

Business Understanding

Sustainable Development Goal

Goal 6 Ensure availability and sustainable management of water and sanitation for all [\[UN\]](#)

Target 6.1 By 2023, achieve universal and equitable access to safe and affordable drinking water [\[UN\]](#)

Indicator 6.1.1 Proportion of population using safely managed drinking water services

“I see four key areas to accelerate results and change the present situation. First — closing the water management gap. Governments must develop and implement plans that ensure equitable water access for all people while conserving this precious resource.”

‘Bring the Water Action Agenda to life’, Secretary-General urges conference, calling for Game-Changing commitments on world’s most important resource | Meetings coverage and press releases. (2023, March 22). <https://press.un.org/en/2023/sgsm21737.doc.htm>

Problem statement

Access to safe drinking water is a major public health issue in Indonesia, affecting millions of lives. Large parts of the population still rely on unsafe water sources, despite efforts made to improve access to safe water supplies. It is estimated that **192 million people** - almost **70% of the local population** - lack access to safe water. This makes the issue both urgent and critical for public health, economic development, and overall well-being.

Research question

What is the relationship between GDP per capita and public access to safe drinking water in Indonesia? What is the impact of Official Development Assistance (ODA) on access to safe drinking water?

Introduction

Water is one of the basic resources for life and well-being for humans. However, the problem of access to safe drinking water affects a significant portion of the Indonesian population. Despite various initiatives targeted at improving water infrastructure, an estimated **192 million people** - almost **70% of the population** - still rely on unsecured water sources. This situation has wide-ranging impacts, extending beyond public health to affect economic stability and overall social well-being.

In a country like Indonesia, understanding how economic factors relate to safe drinking water access is essential. This research investigates how economic growth indicators, such as GDP

per capita and Official Development Assistance (ODA), correlate with improvements in safe drinking water access. By analyzing these factors for Indonesia and comparing them to other countries in the region, this study aims to reveal insights into how economic growth influences public health outcomes and infrastructure improvements.

Data Understanding

This research project utilizes multiple data sources to analyze the correlation between GDP per capita, Official Development Assistance (ODA) in U.S. dollars, and improvements in access to safe drinking water. Data on safe drinking water access was obtained from the United Nations dataset, which tracks the proportion of the population using safely managed drinking water in percentages. GDP data was sourced from the “Our World in Data” dataset for the period 2000-2022. For the analysis, GDP is measured in International Dollars (Int-\$) at Purchasing Power Parity (PPP) to provide accurate comparisons of economic capacity across countries. The dataset includes the following variables: country name, year, location, population, proportion of the population using safely managed drinking water (in %), and GDP (International-\$).

These variables are crucial for exploring the relationship between GDP per capita and improvements in safe drinking water access. Through this analysis, the study aims to offer insight into the influence of economic factors on the accessibility of safe drinking water.

Initial data quality challenges

Several data quality issues were found during the analysis, such as data type mismatches, incomplete records, typos and misspellings. Some fields had mismatched data types, such as numeric data stored as text or inconsistent date formats, impacting data processing and interpretation. In some cases, records were missing relevant information, affecting data completeness and the reliability of insights. Lastly, typos and misspellings in text fields can compromise data quality, affecting accurate categorization and filtering.

Initial Insights

The initial exploration of the data revealed that larger economies, such as Singapore, typically have no issues with access to safe drinking water. This preliminary analysis indicated a strong correlation between high GDP levels and near-universal access to safe drinking water, suggesting that economic strength may play a significant role in supporting infrastructure for safe water accessibility.

Data Preparation

The data preparation was mainly conducted in Power BI – Power Query. The main objective was to guarantee high-quality data relevant to research questions.

Tools and Methods Used to handle data issues

To tackle data issues, I used Power Query for initial troubleshooting. Data type mismatches were resolved by adjusting column data types to appropriate formats, ensuring consistency across the datasets. I standardized country names manually to align with a uniform format across all datasets, correcting casing discrepancies where needed. Records irrelevant to the dashboard's range were excluded, keeping only countries within Southeast Asia.

Excel was then used to calculate average change ratios for GDP per capita and water access for GDP per capita and water access. The new metrics were added to the Safe Drinking Water dataset to improve analysis.

For missing values, I adopted a strategy that highlights the regional situation without dividing the data into rural and urban sectors, as some details were unavailable at that level. It was necessary to convert the data's format from the wide format table to the long format table. On this purpose I used Jupiter Notebook in Python.

Modeling

The dashboard emphasizes descriptive and correlation analysis rather than predictive modeling. It applies several techniques to examine the relationship between GDP and safe drinking water access, as well as between Official Development Assistance (ODA) and safe drinking water access.

Descriptive analysis

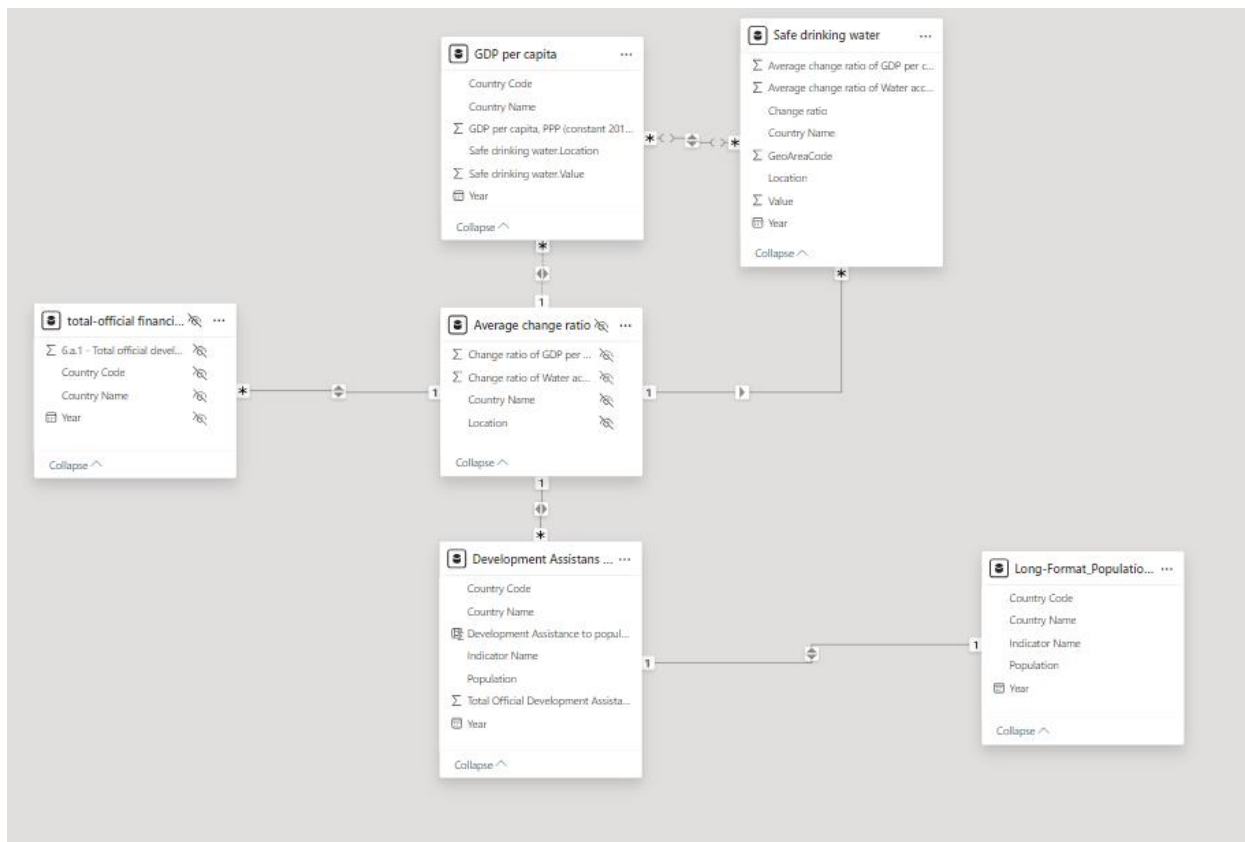
Descriptive analysis was conducted to summarize key data points across various countries and regions. The visuals describing safe drinking water access and GDP per capita are of the same type. In the dashboard, a map provides a geographic overview, and a line chart shows changes in key metrics over time, helping to highlight trends and patterns across different countries and regions. To summarize central tendencies, a card displays the median value across all given countries in that region. For the median, I obtained a value of **57.4%** for all areas (rural and urban) for water access. When it comes to the median GDP per capita in this region, the value is **\$11,800**. the median was chosen over the mean because the values are widely distributed.

Diagnostic analysis and Comparative Case Studies

The diagnostic analysis and comparative case studies investigate why Indonesia's access to safe drinking water remains low. Interestingly, despite Indonesia having a higher GDP per capita (\$9,160) than Cambodia (\$3,130), Cambodia's access rate to safe drinking water is significantly higher at 2.49% compared to Indonesia's 1.15%. The water access and GDP per capita correlation coefficient is 0.5589. To understand this disparity, I compared Official Development Assistance (ODA) for each country. Although Indonesia receives more total ODA, Cambodia's ODA per capita is higher, suggesting more effective resource allocation per person. This insight highlights that Indonesia's slower improvement in water access is partly due to lower ODA funding on a per-person basis, providing a clearer view of one factor impacting Indonesia's safe drinking water access.

Model View

The dashboard's view model is outlined below. Its structure resembles a star schema, except for one connection. This design allowed us to achieve the desired appearance for the dashboard.



Data Model View Power BI

Evaluation

Meeting Business Objectives

The dashboard effectively meets the business objectives by offering valuable insights into the relationships between GDP, Official Development Assistance (ODA), and access to safe drinking water. The visualizations play a significant role in conveying this information clearly, allowing users to grasp the current situation in the region. Key features, including maps, scatter plots, matrices, line charts, slicers, and cards, visually represent the connections between these economic factors and safe drinking water access. These interactive elements enhance user engagement, making it easier to explore data and identify trends or correlations that can inform decision-making and policy development.

Limitations of the Analysis

While the analysis successfully meets its business objectives, several limitations should be considered. Significant data quality issues were present, including gaps in information, such as the lack of data for Thailand and insufficient detail on rural and urban regions in Malaysia. Additionally, data type mismatches and inaccuracies stemming from typos and misspellings could undermine the credibility of the findings.

The methodology primarily relies on descriptive and correlational analyses, which limits the ability to establish causal relationships and obscures important variations in the data by using median values instead of means. Furthermore, the focus on GDP per capita and Official Development Assistance (ODA) may oversimplify the complex factors influencing water access, as governance, local policies, and cultural attitudes also play critical roles in shaping outcomes.

Areas for improvement

The dashboard could be improved in several key areas. one significant improvement would involve expanding the dataset to include additional economic factors that influence water access, such as investments in water infrastructure, government policies, and issues like corruption. By including these elements, the analysis would provide a more comprehensive understanding of the various factors that contribute to economic growth beyond just access to safe drinking water. This broader perspective would enable more informed decision-making and policy development.

Deployment

After finalizing the dashboard, the next step was deployment to ensure it was accessible and easily shareable. The dashboard is published on Power BI, allowing BUas SDG Hub members to access it. Moreover, to provide an alternative access point, the dashboard is published on GitHub as .pbix file. This setup enables easy downloading, review, and customization, aligning with the project's aim of maximizing accessibility and usability.

The target audience for the dashboard is BUas SDG Hub, a group focused on Sustainable Development Goals (SDGs). They will use the dashboard to gain insights into the relationship between GDP, ODA, and access to safe drinking water for countries in Southeast Asia.

Future research

Although this research offers valuable insights into the link between GDP per capita, ODA and access to safe drinking water for countries in southeast Asia, there are areas that could be further developed or improved in future studies. Tackling existing limitations and integrating new methodologies could deepen the analysis and improve accuracy, benefiting stakeholders.

Addressing Data Limitations

The dataset utilized in this study was comprehensive, encompassing the necessary period from 2000 to 2022. However, there are several opportunities to enhance future research. Expanding the range of variables to include factors such as annual expenditure on water infrastructure and local policy measures could provide deeper insights into the dynamics in the region. Additionally, broadening the current database with data from subsequent years would allow for a more longitudinal analysis, capturing recent developments and trends. These enhancements could significantly enrich the study's findings and offer a more nuanced understanding of the underlying relationships.

Emerging Techniques and Tools

There are several methods that fit well with the goals of this study because they are tailored to handle complex, multi-faceted datasets and address specific challenges in understanding regional and economic influences on water access:

1. Spatial Analysis for Regional Disparities - Spatial analysis tools are designed to reveal geographic patterns and can highlight regional disparities in access to water. By mapping out data across different Southeast Asian regions, spatial analysis can help identify specific areas that lag in water access or economic development, even within the same country.

2. Machine Learning for Predictive Insights - Machine learning models excel at identifying patterns within large datasets, which can help with future predictive analysis focused on access to safe drinking water based on historical data. By training models on factors like GDP, ODA, and existing water access rates, machine learning can offer predictions and even uncover hidden relationships. Predictive insights from these models would allow researchers and policymakers to anticipate future outcomes and allocate resources more effectively.

Targeted audiences

The primary audience for the dashboard is the BUas SDG Hub, a group dedicated to the Sustainable Development Goals (SDGs), along with the wider community. This group will utilize the dashboard to gain insights into the connections between GDP, Official Development Assistance (ODA), and access to safe drinking water in Southeast Asia. By doing so, they will be able to evaluate progress and pinpoint areas that require targeted interventions in the region.

The dashboard will be presented in the portable device, and the dashboard could be deployed in the required environments. These are the ways a dashboard could be deployed and repurposed for any business use cases.

Stakeholders and communities

The research could significantly impact various stakeholders, including government agencies, non-governmental organizations, and development partners working on water accessibility and economic development in Southeast Asia. By highlighting the relationship between economic indicators like GDP and ODA and water access, the study provides actionable insights for policymakers aiming to improve public health and infrastructure. The findings may also benefit local communities by informing more targeted and efficient resource allocation, potentially accelerating improvements in access to safe drinking water, which is essential for health, economic stability, and sustainable development.

References

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ChatGPT was used to check the grammar mistakes:

“Check the text for grammatical errors”