A Project Report

On

Global Malnutrition Trends: A Power BI Analysis (1983-2019)

Submitted for fulfilment of

Experiential Project Based Learning(EPBL)

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This project is a result of collective efforts, and I sincerely appreciate everyone's contributions in making it a meaningful and insightful study.

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ABSTRACT

Malnutrition remains a significant global health challenge, affecting millions of children and adults worldwide. This project, " Global Malnutrition Trends: A Power BI Analysis (1983-2019)" aims to analyse malnutrition trends from 1983 to 2019 using a data-driven approach. The project utilizes Power BI to visualize key malnutrition indicators such as stunting, wasting, underweight, overweight, and severe wasting across different countries and income classifications.

The dataset was collected from credible sources and underwent thorough data cleaning and transformation to ensure accuracy and consistency. Advanced DAX calculations were implemented to derive meaningful insights, such as malnutrition rate percentages, year-over-year changes, and country rankings. The interactive dashboard includes line charts, bar charts, and geographic maps, allowing users to explore malnutrition trends dynamically and identify high-risk regions.

The findings reveal regional disparities in malnutrition rates, with lower-income countries exhibiting higher levels of stunting and underweight cases. Additionally, the temporal analysis highlights improvements in some regions while showing persistent malnutrition challenges in others.

This project provides a comprehensive decision-support tool for policymakers, healthcare organizations, and researchers, enabling them to make data-driven interventions. Future enhancements could include predictive modeling and real-time data integration to further improve malnutrition monitoring and response strategies.

Keywords: Malnutrition, Power BI, Data Visualization, Stunting, Wasting, Underweight, Public Health Analytics.

TABLE OF CONTENTS

Chapter 1: INTRODUCTION

1.1 Project Overview

Malnutrition is a critical global issue that affects millions of individuals, particularly children under the age of five. It is a major contributor to mortality, developmental delays, and long-term health complications. Despite various international efforts, malnutrition remains prevalent, especially in low- and middle-income countries. Understanding the trends, patterns, and underlying causes of malnutrition is essential for designing effective interventions and policies.

This project, "Global Malnutrition Trends: A Power BI Analysis (1983-2019)" aims to provide a data-driven approach to analyzing malnutrition trends from 1983 to 2019. The project leverages Power BI to visualize key malnutrition indicators, including stunting, wasting, underweight, overweight, and severe wasting. By utilizing an interactive dashboard, users can explore historical patterns, regional disparities, and the relationship between malnutrition and economic classifications. The goal is to help policymakers, researchers, and organizations make informed decisions based on data insights.

1.2 Purpose

The primary purpose of this project is to develop an interactive and analytical dashboard that enables:

Trend Analysis: Identifying how malnutrition has evolved over the years.

Geospatial Insights: Understanding malnutrition distribution across different countries and income levels.

Comparative Analysis: Comparing malnutrition rates based on income classification and country-specific trends.

Decision Support: Assisting organizations like WHO, UNICEF, and health ministries in targeting interventions effectively.

By integrating data visualization, statistical analysis, and interactive filtering, the dashboard provides a comprehensive tool for exploring malnutrition patterns and guiding future health initiatives.

This project not only highlights existing challenges but also paves the way for data-driven solutions to address one of the most pressing global health issues.

Chapter 2: IDEATION PHASE

2.1 Problem Statement

Malnutrition remains a critical global issue affecting millions, particularly children under five. Despite various international efforts, data-driven insights remain insufficient for tracking long-term trends, identifying high-risk regions, and implementing effective policies.

Problem Statement (PS)	**I am (Customer)**	**I'm trying to**	**But**	**Because**	**Which makes me feel**
PS-1	A Computer Science student	Understand long-term trends (1983-2019)	Data is vast and complex	Malnutrition affects millions worldwide	Motivated to find solutions
PS-2	Interested in data analysis	Identify key causes of malnutrition	Some data sets may be incomplete	Patterns help policymakers make informed decisions	Challenged by data complexity

The primary challenges include:

- Vast and Complex Data: The dataset covers multiple years and regions, requiring proper cleaning and transformation.
- Incomplete and Inconsistent Data: Missing values and inconsistent records make accurate analysis difficult.

- Comparative Limitations: Insights into malnutrition trends need to be classified by region, income levels, and time periods to ensure better understanding.
- This project aims to develop an interactive Power BI dashboard that provides a comprehensive analysis of malnutrition trends (1983-2019), focusing on stunting, wasting, underweight, and overweight prevalence across various regions.

2.2 Empathy Map Canvas

The Empathy Map Canvas helps in understanding the perspective of key stakeholders, including policymakers, healthcare organizations, NGOs, and researchers.

Aspect	Details
WHO are the stakeholders?	Policymakers, NGOs, healthcare professionals, researchers, and data analysts.
WHAT do they need?	A **dynamic and data-driven approach** to monitor malnutrition trends and make policy decisions.
WHY do they need it?	To allocate resources effectively, assess the impact of interventions, and improve public health strategies.
HOW will they use it?	Through interactive **visualizations, reports, and trend analysis** in Power BI, which allows filtering data based on country, income level, and year.

2.3 Brainstorming

During the brainstorming phase, key focus areas were identified to guide the development of the dashboard:

Data Selection

- Selecting datasets with malnutrition indicators across multiple years.
- Standardizing country names and income classifications.

Data Cleaning & Transformation

- Handling missing values through data imputation.
- Converting text-based numerical data into appropriate data types.
- Creating calculated fields, such as malnutrition rate percentages and Year-over-Year (YoY) changes.

Key Insights to Extract

- Trend Analysis: Understanding how malnutrition has evolved over time.
- Regional Disparities: Identifying high-risk countries and continents.
- Comparative Analysis: Examining malnutrition based on income levels.
- Correlation Analysis: Exploring relationships between malnutrition and socio-economic factors.

Visualization Planning

- Map Chart for global distribution of malnutrition.
- Line Chart for year-over-year trends.
- Bar Chart to compare malnutrition rates across countries.
- KPI Cards for quick insights into global malnutrition statistics.
- Interactive Filters for users to explore different perspectives.

Chapter 3: REQUIREMENT ANALYSIS

The Requirement Analysis phase outlines the essential aspects necessary for the development of the Power BI Dashboard for Global Malnutrition Analysis. This includes the Customer Journey Map, Solution Requirements, Data Flow Diagram, and Technology Stack, ensuring a well-structured approach to data processing and visualization.

3.1 Customer Journey Map

The Customer Journey Map illustrates the step-by-step flow of how stakeholders—such as policymakers, researchers, and NGOs—interact with the malnutrition analysis dashboard.

Stage	Actions Taken	Expected Outcome
Data Collection	Gather malnutrition datasets from verified sources (WHO, UNICEF, World Bank).	Availability of raw data for analysis.
Data Cleaning & Transformation	Handle missing values, standardize country names, and create calculated fields.	Structured and usable data.
Data Visualization	Develop interactive charts and reports in Power BI.	Meaningful insights into malnutrition trends.
Dashboard Interaction	Users apply filters, drill down into specific regions, and compare malnutrition rates.	Data-driven decision-making.
Report Generation	Export data and visual reports for further analysis and policymaking.	Shareable insights for policy development.

This journey ensures seamless interaction with the dashboard, allowing users to explore and derive meaningful insights efficiently.

3.2 Solution Requirement

The Solution Requirement section outlines the key functionalities and technical needs for the project.

3.2.1 Functional Requirements

- Data Integration: Import datasets related to malnutrition trends (1983-2019).
- Data Cleaning & Transformation: Handle missing values, normalize country names, and convert data types.
- Computed Measures: Calculate malnutrition percentages, country-wise aggregates, and year-over-year (YoY) changes.
  Interactive Power BI Dashboard with multiple visualizations:

- Map Chart: Geographic distribution of malnutrition.
- Line Chart: Trends over time.
- Bar Chart: Country-wise malnutrition comparison.
- Pie Chart: Distribution of malnutrition types.

3.2.2 Non-Functional Requirements

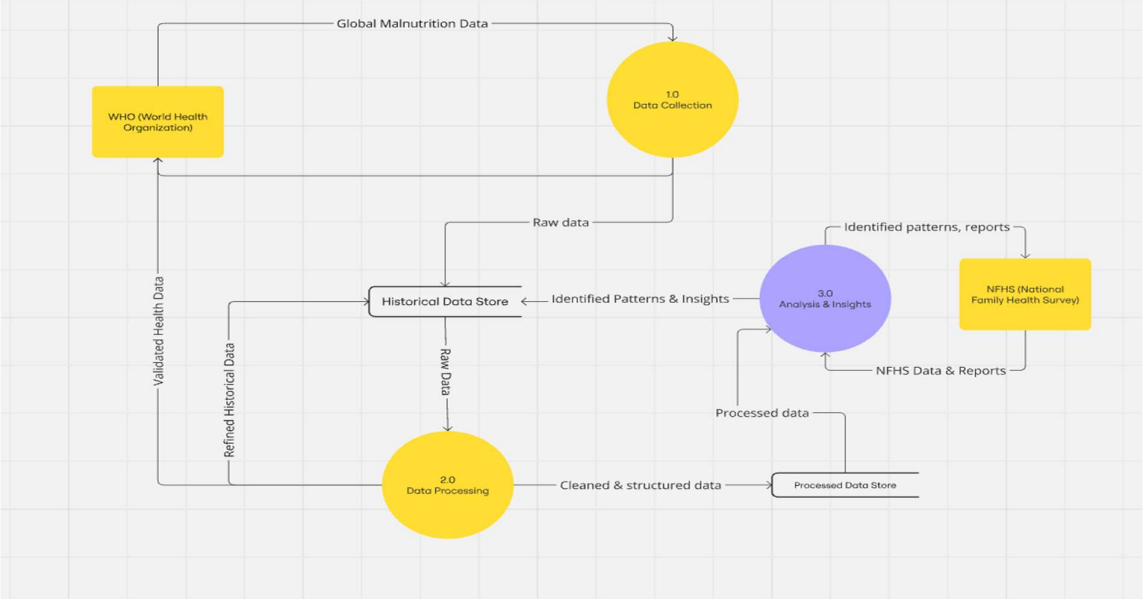
Performance & Scalability:

- Dashboard should load within 5 seconds.
- Capable of handling large datasets efficiently.
  Usability & Accessibility:
- User-friendly UI/UX for seamless navigation.
- Properly labeled KPIs, charts, and tooltips for better interpretation.
  Security & Data Integrity:
- Ensure data consistency and accuracy.
- Implement read-only access to maintain data integrity.

3.3 Data Flow Diagram

The Data Flow Diagram (DFD) represents how data is processed from input (raw dataset) to output (dashboard visualization).

Level 0: High-Level Overview



Level 1: Detailed Data Flow

1)Data Source:

- Import datasets (CSV files from WHO, UNICEF).

2)Data Cleaning & Transformation:

- Handle missing values.
- Convert text-based numbers to numeric format.
- Standardize country names and income classification.

3)Data Storage:

- Processed data is stored in Power BI's data model.

4)Dashboard & Reporting:

- Users interact with charts, filters, and KPIs.
- Reports can be exported in PDF/Excel formats.

This flow ensures seamless data processing and visualization while maintaining data accuracy and usability.

3.4 Technology Stack

The project leverages a robust technology stack for data handling, analysis, and visualization.

Category	Technology/Tool	Purpose
Data Storage	CSV, Excel, SQL Database	Storing and processing malnutrition data.
Data Processing	Power Query (Power BI)	Data cleaning and transformation.
Data Visualization	Power BI	Dashboard and report generation.
Data Analysis	DAX (Power BI)	Creating calculated fields and measures.
Additional Tools	Python (for preprocessing if needed)	Handling missing values, feature engineering.

This technology stack ensures that the Power BI dashboard remains scalable, efficient, and user-friendly while delivering high-quality insights into global malnutrition trends.

Chapter 4: PROJECT DESIGN

The Project Design phase defines the proposed solution, its architecture, and how it addresses the identified problem. This section includes the Problem-Solution Fit, Proposed Solution, and Solution Architecture, ensuring a structured and efficient approach to building the Power BI dashboard.

4.1 Problem-Solution Fit

Malnutrition is a persistent global health issue, requiring data-driven insights to track trends, identify high-risk areas, and guide interventions. Traditional reports often lack interactivity, making it difficult for policymakers to analyze historical trends and real-time data efficiently.

How the Solution Fits the Problem:

- Provides Interactive Data Analysis: Enables stakeholders to analyze malnutrition trends dynamically instead of relying on static reports.
- Enhances Decision-Making: Offers filters, visualizations, and KPIs for region-specific and year-based insights.
- Ensures Scalability: The dashboard can integrate additional datasets or future health-related indicators.

This project bridges the gap by transforming raw malnutrition data into a Power BI dashboard, making insights accessible and actionable.

4.2 Proposed Solution

The Power BI Dashboard for Global Malnutrition Analysis will provide:

Key Features:

✓ Data Cleaning & Transformation: Handling missing values, ensuring consistency in country names, and computing malnutrition percentages.
✓ Multiple Visualizations:

- Line Chart: Tracks malnutrition trends over time.
- Map Chart: Displays geographic malnutrition distribution.
- Bar Chart: Compares malnutrition rates across countries.
- Pie Chart: Highlights the proportion of different malnutrition types.

  ✓ Interactive Filters: Users can filter data based on Year, Country, Income Level, and Malnutrition Type.

  ✓ Report Exporting: Ability to export data-driven reports in PDF and Excel formats.

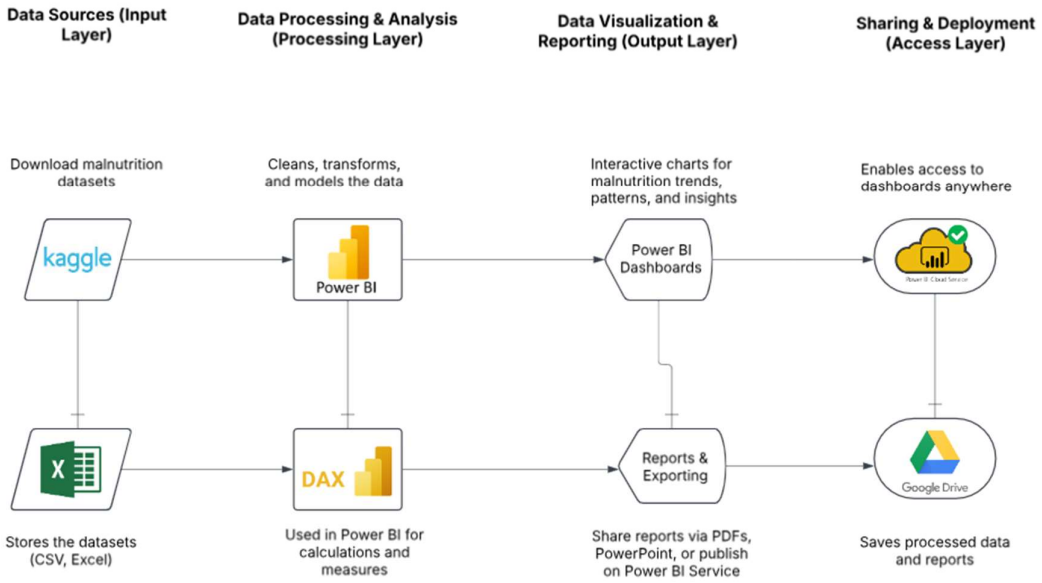
Expected Outcomes:

- Identification of high-risk regions for targeted interventions.
- Year-over-year analysis of malnutrition trends globally.
- Better understanding of how economic factors influence malnutrition rates.

4.3 Solution Architecture

The Solution Architecture describes the system's structure, focusing on data processing, storage, and visualization.

System Workflow:



1)Data Source:

- Import datasets from CSV files (WHO, UNICEF, World Bank).

2)Data Cleaning & Processing:

- Handle missing values and normalize data using Power Query in Power BI.
- Create calculated fields (Malnutrition Rate %, Country Rankings).

3)Data Storage:

- Store processed data in Power BI's data model for optimized querying.

4)Visualization & User Interaction:

- Display charts, KPIs, and tables for analysis.
- Allow users to interact via filters, slicers, and drill-down options.

5)Report Generation:

- Export insights in PDF, CSV, or Excel formats for further use.

Chapter 5: PROJECT PLANNING & SCHEDULING

The Project Planning & Scheduling phase outlines the sprint-based approach used to develop the Power BI Global Malnutrition Analysis Dashboard. This section is structured according to the Product Backlog, Sprint Planning, and Estimation as specified in the Project Planning Template.

5.1 Project Planning

The project follows an Agile methodology, dividing tasks into two sprints for efficient execution. Each sprint contains a set of user stories, defining specific tasks with assigned priorities and estimated effort in story points.

Product Backlog & Sprint Schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Data Collection	GMT-22	Collect the data	2	High	Harshit Pandey
Sprint-1	Data Collection	GMT-23	Loading Data	1	High	Chirag Dixit
Sprint-1	Data Processing	GMT-34	Transforming data	3	Low	Harshit Pandey
Sprint-1	Data Visualization & Development	GMT-27	Visualization of data	2	Medium	Chirag Dixit
Sprint-1	Data Visualization & Development	GMT-28	Creating Interactive Dashboards	5	High	Aniket Raghav

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-2	Project Documentation & Demonstration	GMT-32	Record explanation video for project end-to-end solution	2	High	Aniket Raghav, Chirag Dixit, Harshit Pandey, Manish Sharma
Sprint-2	Project Documentation & Demonstration	GMT-33	Project Documentation/Report Creation	3	High	Manish Sharma

Sprint Planning & Velocity Calculation

Sprint	Total Story Points	Duration	Sprint Start Date	Sprint End Date (Planned)	Story Points Completed (As on Planned End Date)	Sprint Release Date (Actual)
Sprint-1	13	3 Days	07 Feb 2025	09 Feb 2025	13	10 Feb 2025
Sprint-2	05	2 Days	10 Feb 2025	11 Feb 2025	05	11 Feb 2025

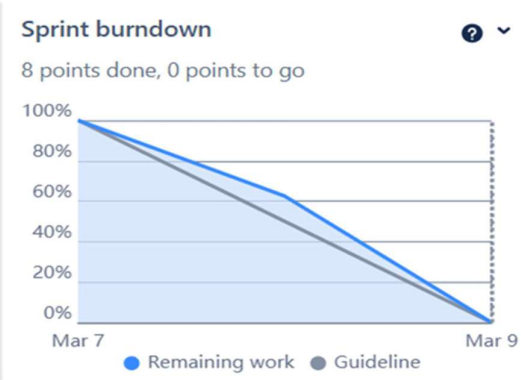
Velocity Calculation:

- Sprint 1: 13 Story Points
- Sprint 2: 5 Story Points
- Total Story Points: 13 + 5 = 18
- Number of Sprints: 2

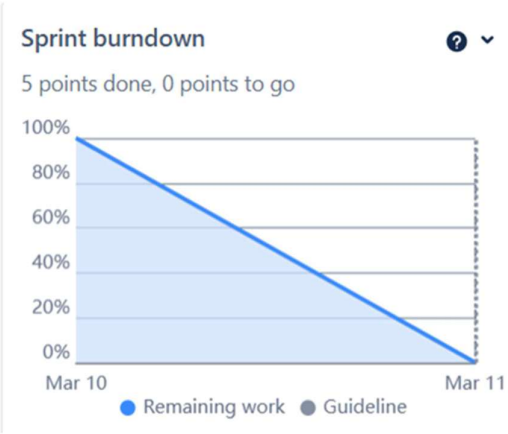
- Velocity = Total Story Points Completed / Number of Sprints
  Velocity = 18 / 2 = 9 Story Points per Sprint

Burndown Chart Analysis

Sprint 1:



Sprint 2:



Chapter 6: FUNCTIONAL AND PERFORMANCE TESTING

The Functional and Performance Testing phase ensures that the Power BI Global Malnutrition Analysis Dashboard meets the required performance, accuracy, and usability benchmarks. This section evaluates the system's ability to handle large datasets, execute DAX queries efficiently, and provide a seamless user experience.

6.1 Performance Testing

Performance testing was conducted to assess data rendering, preprocessing, filtering, query execution, dashboard responsiveness, and report generation.

Model Performance Testing Summary

S.No.	Parameter	Details
1	Data Rendered	Tables Used: `Country-wise-average` Table (Columns: 11, Rows: 140) `Malnutrition-estimates` Table (Columns: 20, Rows: 923)
2	Data Preprocessing	Replaced errors in `Survey Sample` column with `0`. Changed data types for `Severe Wasting, Underweight, Overweight, Wasting, Stunting, U5 Population` in both tables. Removed null values to improve consistency.
3	Utilization of Data Filters	Filters Used: - `Top 10` filter in Line Chart. - `Top 5` filter in Clustered Bar Chart.
4	DAX Queries Used	Aggregations & Measures: - `Avg_Stunting = AVERAGE('malnutrition-estimates'[Stunting])` - `Total_U5_Population = SUM('malnutrition-estimates'[U5`

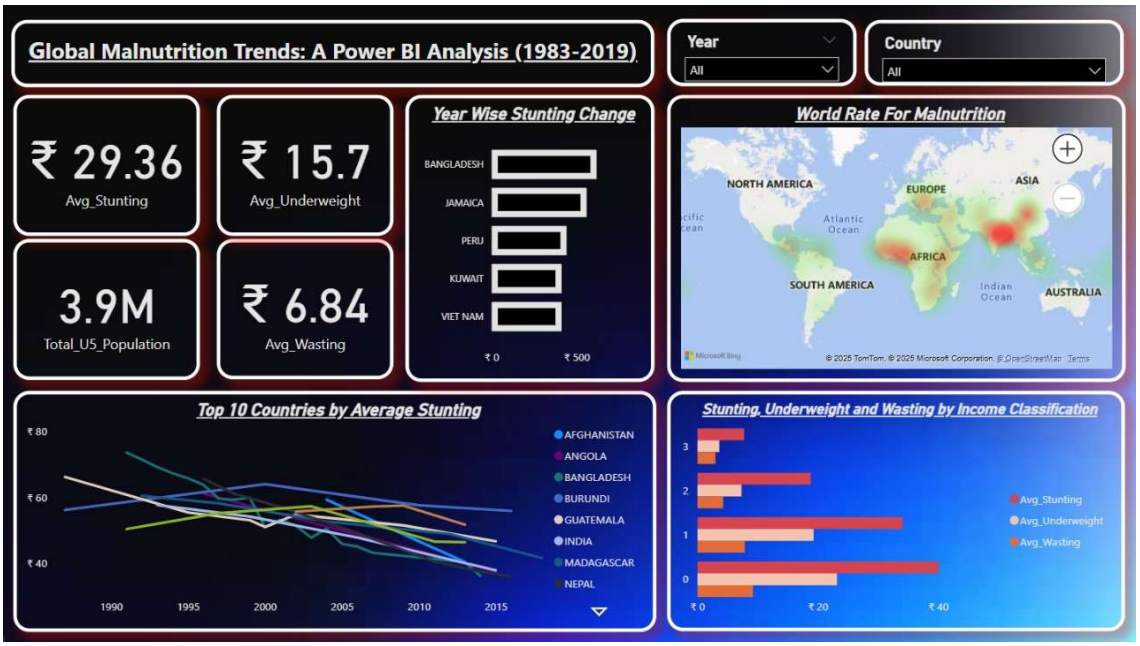
S.No.	Parameter	Details
		Population ('000s)]) - YoY_Stunting_Change = VAR PrevYear = CALCULATE(AVERAGE('malnutrition-estimates'[Stunting]), PREVIOUSYEAR('malnutrition-estimates'[Year])) RETURN AVERAGE('malnutrition-estimates'[Stunting]) - PrevYear - Malnutrition_Severity = IF([Stunting] >= 40, "High", IF([Stunting] >= 20, "Medium", "Low")) - Income_Group = SWITCH([Income Classification], 0, "Low Income", 1, "Lower-Middle Income", 2, "Upper-Middle Income", 3, "High Income")
5	Dashboard Design	No. of Visualizations: - Card – Sum of Overweight - Card – Sum of Stunting - Card – Sum of Underweight - Card – Total_U5_Population - Clustered Bar Chart – Year-wise Stunting Change - Slicer – Year & Country - Line Chart – Top 10 Countries by Average Stunting - Clustered Bar Chart – Stunting, Underweight, and Wasting by Income Classification - Map – World Rate for Malnutrition
6	Report Design	Report includes: - Summary Cards for Key Malnutrition Indicators - Comparison Charts (Year-wise, Country-wise, Income Classification) - Global Malnutrition Map for easy visualization

Performance Optimization Strategies Implemented

- Data Model Optimization: Removed unnecessary columns, optimized data types.
- DAX Performance Tuning: Used optimized DAX queries to improve calculation speed.
- Filter & Query Optimization: Applied Top N filters for efficient visualization rendering.
- Data Aggregation Techniques: Summarized datasets to improve query execution time.

Chapter 7: RESULTS

7.1 Screenshots of Report and Observations



Key Observations from the Report:

Malnutrition Trends:

- A declining trend in stunting and underweight rates was observed in several regions over the years.
- Some countries still show persistent high malnutrition rates, indicating a need for targeted interventions.

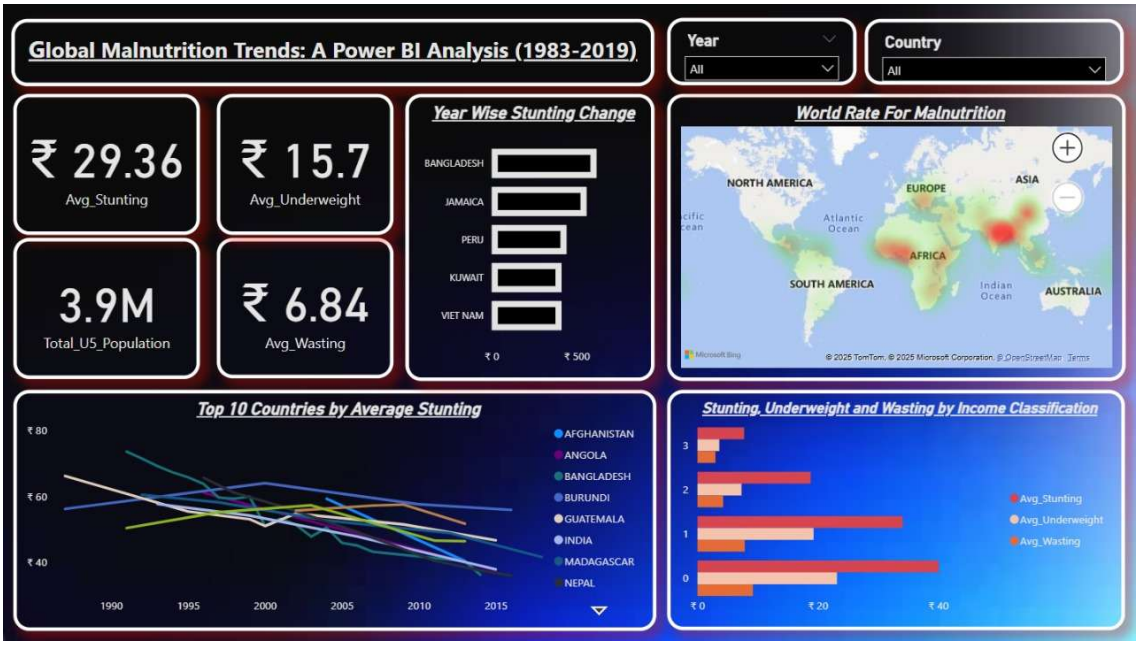
Country-wise Analysis:

- Low-income countries exhibit significantly higher malnutrition rates compared to middle and high-income countries.
- The Top 10 most affected countries have consistently high rates of stunting and underweight prevalence.

Income-Based Comparison:

- Lower-income nations suffer from higher wasting and stunting rates, whereas higher-income nations show an increasing trend in childhood overweight cases.

7.2 Screenshots of Dashboard and Observations



Key Observations from the Dashboard:

Global Malnutrition Map:

- High-risk regions are concentrated in Africa and South Asia, with malnutrition severity categorized based on stunting percentages.

Time-Series Analysis:

- Year-over-year (YoY) trends reveal a steady decline in global malnutrition indicators, but certain regions still face slow improvement.

Interactive Filters & Insights:

- Users can filter by year, country, and income level to analyze malnutrition trends dynamically.
- "Top N" filters help visualize the most affected nations for a given year.

Chapter 8: ADVANTAGES & DISADVANTAGES

8.1 Advantages

- Interactive Data Exploration:
  Users can filter data dynamically based on year, country, income level, and malnutrition type.Drill-down capabilities allow in-depth analysis of regional and yearly trends.
- Data-Driven Decision Making:
  Enables policymakers and organizations to identify high-risk regions and target interventions effectively.Trend analysis helps in tracking the impact of global health initiatives.
- Visually Engaging and Easy to Interpret:
  Map, line charts, bar graphs, and KPI cards make complex data visually intuitive.Custom DAX measures ensure accurate calculations for malnutrition rate changes and severity classification.

- Efficient Performance and Scalability:
  Optimized DAX queries and data transformations enhance performance. Can be expanded with new datasets in the future without affecting efficiency.
- Export and Sharing Capabilities:
  Users can export reports in PDF and Excel formats for further analysis.The dashboard can be shared across multiple stakeholders for collaboration.

8.2 Disadvantages

- Limited Real-Time Data Updates:
  The dashboard relies on historical datasets (1983-2019) and does not integrate real-time updates.Requires manual updates when new data becomes available.
- Data Gaps and Inconsistencies:
  Some countries have missing or incomplete data due to survey limitations.
  Imputation techniques were used, but accuracy may vary.
  Performance Limitations for Large Datasets:

  Handling very large datasets may lead to increased loading time.
  Requires further optimization if more granular data (e.g., city-level insights) is added.
- Dependency on Power BI Licenses:
  Some advanced features (e.g., publishing to Power BI Service) require Power BI Pro or Premium licenses.Sharing dashboards externally may require additional permissions or licenses.

Chapter 9: CONCLUSION

The Global Malnutrition Trends: A Power BI Analysis (1983-2019) successfully provides an interactive and data-driven approach to understanding malnutrition trends from 1983 to 2019. By leveraging Power BI, the project transforms raw malnutrition data into meaningful visualizations, enabling policymakers, researchers, and organizations to identify high-risk regions, track malnutrition trends, and analyze the impact of economic factors on child health.

Key Takeaways:

Comprehensive Analysis: The dashboard enables year-over-year comparisons, country-wise analysis, and income-level insights, offering a deep understanding of malnutrition patterns.

Data Visualization & Interactivity: With line charts, bar charts, maps, and KPI indicators, the dashboard presents data in an engaging and easy-to-interpret manner.

Actionable Insights for Policymakers: The findings help NGOs, government agencies, and global health organizations allocate resources effectively and design targeted interventions.

Scalability & Future Expansion: The framework supports additional datasets, real-time updates, and predictive analytics to enhance decision-making.

Chapter 10: FUTURE SCOPE

The Global Malnutrition Analysis Dashboard has significant potential for future enhancements that can improve its accuracy, usability, and impact. Expanding its features will allow policymakers, researchers, and organizations to make more informed and proactive decisions in addressing malnutrition worldwide.

The first major improvement could be the integration of real-time data sources from global health organizations like WHO, UNICEF, and national health agencies. This would enable dynamic tracking of malnutrition trends, providing updated insights instead of relying solely on historical data.

Another key enhancement would be the implementation of predictive analytics and machine learning algorithms to forecast future malnutrition trends. By analyzing economic conditions, food security levels, and historical patterns, the system could help predict which regions are at the highest risk of increasing malnutrition rates.

Expanding the dataset to include granular-level insights, such as city-wise or district-wise data, would improve localized decision-making. Adding demographic segmentation, such as age groups, gender, and rural vs. urban disparities, would make the analysis more precise and actionable.

Future updates could also focus on enhancing the dashboard's features, such as allowing customized dashboards for different user groups, incorporating AI-

driven insights, and making the platform mobile-friendly for use by field health workers and NGOs.

Collaboration with global health organizations and government agencies can further standardize malnutrition monitoring frameworks, ensuring better data accuracy, intervention tracking, and policymaking.

By implementing these improvements, the Power BI Global Malnutrition Analysis Dashboard can become a more powerful, scalable, and real-time decision-support tool for combating malnutrition on a global scale.

Chapter 11: APPENDIX

- Source Code (if any)

https://www.kaggle.com/datasets/ruchi798/malnutrition-across-the-globe?select=country-wise-average.csv

- Dataset Link

The datasets used in this project were sourced from global organizations such as WHO, UNICEF, and the World Bank. The original datasets and any processed versions used in the Power BI dashboard are available at the following link:

Dataset Link: https://www.kaggle.com/datasets/ruchi798/malnutrition-across-the-globe?select=country-wise-average.csv

- GitHub & Project Demo Link

GitHub Repository: AniketRaghav05/EPBLProject
Project Demo Link: AniketRaghav05/EPBLProject