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

CHAPTER-1

INTRODUCTION

1. INTRODUCTION:

ABC Company is undertaking an in-depth analysis of global malnutrition trends from 1983 to 2019 to better understand the prevalence and distribution of various forms of malnutrition among children under five years of age. Utilizing a comprehensive dataset from UNICEF/WHO/World Bank, the project aims to analyse severe wasting, wasting, stunting, underweight, and overweight conditions across different countries. By classifying countries according to their income levels (low, lower-middle, upper-middle, and high income) and other categories such as Least Developed Countries (LDC), Low Income Food Deficient (LIFD), Land Locked Developing Countries (LLDC), and Small Island Developing States (SIDS), the project seeks to uncover correlations between economic status and malnutrition rates. Through the use of advanced data visualization techniques in Power BI, including stacked bar charts and line charts, ABC Company aims to generate actionable insights that can guide policy- making and resource allocation to combat child malnutrition effectively.

Malnutrition remains a critical global health issue, with children in lower-income countries dis-proportionately affected. ABC Company aims to address the challenge of identifying key patterns and trends in child malnutrition data over several decades. The primary problem is to determine how various forms of malnutrition correlate with economic and geographical classifications of countries, and to identify which countries and regions are most affected. By leveraging historical data, the project will highlight areas needing urgent attention and support, helping stakeholders to prioritize interventions and strategies for reducing malnutrition and its associated health risks among children under five. This analysis is crucial for developing targeted, data-driven solutions to improve child health outcomes worldwide

1.1 PROJECT OVERVIEW:

To explore and visualize global malnutrition patterns over 36 years, identifying key trends, regional disparities, and socioeconomic correlations using interactive Power BI dashboards.

Goals

- Track changes in malnutrition indicators (stunting, wasting, Under-weight) across countries and regions.

- Highlight high-risk areas and vulnerable populations.
- Correlate malnutrition with economic, health, and education metrics.
- Provide actionable insights for policymakers, NGOs, and researchers.

1.2 Project Objectives:

1. **Analyse Global Malnutrition Trends (1983–2019)**
   - Track changes in key indicators like stunting, wasting, and undernourishment across countries and regions.
2. **Identify High-Risk Regions and Populations**
   - Pinpoint areas with persistent or rising malnutrition rates to support targeted interventions.
3. **Correlate Malnutrition with Socioeconomic Factors**
   - Explore relationships between nutrition and variables like GDP, education, healthcare access, and food availability.
4. **Visualize Data for Better Understanding**
   - Use Power BI to create interactive dashboards that make complex data accessible and actionable.
5. **Support Policy and Decision-Making**
   - Provide insights that help governments, NGOs, and global health organizations design effective nutrition programs.

Advantages

- **Data-Driven Insights**: Helps stakeholders make informed decisions based on historical and regional trends.
- **Interactive Visuals**: Power BI dashboards enhance understanding and engagement.
- **Scalable Analysis**: Can be expanded to include newer data or additional indicators.
- **Policy Impact**: Supports evidence-based policymaking and resource allocation.
- **Global Perspective**: Offers a comprehensive view across continents and decades.

Disadvantages

- **Data Gaps**: Incomplete or inconsistent data from certain regions may affect accuracy.
- **Complexity**: Requires careful modelling and cleaning to ensure reliable analysis.
- **Limited Real-Time Updates**: Historical data may not reflect current emergencies or rapid changes.
- **Overgeneralization Risk**: Aggregated data might mask local nuances or cultural factors.

- **Dependency on External Sources**: Relies heavily on the quality and availability of global datasets.

CHAPTER-2

Problem Initialization and Planning Phase

2.1. Define Problem Statement:

A problem statement is a concise description that identifies a gap between a current and desired future state, outlining the specific issue a project aims to address. It provides crucial context for a team or organization, guiding the problem-solving process by defining the problem, who is affected, why it's important, and the ideal outcome.

Key Components of a Problem Statement

- **Current State:** What is the current situation or the existing problem?
- **Desired State:** What is the ideal or desired future situation?
- **The Gap:** The difference between the current and desired states, which the project will aim to bridge.
- **Context:** Information about the specific problem, including who is affected, where and when it occurs, and why it's important.

Existing Problem

Malnutrition remains one of the most persistent and complex global health challenges. Despite significant progress in some regions, millions of people, especially children and women, continue to suffer from undernutrition, micronutrient deficiencies, and, increasingly, over-nutrition. The coexistence of these forms of malnutrition across different populations highlights the growing **"double burden"** of malnutrition worldwide.

- **Undernutrition** (stunting, wasting, under-weight) remains prevalent in low- and middle-income countries, particularly in sub-Saharan Africa and South Asia.
- **Micronutrient deficiencies**, such as lack of iron, vitamin A, and iodine, affect billions and lead to impaired immunity, cognitive delays, and increased mortality.
- **Over-nutrition** and **obesity** are rising rapidly due to urbanization, changing diets, and sedentary lifestyles, creating a paradox where undernutrition and obesity coexist within the same populations or even households.

Proposed Solution

To address the persistent and complex issue of global malnutrition, this project proposes a **data-driven analytical framework** that integrates global nutrition, socio-economic, and environmental datasets to identify patterns, predict future trends, and support targeted interventions. The proposed solution aims to combine technology,

research, and policy analysis to create actionable insights that can drive meaningful progress toward ending malnutrition worldwide.

- **Data Collection:** Gather reliable, standardized nutrition indicators (stunting, wasting, underweight, obesity) from global databases.
- **Data Cleaning and Integration:** Merge datasets from multiple sources to ensure consistency and comparability.
- **Exploratory Data Analysis (EDA):** Identify relationships between nutrition outcomes and factors such as income, education, gender, and climate.

2.2. Project Proposal (Proposed Solution):

a. Data Integration and Analysis

- Collect and integrate datasets from sources such as WHO, UNICEF, FAO, and World Bank, focusing on indicators like stunting, wasting, underweight, and micronutrient deficiencies.
- Perform data cleaning, transformation, and normalization to ensure cross-country comparability.
- X-malnutrition indicators and factors such as income, education, gender, and urbanization.

b. Predictive Modelling

- Incorporate socio-economic, demographic, and climate-related variables to improve model accuracy.
- Develop predictive dashboards for real-time visualization and tracking.

c. Geographic and Demographic Insights

- Use **geospatial analysis** to map malnutrition prevalence by region and demographic groups.
- Identify “hotspots” of severe malnutrition and regions at risk based on environmental and economic indicators.

d. Policy Recommendation Framework

- Translate data insights into **actionable policy recommendations** for governments, NGOs, and global agencies.
- Suggest targeted intervention strategies such as school feeding programs, agricultural diversification, and maternal nutrition initiatives.

- Create data visualizations and reports tailored for policymakers and stakeholders.

e. Sustainable Monitoring System

- Design a **sustainable monitoring framework** with open-data tools (like Tableau Public or Power BI dashboards) for periodic updates.
- Recommend data-sharing mechanisms to support ongoing collaboration between global organizations.

1. Hardware Requirements

Hardware Component	Specification / Description	Purpose
Computer / Laptop	Processor: Intel i7 / AMD Ryzen 7 or higher; RAM: Minimum 16 GB; Storage: 1 TB SSD	To perform large-scale data analysis and machine learning modelling
External Storage / Cloud Backup	Minimum 500GB capacity	For secure storage of datasets, analysis outputs, and visualization files
Internet Connectivity	Minimum 50 Mbps high-speed connection	For downloading large datasets and accessing global data repositories

2. Software Requirements

Software / Tool	Type	Purpose / Application
Tableau / Power BI	Commercial / Academic	Creation of interactive dashboards and trend visualizations
GitHub / GitLab	Version Control	Collaborative project tracking and code version management
MS WORD	Document	To Prepare the Documents

3. Data Requirements

Data Source / Organization	Type of Data	Purpose / Description
World Health Organization (WHO)	Global nutrition indicators (stunting, wasting, underweight, obesity)	To assess overall malnutrition levels and health outcomes

2.3. Initial Project Planning

Day	**Milestones**
Day 1	Data collection and extraction from Database
Day 2	Data Loading
Day 3	Data Cleaning
Day 4	Data Visualization
Day 5	Dashboard
Day 6	Report
Day 7	Performance Testing

CHAPTER-3

Data Collection and Pre-processing Phase

3.1 Data Collection Plan & Raw Data Sources Identification Report:

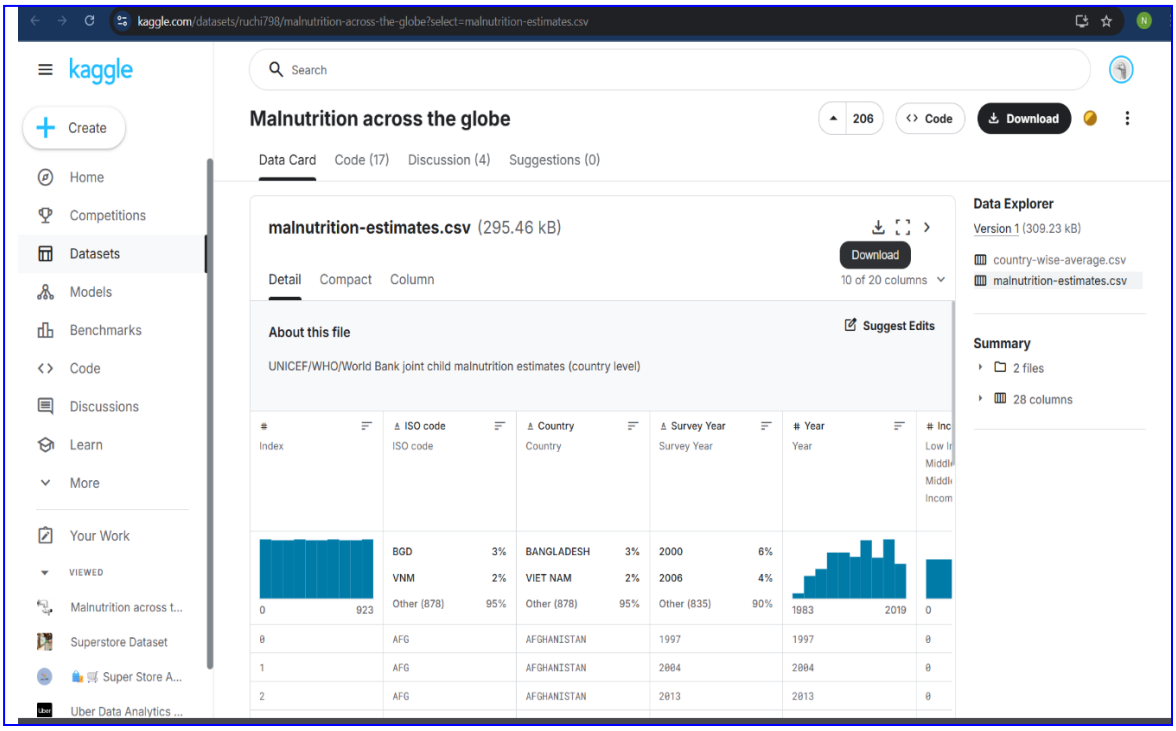
Data collection is the process of gathering and measuring information on variables of interest, in an established systematic fashion that enables one to answer stated research questions, test hypotheses, evaluate outcomes and generate insights from the data.

Data Sources:

The dataset on global malnutrition trends was also collected from **Kaggle**, a trusted open data platform widely used by data analysts and researchers. It was downloaded in **CSV format** and imported into **Power BI** for cleaning and visualization. This source was selected for its accessibility, comprehensive coverage, and ease of integration with analytical tools.

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

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



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

Section	Description
Data Collection Plan	The data was collected from reputable international health and development organizations. The main sources include global open datasets, statistical repositories, and WHO (World Health Organization) estimates. Data collection focused on ensuring reliability, validity, and consistency over multiple years for cross-country comparison.
Raw Data Sources Identified	1. World Health Organization (WHO) – Provides official estimates of malnutrition indicators like underweight, stunting, and wasting by country and year. 2. UNICEF Data Warehouse – Supplies complementary data on child nutrition, demographic segmentation, and regional breakdowns. 3. Internal Dataset: country-wise-average.csv – A derived dataset used to compute aggregated national averages for visualization and comparison. 4. Internal Dataset: malnutrition-estimates.csv – A cleaned dataset containing country-wise, year-wise malnutrition indicators used for Power BI analysis and modeling.

3.2. Data Quality Report:

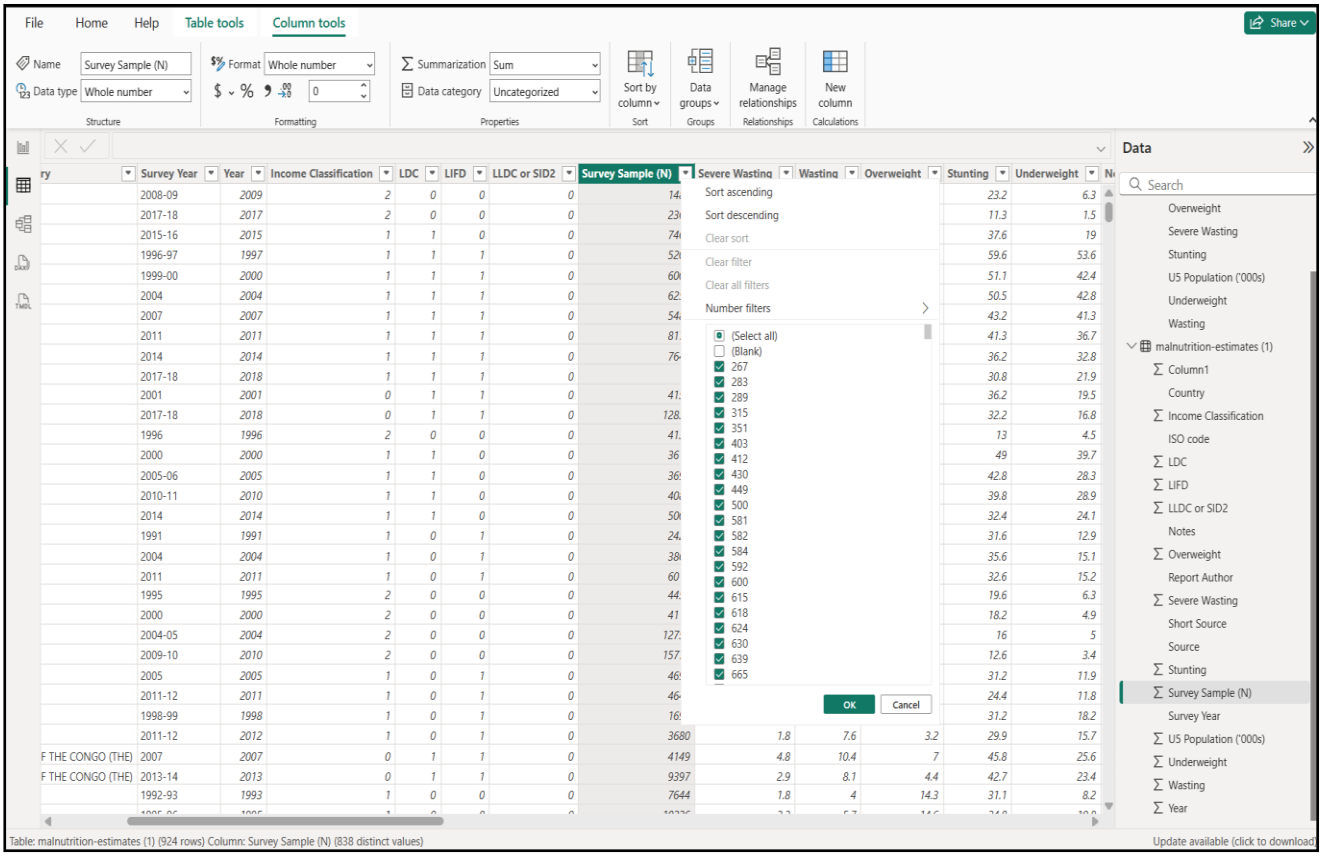
Data Preparation for Visualization:

Preparing the data for visualization is a crucial step that ensures the datasets are accurate, consistent, and ready for analysis. In this project, the malnutrition data collected from and Kaggle was carefully reviewed to ensure completeness and correctness. The preparation process involved cleaning the data by removing blank and null values, standardizing numerical formats, fixing decimal precision, and converting proportion-based columns into percentage format. The datasets were then organized and structured to be easily imported into visualization tools like **Power BI**.

1. The data has been loaded into power BI. The Next step is to clean the data

2. For this transform data to the power Query Editor.

3. After loading the data select each column and remove null and blank values for data consistency and accuracy.



Data Source / Dataset	Data Quality Issue	Severity	Resolution Plan
Country-wise	Blank or null values in columns	Moderate	Removed all blank and null values from the dataset
Country-wise Average	Unorganized numerical data	Low	Sorted and arranged numerical columns for easier analysis
Country-wise Average	Inconsistent decimal precision in numerical columns	Low	Converted decimal columns into fixed decimal format for uniformity and readability
Country-wise Average and Malnutrition Estimates	U5 population columns not in percentage format	Low	Converted population proportion columns into proper percentage format for clarity
Malnutrition Estimates	Blank or null values in columns	Moderate	Removed all blank and null values from the dataset
Malnutrition Estimates	Unorganized numerical data	Low	Sorted and arranged numerical columns for easier analysis

3.3 Data Exploration and Preprocessing Report:

To explore, clean, and preprocess global malnutrition data to ensure data accuracy, consistency, and readiness for analysis in Power BI.

Section	Description
Data Overview	Two datasets were used: malnutrition-estimates.csv (country-wise malnutrition estimates) and country-wise-average.csv (aggregated averages). These enable global and country-level analysis of malnutrition trends.
Data Cleaning	- Removed duplicate rows using Power Query. - Corrected errors such as inconsistent wrong data types.
Data Transformation	- Filtered columns by changing numerical values into fixed decimal numbers
Data Modeling	Established a one-to-many relationship between country-wise-average and malnutrition-estimates. Created DAX measures like Average Malnutrition %, Yearly Change %, and Global Average. Added a Date Table for time intelligence.
Save Processed Data	Loaded cleaned data into Power BI. Saved processed datasets as .xlsx and .pbix for reuse and backup. Maintained versioned files for reproducibility.
Conclusion	The preprocessing ensured that all data is clean, consistent, and ready for analysis. The datasets are now optimized for Power BI dashboards to visualize global malnutrition trends effectively.

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Data Visualization

4.1. Framing Business questions:

1. How many countries have the highest proportion of overweight children under age five?

2. How many total survey samples were collected across all countries between 1983 and 2019?

3. What percentage of the overall child population is underweight globally?

4. Which countries have the highest sums of overweight cases?

5. How does the average stunting rate differ across income classifications — LDC, LIFD, LLDC, and SID2?

6. What is the ratio of overweight to underweight in each income classification?

7. How does the sum of income classification correlate with malnutrition indicators such as underweight, overweight, and stunting?

4.2. Developing Visualizations:

1. Count of U5 Population:

- Go to **Report view** (paint roller icon).
- Click **Card visual** from the Visualizations pane.
- Drag **U5 Population ('000s)** from your dataset into **Values**.
- Change aggregation → click the drop-down → choose **Count**.
- Title: "Count of U5 Population ('000s)".

2. Sum of Survey Sample (N):

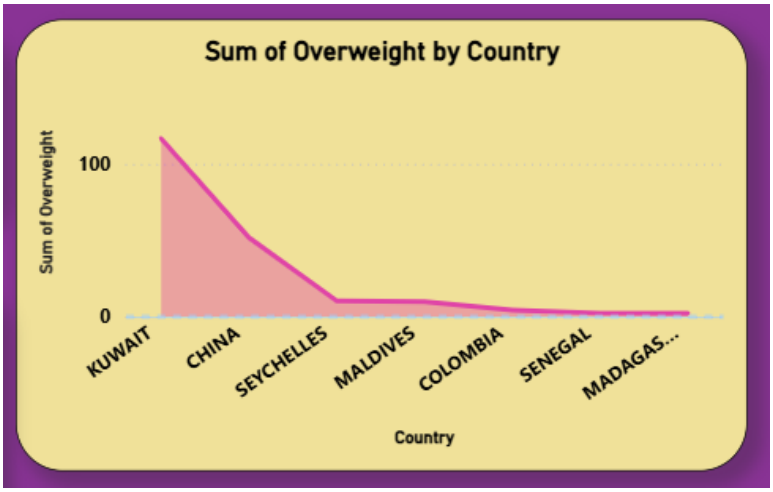
- Duplicate the first card or insert a new Card visual.
- Drag Survey Sample (N) to Values.
- Aggregation: Sum.
- Format and title it as "Sum of Survey Sample (N)".

3. Sum of Underweight:

- Add another **Card visual**.
- Drag **Underweight** field into **Values**.
- Aggregation: **Sum.**
- Title: "Sum of Underweight".

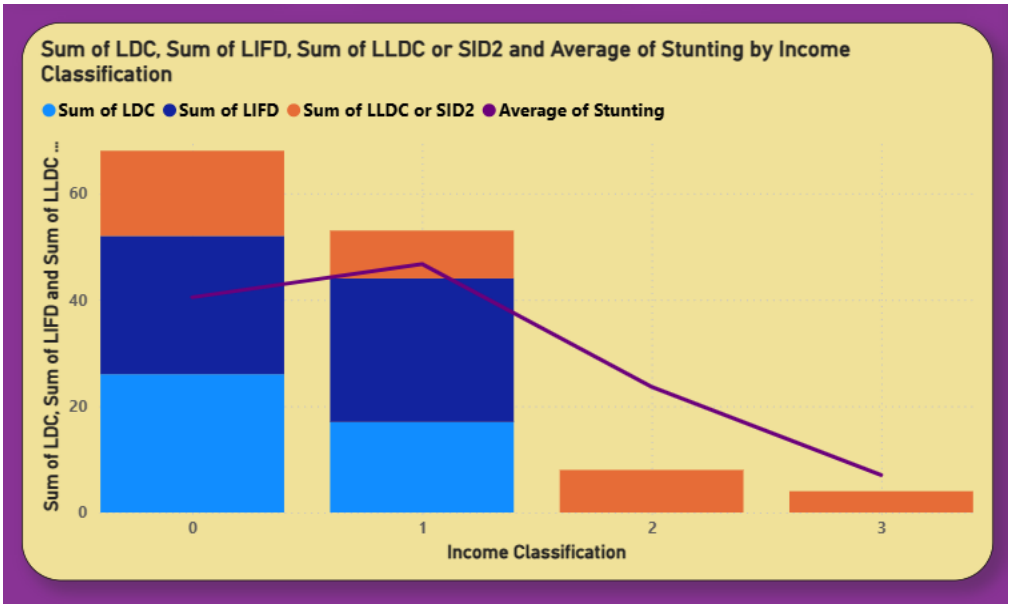
4. Line Chart – Sum of Overweight by Country

- Click on **Line Chart** visual.
- Drag **Country** to the **X-axis**.
- Drag **Overweight** to the **Y-axis (Values).**
- Aggregation: **Sum.**
- Title: "Sum of Overweight by Country".



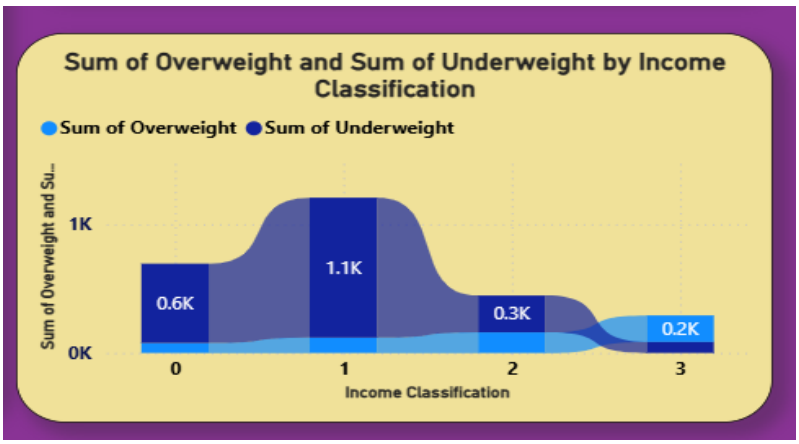
5. Combo Chart – LDC/LIFD/LLDC/SID2 vs Average Stunting:

- This visual compares multiple sums and an average together.
- Select **Combo Chart** (Clustered Column and Line chart icon).
- Drag **Income Classification** to the **X-axis**.
- Drag the following fields to **Column values**:
    - LDC
    - LIFD
    - LLDC or SID2 (as per your dataset)
- Drag **Stunting** to the **Line values**.
- Aggregations:
    - LDC/LIFD/LLDC/SID2 → **Sum**
    - Stunting → **Average.**



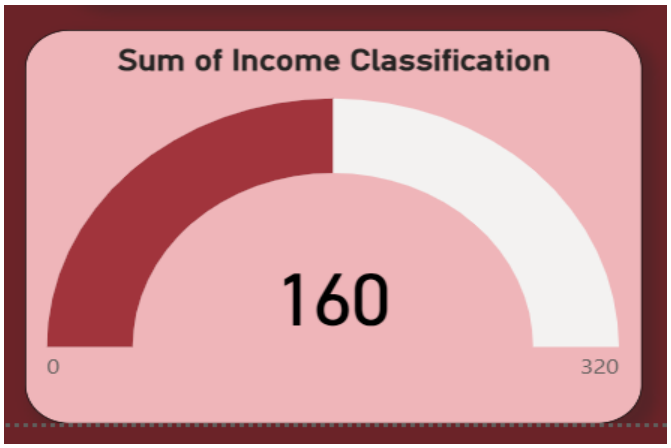
6. Area Chart – Overweight vs Underweight by Income Classification

- Select **Area Chart** from the Visualizations pane.
- Drag **Income Classification** to the **X-axis**.
- Drag **Overweight** and **Underweight** to **Y-axis (Values).**
- Aggregation: **Sum**.
- Title: "Sum of Overweight and Sum of Underweight by Income Classification".



7. Add the Gauge Visual:

- Go to **Report View** (paint roller icon).
- From the **Visualizations pane**, select the **Gauge icon** (it looks like a speedometer).
- Drag **Total Income Classification** measure into the **Value** field well.



CHAPTER-5

Dashboard

5.1 Dashboard Design File

A dashboard is a graphical user interface (GUI) that displays information and data in an organized, easy-to-read format. Dashboards are often used to provide real-time monitoring and analysis of data and are typically designed for a specific purpose or use case. Dashboards can be used in a variety of settings, such as business, finance, manufacturing, healthcare, and many other industries. They can be used to track key performance indicators (KPIs), monitor performance metrics, and display data in the form of charts, graphs, and tables.

To Create a Dashboard:

In Dashboards, we have created a Title box, a Stacked Area chart, a Line and Stacked column chart, a Ribbon chart.

1. To create a title box- go to home tab -> click on text box -> select and drag the text box -> Enter the title GLOBAL MALNUTRITION TRENDS (1983 – 2019)
2. Next, create three cards:

   The first card displays the country-wise average of U5 population. The second card shows the sum of survey samples of malnutrition estimates. The third card shows the total of underweight malnutrition estimates.
3. For the Stacked Area chart:

   Place Country in the x-axis and the sum of overweight in the y-axis.

   Filter the countries of Kuwait, China, Seychelles, Maldives, Colombia, Senegal, and Madagascar.

   Now format it using the format visual to change the color of the background, text, and title.
4. For the Line and stacked column chart:

   Place the Income Classification in the X-axis, and place Sum of LDC, Sum of LIFD, Sum of LLDC or SID2 in the Y-axis.

   Place the Average area of Stunting in Line Y-axis.

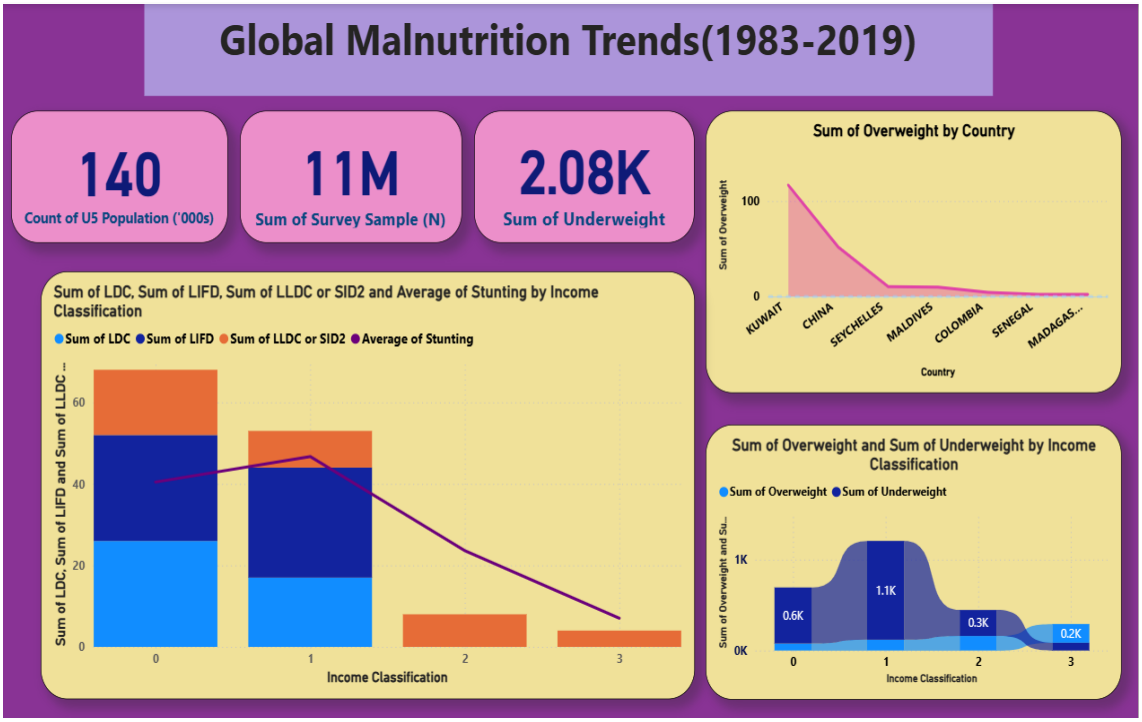
   Now format it using the format visual to change the color of the background, text, and title.

   Here, select the Legend in format visual, which determines the color of the graph
5. For the Ribbon chart:

Place the Income Classification in the X-axis of malnutrition estimates, and place Sum of Overweight and Sum of Underweight in the Y-axis.

Measures are the Quantitative data that represent the numerical data.

Now format it using the format visual to change the color of the background, text, and title. Place the Data labels on to show the values in the ribbon chart.



CHAPTER-6

Report

6.1 Story Design File:

Designing a report in Power BI involves connecting to data sources, creating visualizations like charts and graphs, customizing their appearance and interactivity, organizing them logically on the canvas, formatting elements for consistency and clarity, and optionally creating dashboards for a summarized view. Throughout the process, it's essential to consider the audience's needs and ensure the report effectively communicates insights from the data. Finally, iterate based on feedback to continually improve the report's design and usefulness.

To create a report:

In the report, we have inserted an image, a Gauge card, and a text box

1. To insert the image:

   Click on Insert tab -> then click on Insert Image -> select the image-> click on open. The image will be inserted.

2. To insert a Gauge card:

   Select the Gauge card in the Visualization pane -> Place Sum of Income Classification in the value. The value will be 160.

3. Report is placed in the Textbox.

   - The data spans from 1983 to 2019, focusing on global malnutrition trends.
   - The count of US population is 140 (in thousands).
   - The total survey sample is 317 million.
   - The sum of underweight individuals is 10.34 thousand.
   - Malnutrition trends vary across income classifications.
   - Lower income classifications have higher underweight sums.
   - Higher income classifications have higher overweight sums.
   - Kuwait has the highest sum of overweight individuals.
   - Overweight sums increase with higher income classifications.
   - Underweight sums decrease as income classification increases.
   - The Gauge Card describes the sum of Income Classification is 160.

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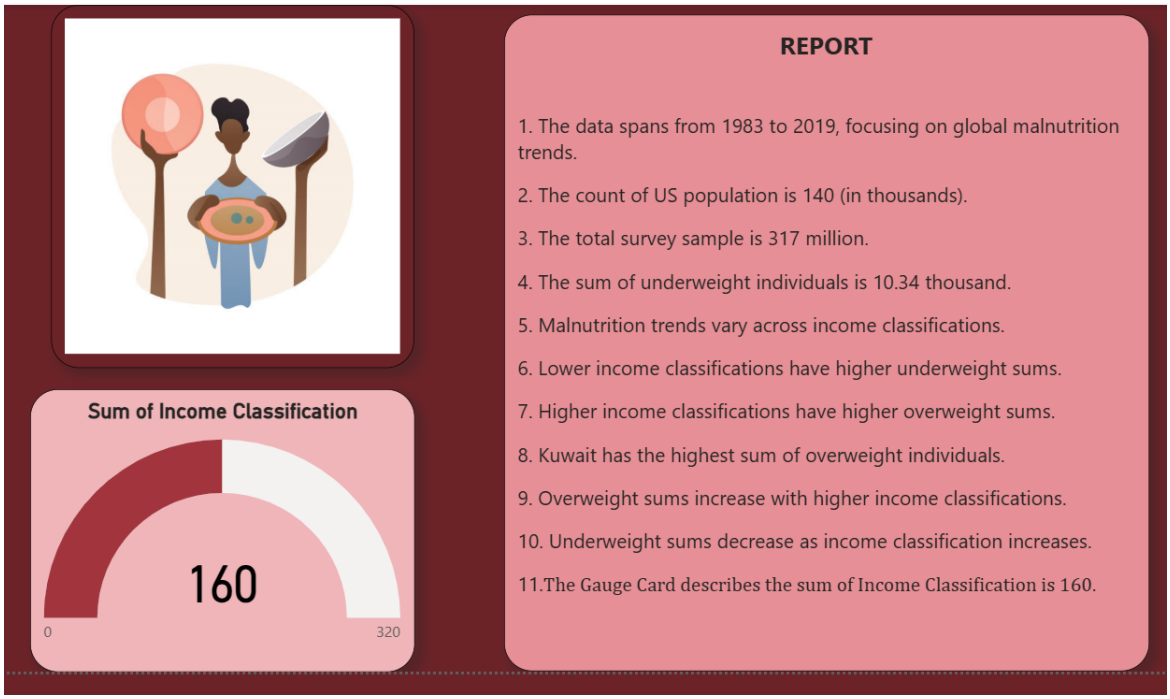


CHAPTER-7

7. Performance Testing

7.1 Utilization of Data Filters:

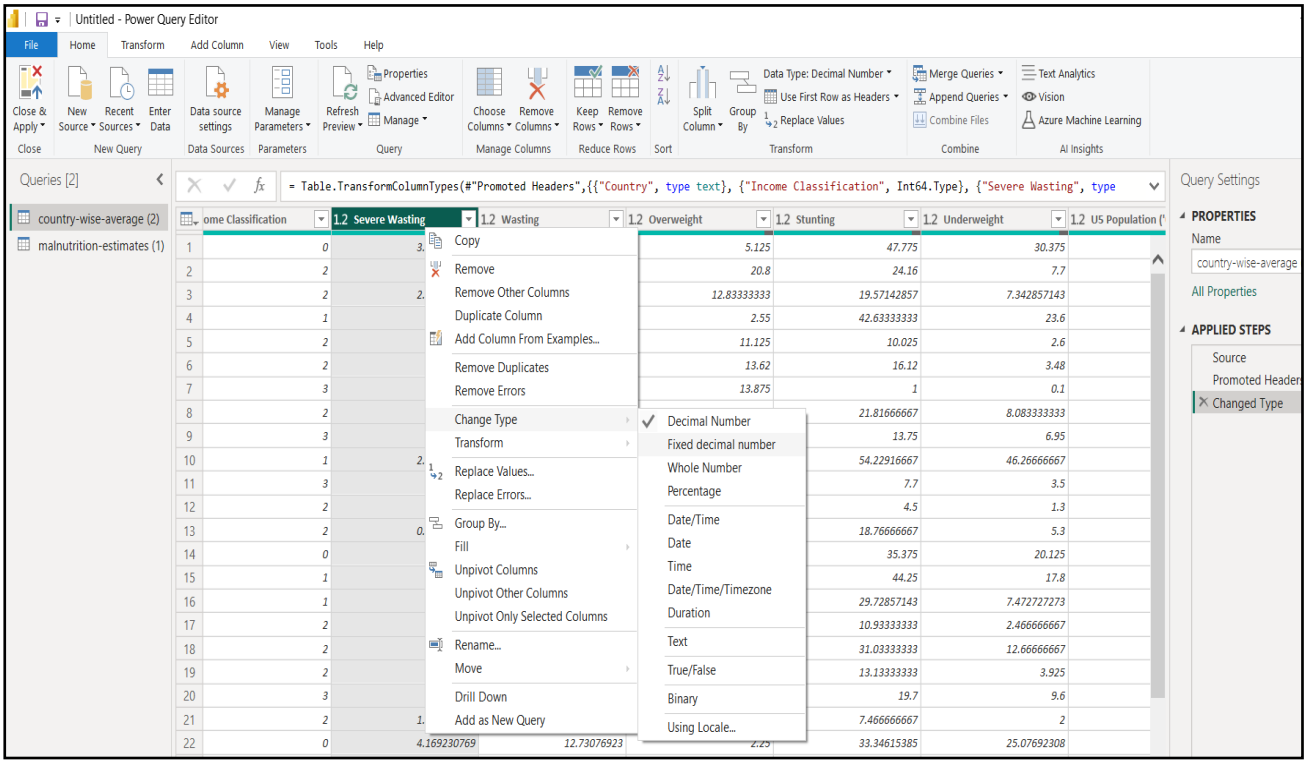
Data filters were applied strategically to improve interactivity and enhance user experience. Filters were used to enable country-wise and regional comparisons of malnutrition indicators such as stunting, wasting, and underweight prevalence.

Purpose: To allow users to focus on specific subsets of data and analyze targeted areas of interest.

Performance Check: Filters load data dynamically with minimal lag, ensuring smooth navigation and quick data refresh during interactions.

1. Applied filters for every column for both data sets. The numerical columns has been converted to fixed decimal data type.

2. The column containing U5 Population in both data sets has been converted to percentage data type.



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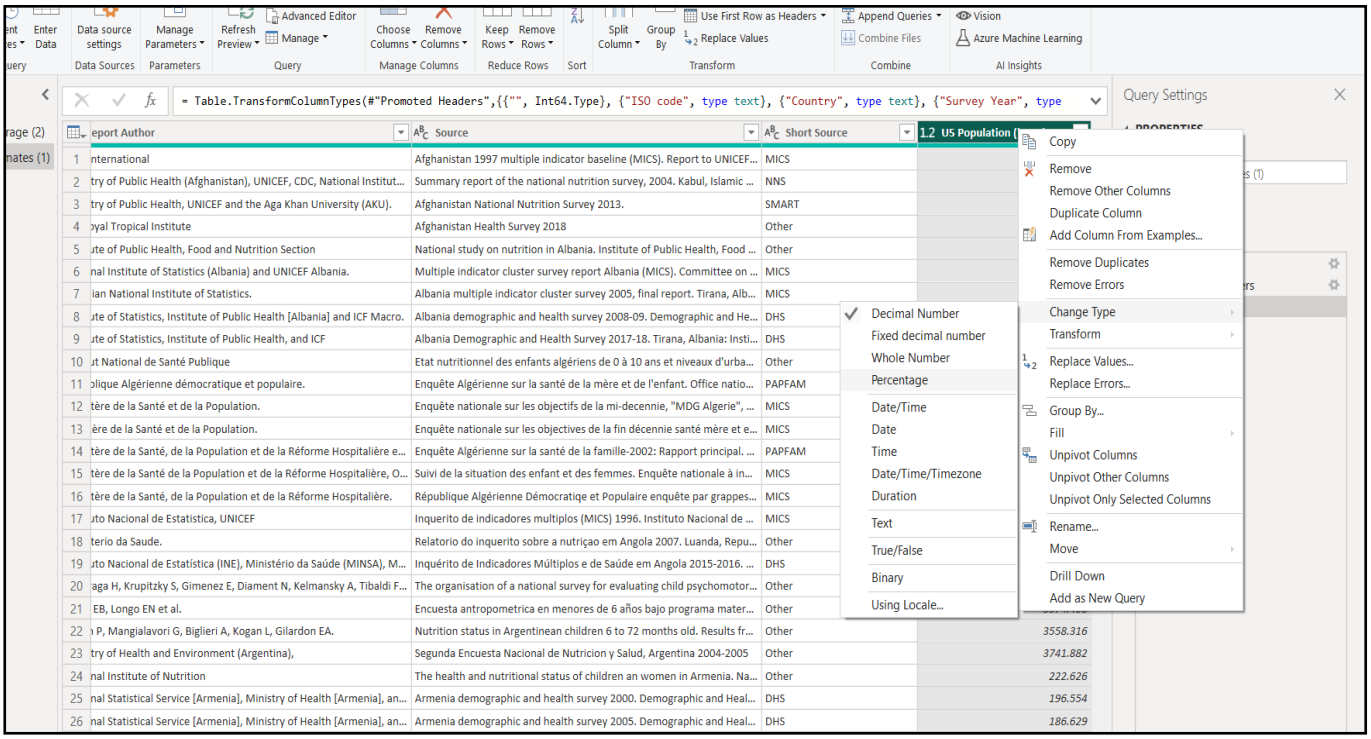
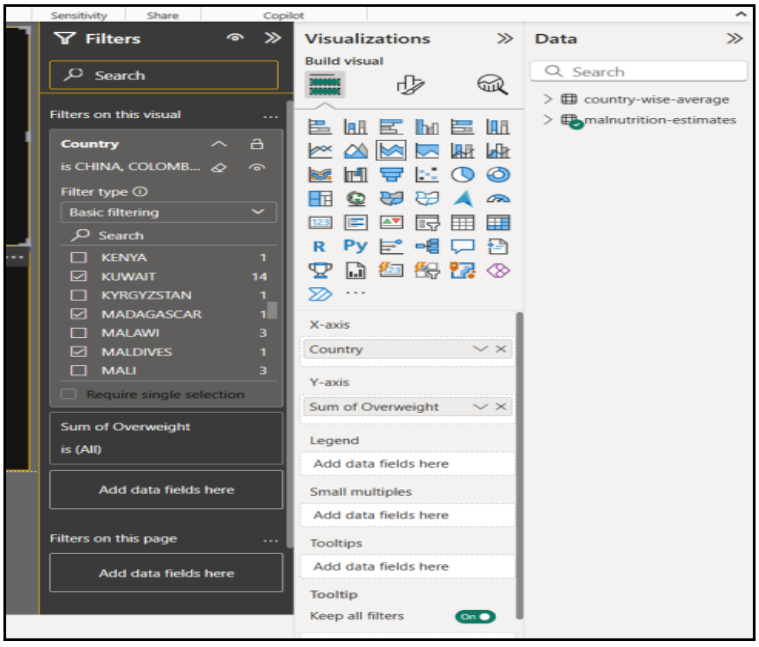


3. Selected “Country” as a Filter



7.2 No of Visualizations:

1. Count of U5 Population.
2. Sum of Survey Sample (N).
3. Sum of Underweight.
4. Total Income Classification.
5. Sum of Overweight and Underweight by income Classification.
6. Sum of LDC, LIFD, LLDC, SID2 and Average of Stunting by Income Analysis.
7. Sum of Overweight by Country.

CHAPTER-8

CONCLUSION

Conclusion:

1. Overall Data Insight:

- The global analysis of malnutrition data between 1983 and 2019 shows significant variation in child nutrition indicators such as underweight, overweight, and stunting across different income classifications and countries.

2. Underweight & Overweight Trends:

- The global underweight rate remains a major concern, though some progress is seen in higher-income groups.
- Overweight **cases** are increasing in several middle- and high-income countries, indicating a growing issue of over nutrition alongside undernutrition.

3. Country-Level Patterns:

- Countries like Kuwait, China, and Seychelles show higher proportions of overweight children, reflecting changes in diet and lifestyle.
- In contrast, Madagascar and Senegal report lower overweight but relatively higher stunting, showing persistent food insecurity.

4. Income Classification Insights (Gauge Chart Observation):

- The Gauge Chart for the Sum of Income Classification indicates that as income classification increases (from LDC → LIFD → LLDC → SID2), malnutrition indicators like stunting and underweight tend to decrease.
- This suggests that economic development correlates positively with better child nutrition outcomes.

5. Stunting and Development Correlation:

- The Combo Chart shows that Least Developed Countries (LDCs) experience the highest average stunting rates, whereas Small Island Developing States (SID2) show the lowest.

6. Global Outlook:

- While underweight prevalence is gradually reducing, overweight and obesity in children under five are emerging global challenges.
- The data suggests a nutrition transition, where some countries face dual burdens of malnutrition — both undernutrition and over nutrition

CHAPTER-9

Future Scope

Future scope:

1. Integration of Recent Data (Post-2019):

- Update the dataset with the latest WHO and UNICEF malnutrition statistics to track progress after 2019.
- This will help assess the impact of global initiatives like the Sustainable Development Goals (SDG-2: Zero Hunger).

2. Predictive Analysis:

- Use machine learning or forecasting models in Power BI or Python to predict future malnutrition trends based on historical data.
- This can support governments and NGOs in early intervention planning.

3. Regional and Gender-Based Insights:

- Expand the analysis to compare urban vs. rural and male vs. female malnutrition patterns.
- Helps identify vulnerable populations for more targeted nutrition programs.

4. Correlation with Economic and Health Indicators:

- Combine malnutrition data with other datasets such as GDP, healthcare access, and education level to study broader socio-economic impacts.
- This can help in designing evidence-based policy decisions.

5. Interactive Dashboards for Stakeholders:

- Develop an interactive, web-based Power BI dashboard for use by policy makers, NGOs, and researchers to visualize real-time insights.
- Include slicers for year, region, and income group to enhance user experience.

6. Monitoring Nutrition Programs:

- Integrate program-level data (like food supply, supplementation coverage, and government schemes) to evaluate effectiveness of interventions.
- Could be useful for agencies like UNICEF, WHO, and FAO.

7. Awareness and Education Support:

- The insights can be turned into visual storytelling dashboards to raise awareness among communities and schools about healthy nutrition practices.

The current dashboard provides a strong foundation for understanding global malnutrition trends.
By incorporating predictive analytics, real-time updates, and socio-economic context, the project can evolve into a powerful decision-support system to guide global and national efforts toward eliminating malnutrition by 2030.

CHAPTER-10

Appendix

10.1. GitHub & Project Demo Link:

GitHub Link: https://github.com/cvictorjoy004/Global-Malnutrition-Trends-A-Power-BI-Analysis-1983-2019---C-VICTOR-JOY

Demo Link: https://drive.google.com/file/d/1EQaM4gBtwHnMOq_HCTMkQtq77ShoGxlJ/view?usp=drive_link