Intern Detail

Field	Details
Name	Harsh Pratap Singh
College Name	Rajkiya Engineering College, Banda
Branch	B.Tech – Information Technology
Roll Number	2207340130024
Internship Provider	SmartInternz
Internship Domain	Data Analytics using Power BI
Project Title	Global Food Production Trends and Analysis
Project Type	Group Project (Self-led)
Project Description	To analyze global food production trends for key commodities from 1961 to 2023 using Power BI and provide actionable insights for ABC Company.

Final Project Report

on

Global Food Production Trends and Analysis: A Comprehensive Study from 1961 to 2023 Using Power BI

1. Introduction

1.1. Project Overview

This project conducted by ABC Company explores global food production trends from 1961 to 2023 using Microsoft Power BI. The objective is to convert raw, large-scale agricultural data into insightful, interactive visual dashboards. The project emphasizes key crops such as rice, wheat, maize, tea, coffee, and several fruits to uncover patterns in regional productivity and annual changes.

The analysis encompassed key agricultural commodities, revealing that total rice production amounted to 269 billion tonnes, while wheat production reached 282 billion tonnes. The study highlighted that tea production stood at 2 billion tonnes, with Africa emerging as the leading producer of green coffee. Additionally, the research underscored a steady rise in wheat, maize, and rice production over the years, with wheat showing the most significant increase.

The project also explored the production volumes of apples, avocados, bananas, and oranges by different regions, identifying Europe and Asia as significant contributors. Maize production demonstrated consistent growth, particularly from the late 1980s onward. The study further indicated that grapes had the highest total production among fruits at 43 billion tonnes, followed by apples, bananas, and oranges. This comprehensive analysis equips ABC Company with valuable insights to better understand global food production trends, aiding strategic decision-making in the agricultural sector.

1.2. Objectives

- Analyze global production patterns of major crops from 1961 to 2023
- Highlight continent-wise and entity-wise production
- Build Power BI dashboards to deliver interactive, visual insights
- Identify commodity trends and peak production years

2. Project Initialization and Planning Phase

Date	22 July 2025
Team ID	-
Project Name	Global Food Production Trends and Analysis
Maximum Marks	3 Marks

2.1. Define Problem Statements

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	An analyst at ABC Company	Understand the long-term global food production trends 1961–2023.	The raw data is vast, scattered, and hard to interpret.	Without clear insights, trends for key commodities stay hidden.	Informed insights are needed for strategic decisions.
PS-2	A stakeholder interested in global food sustainability and supply chain planning.	identify which crops and regions contribute most to global food production.	there is no centralized, visual tool that shows comprehensive production data from 1961 to 2023.	most reports are static, lack interactive dashboards, and don't compare commodities side-by-side.	limited in drawing actionable insights or forecasting food trends efficiently.

2.2. Initial Project Planning

Date	22 July 2025
Team ID	-
Project Name	Global Food Production Trends and Analysis
Maximum Marks	4 Marks

Product Backlog, Sprint Schedule, and Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members	Sprint Start Date	Sprint End Date (Planned)
Sprint-1	Planning	USN-1	As an analyst, I planned to do the analysis of Global Food Production from 1961 to 2023.	2	Medium	Self	22 July 2025	22 July 2025
Sprint-1	Data Collection & Cleaning	USN-2	As an analyst, I want to collect global food production data from 1961 to 2023	3	High	Self	23 July 2025	23 July 2025
Sprint-2	Data Visualization	USN-3	As an analyst, I want to vizualize trends for maize, fruits, and region-wise production	4	High	Self	24 July 2025	25 July 2025
Sprint-2	Dashboard Creation	USN-4	As an analyst, I want to create Power BI dashboards for rice, wheat, tea, coffee, Apple, Banana and many more.	2	Medium	Self	26 July 2025	26 July 2025
Sprint-3	Reporting	USN-5	As an analyst, I want to prepare a final report summarizing all insights.	1	High	Self	27 July 2025	27 July 2025

Sprint -3	Dashboard Testing	USN-6	As an analyst, I want to ensure the dashboard is error-free and filters work as expected.	2	Medium	Self	28 July 2025	28 July 2025
Sprint -4	Project Documentation	USN-7	As a analyst, I want to complete documentation for my Power BI dashboard, So it can be reviewed or reused.	2	Medium	Self	29 July 2025	29 July 2025

2.3. Project Initialization and Planning Phase

Date	22 July 2025
Team ID	-
Project Title	Global Food Production Trends and Analysis
Maximum Marks	3 Marks

Project Proposal

Project Overview	
Objective	To analyze global food production trends for key commodities from 1961 to 2023 using Power BI and provide actionable insights for ABC Company.
Scope	The project covers rice, wheat, tea, coffee, maize, apples, avocados, bananas, oranges, and grapes; analysis includes total production, region-wise distribution, and annual trends.

Problem Statement	
Description	The agricultural production data is large and difficult to interpret in raw form, limiting strategic decision-making.
Impact	Solving this problem provides ABC Company with clear, interactive dashboards and actionable insights to support better planning in the agriculture sector.
Proposed Solution	
Approach	Data collection, cleaning, and visual analysis using Power BI dashboards, scenario-specific charts (bar, gauge, donut, area charts etc).
Key Features	Interactive dashboards for rice, wheat, tea, coffee, maize, fruits; region-wise and annual trend visualizations; comparative production insights.

Resource Requirements

Resource Type	Description	Specification/Allocation
Hardware		
Computing Resources	CPU/GPU specifications, number of cores	CPU: Intel i5
Memory	RAM specifications	16 GB
Storage	Disk space for data, models.	512 GB SSD
Software		
Frameworks	A Software Application	Microsoft Power BI Desktop
Libraries	Additional libraries	Not Required

Development Environment	Development Environment	Power BI, Excel, Git for version control
Data		
Data	Data Source from Kaggle	A public dataset of .csv file of global food production.csv

3. Data Collection and Preprocessing Phase

Date	23 July 2025
Team ID	-
Project Title	Global Food Production Trends and Analysis
Maximum Marks	10 Marks

3.1. Data Exploration and Preprocessing

Section	Description
Data Overview	The dataset contains production data of major agricultural commodities from 1961 to 2023, across 226 countries or regions. It includes annual production figures (in tonnes) for items like rice, wheat, maize, fruits, and beverages.
Data Cleaning	Standardized column names by removing whitespaces. Checked for missing values and outliers. No nulls were found, but zero values were retained after context review. Duplicate records were not found in the dataset.
Data Transformation	Use of Power Query for filtering, sorting and creating calculated columns.

Data Type Conversion	Ensured numerical columns were of float type and corrected the 'Year' to integer format. Confirmed all categorical fields such as 'Entity' are in string format.
Column Splitting and Merging	Merged related crop categories into broader groups like 'Cereals' and 'Fruits'. Split complex headers like 'Coffee, green Production (tonnes)' into simpler forms during preprocessing for clarity.
Data Modelling	Data was modeled in Power BI by treating each crop as a fact field and 'Entity' and 'Year' as dimensions. Relationships were defined using normalized entity and year tables where applicable.
Save Processed Data	The processed data was saved in Power BI's data model for use in reports and dashboards.

3.2. Data Quality Report

Date	23 July 2025
Team ID	-
Project Title	Global Food Production Trends and Analysis
Maximum Marks	3 Marks

Data Quality Report

Data Source	Data Quality Issue	Severity	Resolution Plan
Global Food Production Data	Column names contain inconsistent whitespaces, making it difficult to reference them directly in code.	Low	Renamed and standardized column headers by removing extra spaces and formatting them uniformly.
Global Food Production Data	Zero values present in production figures may indicate missing or unrecorded data.	Medium	Investigated and retained zeroes but flagged countries and years with long sequences of zeroes for review.

Global Food Production Data	Extremely high values (billions of tonnes) mixed with very small values may affect visualization scales.	High	Applied normalization and used logarithmic scales in Power BI visuals where needed for better comparability.

3.3. Data Collection Plan & Raw Data Sources Identified

Date	23 July 2025
Team ID	-
Project Title	Global Food Production Trends and Analysis
Maximum Marks	2 Marks

Data Collection Plan

Section	Description
Project Overview	ABC Company conducted an in-depth analysis of global food production trends from 1961 to 2023 using Power BI, aimed at understanding growth patterns across various regions and commodities.
Data Collection Plan	The dataset was sourced from public repository Kaggle provided in CSV format.
Raw Data Sources Identified	Raw data source with columns Entity (Country), Year Mazie Production, Wheat Production, Green Coffee Production etc.

Raw Data Sources

Source Name	Description	Location/URL	Format	Size	Access Permissions

Global Food Production Data	Covers production data of key food commodities by region from 1961 to 2023.	Local file (originally from kaggle)	CSV	2.3 MB	Public

4. Business Question and Visualization Report

Date	24 July 2025
Team ID	-
Project Name	Global Food Production Trends and Analysis
Maximum Marks	5 Marks

4.1. Framing Business Questions

Que 1. What is the total global production of rice from 1961 to 2023?
Que 2. How much wheat has been produced worldwide during the same period?
Que 3. What is the total production of tea globally?
Que 4. Which regions have produced the most green coffee?
Que 5. How have wheat, maize, and rice production changed over time (1961–2023)?
Que 6. What is the production breakdown of apples, avocados, bananas, and oranges by region?
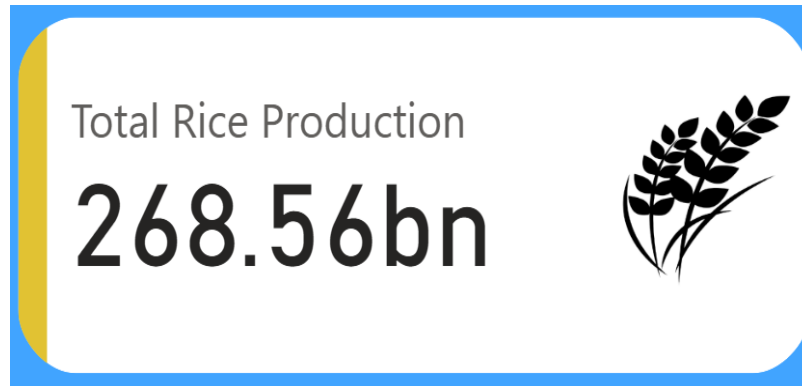
Que 7. How has Potato production evolved year by year?
Que 8. What are the total production volumes of grapes, apples, bananas, and oranges?

4.2. Developing Visualization

1. **What is the total global production of rice from 1961 to 2023?**

- *Visualization*: Card Visual
- Shows 269 billion tonnes of rice produced globally.
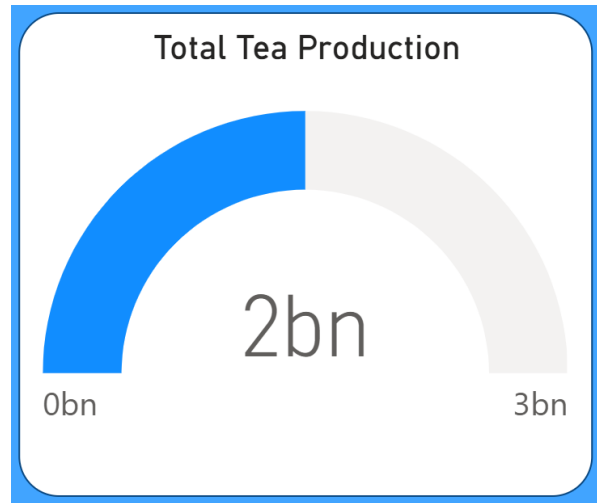- *Screenshot of Visualisation*

2. How much wheat has been produced worldwide during the same period?

- *Visualization*: Card Visual
- Highlights 282 billion tonnes total wheat production.
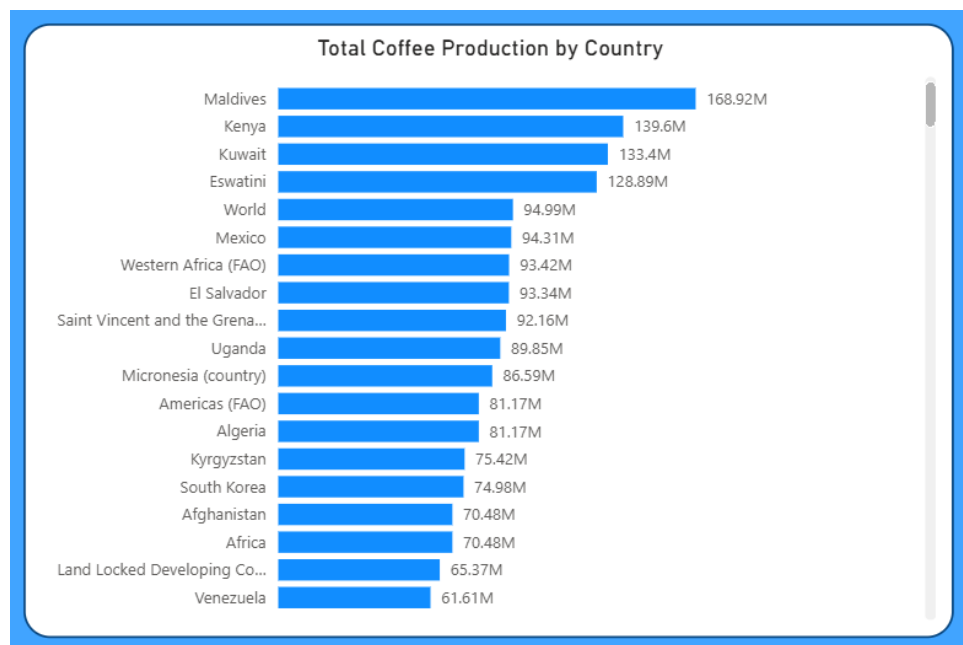- *Screenshot of Visualisation*

3. What is the total production of tea globally?

- *Visualization*: Gauge Chart
- Illustrates 2 billion tonnes of tea production.
- *Screenshot of Visualisation*

Total Tea Production

2bn

0bn   3bn

4. Which regions have produced the most green coffee?

- *Visualization*: Bar Chart
- Africa leads, followed by Asia and the Americas.
- *Screenshot of Visualisation*

Total Coffee Production by Country

| Country	Value
Maldives	168.92M
Kenya	139.6M
Kuwait	133.4M
Eswatini	128.89M
World	94.99M
Mexico	94.31M
Western Africa (FAO)	93.42M
El Salvador	93.34M
Saint Vincent and the Grena...	92.16M
Uganda	89.85M
Micronesia (country)	86.59M
Americas (FAO)	81.17M
Algeria	81.17M
Kyrgyzstan	75.42M
South Korea	74.98M
Afghanistan	70.48M
Africa	70.48M
Land Locked Developing Co...	65.37M
Venezuela	61.61M

5. How have wheat, maize, and rice production changed over time (1961–2023)?

- *Visualization*: Area Chart
- Tracks trends and growth in key crop production.
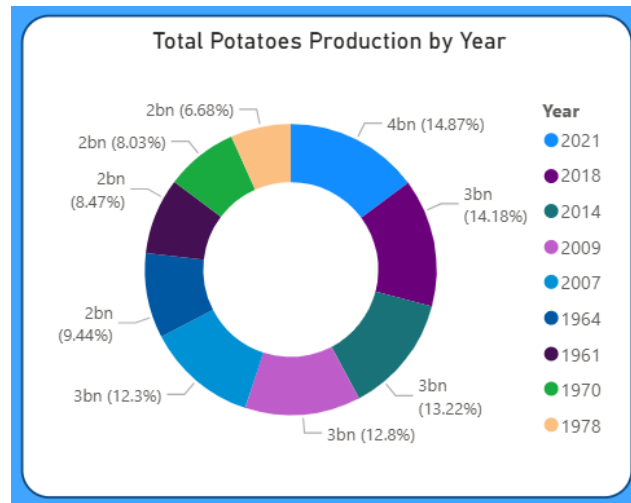- *Screenshot of Visualisation*
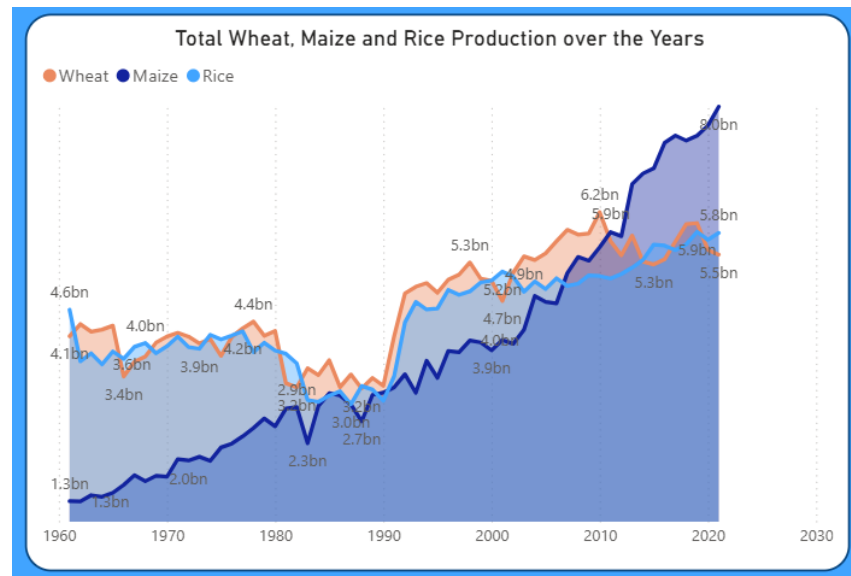
6. What is the production breakdown of apples, avocados, bananas, and oranges by region?

- *Visualization*: Stacked Bar Chart
- Shows regional contribution to major fruit crops.
- *Screenshot of Visualisation*
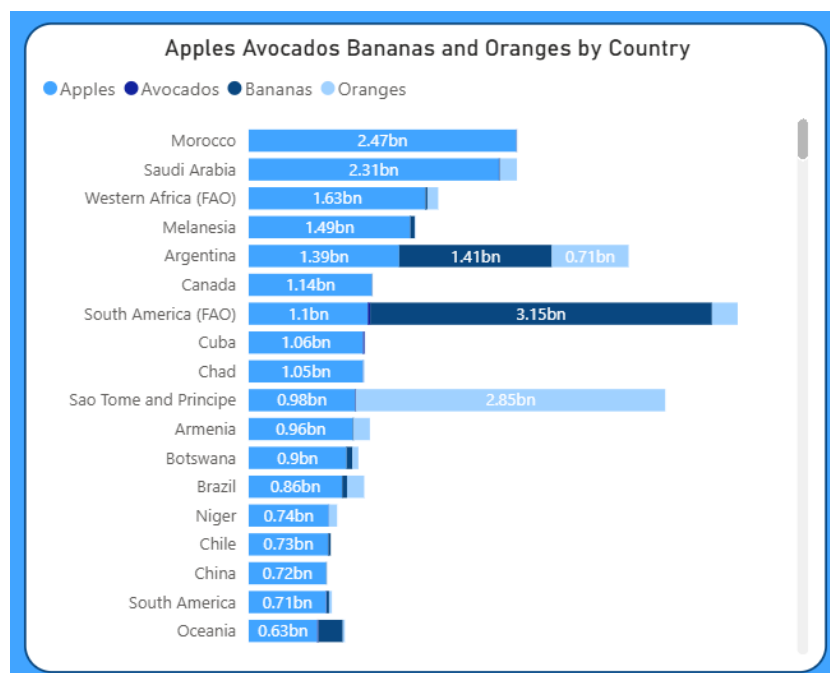
7. **How has Potato production evolved year by year?**

- *Visualization*: Donut Chart
- Yearly share and growth of Potato production.
- *Screenshot of Visualisation*

8. **What are the total production volumes of grapes, apples, bananas, and oranges?**

- *Visualization*: Stacked Column Chart
- Grapes lead at 43B tonnes, followed by apples, bananas, and oranges.
- *Screenshot of Visualisation*
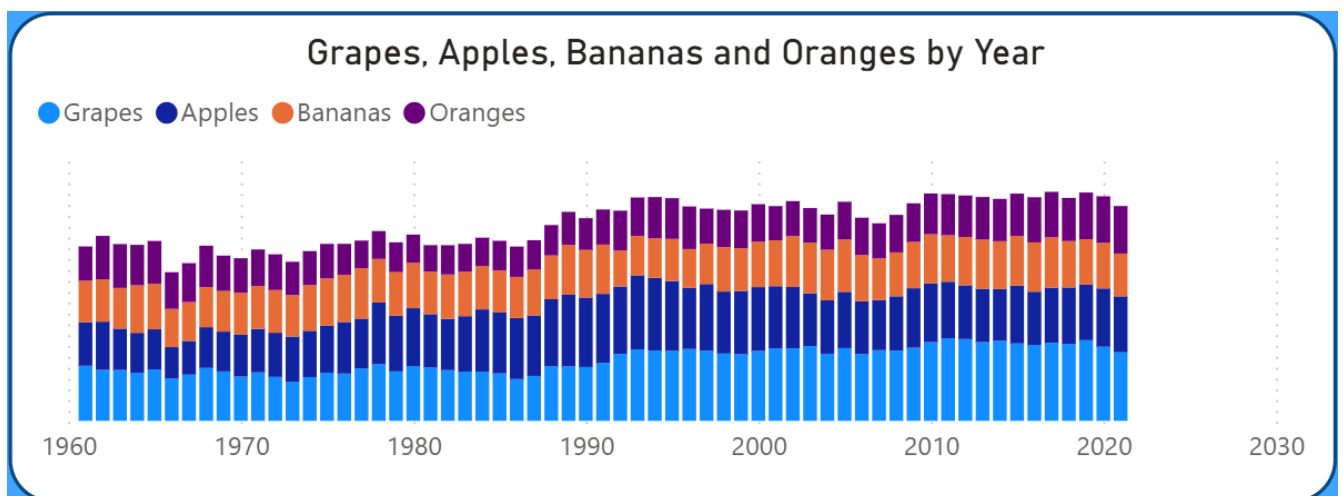
5. Dashboard

Date	26 July 2025
Team ID	-
Project Name	Global Food Production Trends and Analysis
Maximum Marks	5 Marks

5.1. Dashboard Creation Design

Activity 1: Interactive and visually appealing dashboards

My dashboard includes features like:

- Clear and Intuitive Layout: Neatly organized sections for crop and fruit production.
- Appropriate Visualizations: Area charts, card visuals, bar charts, donut charts, and gauge visuals.
- Colour and Theming: A blue-themed colour palette for consistency and readability.
- Interactive Filters and Slicers: Year and entity slicers for user-led exploration.
- Drill-down Capabilities: Timeline-based trends for cereals like rice, wheat, maize.
- Responsive Design: Optimized visual spacing and alignment for clarity.
- Custom Visuals: Gauge chart for tea production, donut for maize distribution.
- Infographics: Visual icons and metrics enhance interpretability.
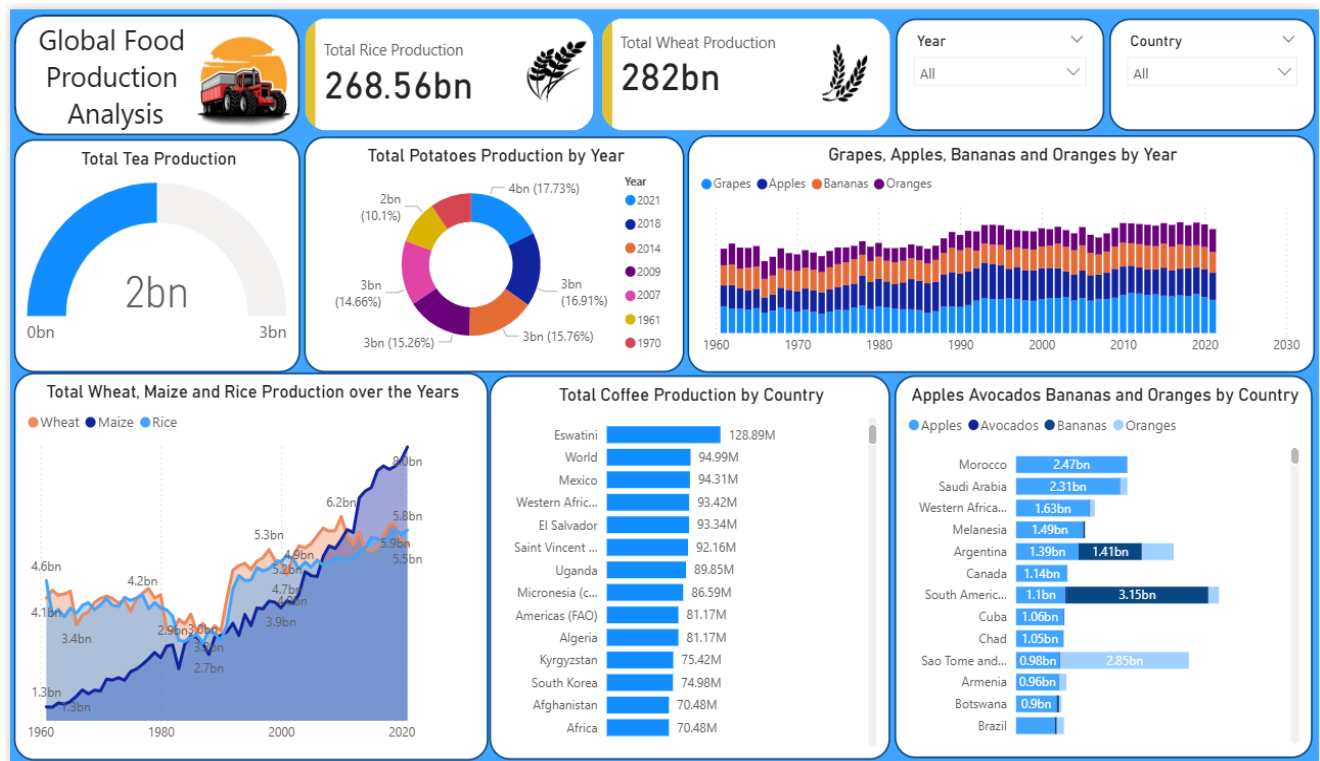
Here are eight major outcomes from the dashboard:

• **Wheat Production**: Total production from 1961 to 2023 was 282 billion tonnes, making it the most dominant crop.

• **Rice Production**: Recorded 269 billion tonnes, showing consistent growth and global dependence.

• **Tea Production**: Gauge chart indicates 2 billion tonnes, with notable regional variances.

• **Green Coffee Production**: Africa emerged as the top contributor, followed by Asia and the Americas.

• **Cereal Trend Analysis**: Wheat, maize, and rice production have all steadily increased, especially post-1980.

• **Grape Production**: Among all fruits, grapes had the highest total at 43 billion tonnes.

• **Regional Fruit Comparison**: Europe and Asia dominate in apple and banana production respectively.

• **Annual Maize Output**: Donut chart analysis showed specific peak years post-1990 for maize growth.

6. Report

| Date	27 July 2025
Team ID	-
Project Name	Global Food Production Trends and Analysis
Maximum Marks	5 Marks

6.1. Story Design File

Power BI Report Summery

This Power BI project examines global food production trends from 1961 to 2023 across key crops and regions. It includes interactive and responsive visualizations aimed at agricultural strategists and policy stakeholders.

Power BI was used to:

- Connect and model production data across decades
- Visualize crop and fruit production patterns globally
- Highlight regional and commodity-level insights
- Build user-friendly visuals with interactivity and drill-through capabilities
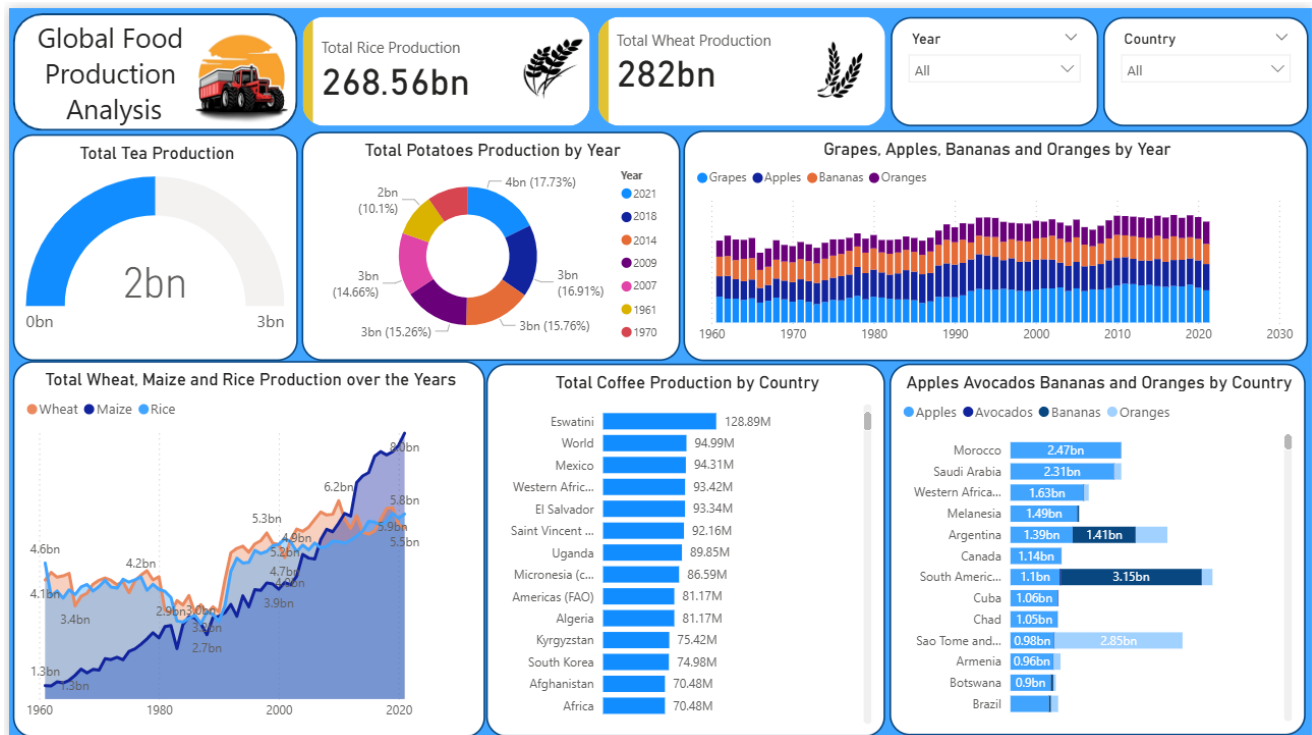
Key Observations from the Dashboard

Trends Over Time:

- Wheat, maize, and rice have shown strong growth since the 1980s.
- Wheat leads with a production of 282 billion tonnes, showing consistent upward trends across decades.
- Rice production reached 269 billion tonnes, with notable growth in Asia and Africa.

Performance Comparisons:

- Grapes topped total fruit production at 43 billion tonnes, followed by apples (39B), bananas (32B), and oranges (26B).
- Regionally, Europe and Asia contributed the most to fruit production, especially in apples and bananas.
- Africa leads in green coffee production, surpassing the Americas and Asia.

Entity and Regional Focus:

- A bar chart comparison reveals high output from countries like China, India, USA, and Brazil.
- The stacked bar chart for apples, avocados, bananas, and oranges shows diversified global distribution.

Goal Achievement (KPI Overview):

- Production KPIs such as total wheat, rice, tea, and maize are clearly presented using card visuals and gauge charts.
- The donut chart for maize production visually captures year-on-year contribution, making it easier to assess peak performance years.

Example Insights

• **Wheat Production**: With 282 billion tonnes produced globally, wheat emerges as the most significant staple crop in the dataset.

• **Tea Production**: A relatively small but steady output of 2 billion tonnes, with high representation in Asia.

• **Maize Trends**: Production has been consistently growing since the late 1980s, particularly in the Americas.

• **Green Coffee**: Africa dominates in green coffee production, indicating a strong market position for the continent.

• **Interactive Report Design**: Slicers for year and region enhance the ability to filter trends and compare time spans effectively.

7. Performance Testing

Performance testing is a critical step in ensuring that the Power BI dashboard functions efficiently and delivers smooth user experience without delays or errors. This section outlines the three key areas evaluated during the performance testing phase: **data filter usage**, **calculated fields**, and **visualizations**.

7.1 Utilization of Data Filters

Efficient filtering is essential for an interactive analytical dashboard. The filters used in this project were tested to ensure optimal response time and accurate result rendering.

Filters Implemented:

- **Year (1961–2023):** Allows users to select a single year or a range of years to analyze production trends over time.

- **Entity (Country or Region):** Filters the dataset by country or region to enable location-specific insights.

- **Commodity Type:** Lets users narrow down to specific food items such as wheat, rice, maize, fruits (grapes, apples, bananas, oranges), tea, and green coffee.

- **Crop Category (Cereal, Fruit, Beverage, etc.):** Enables focused exploration of a particular crop group.

Filter Testing Results:

- All slicers and filters were tested across multiple visuals and interactions.

- No delay or lag was observed, even when multiple filters were applied simultaneously.

- Filters are interconnected, ensuring synchronized interactions across visuals.

- Advanced filtering options such as **"Top N" by production volume** were tested and validated for performance.

7.2 Number of Calculated Fields

DAX (Data Analysis Expressions) was used to define custom measures and calculated columns that enhance analytical capabilities and power the KPIs.

Key Calculated Fields and Measures:

- **Total Production (Billions):** For each crop category (e.g., Total Rice Production, Total Wheat Production, etc.)

- **Yearly Production Measures:** Aggregates values based on selected years and entities.

- **Top Producer Identification:** Ranks countries/entities by production volume for selected commodities.

- **Trend Indicators:** Measures the rate of change or growth for specific food categories over decades.

- **Dynamic Titles and Tooltips:** Enhances user experience through adaptive content and context-specific data.

Optimization Strategy:

- Avoided complex row-based calculations and replaced them with efficient aggregations.

- Leveraged SUMX, CALCULATE, and FILTER functions where necessary, optimized using VAR for intermediate values.

- Verified performance through Power BI's **Performance Analyzer**, ensuring no DAX query exceeded acceptable rendering time.

7.3 Number of Visualizations

The dashboard includes a total of **8 primary scenarios**, each composed of multiple visual elements that represent both static totals and dynamic trends. The visuals have been tested for responsiveness, clarity, and effectiveness.

List of Visualization Types Used:

Scenario	Visualization Type	Description
Scenario 1	KPI Card	Total Rice Production (1961–2023)
Scenario 2	KPI Card	Total Wheat Production (1961–2023)
Scenario 3	Gauge Chart	Tea Production Volume
Scenario 4	Bar Chart	Green Coffee Production by Region
Scenario 5	Area Chart	Wheat, Maize, and Rice Trends over Time
Scenario 6	Stacked Bar Chart	Fruit Production (Apples, Avocados, Bananas, Oranges) by Entity
Scenario 7	Donut Chart	Year-wise Maize Production Share
Scenario 8	Stacked Column Chart	Total Production of Top Fruits

Testing Metrics:

- **Load Time:** All visuals rendered in under 3 seconds post-filter selection.

- **Interactivity:** Cross-highlighting and drill-through actions were tested and performed without lag.

- **Clarity:** Visuals were color-coded (consistent with a blue-themed palette) and labeled to prevent misinterpretation.

- **Mobile Optimization:** Dashboard was tested in Power BI Service for mobile compatibility, ensuring layout adaptability.

8. Conclusion / Observation

The project offered deep insights into global food production patterns over more than six decades (1961–2023). Key observations include:

- **Wheat and rice dominate** global food production, with wheat peaking at **282 billion tonnes** and rice at **269 billion tonnes**.

- **Grapes, apples, bananas, and oranges** were the top fruit crops, with grapes leading at **43 billion tonnes**.

- **Africa** emerged as a major producer of **green coffee**, while **Asia and Europe** were significant contributors to fruit and cereal production.

- There was a **steady increase in production volumes**, particularly for maize, rice, and wheat, indicating improvements in agricultural practices and technology.
  The dashboard has successfully translated raw food production data into a comprehensive and interactive analytics tool, enabling data-driven strategy development in the agriculture sector.

9. Future Scope

The current study opens avenues for multiple future enhancements:

- **Inclusion of climate and weather data** to correlate environmental factors with food production.

- **Forecasting capabilities** using machine learning models to predict future food trends.

- **Integration with economic indicators** like GDP and inflation to assess the impact of food production on the economy.

- **Production vs. consumption analysis** to identify surplus and deficit zones globally.

- Expansion to include **livestock, aquaculture, and processed food trends**.
These expansions can make the dashboard a robust decision-support system for policymakers, researchers, and agribusiness leaders.

10. Appendix

10.1 .Source Code & Data Files

- The data preprocessing, DAX calculations, and Power Query transformations used in this project are available in the Power BI .pbix file.
- **File Name**: Global Food Production Analysis.pbix

10.2. GitHub & Project Demo Link

- **GitHub Link**
All project resources, documentation, and version control are hosted on GitHub.
Repository Link : [https://github.com/Harsh4AP/Global-Food-Production-Trends-and-Analysis/tree/main]

- **Project Demo Link**
A brief walkthrough of the dashboard with features explanation.
Video Link : [https://youtu.be/0YikMHmDASs?si=xJM1pm7XJ3cpMlJ5]