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A Business Intelligence Approach to Analysing Youth Unemployment Trends and Provincial Disparities in Indonesia (2021–2025)

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ABSTRACT

Youth unemployment continues to be a significant challenge in Indonesia, reflecting structural constraints in labour market absorption and regional disparities. This study aims to analyse youth unemployment trends and provincial differences using a Business Intelligence (BI) dashboard approach based on data from the National Labour Force Survey (SAKERNAS) covering 38 provinces during the period 2021–2025. The analysis integrates trend observation and comparative benchmarking to evaluate temporal dynamics and provincial performance relative to the national average. The results indicate that youth unemployment exhibits fluctuating patterns without sustained improvement. At the provincial level, significant disparities are observed, with several provinces such as Maluku, Banten, Aceh, and Jawa Barat consistently recording higher unemployment rates compared to the national benchmark and there is a total of 22 provinces identified as high-risk regions. From this study, the implementation of the BI dashboard enables to integrate the multiple analytical perspectives into a single interface, facilitating clearer interpretation of trends, regional differences, and priority areas. This study contributes by demonstrating how BI-based analytical approaches can enhance the interpretation of labour market data and support data-driven decision-making. The findings highlight the importance of region-specific strategies in addressing youth unemployment, as national-level policies may not adequately capture local dynamics.

A. INTRODUCTION

Youth employment represents a persistent structural challenge in the economic development of Indonesia, especially in the context of demographic transition and labour market expansion. At the global level, young individuals aged 15–24 consistently experience higher unemployment rates compared to other age groups, reflecting structural barriers in transitioning from education to employment (International Labour Organization, 2024; McGuinness et al., 2018; O'Higgins, 2025). In Indonesia, this issue is equally critical. According to the data from the National Labour Force Survey (SAKERNAS), the rate of unemployment in Indonesia has remained significantly higher than the overall unemployment rate (Pratomo et al., 2025; Zahra et al., 2025). Furthermore, according to data from the Central Bureau of Statistics (BPS-Statistics, 2025), the youth unemployment rate (aged 15-24) in Indonesia reached approximately 16.5% as of February 2025, equivalent to around 3.6 million individuals who remain unemployed

despite being part of the labour force. This condition highlights the substantial barriers young job seekers face in securing employment.

This persistence of youth unemployment cannot be attributed to only a short-term economic issue, but also reflects a deeper structural problem in identifying and developing the young potential. Previous studies highlight that youth unemployment is strongly associated with structural factors such as Skills mismatch, unequal access to education and training, and disparities in regional economies (McGuinness et al., 2018; Pratiwi, 2025; Septiana & Utomo, 2025; Yanindah, 2022). Research by Septiana and Utomo (2025) found that educational background, regional inequality, and urban labour competition significantly influence youth unemployment among educated workers in Indonesia. Similarly, Wafi and Kafa (2024)emphasised that labour market mismatch and unequal employment opportunities contribute to persistent unemployment among young individuals. Other studies also highlight that youth workers are particularly vulnerable to economic instability and structural changes in the labour market, especially following the COVID-19 pandemic (Pratomo et al., 2025).

In Indonesia, variations in industrial structure, investment distribution, and employment opportunities across provinces contribute to uneven labour market outcomes (Witta & Handra, 2025). Youth unemployment cannot be understood or adequately addressed through national statistics alone. A more analytical approach is therefore required for better decision-making in the development focus for each part of Indonesia. Despite the availability of statistical data, current analytical practice remains descriptive and fragmented according to ad hoc analytical needs (BPS-Statistics, 2026; Wafi & Kafa, 2024). Existing reports are commonly presented in static tabular or descriptive formats, making it difficult to identify temporal patterns, regional disparities, and priority areas simultaneously. In addition, previous studies rarely integrate comparative benchmarking between provincial and national unemployment conditions within a single analytical environment. Consequently, policymakers may face challenges in interpreting labour market dynamics efficiently and identifying regions requiring greater attention. To address this gap, this study proposes the implementation of a Business Intelligence (BI) dashboard to support integrated analysis of youth unemployment trends and provincial disparities in Indonesia.

Business intelligence (BI) has been well known in the business environment to help data-driven decision-making in a holistic view. It provides a data-driven approach to address business problems by transforming raw data into structured, interactive, and analytically meaningful visualisations (Sharda et al., 2020; Tirupati et al., 2023; Turban et al., 2011). BI enables users to explore trends, compare regional performances, identify anomalies, and interpret key indicators within a single interface (Picozzi et al., 2024; Tirupati et al., 2023).

In the public sector, BI has been increasingly playing a significant role in supporting decision-making by providing accurate and timely insight (Larasati et al., 2024; Tandilino et al., 2025; Wowczko, 2016). BI in public policy has been adopted to provide strategic information and derive data-driven decision-making (Hartley, 2015; Manikam et al., 2019). It is employed in many sectors and areas such as geospatial analysis, financial projection, market size and growth, etc. Recent studies also demonstrate the effectiveness of interactive BI dashboards in visualising regional trends and supporting policy interpretation through integrated analytical interfaces (Rosnita et al., 2025). In the context of labour market analysis, a BI dashboard is relevant to identify patterns of disparities and deviations to support evidence-based policy formulation. Furthermore, the integration of multiple analytical perspectives within a single dashboard can assist

policymakers in identifying regions with unfavourable patterns and potential labour market risks more efficiently.

This study aims to develop a business intelligence dashboard to analyse youth unemployment trends and provincial disparities in Indonesia from 2021 to 2025. The study focuses on: (1) examining temporal trends in youth unemployment, (2) comparing provincial unemployment rates with national benchmarks, and providing an analytical framework to support the interpretation of regional labour market conditions. By integrating trend analysis and comparative evaluation within a dashboard, this study contributes to the application of BI in socioeconomic analysis and supports more informed decision-making in the public sector.

Although this study focuses on descriptive and comparative analytics, the proposed BI dashboard provides a foundation for future analytical development. The integration of additional sectoral variables, such as educational attainment, industrial employment structure, and regional economic indicators, may further enhance the analytical capability of the dashboard and support more comprehensive policy evaluation. In addition, future studies may extend this approach by incorporating predictive analytics to strengthen early identification of labour market risks.

B. METHODS

This study focuses on descriptive and comparative analytics to identify temporal trends and regional disparities in youth unemployment. Therefore, the analysis emphasises visualisation-based interpretation and benchmarking rather than causal or determinant modelling. The dashboard is intended to support exploratory and decision-support analysis, while investigation of causal relationships and determinant factors may be considered in future studies. The methodology comprises data preparation, analytical modelling and interactive visualisation to transform raw data into meaningful insights. The detailed methodology stage is illustrated in **Figure 1**.

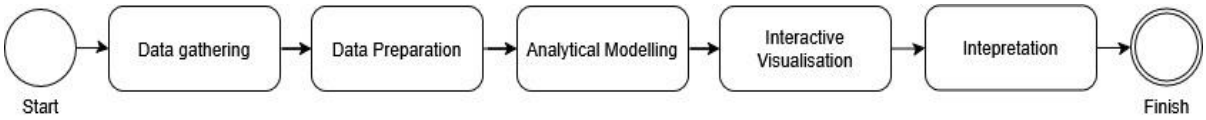

Figure 1. Research Methodology

1. Data Preparation

The data used in the study is public data obtained from the National Labour Force Survey (SAKERNAS) published by the Central Bureau of Statistics (BPS). The dataset consists of 38 provinces in Indonesia over the period 2021-2025, which are separated into two periodical surveys between February and August in each year. The main variables include youth unemployment rate (aged 15-24), overall or national unemployment rate, province, and year.

Data preparation in this study consists of several stages, beginning with data cleaning, data transformation and ending with data validation. First, data cleaning is conducted to ensure completeness and consistency across years, including missing values and aligning variable formats.

Second, data transformation takes the biggest part of the data preparation stage, in which the raw material is transformed and integrated into a single scheme called the star schema. Star schema modelling is widely used in Business Intelligence systems because it enables efficient analytical processing and simplifies multidimensional data exploration (Kirmani, 2017; Turban et al., 2011). The star modelling in the study is designed in a single

table fact named *fact_UnemploymentRate*, which is circulated by two dimensions called *dim_Province* and *dim_DateSurvey* with a one-to-many table relation to the fact tables. The detailed dimensional modelling of the study can be seen in **Figure 2**.

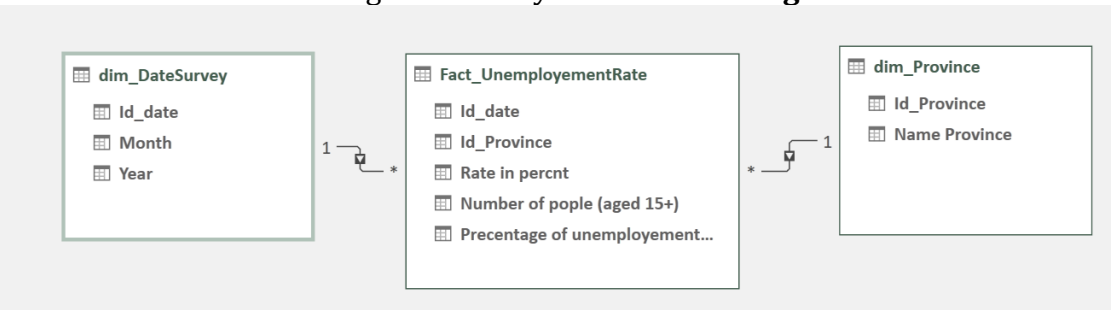

Figure 2. Star scheme of the dataset

Third, data validation is carried out to ensure the consistency of the data after transformation with the official statistical publication by BPS. The data are cross-checked to ensure that all values are consistent. The consistency validation is applied to ensure uniform variable definitions and measurement units across the dataset.

2. Analytical Framework and Indicators

The analytical framework is designed to capture temporal dynamics and regional disparities in youth unemployment. Both analytical frameworks are used to identify the data pattern and trends, then identify the anomalies to make an early warning dashboard comparing the provincial rate with the national benchmark. The analytical framework is based on the analytical questions:

The first analytical question is which provinces exhibit increasing trends in youth unemployment during the period 2021–2025. Trend analysis is applied to evaluate changes in youth unemployment rates over the period from 2021 to 2025. It identifies patterns such as increasing, decreasing, or stable across provinces. The analysis does not solely present the increasing trend but also tries to reveal unique or unusual trends in the data. The second question is to compare provincial youth unemployment rates with the national average. This analytical dimension aims to trace the province's rate, whether it has passed or not passed the national rate. Here, the comparative analysis is conducted to compare each province's rate with the national benchmark. This approach is used to assess relative performance and identify the province that is consistent with the national rate. Lastly, the third analytical query is to identify which provinces can be identified as higher-risk regions based on the combination of trend patterns and relative performance. This analytical framework is designed to find how many and which provinces need more attention in tackling the unemployment rate.

Furthermore, to operate those frameworks, several indicators are defined in the following **Table 1**.

Table 1. Analytical Indicators

No	Indicator	Description	Formula / Tableau Calculation	Measurement Rule
1	Youth Unemployment Rate (%)	Proportion of unemployed individuals aged 15–24 within the youth labor force	SUM([Unemployed_Youth]) / SUM([Labor_Force_Youth]) * 100	Calculated per province and year
2	National Average Youth Unemployment	Average unemployment rate across all provinces	WINDOW_AVG(AVG([TPT_Youth]))	Computed per year across provinces

No	Indicator	Description	Formula / Tableau Calculation	Measurement Rule
3	Provincial Average (2021–2025)	Average unemployment rate per province over the observation period	AVG([TPT_Youth])	Aggregated across years
4	Trend (National)	Overall direction of unemployment change over time	Visual (line chart)	Interpreted from time-series pattern
5	Provincial Trend	Direction of change in unemployment at provincial level	Visual (multi-line chart)	Categorized as increasing, stable, or decreasing
6	Deviation from National Benchmark	Difference between provincial value and national average	AVG([TPT_Youth]) - [National_Avg]	Positive = above national (worse), Negative = below
7	High-Risk Classification	Identification of provinces with unfavorable conditions	Logical combination: High value + unfavorable trend	Determined from trend + relative position
8	Number of High-Risk Provinces	Count of provinces classified as high risk	COUNTD(IF [Risk] = "High" THEN [Province] END)	Aggregated count

These indicators are implemented within Tableau using calculated fields and table calculations. The integration of these indicators enables the dashboard to support structured interpretations and identification of regional disparities in youth unemployment.

3. Dashboard Development

The BI dashboard of the study is developed using Tableau as the visualisation to integrate analytical analysis and interactive data exploration. The dashboard is designed to support both overview analysis and detailed investigation of the raw data. The visualisation design includes multiple chart types such as Line charts, Bar Charts, and KPI to summarise critical information. The multiple chart types are chosen to specifically represent the data along with the analytical framework. The line chart is designed to represent the trend by year and identify the changes per year. Moreover, the choice of bar chart was implemented to easily analyse the comparison of values among the provinces and the national benchmark. The choices of the type chart are justified according to how the chart type can tell a story of the data (Santoso et al., 2026; Williams & Watson, 2016).

Furthermore, interactive features such as filtering by province and by month survey are incorporated to allow users to individually explore the dataset. The dashboard is designed to reveal the risk province according to a national benchmark. From an analytical perspective, the dashboard is not only a visualisation tool but also an interface for interpreting data. By integrating trend analytics and comparison analysis in a single visualisation, the dashboard supports more efficient identification of the trend pattern and the gap in the data.

C. RESULT AND DISCUSSION

To support the analysis of youth unemployment trends and regional disparities, a BI dashboard was developed to integrate multiple analytical perspectives in an interactive single interactive interface. The dashboard shows the key indicators, trend, comparative performance across provinces and risk-based regional prioritisation. At the header row

of the dashboard, the summarised national-level indicators are presented, such as the unemployment rate, the number of provinces, the total working age population, and the number of provinces categorised as a high risk. The dashboard integrates three main analytical components, such as visualisation representing a changing trend over time, a comparative evaluation between province and national benchmark, and a chart that indicates the risk province by making a rank from the most prioritised risk province.

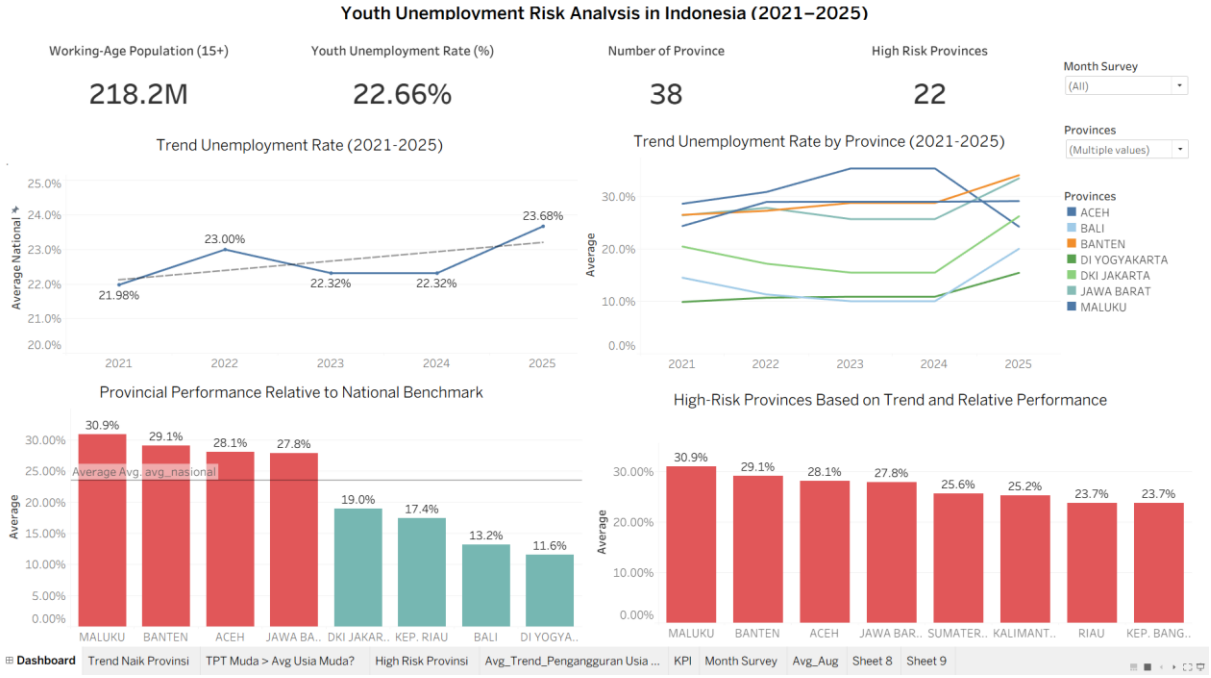

Figure 3. Youth Unemployment BI Dashboard

According to **Figure 3**, the dashboard summarises the key indicators related to the youth unemployment rate in Indonesia. The result indicates that the youth unemployment rate in Indonesia reaches about 22.66 %, while the total working-age population (aged 15 and above) amounts to approximately 218.2 million individuals. It reflects a substantial proportion of young individuals who are unable to secure their jobs. The relatively high percentage suggests that the transition from education to employment remains a critical challenge. From a structural perspective, this condition might indicate a mismatch between the skills possessed by young workers and the demands of the labour market, as well as the availability of job opportunities. The scale of the working-age population also emphasises the critical issues. With more than 218 million people in the working-age category, the moderate increase in the rate might affect a significant number of individuals. Although the working-age category includes all individuals aged above 15, the disproportionately high unemployment rate among youth indicates that younger cohorts are more severely affected compared to the overall population. Furthermore, another important insight derived from the KPI card is that there are 22 provinces identified as high-risk positions out of a total of 38 provinces. This means that more than half of the provinces in Indonesia highlight relatively unfavourable youth labour market conditions. This proportion indicates that youth unemployment is not only in isolated regions but also represents a widespread challenge across the region in Indonesia.

The data show that the combination of a high youth unemployment rate and a large number of high-risk provinces suggests that the issue is both quantitatively significant and geographically extensive. From an analytical perspective, it indicates that the labour market challenges are not only always related to the overall job availability but also to

regional disparities in economic development. These KPI-level findings provide a critical summary and baseline for further analysis.

The single line chart in **Figure 3** indicates that youth unemployment in Indonesia fluctuates over the period of 2021-2025, with an overall tendency towards stagnation between 2023 and 2024 and a sharp increase to 23.68% in 2025. This pattern indicates that the improvement in youth unemployment is not sustained over time. From an analytical perspective, the stagnation between 2023 and 2024 can be interpreted as a phase of limited adjustment, where the labour market is able to maintain but not significantly improve employment outcomes for youths. However, the surge in 2025 reinforces the interpretation. An increase after a period of stability suggests that the labour market continues to face challenges in economic conditions. This may be associated with factors such as the influx of new labour force entrants, insufficient alignment between education and industry needs, and limited expansion of employment opportunities in high-demand sectors. In this context, the trend analysis provides an important foundation for understanding the dynamics of youth unemployment, as it reveals not only direction change but also instability of the labour market over time.

At the provincial level, the pattern varies quite a bit across the regions, indicating heterogeneous labour market dynamics in Indonesia. By focusing on provinces with more pronounced trend patterns, the dashboard highlights three general trajectories: increasing, stable, and decreasing trends over the period 2021–2025. Several provinces demonstrate increasing trends, particularly towards the later years of observations. In contrast, a small number of provinces, such as Aceh and Maluku, show a slight decrease in unemployment rates in 2025. However, despite the decline, both provinces continue to exhibit relatively high unemployment levels compared to the other regions, indicating that these declines represent only marginal improvements within persistently unfavourable conditions. Meanwhile, the regions' experience increasing trends suggest worsening employment conditions, while stable or declining indicates relatively better labour market conditions. The variations highlight the importance of analysing unemployment at the regional level rather than only relying on the national aggregate.

In accordance with the bar chart comparing the unemployment rates of each province with the national threshold, provinces such as Maluku, Banten, Aceh, and Jawa Barat demonstrate the highest unemployment level related to the national benchmark, exceeding 27%, significantly higher than the national benchmark, which is only at 23%. In contrast, provinces such as DI Yogyakarta, Bali, and Kepulauan Riau consistently remain below the national average, indicating comparatively more favourable labour market conditions; notably, DI Yogyakarta records the lowest unemployment rate, with only 11.6%, suggesting a stronger capacity for youth employment absorption. The wide gap between the highest and the lowest provinces pronounced regional inequality, implying that the national-level improvement does not deliver evenly across regions. From the analytical perspectives, this deviation from the national benchmark serves as a critical indicator identifying the disadvantaged provinces and underscores the importance of region-specific policy interventions.

Furthermore, the bar chart illustrating the ranking of high-risk provinces highlights a clear concentration of vulnerability in several regions. It consistently shows Maluku, Banten and Aceh are the most unfavourable provinces, indicating a significant need for specific treatment. These provinces are followed by Sumatra Selatan and Kalimantan Barat, with unemployment rates of approximately 25,6% and 25.2% respectively, while Riau and Kepulauan Bangka record similar values at around 23.7%. The clustering of

these provinces within a relatively high range suggests that youth unemployment challenges are not isolated but rather widespread across multiple regions.

The disparities observed across provinces may also be associated with differences in regional economic structure, educational attainment, and employment infrastructure. Provinces with limited industrial diversification and lower availability of formal employment opportunities may experience greater difficulty in absorbing young workers into the labour market. In addition, variations in access to education and workforce preparation programs can influence the readiness of youth to meet labour market demands. Regions with stronger economic activity and broader employment ecosystems tend to demonstrate relatively lower unemployment rates, while provinces with more constrained economic conditions are likely to face persistent labour market challenges. Although these factors are not empirically tested in the current study, they provide important contextual explanations for understanding provincial disparities in youth unemployment.

Overall, the result indicates that the youth of unemployment in Indonesia is characterised by fluctuating trends and significant disparities. The combination of trend analysis, comparing benchmarks, and risk ranking can reveal the provinces with persistence and worsening conditions. In this context, a BI dashboard provides data-driven decision-making by integrating this analytical perspective into a single interactive interface. The findings note that youth unemployment is a widespread structural issue requiring targeted and region-specific policy responses.

D. CONCLUSION AND SUGGESTIONS

This study demonstrates that integrating trend analysis and comparative benchmarking within a Business Intelligence framework provides a structured approach for analysing youth unemployment across provinces in Indonesia. The use of a dashboard enables the transformation of fragmented statistical data into coherent insights, supporting clearer interpretation of temporal dynamics and regional disparities, as well as identification of provinces that require greater analytical attention.

For future development, the analysis can be enhanced by incorporating additional variables such as education level, sectoral employment, and regional economic indicators to provide deeper explanatory insight. Further research may also extend this approach by integrating predictive techniques, statistical modelling and more granular data to strengthen the analytical capability and support more precise, data-driven decision-making.

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