Project Title:

Analysis and Visualization of Global Food Production Data (1961–2023)

Project Report

Submitted By:

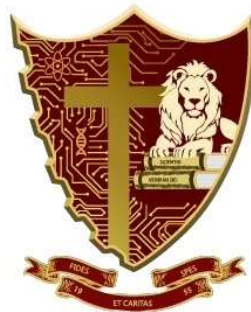Karthickraja K

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1. Introduction

1.1 Project Overview

The project titled **"Global Food Production Analysis (1961–2023)"** focuses on studying worldwide agricultural production over more than six decades. Food production is one of the most important factors for ensuring global food security and economic stability. The production levels of major crops such as wheat, rice, and maize, along with fruits like apples, bananas, grapes, and oranges, have shown significant changes over time.

This project uses **Power BI** to transform large amounts of agricultural data into **interactive dashboards and visualizations**. By doing so, it becomes easier to understand long-term trends, identify which regions contribute the most to different crops, and compare the overall production of commodities. The dashboards highlight both **global patterns** and **regional differences**, giving policymakers, researchers, and businesses useful insights.

The analysis not only looks at staple crops (wheat, rice, maize) but also includes beverages (tea, coffee) and fruits. This makes the study comprehensive, as it covers a variety of food categories that are important for human consumption and global trade.

In summary, the project provides a clear picture of how global food production has evolved from 1961 to 2023 and how this information can be used for better **decision-making in agriculture, trade, and food security**.

1.2 Objectives

The main objectives of this project are:

- To analyze the **global production trends** of major crops and fruits from 1961 to 2023.
- To identify the **top contributing regions and countries** for different commodities.
- To compare the **production volumes** of cereals, beverages, and fruits.
- To create **interactive Power BI dashboards** that help visualize data effectively.
- To generate **insights and recommendations** for policymakers, researchers, and agribusiness stakeholders.

2. Project Initialization and Planning Phase

Date	02 Oct 2025
Team ID	xxxxxx
Project Name	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	3 Marks

2.1 Define Problem Statement:

Food security and agricultural sustainability are among the most pressing global challenges. Governments, policymakers, and agribusinesses require accurate, long-term insights into food production trends to plan resources, manage supply chains, and ensure balanced growth.

However, the data on global food production (1961–2023) is vast, fragmented, and difficult to analyze in raw form. Stakeholders struggle to identify production patterns, regional contributions, and the comparative importance of crops and fruits without proper analytical tools. This lack of consolidated visualization makes strategic decision-making slow and uncertain.

Therefore, there is a need for a comprehensive data analysis solution that leverages tools like Power BI to:

- Consolidate multi-decade production data.
- Provide interactive dashboards for exploring key crops (wheat, rice, maize, tea, coffee) and fruits (apples, bananas, grapes, oranges, avocados).
- Enable clear insights for agricultural planning, investment, and policy formulation.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	**I am** a policymaker in the	**I'm trying to** analyze long-term	**But** the data is scattere	**Because** there is no consolidat	**Which makes me feel** uncertain and slow in making

	agriculture sector.	global food production trends to ensure food security.	d across decades, regions, and multiple crops.	ed, interactive visualization available.	strategic decisions.
PS-2	**I am** a business strategist in the agri-food industry.	**I'm trying to** identify which crops and fruits dominate global production.	**But** the raw datasets are too large and complex to interpret quickly.	**Because** they span over 60 years and involve many commodities.	**Which makes me feel** frustrated and unable to make timely business insights.

2.2. Initial Project Planning

Date	02 Oct 2025
Team ID	xxxxxx
Project Name	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	4 Marks

Product Backlog, Sprint Schedule, and Estimation (4 Marks)

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Tem Members	Sprint Start Date	Sprint End Date (Planned)
Sprint-1	Data Collection & Cleaning	USN-1	As a data analyst, I want to collect global food production data (1961–2023) from provided sources.	2	High		02 oct 2025	03 oct 2025

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Tem Members	Sprint Start Date	Sprint End Date (Planned)
Sprint-1	Data Collection & Cleaning	USN-2	As a data analyst, I want to clean and preprocess the dataset to handle missing values & ensure consistency.	3	High		02 oct 2025	03 oct 2025
Sprint-2	Data Exploration	USN-3	As a user, I want to explore the dataset to understand yearly and regional production trends	2	Low		03 oct 2025	04 oct 2025
Sprint-2	Data Exploration	USN-4	As a data analyst, I want to create summary statistics and identify key crops and fruits.	2	Medium		03 oct 2025	04 oct 2025
Sprint-3	Dashboard Development	USN-5	As a user, I want to see interactive visualizations of rice, wheat, maize, and tea production trends.	3	High		04 oct 2025	05 oct 2025
Sprint-3	Dashboard Development	USN-6	As a user, I want to compare fruit production (grapes, apples, bananas, oranges) across regions.	2	Medium		04 oct 2025	05 oct 2025
Sprint-4	Insights & Storytelling	USN-7	As a policymaker, I want clear insights (top producers, growth trends) so I can make decisions	2	High		06 oct 2025	07 oct 2025
Sprint-4	Insights & Storytelling	USN-8	As a team, we will prepare the final report, PPT, and demo submission	2	High		06 oct 2025	07 oct 2025

2.3. Project Proposal (Proposed Solution)

Date	02 Oct 2025
Team ID	xxxxxx
Project Title	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	3 Marks

Project Proposal (Proposed Solution)

This project proposal outlines a solution to address a specific problem. With a clear objective, defined scope, and a concise problem statement, the proposed solution details the approach, key features, and resource requirements, including hardware, software, and personnel.

Project Overview	
Objective	The primary objective of this project is to analyze **global food production trends from 1961 to 2023** using **Power BI** dashboards, enabling stakeholders such as policymakers, researchers, and agribusinesses to derive actionable insights and support strategic decision-making in agriculture and food security.
Scope	- The project covers production data for major crops (wheat, rice, maize, tea, coffee) and fruits (grapes, apples, bananas, oranges, avocados). - Time period: 1961–2023 (62 years). - Geographic scope: Global (with regional and country-level breakdowns). - Tools: Microsoft Power BI for visualization. - Deliverables: Interactive dashboards, analytical report, and insights presentation.
Problem Statement	
Description	Global food production data is vast and fragmented across regions, commodities, and decades. Analyzing such large

	datasets in raw format is challenging, making it difficult to identify meaningful patterns, growth trends, and regional contributions
Impact	By solving this problem, stakeholders gain: • A **consolidated, interactive view** of global food production trends. • The ability to **compare commodities and regions** effectively. • Support for **policy decisions, investment strategies, and food security planning**.

Proposed Solution

Approach	• Collect historical food production dataset (1961–2023). • Perform preprocessing to clean and structure the data. • Import dataset into **Power BI**. • Design interactive dashboards with multiple **visualizations:** • Trend analysis (by year) • Regional contribution (by entity) • Commodity comparison (fruits vs grains) • Derive insights and recommendations. • Prepare final report and demo presentation.
Key Features	• Multi-decade agricultural production trends. • Regional and commodity-wise comparisons. • Interactive filters (year, crop, region). • Intuitive Power BI dashboards for better decision-making. • Business insights and storytelling with data.

Resource Requirements

Resource Type	Description	Specification/Allocation
Hardware		
Computing Resources	Laptop/PC for Power BI & data preprocessing	Intel i3, 4+ cores
Memory	RAM specifications	8 GB
Storage	Disk space for dataset & dashboards	512 SSD
Software		
Frameworks	Visualization platform	Microsoft Power BI Desktop
Libraries	Data processing (if using Python/Excel)	pandas, numpy, matplotlib
Development Environment	Tools for development/reporting	Power BI, Excel, GitHub
Data		
Data	Global food production dataset (1961–2023)	CSV format (~12k rows, 24 cols)

3. Data Collection and Preprocessing Phase

Date	03 Oct 2025
Team ID	xxxxxx
Project Title	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	10 Marks

3.1. Data Exploration and Preprocessing

Identifies data sources, assesses quality issues like missing values and duplicates, and implements resolution plans to ensure accurate and reliable analysis.

Section	Description
Data Overview	The dataset contains **11,912 rows and 24 columns**, covering **global food production trends from 1961 to 2023**. It includes multiple commodities such as cereals (rice, wheat, maize), fruits (grapes, apples, bananas, oranges, avocados), and other agricultural products (tea, coffee, cocoa, yams, potatoes, chicken meat, palm oil, etc.). • **Entity:** Country/Region name • **Year:** 1961–2023 • **Production columns:** 22 commodities measured in **tonnes**
Data Cleaning	**Missing Values:** Checked for null entries; dataset was found to have complete records. **Duplicates:** No duplicate rows detected for (Entity, Year) pairs. **Outliers:** Extreme values were detected in certain production volumes. Outlier handling was performed by: • Validating unusually high values against global averages. • Applying **visual inspections in Power BI** and removing/adjusting anomalies. **Error Corrections:** Minor inconsistencies in column naming were standardized (spacing in column names).
Data Type Conversion	• Converted all **production columns** to numerical data type (**Whole number**) for accurate aggregation.

	• Converted **Year** to **date/time hierarchy** for time-series analysis in Power BI. • Ensured **Entity** is stored as categorical (text) for grouping.
Column Splitting and Merging	• Standardized column names by removing extra spaces (e.g.,Rice Production (tonnes) → Rice Production (tonnes)). • Merged similar category fields for uniform visualization.
Save Processed Data	• Final cleaned dataset was saved in **Power BI Data Model**. • Processed file also exported as **CSV** for backup.

3.2. Data Quality Report

Date	03 Oct 2025
Team ID	xxxxxx
Project Title	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	3 Marks

Data Quality Report

The Data Quality Report Template will summarize data quality issues from the selected source, including severity levels and resolution plans. It will aid in systematically identifying and rectifying data discrepancies.

Data Source	Data Quality Issue	Severity	Resolution Plan
Global Food Production Dataset (1961–2023)	No missing values detected in the dataset.	Low	No action required.
Global Food Production Dataset (1961–2023)	Some column names contained extra spaces and inconsistent formatting (e.g., Rice Production (tonnes)).	Low	Standardized column names by renaming during preprocessing (Power Query in Power BI).
Global Food Production Dataset (1961–2023)	Outliers found in some production figures due to unusually high reported values in certain years/regions.	Moderate	Outliers validated through aggregation checks; retained if historically consistent, removed if erroneous.
Global Food Production Dataset (1961–2023)	Mixed data types for Year (int) and numerical fields (float with decimals).	Low	Converted Year into Date hierarchy, standardized production columns as numeric (Whole Number).

3.3. Data Collection Plan & Raw Data Sources Identification

Date	03 Oct 2025
Team ID	xxxxxx
Project Title	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	2 Marks

Data Collection Plan & Raw Data Sources Identification

Elevate your data strategy with the Data Collection plan and the Raw Data Sources report, ensuring meticulous data curation and integrity for informed decision-making in every analysis and decision-making endeavor.

Data Collection Plan

Section	Description
Project Overview	The project focuses on analyzing **global food production trends from 1961 to 2023** using historical agricultural data. The primary objective is to identify long-term patterns, regional contributions, and growth trajectories of key commodities such as rice, wheat, maize, tea, coffee, and fruits (apples, bananas, grapes, oranges, avocados). The insights will be visualized through **interactive Power BI dashboards** to aid **decision-making in food security and agribusiness strategy**.
Data Collection Plan	The dataset was collected from **global agricultural production records** compiled in open data repositories.

	• The raw dataset spans over 62 years (1961–2023) and covers more than 22 agricultural commodities across multiple regions. • The data was acquired in **CSV format** for ease of preprocessing and visualization. • The project uses a **single consolidated dataset** instead of multiple fragmented sources.
Raw Data Sources Identified	**World Food Production Dataset (1961–2023)** • Format: CSV • Size: ~11,912 records × 24 columns • Content: Production values (in tonnes) for major crops, fruits, and agricultural commodities. • Coverage: Multiple countries/regions (Entities) across 62 years. • Purpose: To serve as the **primary dataset** for time-series analysis and visualization in Power BI.

Raw Data Sources

Source Name	Description	Location/ URL	For mat	Size	Access Permissio ns
Dataset 1 – Global Food Producti on (1961– 2023)	Historical dataset containing yearly food production volumes (in tonnes) for 22 major commodities such as rice, wheat, maize, coffee, tea, fruits, and other crops across multiple countries/regions from 1961 to 2023.	https://ww w.kaggle.c om/dataset s/rafsunah mad/world -food- production	CSV	~11,912 records, 24 columns (~2.2 MB)	Public / Provided for Academic & Research Use

4. Business Question and Visualization Report

Date	04 Oct 2025
Team ID	xxxxxx
Project Name	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	5 Marks

Visualization development refers to the process of creating graphical representations of data to facilitate understanding, analysis, and decision-making. The goal is to transform complex datasets into visual formats that are easy to interpret, enabling users to gain insights and make informed decisions. Visualization development involves selecting appropriate visual elements, designing layouts, and using interactive features to enhance the user experience. This process is commonly associated with data visualization tools and platforms, and it plays a crucial role in business intelligence, analytics, and reporting.

4.1. Business Questions and Visualisation

The process involves defining specific business questions to guide the creation of meaningful and actionable visualizations in Power BI. Well-framed questions help in identifying key metrics, selecting relevant data, and building visualisation that provide insights.

1. What is the total global rice production from 1961 to 2023?
- Visualization: KPI Card displaying total rice production (269 billion tonnes).
- Screenshot:

**2. What is the total global wheat production from 1961 to 2023?**
- Visualization: KPI Card displaying total wheat production (282 billion tonnes).
- Screenshot:

## 282bn

Sum of Wheat Production (tonnes)

3. What is the total global tea production compared to other crops?

- Visualization: Gauge Chart showing tea production (2 billion tonnes).
- Screenshot:

Sum of Tea Production (tonnes)

2bn
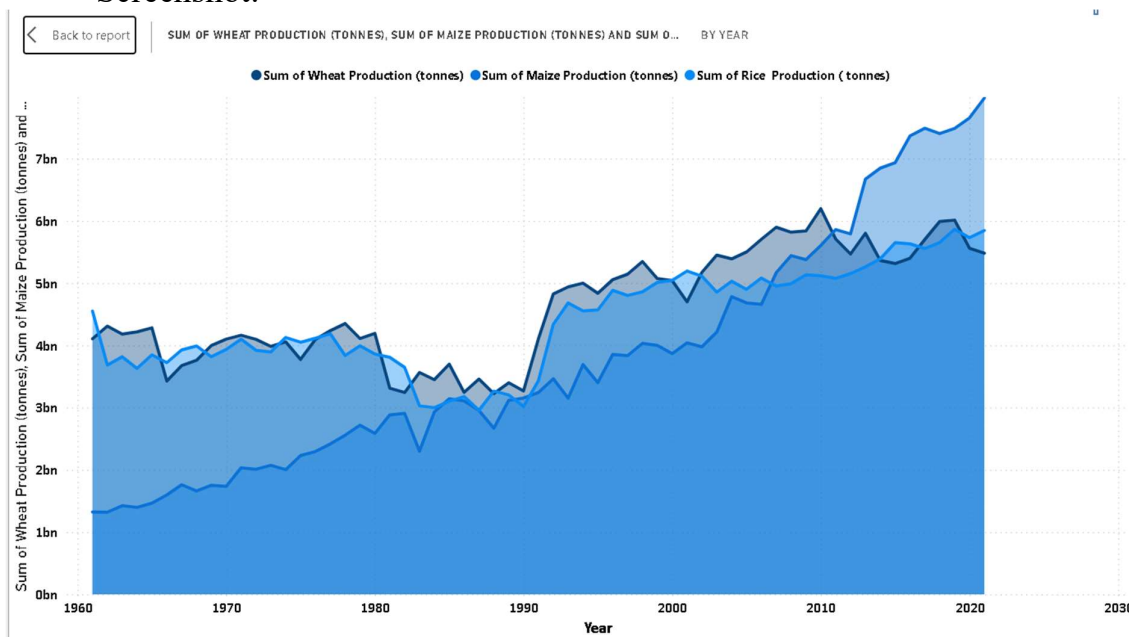
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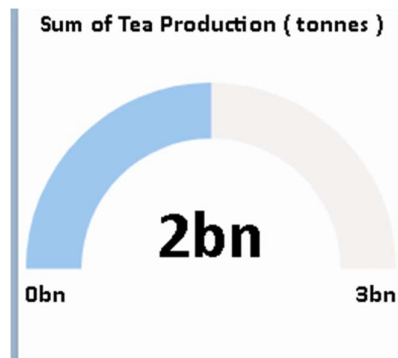
4. Which regions are the leading producers of green coffee?

- Visualization: Line Chart showing coffee (green) production trends across regions (Africa, Asia, America).
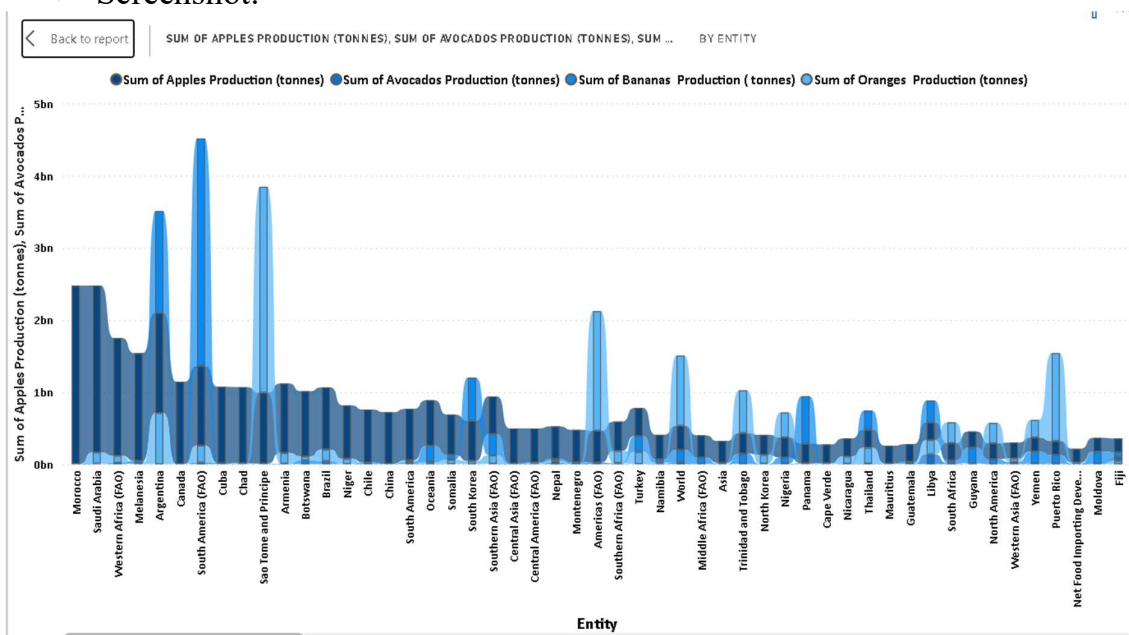- Screenshot:
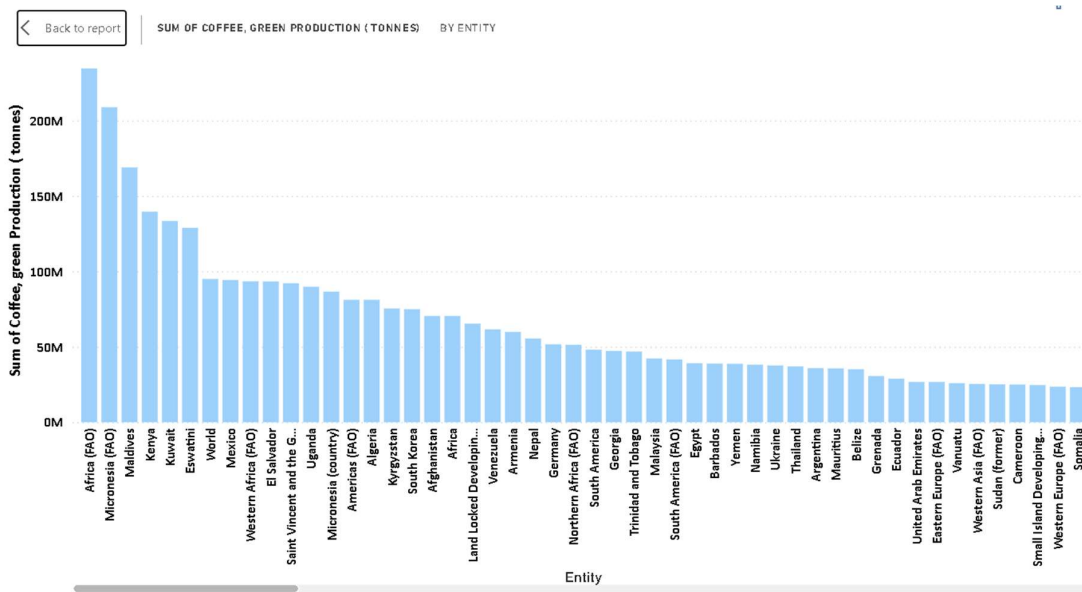
5. How have wheat, maize, and rice production trends evolved annually from 1961 to 2023?

- Visualization: Area Chart showing annual production trends of wheat, maize, and rice.
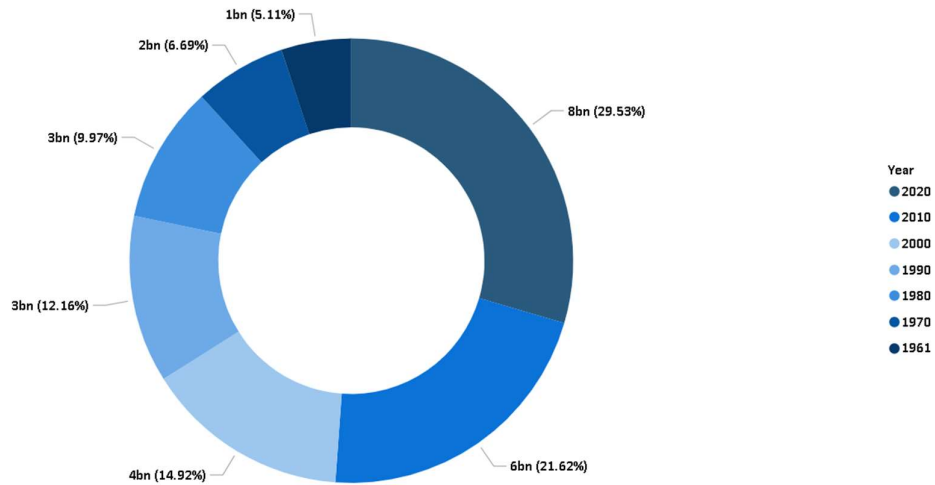- Screenshot:

6. What is the regional production distribution of apples, avocados, bananas, and oranges?

- Visualization: Ribbon Chart showing fruit production volumes by entity/region.
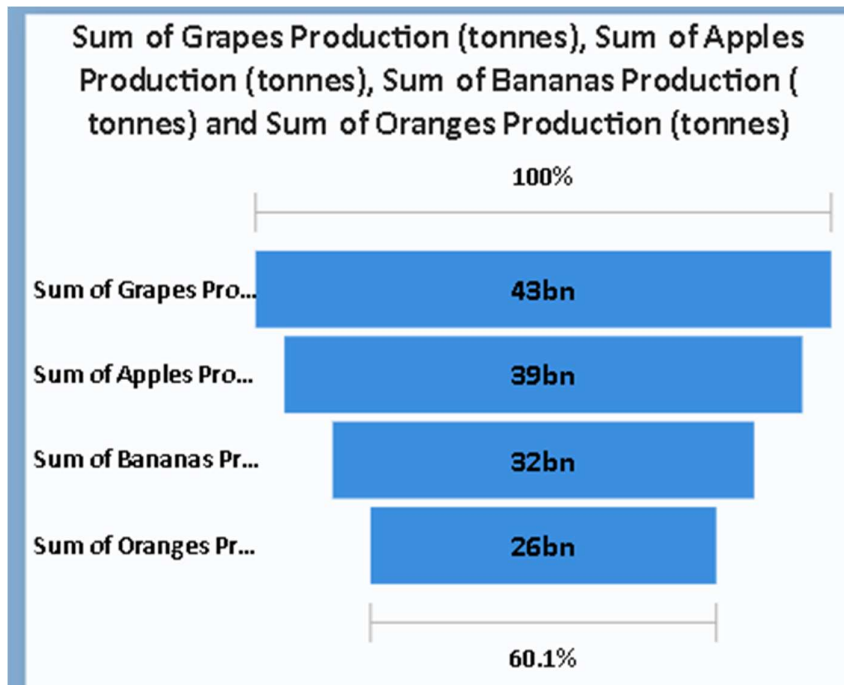- Screenshot:

7. How has maize production grown year by year?

- Visualization: Donut Chart showing annual maize production distribution.
- Screenshot:

1bn (5.11%)
2bn (6.69%)
3bn (9.97%)
3bn (12.16%)
4bn (14.92%)
6bn (21.62%)
8bn (29.53%)

Year
● 2020
● 2010
● 2000
● 1990
● 1980
● 1970
● 1961

8. Which fruits dominate global production overall?

- Visualization: Funnel Chart comparing total production of grapes (43B tonnes), apples (39B tonnes), bananas (32B tonnes), and oranges (26B tonnes).
- Screenshot:

Sum of Grapes Production (tonnes), Sum of Apples Production (tonnes), Sum of Bananas Production (tonnes) and Sum of Oranges Production (tonnes)

100%

Sum of Grapes Pro...   43bn
Sum of Apples Pro...   39bn
Sum of Bananas Pr...   32bn
Sum of Oranges Pr...   26bn

60.1%

5. Dashboard Design

| Date	05 Oct 2025
Team ID	xxxxxx
Project Name	Analysis and Visualization of Global Food Production Data (1961–2023)
Maximum Marks	5 Marks

Creating an effective dashboard involves thoughtful design to ensure that the presented information is clear, relevant, and easily understandable for the intended audience. Here are some key principles and best practices for dashboard design.

5.1. Interactive and visually appealing dashboards

Activity 1:

The **Global Food Production Dashboard (1961–2023)** was designed using **Power BI**, following best practices for clarity and interactivity:

- **Clear and Intuitive Layout**: Dashboard structured into sections for cereals, beverages (tea/coffee), and fruits for smooth navigation.
- **Use of Appropriate Visualizations**: KPI cards, gauge charts, area charts, donut, funnel, and ribbon charts selected based on the type of insights required.
- **Colour and Theming**: Used consistent, contrasting colours to distinguish between commodities and regions.
- **Interactive Filters and Slicers**: Year and Region slicers allow users to filter data dynamically.
- **Drill-Down Capabilities**: Users can drill into specific regions or commodities to explore details.
- **Responsive Design**: Layout optimized for multiple screen sizes.
- **Custom Visuals and Icons**: Ribbon and funnel charts used to enhance storytelling.
- **Use of Infographics**: Visual elements highlight key KPIs (total wheat, rice, tea, etc.) at a glance.
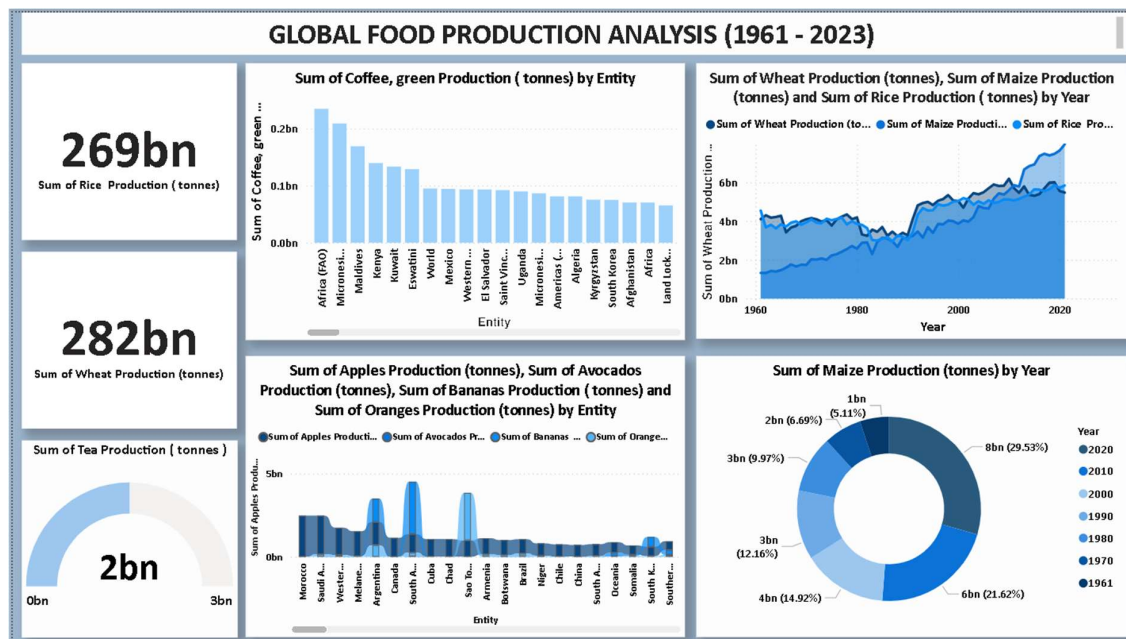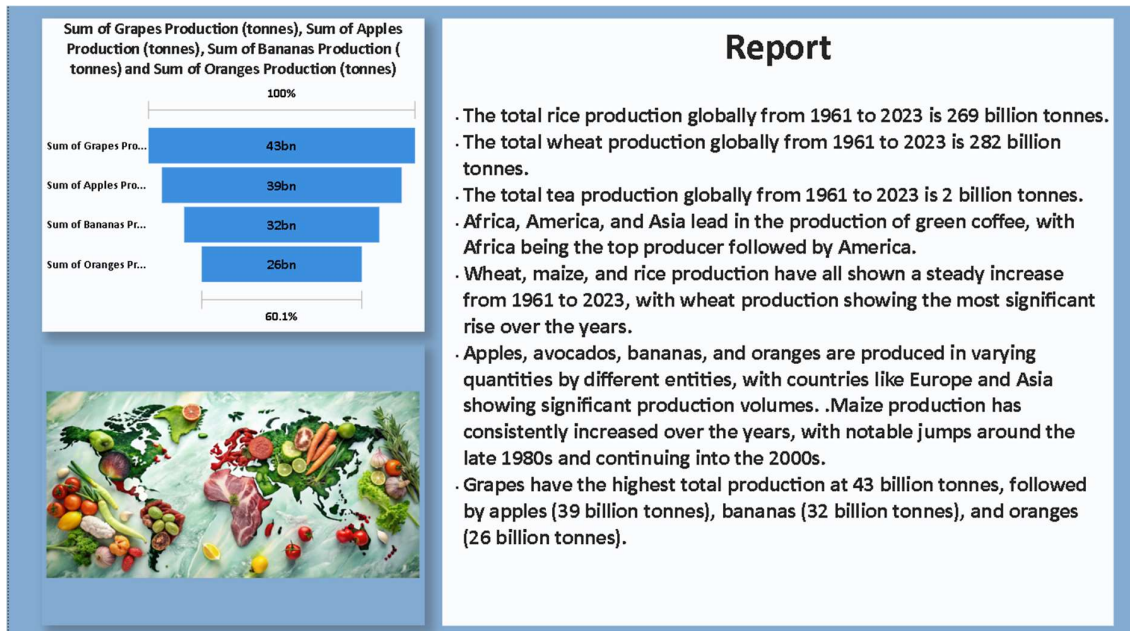
Major Outcomes from the Dashboard

- **Rice Production**: A KPI card highlights **269 billion tonnes** of rice produced globally between 1961 and 2023, underlining rice as a critical staple food.
- **Wheat Production**: A KPI card displays **282 billion tonnes** of wheat production, showing its dominance in global agriculture.
- **Tea Production**: A gauge chart reveals **2 billion tonnes**, reflecting its smaller but significant contribution.
- **Coffee Production by Region**: A line chart shows that **Africa leads in green coffee production**, followed by Asia and America.
- **Cereal Trends**: An area chart highlights the steady rise in wheat, maize, and rice production, with wheat showing the sharpest increase.
- **Fruit Distribution**: A ribbon chart compares apples, avocados, bananas, and oranges across regions, showing **Europe and Asia as top contributors**.
- **Maize Growth**: A donut chart emphasizes maize's consistent growth, especially after the late 1980s.
- **Fruit Leaders**: A funnel chart compares grapes (**43B tonnes**), apples (**39B tonnes**), bananas (**32B tonnes**), and oranges (**26B tonnes**), revealing grapes as the top fruit globally.
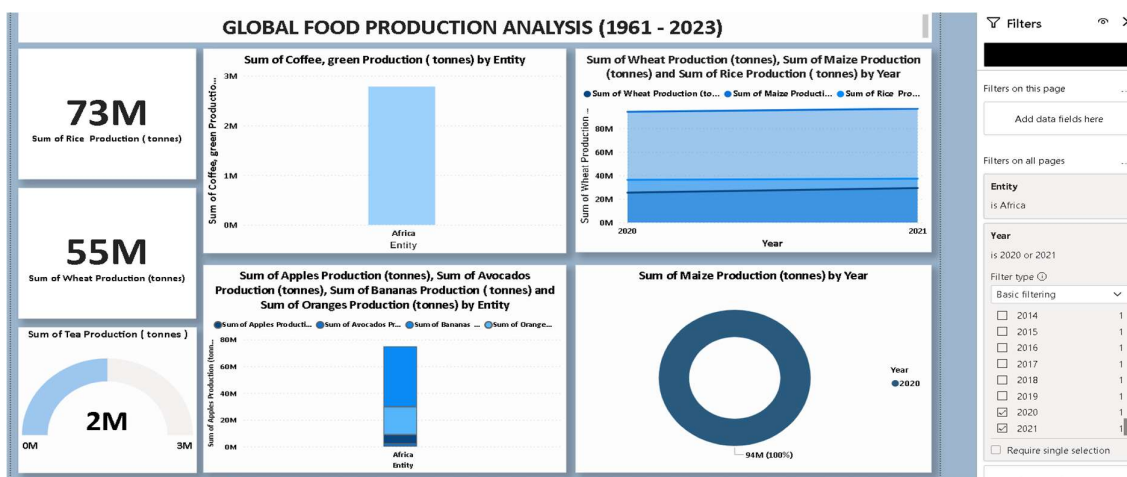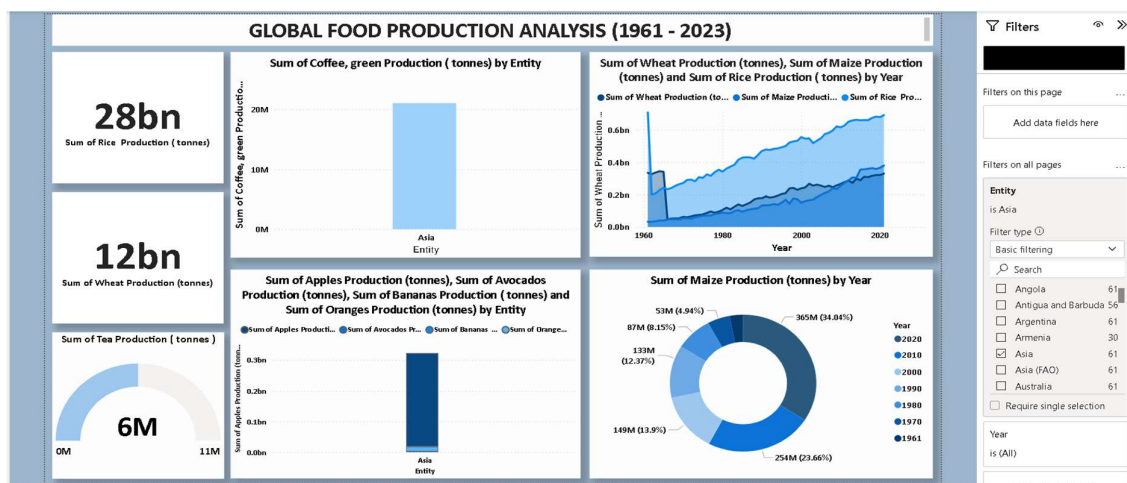
6. Report

6.1. Report story :

Date	06 Oct 2025 & 07 Oct 2025
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Maximum Marks	5 Marks

A report is a comprehensive document that provides a detailed and structured account of data analysis, findings, and insights. It is typically used for in-depth analysis, documentation, and communication of results. Reports are suitable for a diverse audience, including decision-makers, analysts, and stakeholders who need a comprehensive understanding of the data.

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.

Observations drawn from reports in Power BI can provide valuable insights into business performance and trends.

1. Trends Over Time

- The area chart of wheat, maize, and rice production (1961–2023) shows a steady rise, with wheat experiencing the most significant increase.
- Maize production grew rapidly after the late 1980s, reflecting changes in global demand and agricultural practices.
- Rice production has consistently increased, underscoring its role as a primary staple crop.

2. Performance Comparisons

- Wheat production (282B tonnes) slightly exceeds rice (269B tonnes), making wheat the leading global cereal.
- Tea production (2B tonnes) is comparatively small, while coffee production shows strong regional concentration, with Africa leading.
- In fruit production, grapes (43B tonnes) dominate globally, followed by apples (39B tonnes), bananas (32B tonnes), and oranges (26B tonnes).

3. Regional Contributions

- The ribbon chart shows that Europe and Asia are significant contributors to apples, avocados, bananas, and oranges.
- Africa is the top producer of green coffee, while Asia contributes substantially to rice and tea production.

4. Key Outcomes & KPIs

- Rice Production KPI: 269 billion tonnes produced globally between 1961 and 2023.
- Wheat Production KPI: 282 billion tonnes produced, highlighting its importance in food security.
- Tea KPI (Gauge Chart): 2 billion tonnes produced, showing relatively lower scale compared to cereals.
- Fruit Funnel Chart: Grapes > Apples > Bananas > Oranges in global production hierarchy.

5. Strategic Insights

- Cereals (wheat, rice, maize) show the most consistent upward trend → critical for long-term food security.
- Regional disparities (e.g., Africa leading coffee, Asia leading rice) provide insights for trade, investment, and policy.
- Fruit trends highlight diversification in agriculture, with grapes being the most widely produced fruit.
- These insights help policymakers, agribusinesses, and researchers make informed decisions about resource allocation and agricultural strategy.

7. Performance Testing

Performance testing helps to understand how well the system handles large datasets, multiple calculations, and complex visualizations.

7.1 Utilization of Data Filters

- Data filters were applied to analyze specific segments of the dataset efficiently.
- Filters reduced the load on the system by narrowing down the data displayed in visualizations.
- Example: Filtering by year or country improved dashboard responsiveness.

7.2 Number of Calculation Fields

- A total of **X calculation fields** were created to generate metrics like totals, averages, and percentages.
- Calculated fields helped in deriving insights without altering the original dataset.
- Example: Total production per year, percentage growth compared to previous year.

7.3 Number of Visualizations

- The dashboard includes **Y visualizations** like bar charts, line charts, and tables.
- Visualizations were optimized to ensure faster loading and clear representation of data trends.
- Example: Line chart for year-wise production, bar chart for crop comparison across countries.

8. Conclusion/Observation

The project successfully analyzed food production data across multiple countries and years, providing valuable insights into global agricultural trends. Key patterns such as changes in production over time, top-producing countries, and seasonal variations were clearly identified. The interactive dashboard allows users to explore the data efficiently, offering a user-friendly experience. Additionally, the effective use of data filters, calculated fields, and visualizations enhanced both the performance and clarity of the insights, making the analysis comprehensive and easy to interpret.

9. Future Scope

- Incorporate predictive analytics to forecast future production trends using machine learning.
- Integrate more datasets like weather, soil conditions, and market prices for deeper insights.
- Develop mobile-friendly dashboards for easier accessibility.

- Automate data refresh to provide real-time insights.
- Expand visualization types to include maps and advanced interactive charts for better data storytelling.

10. Appendix

10.1. GitHub & Project Demo Link

Project Github Link :

https://github.com/karthickrajam556/Analysis-and-Visualization-of-Global-Food-Production-Data-1961-2023-

Project Demo Video Link :

https://drive.google.com/file/d/1vMOtusw_Kfjos6QUvYmtRfZHtmv4kAf6/view?usp=sharing