

# TABLE OF CONTENTS

<b>QUESTION 1 LEVEL OF DECISION-MAKING AND DATA SOURCE.....</b>	<b>3</b>
1a) Level of Decision Making .....	3
1bi,ii) Data Source Identification.....	4
<b>QUESTION 2 DATA INTEGRATION .....</b>	<b>5</b>
2ai) Data Integration Techniques .....	5
2aii) Challenges Encountered .....	5
<b>QUESTION 3 DATA CLEANING AND PREPROCESSING.....</b>	<b>6</b>
3ai) Data Cleaning Steps.....	6
3bi) Data Transformation.....	8
<b>QUESTION 4 DATA VISUALIZATION AND STORYTELLING.....</b>	<b>10</b>
4ai) Key Objectives.....	10
4aii) Storyline.....	10
4aiii) Insights to be extracted.....	11
4bi) Visualization Techniques .....	11
4ci) Customization & Interactivity .....	13

**QUESTION 5 AI-DRIVEN ANALYTICS .....14**

5ai) Model Selection & Feature Used..... 14

5aii) Justification of AI Feature Choice ..... 14

5bi) Model Evaluation & Interpretation ..... 15

**QUESTION 6 CONCLUSION & DOCUMENTATION.....17**

6ai) Project Summary, Insights & Findings ..... 17

6bi) Recommendations for Stakeholders ..... 17

## **QUESTION 1 LEVEL OF DECISION-MAKING AND DATA SOURCE**

### **1a) Level of Decision Making**

The project's primary focus is built on Operational Level whereby the project aims to aid consumers in assessing the feasibility of their property purchase and rental decisions.

The Operational Level decision making objectives are defined as:

1. Assist expatriates in their decision-making by analysing and visualizing high-end and centrally located rentals.
2. Support international workers and students on finding shared accommodation and location near industrial parks and universities.
3. Provide visual for homebuyers and investors by studying affordability of property

On a macro perspective, this project also aims to study on:

- Operational Level: The primary focus is to empower individual consumers—such as first-time homebuyers, renters, and expatriates—with a personalized tool to assess property affordability. The "My Affordability Profile" dashboard directly serves this purpose by allowing users to filter property options based on their specific job title and income, answering the core question: "Based on my profile, where can I afford to live?"
- Tactical Level: The solution provides property agencies (e.g., IQI Global, PropNex) and investors with the "Investment Opportunity Explorer" dashboard. This tool enables them to identify high-potential investment areas by analyzing a custom Return-on-Investment (ROI) score, which correlates transaction volume (demand) with median prices (cost). This allows them to guide clients' buying and selling strategies effectively.

In summary, while the project centers around operational consumer guidance, it supports upward intelligence flow into tactical housing decisions.

**1bi,ii) Data Source Identification**

The data used in this study are external sources, accessed through open-source data platform Kaggle

Table 1: Data Source Overview

Data Title & Source	Data Attributes & Data Type	Purpose
House Prices in Malaysia (2025)  <a href="https://www.kaggle.com/datasets/lyhatt/house-prices-in-malaysia-2025">https://www.kaggle.com/datasets/lyhatt/house-prices-in-malaysia-2025</a>	Number of Rows: 2000 Number of Columns: 8  Data Type: Township: Nominal Area: Nominal State: Nominal Tenure: Nominal Type: Nominal Median_Price: Ratio Median_PSF: Ratio Transactions: Ratio	To analyze affordability and investment feasibility in Malaysia
Malaysia Salary Data  <a href="https://www.kaggle.com/datasets/bred54/malaysia-salary-data">https://www.kaggle.com/datasets/bred54/malaysia-salary-data</a>	Number of Rows: 1000 Number of Columns: 5  Data Type: Age: Ratio Gender: Nominal Education level: Ordinal Job role: Nominal Years of Experience: Ratio Salary: Ratio	Refines affordability analysis for specific buyer profiles, which enables the development for Affordability Index by Profile

## QUESTION 2 DATA INTEGRATION

### 2ai) Data Integration Techniques

**Measure-Based Integration:** Instead of table joins, relationships were established at the point of analysis. For instance, the `Dynamic_Affordability_Index` measure dynamically calculates the average salary based on a slicer selection from the Malaysia Salary Data table and uses it to evaluate affordability against the `Median_Price` from the House Prices table.

**Structural Transformation:** The `Type` column in the property data contained multi-valued attributes (e.g., "Cluster House, Terrace House"). This was resolved in data query by using "Split Column by Delimiter" function to extract the primary property type, ensuring data was standardized for accurate grouping and filtering.

### 2aii) Challenges Encountered

**Granularity Mismatch:** The primary challenge was the inability to directly join the datasets. This was overcome by treating them as disconnected tables and using DAX measures to bridge them, creating a flexible model where filters from one table could influence calculations across another.

**DAX Scalar Errors:** During development, "a single value for a column cannot be determined" errors were common. This occurs when a measure references a column without proper aggregation. This was resolved by using iterator functions like `AVERAGEX` or wrapping calculations in `CALCULATE` to enforce the correct filter context, ensuring a single scalar value is returned for calculations.

## QUESTION 3 DATA CLEANING AND PREPROCESSING

### 3ai) Data Cleaning Steps

**Handling Structural Errors:** The Type column in the property dataset, which contained comma-separated strings (e.g., 'Bungalow, Semi D'), was transformed. The "Extract Text Before Delimiter" function was used to create a new, clean Primary\_Type column, enabling accurate aggregation.

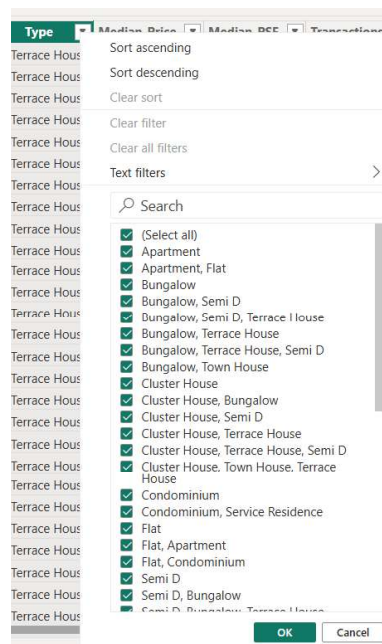


Figure 3.1 Data before structural handling with extract function

**Correcting Geocoding Errors:** Initially, the map visual incorrectly plotted Malaysian townships globally (e.g., Gurney in this dashboard meant Gurney in Penang, Malaysia but it plotted as Gurney in the USA). This was resolved by categorizing the State and Township columns appropriately in Power BI and establishing a Country -> State -> Township hierarchy in the map visual to provide the necessary geocoding context.

**Handling Missing Values:** Rows with null values for critical fields like State were identified as the cause for persistent mapping errors. These rows were removed from the dataset as they lacked the necessary context for geographic analysis.

Table.SelectRows("#Changed Type", each not List.IsEmpty(List.RemoveMatchingItems(Record.FieldValues(\_), {"",

123 Age	124 Gender	125 Education Level	126 Job Title	127 Years of Experience	128 Salary
Valid 99%	Valid 99%	Valid 99%	Valid 99%	Valid 99%	Valid 99%
Error 0%	Error 0%	Error 0%	Error 0%	Error 0%	Error 0%
Empty < 1%	Empty < 1%	Empty < 1%	Empty < 1%	Empty < 1%	Empty < 1%
163	30 Female	Bachelor's	Junior Copywriter	3	
164	35 Male	Bachelor's	Senior Marketing Coordinator	7	
165	41 Female	Master's	Senior Human Resources Ma...	13	
166	27 Male	Bachelor's	Junior Business Development...	1.5	
167	40 Female	Bachelor's	Senior Account Manager	14	
168	46 Male	PhD	Senior Researcher	18	
169	31 Female	Bachelor's	Junior HR Coordinator	4	
170	34 Male	Master's	Senior Software Engineer	9	
171	50 Female	Master's	Director of Finance	20	
172	29 Male	Bachelor's	Junior Marketing Coordinator	2	
173	null	null	null	null	null
174	43 Male	Bachelor's	Senior Project Manager	16	
175	26 Female	Master's	Junior Data Scientist	1.5	
176	35 Male	Bachelor's	Senior Operations Analyst	7	
177	42 Female	PhD	Senior Marketing Manager	18	
178	31 Male	Bachelor's	Junior Accountant	4	
179	38 Female	Bachelor's	Senior Human Resources Co...	10	
180	46 Male	Master's	Director of Operations	20	
181	29 Female	Bachelor's	Junior Sales Representative	2	
182	37 Male	Master's	Senior Business Analyst	9	
183					

Figure 3.2 Categorical data before standardizing

**Standardizing Categorical Data:** The Tenure column was cleaned by replacing redundant categories like 'Freehold,Leasehold' with a single "Both" category as shown in Figure 2.1 below.

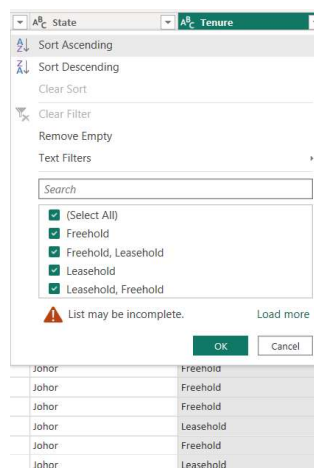


Figure 3.3 Categorical data before standardizing

**Optimizing Data Types:** Numeric columns like 'Years of Experience' were converted to Whole Number, and summarization was disabled to ensure they were treated as categorical attributes where appropriate.

**Convert data to suitable type:** Convert to suitable data type from default values and put as don't summarize in Summarization tab. For example, 'Years of Experience' in Malaysia Salary dataset is changed from decimal to whole number, with summarization off.



Figure 3.4 Data Type and Category Conversion

### 3bi) Data Transformation

To transform raw data into actionable insights, several DAX measures and calculated columns were created:

- **Dynamic Affordability Index:** A core measure was developed to dynamically calculate affordability.

Dynamic\_Affordability\_Index = DIVIDE([Median House Price], [Selected Annual Salary], 0)

This measure responds to user selections in the 'Job Title' slicer to provide a personalized score.

- **Investment Score:** To identify investment potential, a score was created to measure demand (transactions) relative to cost.

Investment\_Score =  
DIVIDE(  
SUM('tbl\_MalaysiaHousing'[Transactions]),  
SUM('tbl\_MalaysiaHousing'[Median\_Price])  
)

Investment\_Score\_By\_State =  
AVERAGEX(  
VALUES('tbl\_MalaysiaHousing'[State]),  
DIVIDE(  
CALCULATE(SUM('tbl\_MalaysiaHousing'[Transactions])),  
SUM('tbl\_MalaysiaHousing'[Median\_Price]))  
)



```
        CALCULATE(SUM('tbl_MalaysiaHousing'[Median_Price]))
    )
)
```

This measure powers the "Investment Opportunity Explorer" dashboard, helping investors find high-potential areas.

- **Top ROI Township:** A more complex measure was created to identify the name of the top-performing township for use in a KPI card.

```
Top ROI Township =
VAR TownshipScores =
ADDCOLUMNS(VALUES('tbl_MalaysiaHousing'[Township]), "@Score",
[Investment Score])
VAR TopTownshipRow = TOPN(1, TownshipScores, [@Score], DESC)
VAR Result = MAXX(TopTownshipRow, [Township])
RETURN Result
```

## QUESTION 4 DATA VISUALIZATION AND STORYTELLING

### 4ai) Key Objectives

The objective is to help operational-level decision makers especially consumers identify which townships are affordable, suitable for their job level, and worth investing in based on demand. Two primary dashboards were designed to tell distinct stories for different user personas.

#### Dashboard 1: "My Affordability Profile" (Operational)

- **Objective:** To provide a personalized, operational-level tool for a potential homebuyer to answer the question, "Based on my job, where can I afford to live?"

#### Dashboard 2: "Investment Opportunity Explorer" (Tactical)

- **Objective:** To enable a property investor to identify townships with the highest investment potential.

### 4aii) Storyline

#### Dashboard 1: "My Affordability Profile" (Operational)

- **User Story:** A user selects their 'Job Title' and 'Years of Experience'. The dashboard instantly updates to show their average salary and a color-coded bar chart of states ranked by affordability. A KPI card points them to the single most affordable township, and a map visualizes all affordable locations.
- **User Journey (local homebuyer in Malaysia):** Mr Abdullah is a new user of this dashboard. He starts by selecting his profession in the 'Job Title' slicer. This action immediately personalizes the entire dashboard, revealing their estimated average salary and dynamically calculating an 'Affordability Index' for all states. Mr Abdullah can then see immediately which states are financially viable, with the bar chart providing a comparative view and the KPI card highlighting the single most affordable option.

#### Dashboard 2: "Investment Opportunity Explorer" (Tactical)

- **User Story:** An investor filters by 'State' and 'Property Type'. An area chart ranks townships by a custom 'ROI Score'. The map highlights these locations, and a KPI card identifies the top investment township, allowing the user to quickly find market "hotspots".

#### 4aiii) Insights to be extracted

**Insight 1:** A Data Analyst earning RM3691/month can afford homes in Perak but not in KL, where the affordability index exceeds 10× their income.

**Insight 2:** Townships in Johor like Kulai have high transaction volumes but mid-range prices, showing strong investment potential.

**Insight 3:** Young professionals are priced out of high-PSF zones like Penang Island and central KL.

#### 4bi) Visualization Techniques

To enhance usability, specific design choices were made:

- **Conditional Formatting:** The affordability bar chart uses a red-orange-green color scale (#D94545, #F5B964, #77B773) to provide immediate visual cues for affordability levels (Unaffordable > 70 percentile, Moderate > 40 percentile, Affordable < 30 percentile).
- **Clear Titling:** Each dashboard has a clear, action-oriented title ("My Affordability Profile", "Investment Opportunity Explorer") to frame the user's purpose.
- **Cards:** These provide immediate, high-level answers. The 'Selected Job Avg Monthly Salary' card confirms the input for the calculation, while the 'Most Affordable Township' card offers a direct, actionable recommendation.
- **Slicers (Job Title, State, Area):** These serve as the primary interactive controls, allowing the user to filter the entire dataset to match their personal context.

- **Bar Chart** (Affordability Index by State): This chart provides a comparative analysis, allowing the user to quickly identify which states are the most and least affordable relative to their income.
- **Map**: A map visual plots each township or area in Malaysia using geographic data, helping users visually identify affordable or high-ROI locations. The bubble size represents the number of property transactions, while the color saturation indicates the Affordability Index or Investment Score

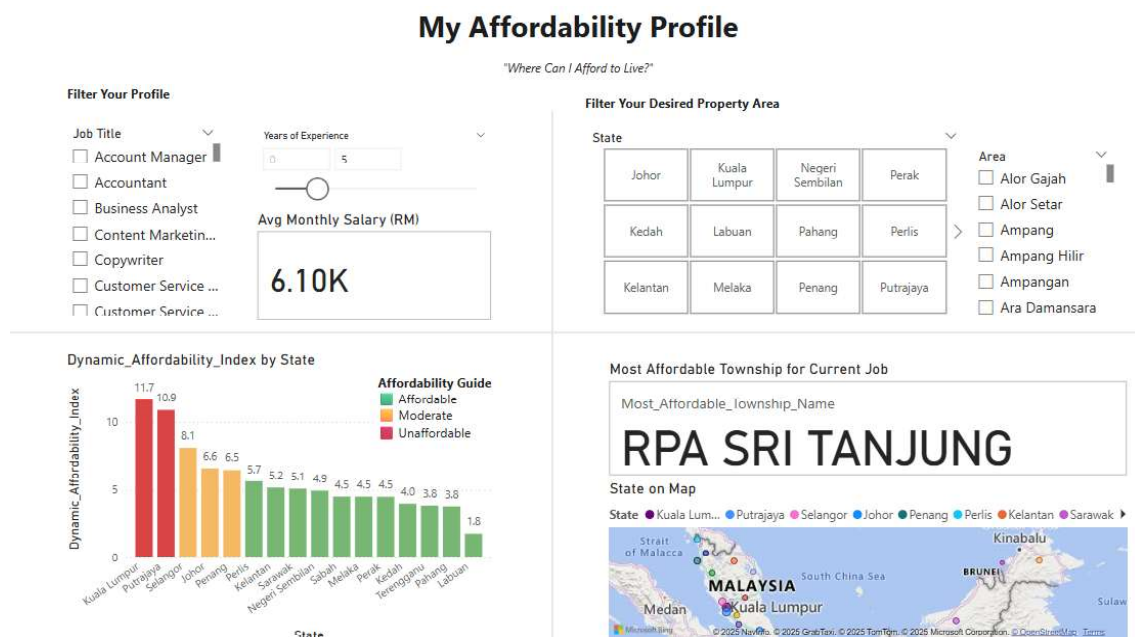


Figure 4.1 Created dashboard: My Affordability Profile

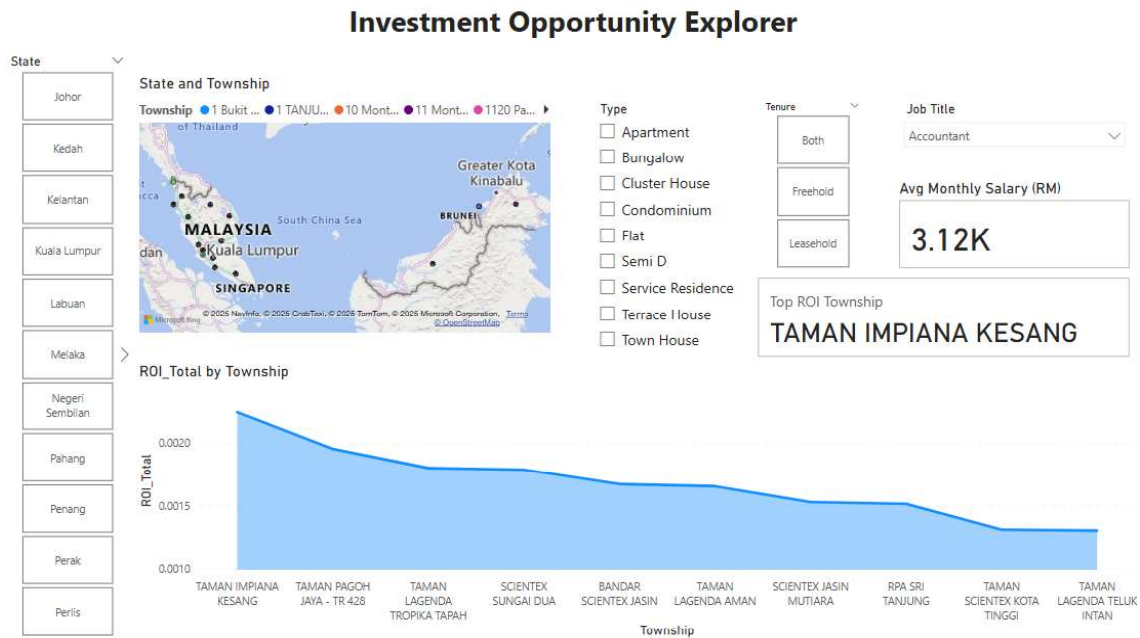


Figure 4.2 Created dashboard: Investment Opportunity Explorer

#### 4ci) Customization & Interactivity

The dashboards are designed to be highly interactive, by using a series of DAX measures. Slicers for Job Title, State, Type, and Tenure allow users to customize the view. All visuals are cross filtered, so clicking on a state in a slicer updates the map, charts, and cards in real-time.

For instance, when a user selects a Job Title, a default `SelectedValue()` function by PowerBI captures this choice. A measure then calculates the average salary for this job. This salary figure is then used in the `Dynamic_Affordability_Index` measure, which divides the median house price of each state/township by the selected salary. Because these are measures, the bar chart and cards recalculate instantly with every new selection, providing a seamless and dynamic user experience.

## **QUESTION 5 AI-DRIVEN ANALYTICS**

### **5ai) Model Selection & Feature Used**

The Key Influencers visual was the primary feature used to analyze the factors driving the Affordability Index. The analysis was configured to explain what influences the property to be unaffordable, using the following features as potential drivers: State, Primary\_Type, Tenure, and Median\_PSF. Other than that, narrative summary is used to generate a summary of each dashboard page for reporting purposes.

### **5aii) Justification of AI Feature Choice**

The insights this study hopes to find from the data using AI is: "What factors most strongly influence a property to be unaffordable?"

In this case, the Key Influencer feature is ideal for this project as it automates statistical analysis and presents the results in an easily interpretable format, perfect for a business audience. It quantifies the impact of different factors, removing guesswork. On the other hand, Narrative feature is used to generate a text summary of each BI page for better accessibility.

5bi) Model Evaluation & Interpretation



Figure 5.1

Based on the AI driven insights by ‘Key Influencer’ feature, the analysis revealed that the most significant factor increasing unaffordability is Property Type = 'Bungalow', which on its own increases the likelihood of a high affordability index by 3.5 times. The second key influencer is State = 'Kuala Lumpur', followed by Tenure = 'Freehold'. These findings confirm the hypothesis that high-value property types in highly urbanized, prime locations are the primary drivers of unaffordability in the Malaysian market. States with high urbanization like KL, Penang rank as least affordable. Salary below RM4000 yields affordability only in 5–10% of townships.

Table 5.1 Narrative Summary from Power BI’s AI Visual

Page	AI Summary
My Affordability Profile	At 11.65, Kuala Lumpur had the highest Dynamic_Affordability_Index and was 556.42% higher than Labuan, which had the lowest Dynamic_Affordability_Index at 1.77.

Investment Opportunity Explorer	Taman Impiana Kesang had the highest ROI_Total and was 71.30% higher than Taman Lagenda Teluk Intan.
AI Driven Insight	The probability of Affordability Category (Percentile) being 'Unaffordable (Top 30%)' increased the most (42.57 times) when Median_PSF went up by 193.23. 10 other factors also influenced Affordability Category (Percentile) to be 'Unaffordable (Top 30%)', explore them in the key influencers visual.



## QUESTION 6 CONCLUSION & DOCUMENTATION

### 6ai) Project Summary, Insights & Findings

This project successfully developed a Business Intelligence solution that translates raw property and salary data into actionable insights for operational, tactical decision-makers. By creating two interactive dashboards, the project addresses the core questions of personal affordability and investment potential in the Malaysian property market.

"My Affordability Profile" dashboard is built to help local homebuyers to discover affordable townships outside of primary urban centers with salaries calculated from job title and years of experience. "Investment Opportunity Explorer" dashboard is built to help agencies to guide clients, expats and investors to identify towards high-ROI townships.

#### Key Findings:

**Significant Affordability Gap:** There is a pronounced affordability gap for entry-level professionals, particularly in central urban areas like Kuala Lumpur and Penang.

**Investment Potential in Emerging States:** States like Johor and Perak demonstrate a strong balance of high transaction volumes and moderate prices, indicating significant investment potential.

**Data-Driven Influencers:** AI analysis confirmed that property type and state are the strongest statistical predictors of property prices and, consequently, unaffordability.

- Entry-level professionals (e.g., Sales Associate, Data Analyst) are priced out of most central areas in KL and Penang.
- Shared accommodation options are scarce in transaction data—future datasets should enrich this view.
- Johor and Perak offer balanced affordability + investment potential.

### 6bi) Recommendations for Stakeholders

Stakeholder	Recommendation
Expatriates	Focus investment searches on freehold condominiums in areas with high transaction volumes (e.g., Kulai, Seberang Perai), as identified in the tactical dashboard, to ensure liquidity.

<b>Malaysian Professionals, Homebuyers</b>	Townships beyond urban cores like Johor, Perak, and Tapah is a relatively good choice to invest from affordability perspective.
<b>Property Agencies</b>	Guide clients towards high-ROI townships in states like Johor and Melaka.