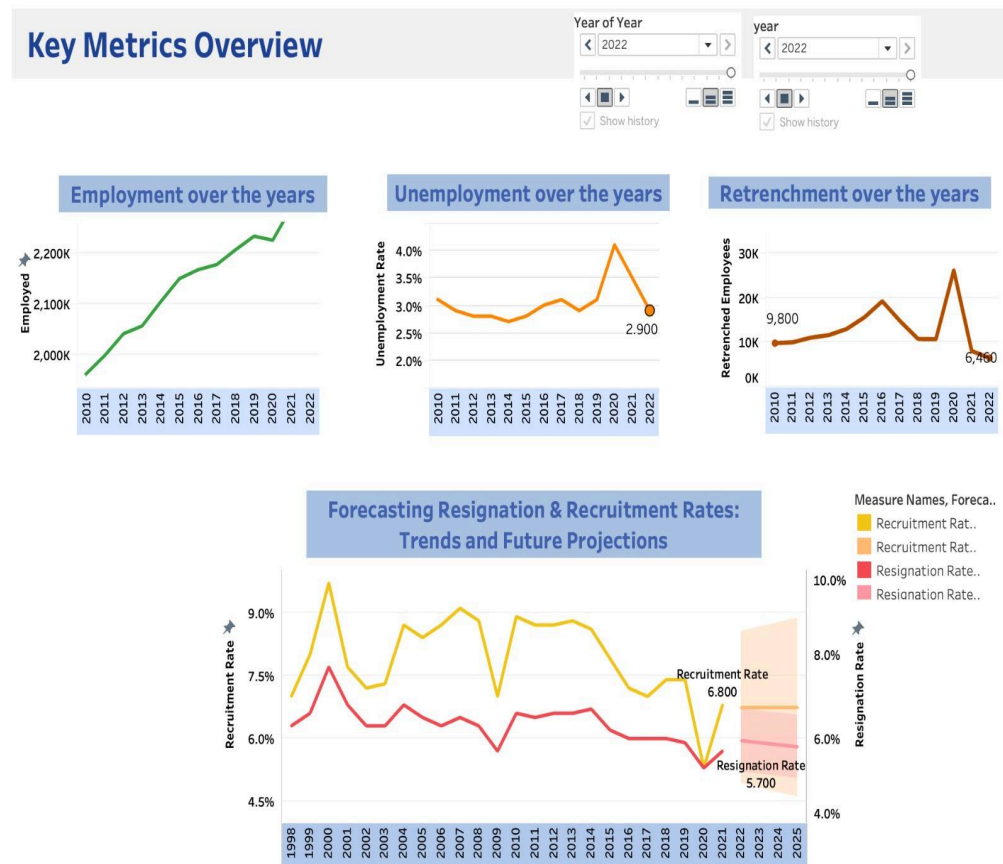


- **Key Metrics Overview:** The "Key Metrics" section provides a comprehensive analysis of key indicators in Singapore's labour market. It includes visualisations for



the employment rate and unemployment rate over the years, highlighting trends and fluctuations in the labour market. Additionally, this section features forecasting for resignation and recruitment rates, offering insights into future workforce trends. The section also includes visualisations of the retrenchment rate over the years, providing an overview of workforce stability and job security in Singapore.

The following shows the screenprint of the section :

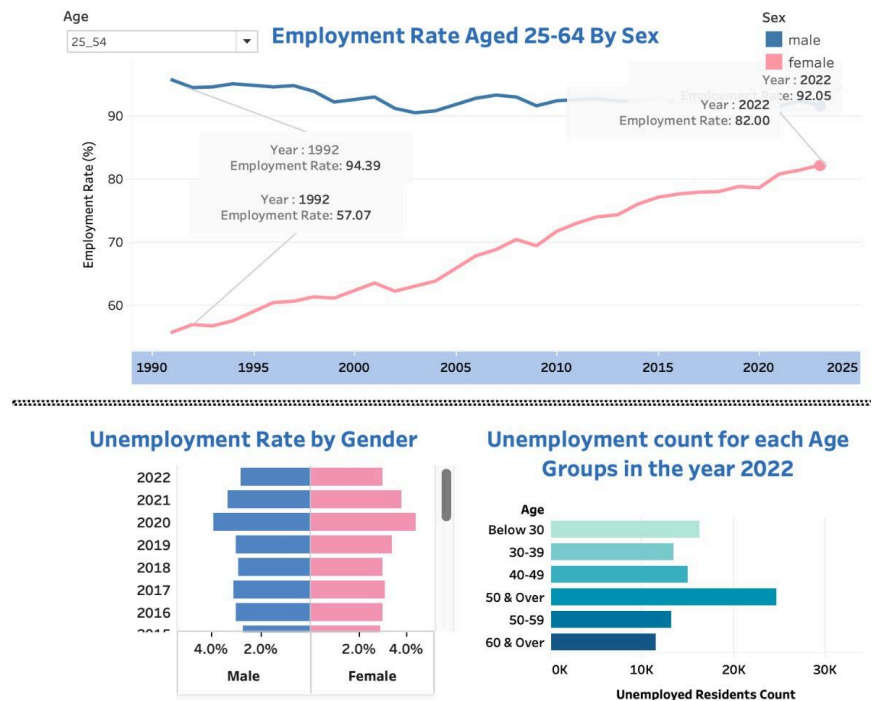


- **Demographic Analysis:** The "Demographic Analysis" section provides a detailed examination of Singapore's labour force composition by sex and age group over the years. It includes visualisations of the employment and unemployment rates, showcasing trends and patterns among different demographic segments.

The following shows the screenprint of the section :

## Demographic Analysis

### Employment & Unemployment Rate By Sex and Age Group Over the Years



- Career Trends & Opportunities :**

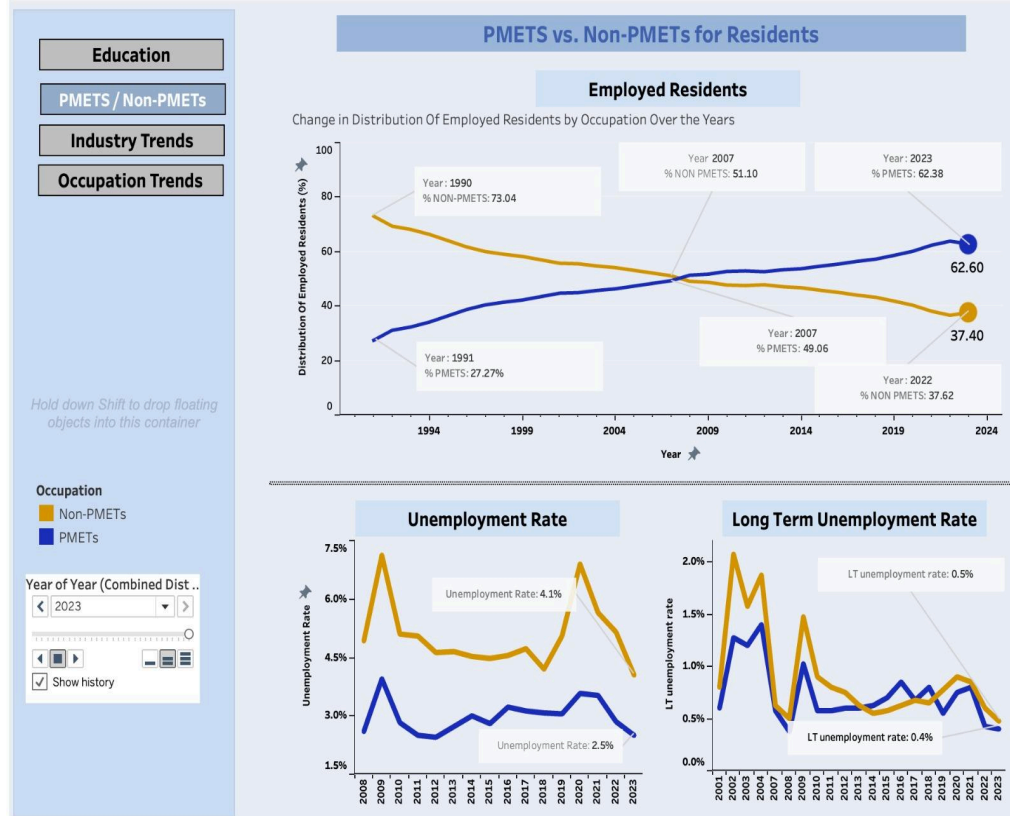
The "Career Trends & Opportunities" section focuses on exploring different aspects of employment trends and opportunities in Singapore. It includes visualisations for the distribution of employment rates over the years for PMETs and Non-PMETs, highlighting trends in employment for these categories. Furthermore, this section includes visualisations for education-employment trends, occupation trends, and industry employment changes, offering a comprehensive view of career paths and opportunities in Singapore's labour market.

The following shows the screenprint of the section :

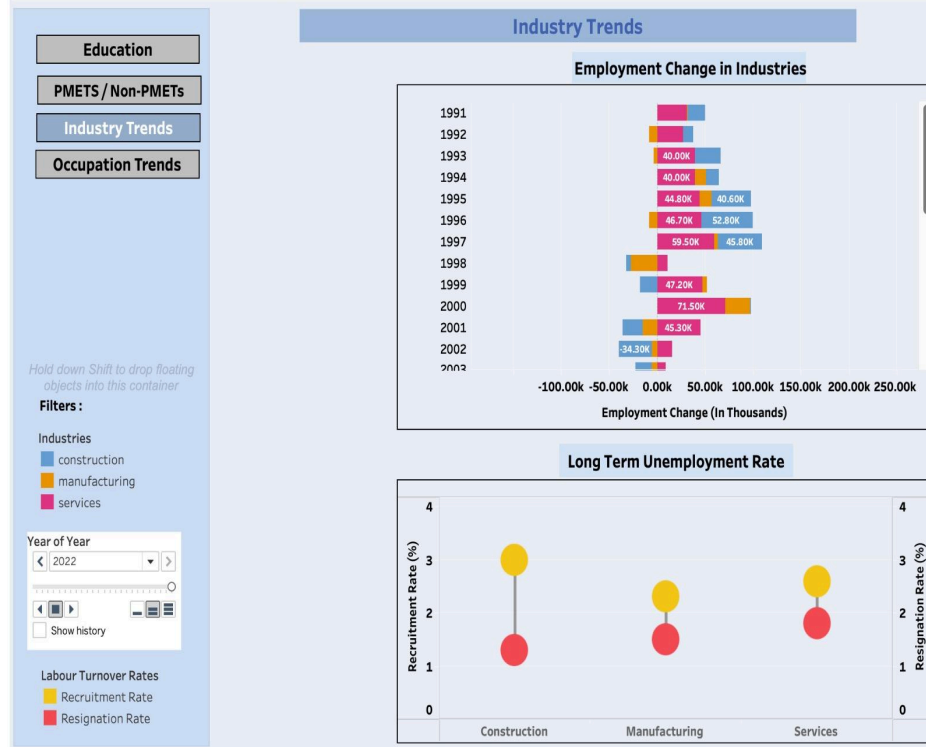
## Career Trends & Opportunities



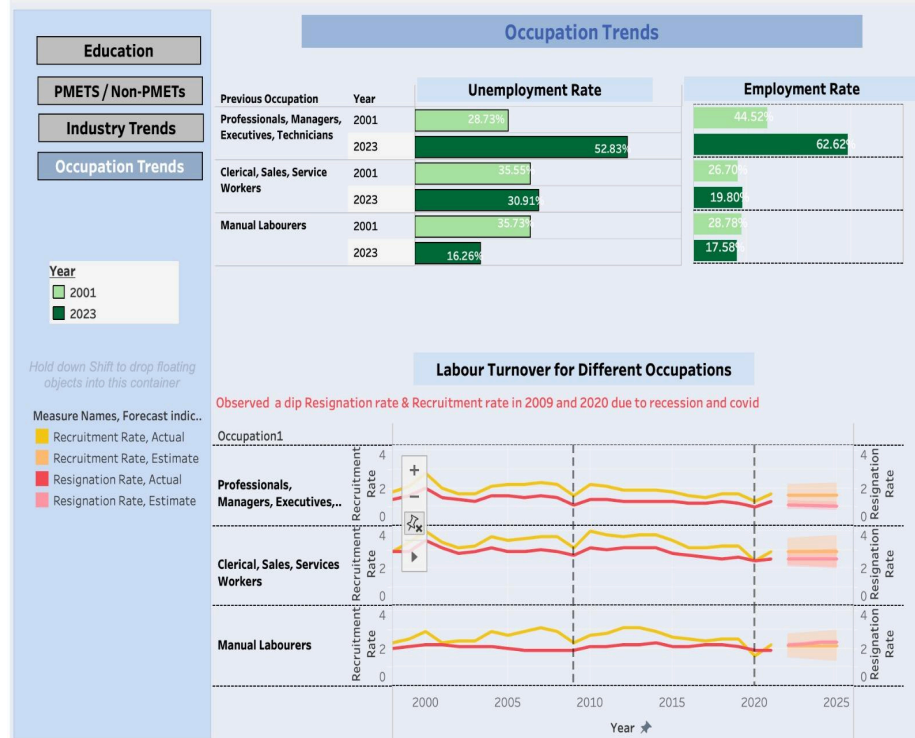
## Career Trends & Opportunities



## Career Trends & Opportunities



## Career Trends & Opportunities



## 8. Conclusion

In conclusion, this project provides a comprehensive analysis of Singapore's employment landscape using Ministry of Manpower data. Through interactive data visualisations, stakeholders such as job seekers, employers, policymakers, and the general public can gain valuable insights into industry trends, talent availability, economic factors influencing employment, and career opportunities. The project aims to bridge the gap in understanding the complexities of Singapore's labour market, empowering stakeholders to make informed decisions and contribute to the country's economic growth and workforce development.