

Final Project Report

1. Introduction

1.1. Project Overviews

The **Global Food Production Trends and Analysis (1961–2023) Using Power BI** project is aimed at analyzing over six decades of worldwide food production data to uncover meaningful insights related to agricultural output, trends, and regional contributions. By utilizing interactive dashboards and advanced visualization tools in Power BI, the project translates complex agricultural datasets into accessible, decision-supporting visuals.

This analysis addresses the growing challenges in global food security, including increasing demand, climate volatility, supply chain inefficiencies, and resource scarcity. By centralizing historical crop production data from sources like FAOSTAT, the project empowers policymakers, agribusinesses, and researchers to assess patterns, identify risks, and forecast future needs with clarity and precision.

1.2. Objectives

The primary objectives of this project are:

- To visualize global food production trends from 1961 to 2023 across key commodities such as rice, wheat, maize, and fruits.
- To compare regional and country-wise contributions to food production using dynamic Power BI visuals.
- To enable easy interpretation of complex data for stakeholders in agriculture, policy, and supply chain management.
- To measure the growth and production patterns of specific food items and monitor performance across time.
- To identify key drivers and gaps in food production that can inform sustainable agricultural practices and economic policies.
- To demonstrate the practical use of BI tools (Power BI, DAX, Data Modeling) in solving real-world agricultural analytics problems.

2. Project Initialization and Planning Phase

2.1. Define Problem Statement

Food production is fundamental to global food security and economic stability. However, increasing global demand, climate change, resource depletion, and trade disruptions pose significant challenges to agricultural output. Understanding food production trends is crucial for policymakers, agribusinesses, and farmers to optimize crop yields and ensure food availability.

The challenge lies in aggregating and analyzing six decades of food production data across different regions, agricultural techniques, and economic policies. Power BI can enable stakeholders to visualize trends, identify risks, and forecast future production needs.

Customer Problem Statement Template				
I am	I'm trying to	But	Because	Which makes me feel
I am ABC Company	I'm trying to understand global food production trends	But the data contains irrelevant or missing data	Because of nature it is not be possible to grow all kinds of crops everywhere	Which makes me feel intrigued
 Customer Problem Statement Template				
I am	I'm trying to	But	Because	Which makes me feel
I am A supply chain manager for a global food exporter	I'm trying to monitor and react quickly to risks in global food supply chains	But real-time data on disruptions due to conflicts, weather, or regulations is hard to visualize comprehensively	Because global food supply chains are complex, involving many actors and cross-border challenges	Which makes me feel concerned about supply chain resilience and business continuity

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	ABC Company	understand global food production trend	the data contains irrelevant and missing data	of nature it is not possible to grow all kinds of crops everywhere	intrigued
PS-2	A supply chain manager for a global food exporter	monitor and react quickly to risks in global food supply chains	real-time data on disruptions due to conflicts, weather, or regulations is hard to visualize comprehensively	global food supply chains are complex, involving many actors and cross-border challenges	concerned about supply chain resilience and business continuity

2.2. Project Proposal (Proposed Solution)

This project proposal outlines a solution to address global food production data analysis challenges. 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	To design a dynamic and insightful Power BI dashboard that visualizes global food production trends from 1961 to 2023, aiding stakeholders in understanding, forecasting, and addressing food security challenges.

Scope	<ul style="list-style-type: none"> • Covers data from over 60 years and multiple food categories (rice, wheat, maize, tea, fruits, coffee, etc.) • Includes region/entity-based and time-series analytics • Enables visual comparison across years, crop types, and continents • Focused on decision-making, resource allocation, and policy planning for stakeholders in agriculture and food sectors
Problem Statement	
Description	<p>Food production is fundamental to global food security and economic stability. However, increasing global demand, climate change, resource depletion, and trade disruptions pose significant challenges to agricultural output. Understanding food production trends is crucial for policymakers, agribusinesses, and farmers to optimize crop yields and ensure food availability.</p>
Impact	<p>Solving this challenge through data visualization empowers stakeholders to:</p> <ul style="list-style-type: none"> • Make informed decisions • Forecast food production needs • Improve sustainability and efficiency in agriculture • Mitigate risks due to geopolitical or climate-based shocks
Proposed Solution	
Approach	<ul style="list-style-type: none"> • Aggregate historical food production data from FAO or similar datasets • Clean and preprocess the data using Power Query in Power BI • Design multiple charts and visuals: bar, donut, ribbon, area, and KPI cards • Use DAX for custom metrics and trend analysis • Create an interactive Power BI dashboard for visual storytelling and insights
Key Features	<ul style="list-style-type: none"> • Clean and professional UI with dynamic visuals • Time-based trend analysis using area charts • Crop-type analysis using bar and donut charts • Country-wise and continent-wise comparisons using ribbon charts

	<ul style="list-style-type: none"> • KPI cards to highlight total production figures • Branded thumbnail and visual assets for reporting and presentation
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Resource Requirements

Resource Type	Description	Specification/Allocation
Hardware		
Computer Resources	Laptop (Macbook Air M1)	Apple Silicone M18-core CPU
Memory	RAM specifications	8 GB
Storage	Disk space for data, models, and logs	256 GB SSD
Software		
Frameworks	Data Visualization Tool	Power BI Desktop
Libraries	DAX, M code (built-in)	Built-in in Power BI
Development Environment	Power BI Desktop	Version 2023 or later
Data		
Dataset	FAOSTAT Global Food Dataset	CSV/XLSX, 1961–2023

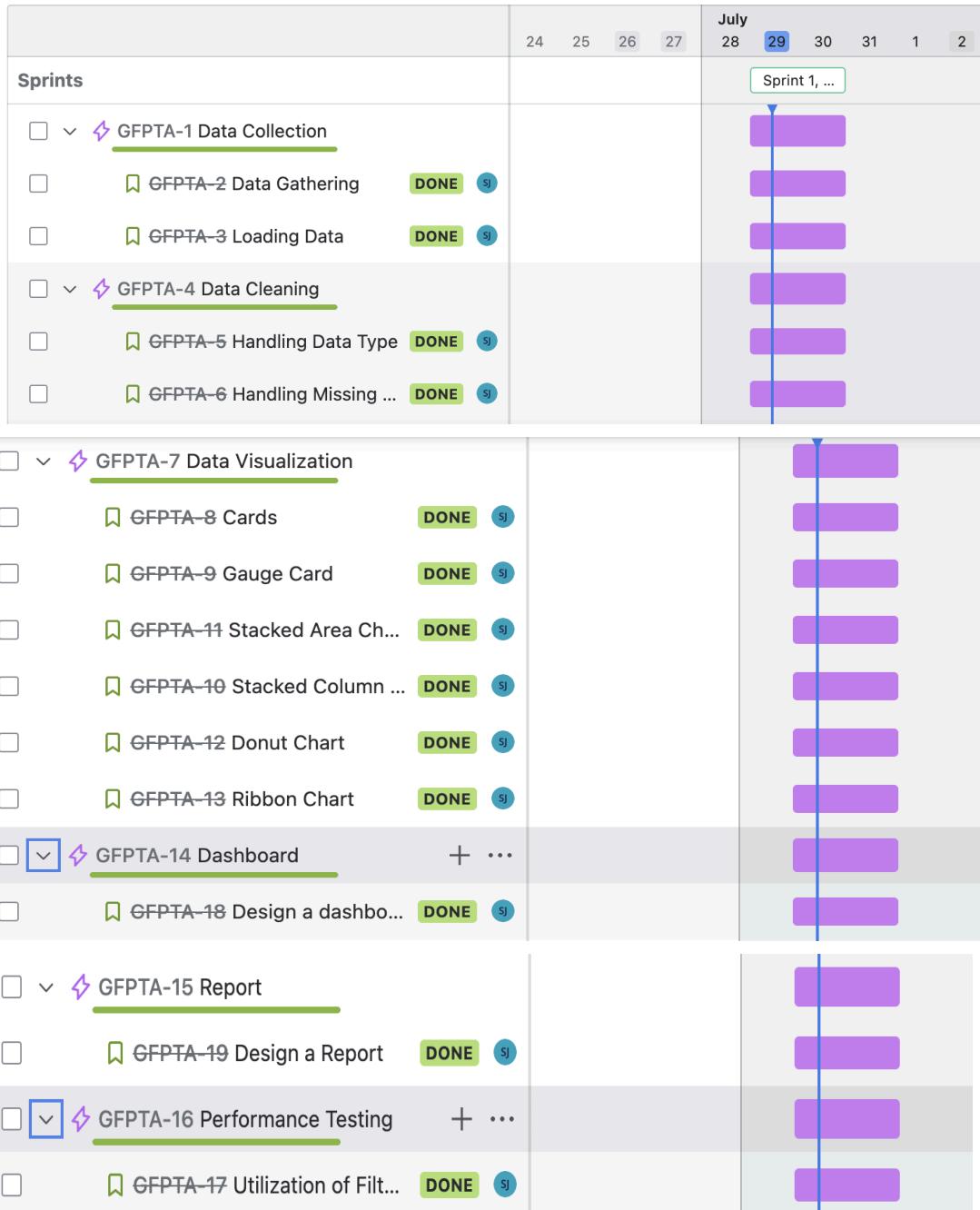
2.3. Initial Project Planning

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	Data Collection	GFPT-1,2	Data Gathering	3	High	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members	Sprint Start Date	Sprint End Date (Planned)
Sprint-1		GFPT-3	Loading Data	1	High	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00
Sprint-1	Data Cleaning	GFPT-4,5	Handling Data Type	2	Medium	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00
Sprint-1		GFPT-6	Handling Missing Values	3	Medium	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00
Sprint-1	Data Visualization	GFPT-7,8	Cards	1	High	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00
Sprint-1		GFPT-9	Gauge Card	2	Low	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00
Sprint-1		GFPT-10	Stacked Column Chart	3	High	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00
Sprint-1		GFPT-11	Stacked Area Chart	3	High	Snehil Jaiswal	29/07/2025 00:00	29/07/2025 15:00
Sprint-2		GFPT-12	Donut Chart	2	High	Snehil Jaiswal	29/07/2025 16:55	30/07/2025 13:00
Sprint-2		GFPT-13	Ribbon Chart	2	High	Snehil Jaiswal	29/07/2025 16:55	30/07/2025 13:00
Sprint-2	Dashboard	GFPT-14,18	Design a dashboard	5	High	Snehil Jaiswal	29/07/2025 16:55	30/07/2025 13:00
Sprint-2	Report	GFPT-15,19	Design a Report	5	High	Snehil Jaiswal	29/07/2025 16:55	30/07/2025 13:00
Sprint-2	Performance Testing	GFPT-16,17	Utilization of Filters	3	Low	Snehil Jaiswal	29/07/2025 16:55	30/07/2025 13:00

Projects

 Global Food Production Trend Analysis 28 ...Summary Timeline Backlog Board Calendar List Forms Goals SJ User icon Epic Status category

3. Data Collection and Preprocessing Phase

3.1. Data Collection Plan and Raw Data Sources Identified

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 Template

Section	Description
Project Overview	This project aims to analyze global food production trends over six decades using Power BI. The objective is to visualize country-wise and crop-wise production changes to support agricultural policy planning, food security, and resource allocation.
Data Collection Plan	The primary dataset has been sourced from https://www.kaggle.com/datasets/rafsunahmad/world-food-production through publicly accessible datasets related to food crop production volumes by country and year. Data was obtained in CSV format and cleaned using Power BI Power Query Editor.
Raw Data Sources Identified	Refer to the table below for detailed information on each dataset used in the project.

Raw Data Sources Template

Source Name	Description	Location/URL	Format	Size	Access Permissions
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Global Food Production Dataset (1961–2021)	Contains annual food production (in tonnes) of 22 major crops across 226 countries. Includes cereals, fruits, oilseeds, legumes, and meats.	https://www.kaggle.com/datasets/rafsunahmad/world-food-production	CSV	856 KB	Public
Power BI Processed File	Cleaned and transformed version of the raw data, ready for dashboard visualization in Power BI.	https://github.com/JaiswalSnehil/Global_Food_Production_Trend_Analysis/blob/main/6.%20Project%20Executable%20Files/Global_Food_Production_Trend%20Analysis.pbix	PBIX	YY GB	Private (Local access)

3.2. Data Quality Report

The Data Quality Report summarizes 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
world food production.csv	Some entities (countries) may have 0 production for specific crops.	Moderate	Entities (countries) with 0 production were removed.
world food production.csv	Some column names include extra spaces.	Low	It can be cleaned for better readability and processing.
world food production.csv	There is high skew in many crop categories due to leading producers	High	Dashboard visualization using bar, area, donut, and ribbon charts

3.3. 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 global food production statistics for 226 countries from 1961 to 2021 across 22 major crops and commodities. It includes over 11,900 records with clean, numerical data ideal for trend analysis and Power BI visualizations.
Data Cleaning	Removed the rows with value as 0 in the columns such as Rice Production, Tea Production, etc.
Data Transformation	Use of Power Query for filtering, sorting, pivoting, and creating calculated columns was not required.

Data Type Conversion	Converted the datatype from Decimal number to Whole number.
Column Splitting and Merging	Split or merge columns was not needed.
Data Modeling	Defining relationships between tables and creating measures was not needed.
Save Processed Data	Saved the cleaned and processed data for future use.

4. Data Visualization

4.1. Framing Business Questions & Developing Visualizations

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.

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.

Sample

1. What is the sum of Rice Production (tonnes) ?

- *Visualization:* KPI card showing sum of rice production.



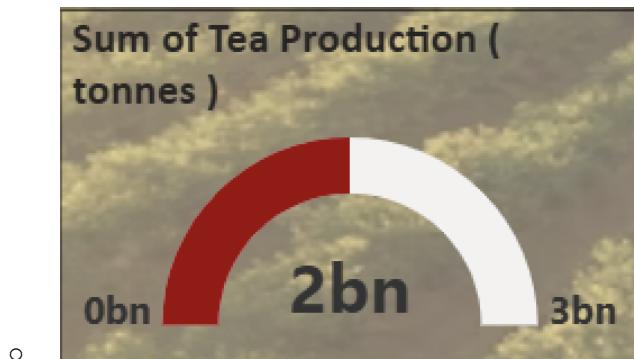
2. What is the sum of Wheat Production (tonnes) ?

- *Visualization:* KPI card showing sum of wheat production.



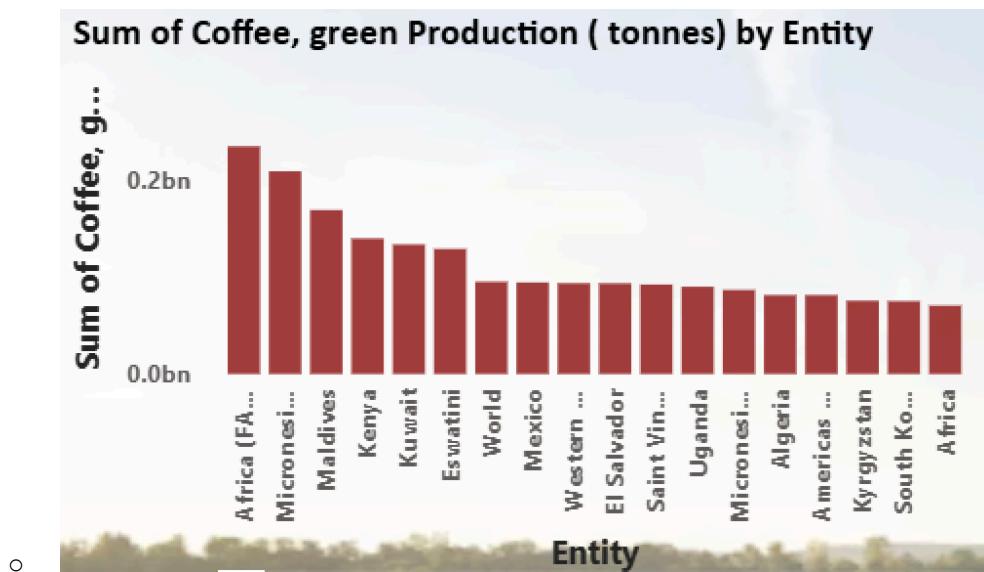
- **3. What is the sum of Tea Production (tonnes) ?**

- *Visualization:* Gauge card showing sum of Tea Production.



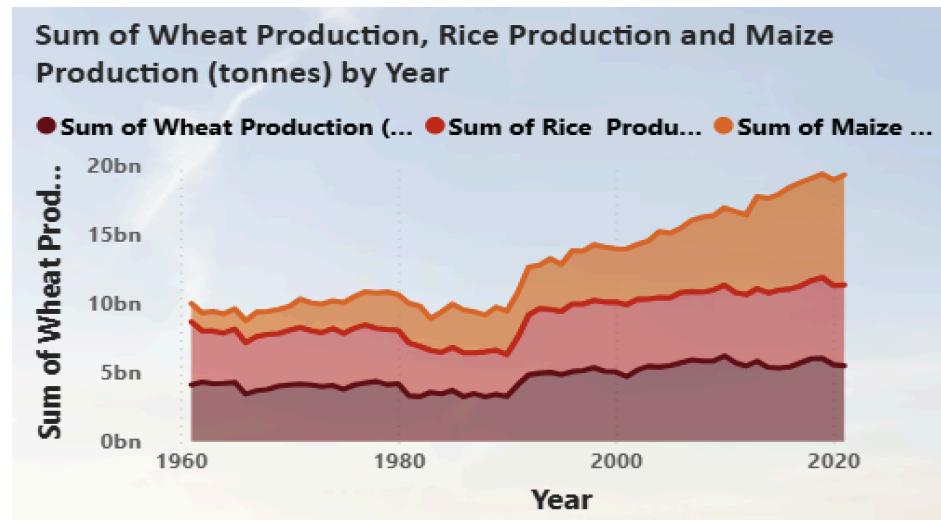
4. What is the sum of Coffee, Green Production (tonnes) by Entity ?

- *Visualization:* Stacked Bar Chart comparing sum of Coffee Production by entities (countries).



5. What is the sum of Wheat, Rice and Maize Production (tonnes) by year?

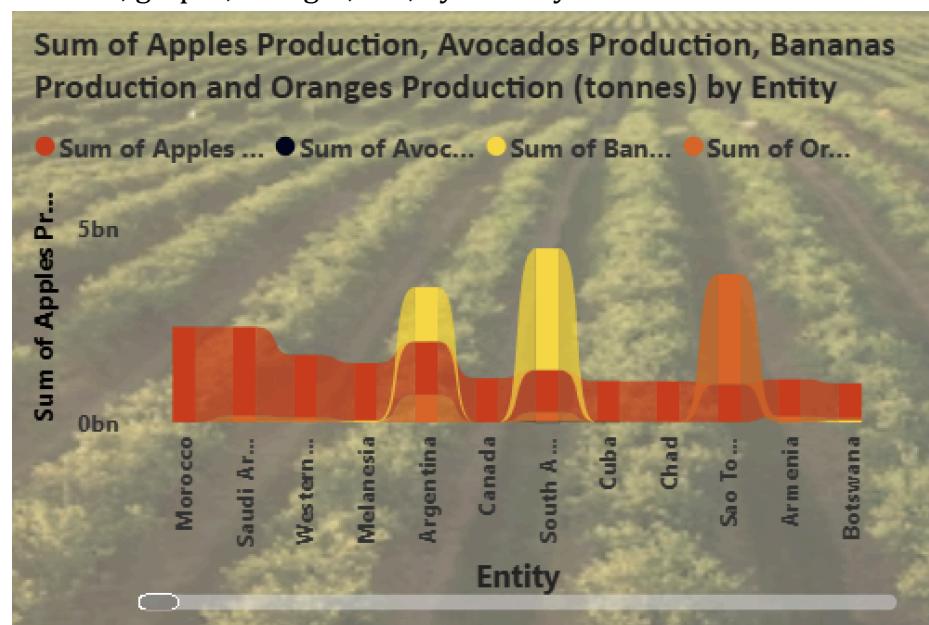
- *Visualization:* Stacked Area Chart comparing cereals (rice, wheat, maize) over decades.



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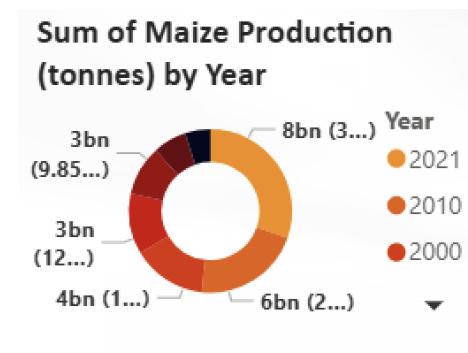
6. Which regions/countries show the highest growth in fruit production ?

- *Visualization:* Ribbon chart or bar chart showing year-wise production of bananas, grapes, oranges, etc., by country.



7. What is the sum of Maize Production (tonnes) by year ?

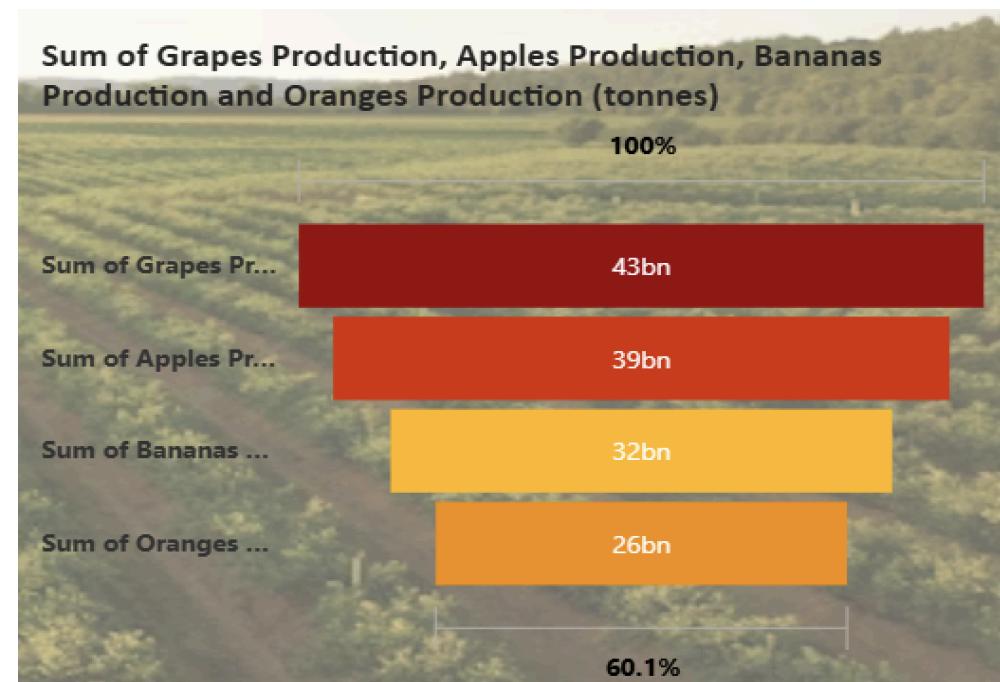
- *Visualization:* Donut chart showing the sum of Maize crop production in a specific year.



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8. What is the sum of Grapes, Apples, Bananas and Oranges Production (tonnes) ?

- *Visualization:* Funnel Chart showing sum of Grapes, Apples, Bananas and Oranges Production.



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5. Dashboard

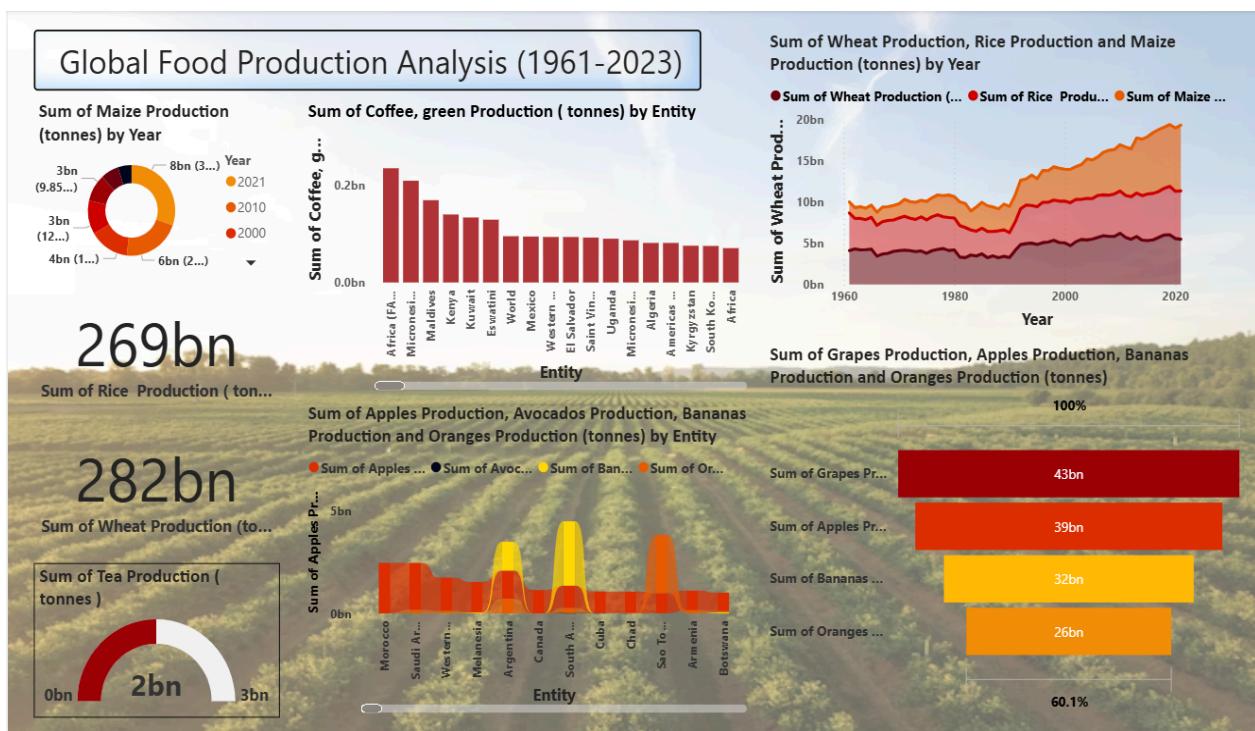
5.1. Dashboard Design File

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

Activity 1: Interactive and visually appealing dashboards

Creating interactive and visually appealing dashboards involves a combination of thoughtful design, effective use of visual elements, and the incorporation of interactive features. Here are some tips to help you design dashboards that are both visually appealing and engaging for users so take care of below points

- Clear and Intuitive Layout
- Use Appropriate Visualizations
- Colour and Theming
- Interactive Filters and Slicers
- Drill-Down Capabilities
- Responsive Design
- Custom Visuals and Icons
- Use of Infographics



Key Highlights from the Dashboard

- **Total Wheat Production** is the highest among all crops, totaling **282 billion tonnes**, followed by **Rice** at **269 billion tonnes**.
- **Maize Production** has shown a **steady upward trend** over the years, with a significant share coming from **2021**, as visualized in the donut chart.
- **Coffee (green) Production** is dominated by a few countries like **Africa (FAO region)**, **Micronesia**, and **Maldives**, with a noticeable drop-off after the top few producers.
- The **stacked area chart** shows that:
 - **Wheat and Maize production have seen continuous growth** since the 1990s.
 - **Rice production** remained relatively stable with mild growth.
- **Tea Production** totals approximately **2 billion tonnes**, visualized through a semi-circular gauge chart.
- **Grapes are the highest produced fruit**, totaling **43 billion tonnes**, followed by:
 - **Apples – 39bn**
 - **Bananas – 32bn**
 - **Oranges – 26bn**
- **Fruit production trends** (Apples, Bananas, Avocados, Oranges) vary significantly by entity, with spikes for countries like **Argentina**, **China**, and **São Tomé**.
- The use of **diverse visualizations** (donut, bar, area, ribbon, KPI cards) enhances interpretability and insight delivery effectively across multiple food categories.

6. Report

6.1. Story Design File

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.

GLOBAL FOOD PRODUCTION ANALYSIS REPORT

- The total rice production globally from 1961 to 2023 is 269 billion tonnes.
- The total wheat production globally from 1961 to 2023 is 282 billion tonnes.
- The total tea production globally from 1961 to 2023 is 2 billion tonnes.
- Africa, America, and Asia lead in the production of green coffee with Africa being the top producer followed by America.
- Wheat, maize and rice production have all shown a steady increase from 1961 to 2023, with wheat production showing the most significance rise over the years.
- Apples, avocados, bananas and oranges are produced in varying quantities by different entities, with countries like Europe and Asia showing significant production volumes.
- Maize production has consistently increased over the years, with notable jumps around the late 1980s and continuing into the 2000s.
- Grapes have the highest total production at 43 billion tonnes, followed by apples (39 billion tonnes), bananas (32 billion tonnes), and oranges (26 billion tonnes).

Production Type	Production Volume (tonnes)
Sum of Grapes Production	43bn
Sum of Apples Production	39bn
Sum of Bananas Production	32bn
Sum of Oranges Production	26bn

Observations from Power BI Reports

1. Trends Over Time:

- The stacked area chart reveals **consistent growth in Wheat and Maize production**, especially after 1990.
- **Rice production**, while stable, shows **milder growth**, indicating slower expansion in some regions.
- **Maize production peaked in recent years**, particularly around 2021, suggesting global reliance on this crop is rising.

2. Performance Comparisons:

- **Wheat leads global crop production** with 282bn tonnes, followed by Rice at 269bn tonnes.
- **Grapes (43bn tonnes)** and **Apples (39bn tonnes)** dominate fruit production, significantly outpacing Bananas and Oranges.
- The bar chart and ribbon chart highlight **country-level leaders**, with African and Asian countries appearing prominently in Coffee and Fruit production.

3. Regional Contributions & Crop Segmentation:

- Entities like **Micronesia, Maldives, and Africa (FAO-defined)** show distinct leadership in Coffee production.
- Countries such as **Argentina, China, and São Tomé** spike in different fruits like Bananas, Apples, and Oranges.
- **Crop diversity** across nations suggests opportunities for targeted agricultural investment based on strengths.

4. Goal Achievement:

- KPI cards indicate **milestone achievements** in key food categories:
 - **Wheat crossed 282bn tonnes**
 - **Rice surpassed 269bn tonnes**

- Tea production reached 2bn tonnes, nearing its upper band
- These indicators demonstrate steady progress in global food output and can benchmark sustainability or food security targets.

7. Performance Testing

7.1. Utilization of Data Filters

"Utilization of Filters" refers to the application or use of filters within a system, software application, or data processing pipeline to selectively extract, manipulate, or analyze data based on specified criteria or conditions.

Selected "Country" as a Filter

The screenshot shows a filter dialog for the entity 'Country'. The title is 'Filters on this visual' with a three-dot menu icon. Below it, 'Entity' is listed as 'is Afghanistan, Armen...'. The 'Filter type' dropdown is set to 'Basic filtering'. A search bar is present. A list of countries is shown with checkboxes:

Country	Value
<input checked="" type="checkbox"/> Select all	
<input checked="" type="checkbox"/> Afghanistan	61
<input type="checkbox"/> Africa	61
<input type="checkbox"/> Africa (FAO)	61
<input type="checkbox"/> Albania	61
<input type="checkbox"/> Algeria	61
<input type="checkbox"/> Americas (FAO)	61

 There is also a checkbox for 'Require single selection'.

Selected "Year" as a Filter

The screenshot shows a filter dialog for the year. The title is 'Year' with a note 'is 1961, 1966, 1970, 1...'. The 'Filter type' dropdown is set to 'Basic filtering'. A search bar is present. A list of years is shown with checkboxes:

Year	Value
<input checked="" type="checkbox"/> Select all	
<input checked="" type="checkbox"/> 1961	180
<input type="checkbox"/> 1962	180
<input type="checkbox"/> 1963	180
<input type="checkbox"/> 1964	180
<input type="checkbox"/> 1965	180
<input checked="" type="checkbox"/> 1966	181
<input type="checkbox"/> 1967	181

 There is also a checkbox for 'Require single selection'.

7.2. Number of Visualizations

- Sum of Rice Production (tonnes)
- Sum of Wheat Production (tonnes)
- Sum of Tea Production (tonnes)
- Sum of Coffee, Green Production (tonnes) by Entity
- Sum of Wheat Production (tonnes), Maize Production (tonnes), Rice Production (tonnes) by Year
- Sum of Apples, Avocados, Bananas, Oranges Production (tonnes) by Entity
- Sum of Maize Production (tonnes) by Year
- Sum of Grapes, Apples, Bananas, Oranges Production (tonnes)

8. Conclusion

The analysis of global food production from 1961 to 2023 using Power BI has provided meaningful insights into long-term agricultural trends, crop performance, and regional contributions. By leveraging interactive visualizations and a comprehensive dataset, this project successfully highlighted the dominance of key crops like wheat, rice, and maize, as well as emerging trends in fruit and beverage crop production across various countries.

The use of Power BI enabled clear, data-driven storytelling through charts, dashboards, and key performance indicators. Stakeholders—including policymakers, agribusinesses, and researchers—can use these findings to assess food security risks, optimize resource allocation, and support sustainable agricultural planning.

Overall, this project demonstrates how business intelligence tools can transform raw data into actionable insights, helping address global challenges related to food production, supply chains, and climate resilience.

9. Future Scope

The current project lays a solid foundation for analyzing historical food production data, but several opportunities exist to expand its scope and impact:

- **Incorporation of Real-Time Data:**
Integrating real-time or near real-time agricultural production data through APIs can enhance the dashboard's relevance for live monitoring and decision-making.
- **Predictive Analytics & Forecasting:**
Leveraging machine learning models within Power BI (or connected tools like Python or Azure ML) can enable forecasting of crop yields and production volumes under various climate and economic scenarios.
- **Integration with Climate and Soil Data:**
Combining food production data with weather, soil quality, and water availability datasets can provide a holistic view of factors affecting agricultural output.
- **Geospatial Deep Dive:**
Adding GIS-based layers to visualize production at sub-national levels (e.g., states, provinces) can support localized policy decisions and resource planning.
- **Interactive Decision Support System:**
Building an embedded or web-based Power BI app that allows users to customize views based on their region, crop, or time frame can enhance stakeholder usability.
- **Sustainability and Policy Indicators:**
Including KPIs such as carbon footprint per crop, water usage efficiency, or yield per hectare can align the analysis with global sustainability goals (e.g., SDG 2: Zero Hunger).

10. Appendix

10.1. GitHub & Project Demo Link

- **GitHub Repository:**
https://github.com/JaiswalSnehil/Global_Food_Production_Trend_Analysis
- **Project Demo:** <https://youtu.be/wG6oSK5xbXc>