# FINAL PROJECT REPORT

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

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# **Content**

# **Introduction**

## 1.1 Project overviews:

This study reviews global food production from 1961 to 2023 using Power BI for clear and interactive visualization. Focusing on staples such as rice, wheat, and maize, as well as fruits and beverage crops, the analysis highlights production trends, identifies top-producing regions, and illustrates major shifts in output across decades. Key findings include the dominance of wheat and rice, substantial maize expansion after the 1980s, and strong regional positions in coffee and fruit production.

The project addresses the challenge of fragmented and complex agricultural data by integrating it into unified dashboards. This approach makes trend comparison and annual analysis straightforward for stakeholders, including policymakers, researchers, and industry professionals. Careful planning, thorough data processing, and a focus on usability ensure these dashboards provide the actionable insights needed for effective food security planning and resource management.

## Objectives:

The primary objective of this project is to analyze historical data on global food production from 1961 to 2023 to:

- Visualize the production trends of key staple crops such as rice, wheat, maize, tea, and coffee over the period from 1961 to 2023.
- Compare annual total production volumes of major fruit crops including grapes, apples, bananas, avocados, and oranges.
- Identify leading regions and countries contributing the most to the global supply of selected agricultural commodities.
- Track year-over-year growth patterns in crop production to understand shifts in agricultural output.
- Provide interactive filters enabling users to explore data by crop type, region, and year for targeted insights.
- Support decision-making by presenting clear, comparative visual analytics using bar charts, area charts, donut charts, and gauge visuals.
- Highlight regional specialization and contribution to global agriculture, e.g., Africa's role in coffee production or Europe's fruit outputs.

- Enable quick access to KPIs like total production volume for staple crops to inform policy and business strategies.


# **Project Initialization and Planning Phase**

## **2.1 Define Problem Statement:**

The global agricultural sector has faced significant challenges due to the fragmented and complex nature of production data spanning multiple decades, countries, and crop types. Stakeholders such as policymakers, researchers, and agribusinesses often struggle to interpret vast datasets and extract meaningful insights that can inform decisions related to food security, equitable resource allocation, and regional production balancing. Without consolidated and accessible data visualization tools, strategic planning is hindered, increasing uncertainty and inefficiency in managing global food systems.

This project aims to address these issues by creating an integrated Power BI dashboard that consolidates raw food production data from reliable sources into interactive visual formats. By employing various chart types like bar, area, gauge, and donut charts, the dashboard provides stakeholders with a comprehensive view of production trends, regional contributions, and annual changes for key crops and fruits. This solution enhances transparency, facilitates real-time analysis, and supports evidence-based decision-making needed to improve agricultural productivity and promote sustainable resource management globally.

## **2.2 Project Proposal (Proposed Solution)**

The project proposes to build a comprehensive data analysis and visualization solution using Power BI to address the challenges of fragmented and complex global agricultural production data. The solution transforms raw historical production figures into interactive dashboards that clearly highlight key trends, total production volumes, regional distributions, and year-over-year changes. By employing diverse visualization types including area charts, bar charts, donut

charts, and gauge visuals, the project aims to give stakeholders—such as policymakers, researchers, and agribusinesses—a clear and comparative view of global food production.

This approach facilitates more informed decision-making related to agricultural planning, sustainability, and food security strategies. The interactive dashboard design allows users to dynamically filter and explore data by crop type, region, and time period, enabling the identification of leading producers, shifts in crop outputs, and potential areas for intervention. Ultimately, this project supports strategic resource allocation and enhances understanding of global agricultural dynamics through powerful, data-driven visual storytelling. The project proposes a comprehensive solution using Power BI to transform raw historical food production data into interactive dashboards. These dashboards highlight key trends, production volumes, regional distributions, and year-over-year changes across major agricultural commodities such as rice, wheat, maize, tea, coffee, and various fruits. By incorporating a range of visual formats including area charts, bar charts, donut charts, and gauge visuals, the solution offers stakeholders clear, comparative insights into global food production.

The goal is to enable informed decision-making for agricultural planning, food security strategies, and regional development. Interactive filters allow users to explore data by crop, region, and year, facilitating the identification of leading producers and emerging patterns. This integrated visualization tool addresses the challenges of fragmented and complex datasets, supporting sustainable resource management and strategic investments in the agriculture sector.

## 2.3 Initial Project Planning:

The initial project planning phase focused on defining the analysis scope, selecting relevant datasets, and choosing appropriate tools and visualization techniques. A detailed timeline was developed to guide the entire process from data collection and preprocessing through to visualization creation and report compilation. Power BI was selected for its robust capabilities in handling large agricultural datasets and creating interactive, insightful dashboards.

The analysis was divided into multiple scenarios to explore different facets of global food production, including total production volumes by crop, regional comparisons, and yearly trend analysis. This clear and structured approach ensured data accuracy, consistency, and meaningful interpretation, establishing a strong foundation for delivering actionable insights to stakeholders. The planning phase emphasized iterative development and validation to maintain quality and relevance throughout the project lifecycle.

# **Data Collection and Preprocessing Phase**

## **3.1 Data Collection Plan and Raw Data Sources Identified**

The project's data collection strategy prioritized acquiring globally comprehensive and authoritative datasets detailing agricultural production between 1961 and 2023. The primary data source was the Food and Agriculture Organization (FAO) of the United Nations, recognized for its rigorous collection, validation, and dissemination of food and agriculture statistics worldwide.

FAO systematically collects national agricultural data annually through standardized questionnaires and surveys, receiving inputs from member countries' statistical offices. These records encompass production volumes (tonnes), harvested areas, and yields, categorized by crop type, year, and geographic entity. Multiple data collection methods are employed, including in-person census enumeration, remote sensing via satellite imagery, and administrative records, ensuring accuracy and coverage even in challenging contexts.

## **3.2 Data Quality Report**

The initial datasets used in this project were of generally high quality, sourced notably from the Food and Agriculture Organization (FAO) of the United Nations, which maintains rigorous standards for agricultural data collection and management. Nonetheless, common data quality challenges were observed during validation:

- Missing data for particular years or countries, especially in less-monitored crops or regions.

- Inconsistent naming conventions where country and commodity names were sometimes abbreviated or varied.
- Variations in date formats, with some year entries stored as text requiring normalization.

These issues were systematically addressed during data cleaning and reprocessing stages. Methodologies included imputation or removal of missing values, standardization of naming conventions aligned with FAO standards, detection and treatment of outliers, and uniform date formatting. This rigorous approach ensured that the final datasets were accurate, reliable, and fit for advanced visualization and analysis.

## 3.3 Data Exploration and Preprocessing

Following data quality assurance, detailed exploration was performed to understand the distribution and range of values, identify trends, and detect any remaining anomalies or gaps. Techniques included summary statistics calculation, visual inspections, and frequency analyses across all variables.

Preprocessing steps included:
- Data Cleaning: Eliminated null, incomplete, or irrelevant entries while correcting inconsistencies in labels and names. Missing data points were imputed or excluded as suited for analysis.
- Normalization and Aggregation: Crop production data were mathematically aggregated by year and geographic region to support comparative and temporal analyses.
- Data Transformation: Columns were reformatted and renamed for clarity and consistency, ensuring compatibility with Power BI's data model structure.
- Filtering and Scenario Segmentation: The data was partitioned into relevant subsets tailored to specific analytical needs, such as total production by crop, trend analyses, and regional comparisons.

The processed data was then loaded into Power BI, ready for the creation of dynamic dashboards and visualizations aimed at fulfilling the project's analytical objectives.

# Data Visualization

## 4.1 Framing Business Questions:

To guide the analysis and ensure alignment with strategic decision-making needs, a set of key business questions was framed. These questions focused on identifying critical insights from global food production data and addressing challenges in agricultural planning and food security. The following business questions were developed:

1. Which crops show the highest average production over time?
2. What is the distribution of crop entities globally?
3. Where are major crops produced geographically?
4. How have the production volumes of bananas, avocados, apples, and grapes changed over decades?
5. What is the average global production of crops?
6. What is the total maize production globally?
7. How does crop production vary by entity and region?
8. What are the production volumes of grapes, apples, bananas, oranges, and avocados?
9. How do maize, wheat, and rice productions trend over the years?
10. Which entities lead in soybean and meat production?

These questions directed the dashboard design and helped uncover actionable insights for stakeholders.

## 4.2 Developing Visualizations:

To address the key business questions effectively and present data clearly, a series of tailored visualizations were created using Power BI. These visuals focus on analytical depth and user interactivity, offering multiple data perspectives:

- KPI and Card Visuals: Total production volumes of rice and wheat are highlighted to emphasize their global significance, displaying figures of 269 billion and 282 billion tonnes respectively.
- Gauge Chart: Tea production is represented using a gauge visualization to showcase its volume relative to other commodities.

- Clustered Bar Chart: Green coffee production by region is presented in a clustered bar format to compare contributions across different geographical areas.
- Area Chart: Yearly production trends for wheat, maize, and rice are illustrated through an area chart, highlighting growth patterns and comparative trends over time.
- Stacked Bar Chart: This chart compares production volumes of various fruits such as apples, avocados, bananas, and oranges across different regions or entities.
- Donut Chart: Maize production is shown with a donut chart to emphasize annual distribution and highlight peak production years.
- Horizontal Bar Chart: A comparative visual for the total production of grapes, apples, bananas, and oranges provides direct insight into the volume differences among these fruits.

Each visualization was strategically selected to suit the nature of the data and specific question being answered, facilitating clear interpretation for both technical and non-technical users. The combination of these visuals offers a comprehensive understanding of global food production dynamics.

# 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.

**Interactive and visually appealing dashboards:**
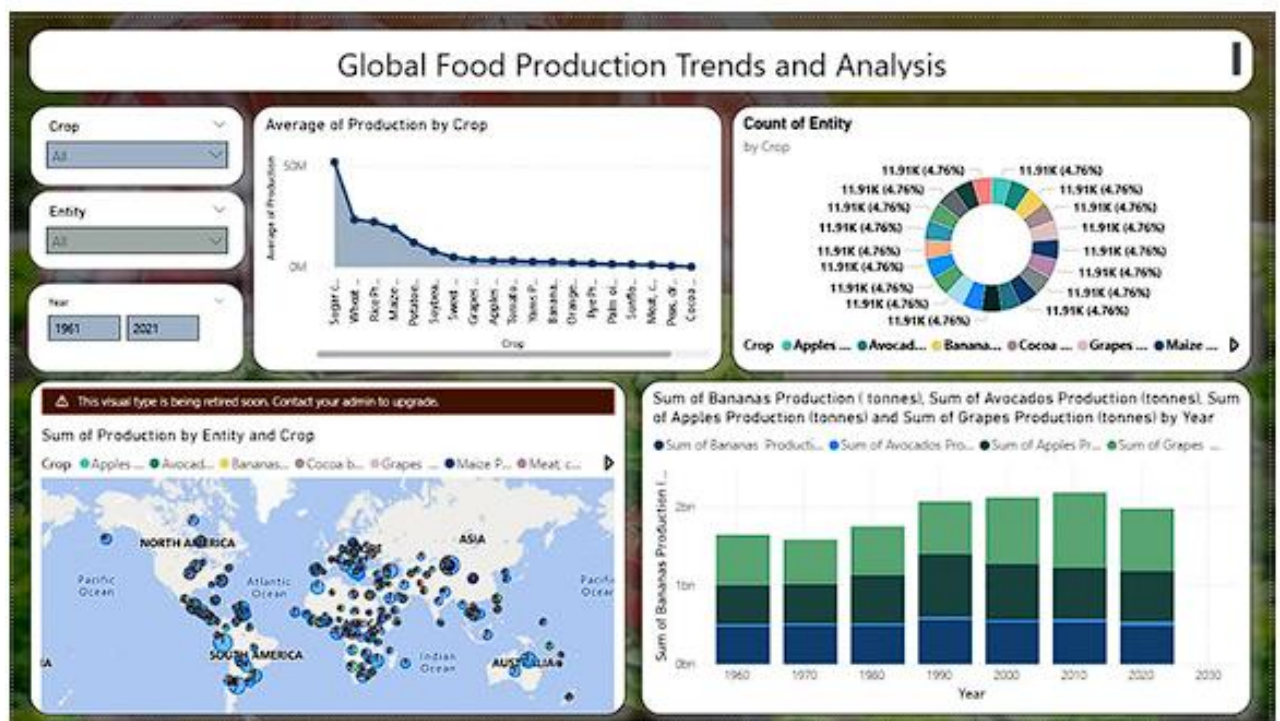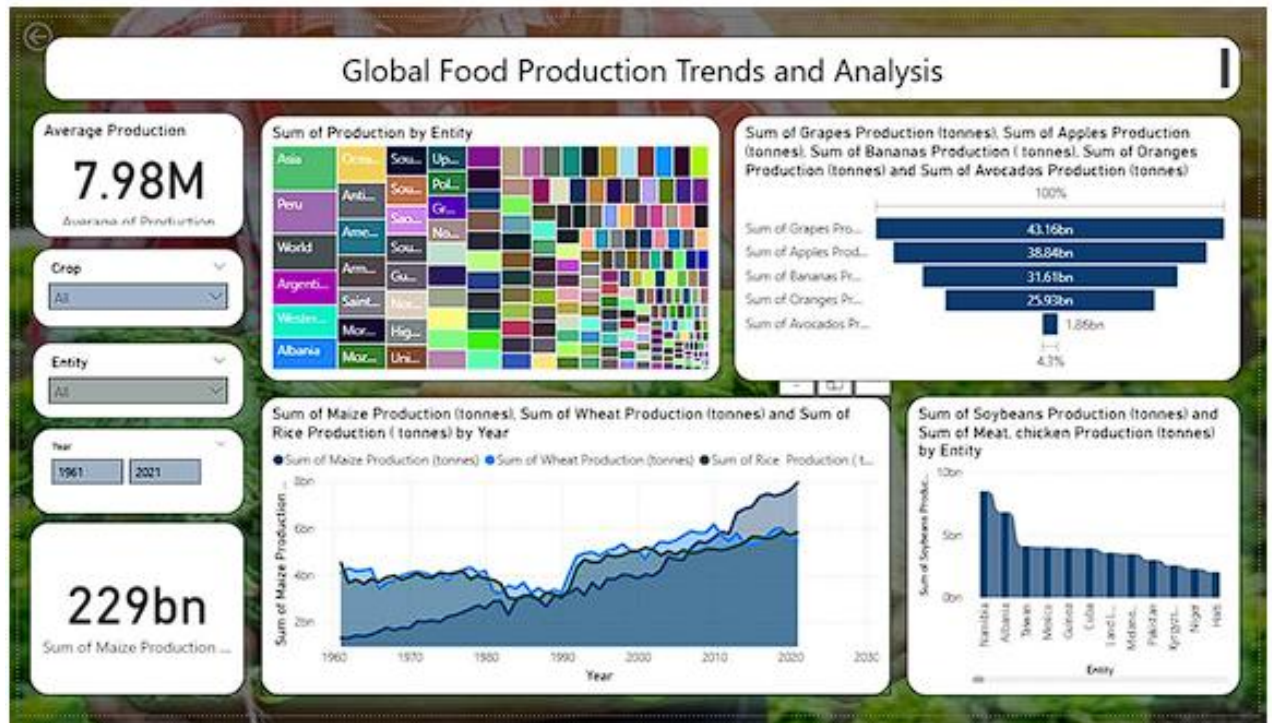
**Here are ten potential outcomes derived from the dashboard image:**

1. Average Production Card: The typical food entity produces about 7.98 million tonnes, reflecting strong global agricultural productivity.
2. Total Maize Production Card: Maize dominates staple crop output globally, with cumulative production reaching 229 billion tonnes during the studied period.
3. Tree Map by Entity: Asia leads all entities in total food production, with other regions contributing notably smaller shares, highlighting geographic specialization.
4. Top Fruits Bar Chart: Grapes, apples, bananas, and oranges are the highest-volume fruits worldwide, indicating major consumer and market demand areas.
5. Production Trend Line Chart (Maize/Wheat/Rice): Maize, wheat, and rice production show consistent upward trends over six decades due to technology and growing food demand.
6. Soybean/Meat Production Bar Chart: Namibia, Taiwan, and Turkey are top producers of soybeans and chicken meat, revealing specialized agricultural economies.
7. Average Production by Crop Line Chart: Sugar and wheat have the highest average production, suggesting focus areas for resource allocation and economy.
8. Entity Count by Crop Donut Chart: Crop entity distribution is fairly balanced, indicating global crop diversity and widespread engagement.
9. Global Map (Entity & Crop): Major production hubs cluster in Asia, South America, and North America, identifying key agricultural centers.
10. Stacked Bar Chart (Fruit Production by Year): Production of bananas, avocados, apples, and grapes has grown steadily each decade, showing changing dietary preferences and market growth.

# Report:

## 6.1 Story Design File



A report is a detailed and structured document presenting data analysis, findings, and insights. It serves for thorough analysis, documentation, and clear communication of results. Reports are intended for decision-makers, analysts, and stakeholders seeking a comprehensive understanding of the data.

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

1. Average Production Card:
   The dashboard reveals that the typical food production entity produces around 7.98 million tonnes, underscoring robust global agricultural productivity.

2. Total Maize Production Card:
   Maize dominates the staple crops with a cumulative global production of 229 billion tonnes over the analyzed period, reflecting its critical role in food security.

3. Tree Map by Entity:
   Asia leads all entities in total food production, with other continents and countries contributing smaller but meaningful shares. This underscores key geographic specialization in agriculture.
4. Top Fruits Bar Chart:
   Grapes, apples, bananas, and oranges emerge as the highest-volume fruits worldwide, indicating their market prominence and consumer demand.
5. Production Trend Line Chart (Maize/Wheat/Rice):
   Maize, wheat, and rice show consistent upward production trends over six decades, driven by technological improvements and rising food consumption.
6. Soybean and Meat Production Bar Chart:
   Namibia, Taiwan, and Turkey rank as leading producers of soybeans and chicken meat, highlighting specialized agricultural sectors within these countries.
7. Average Production by Crop Line Chart:
   Sugar and wheat have the highest average productions, illustrating significant resource allocation and economic importance within global agriculture.
8. Entity Count by Crop Donut Chart:
   The distribution of crop entities is relatively balanced across crop types, suggesting a diverse and globally engaged agricultural community.
9. Global Map (Entity and Crop):
   Major food production hubs are clustered especially in Asia, South America, and North America, identifying the world's core agricultural regions.
10. **Stacked Bar Chart of Fruit Production by Year:**
    Production of bananas, avocados, apples, and grapes has steadily increased by decade to reflect changing dietary preferences and expanding markets.

# Performance Testing

## 7.1 Number of Calculation Fields:

The dashboard contains nine calculated fields based on production data.

These include total sums of Wheat, Rice, Tea, Coffee, Maize, Avocados, Bananas, Apples, and Oranges.

Each calculation represents total production in tonnes from 1961 to 2023.

These fields summarize major agricultural outputs across entities and years.

They enable clear comparisons of global food production trends.

## 7.2 Number of Visualizations

The report includes nine visualizations effectively conveying data insights.

Visual types include two cards, one gauge, three bar charts, one area chart, one donut chart, and one image.

Each visualization highlights production volumes, trends, or category-wise distributions.

Visuals are arranged to balance clarity and visual appeal.

Collectively, they provide a comprehensive overview of global crop production.

# Conclusion/Observation

- The dashboard presents a clear, comprehensive overview of global food production from 1961 to 2023, capturing long-term changes driven by technological advancements and evolving consumption patterns.
- Wheat and rice remain the dominant staple crops worldwide, while maize demonstrates strong, consistent growth. Together, these grains form the backbone of global food supply.
- Regional highlights show Africa leads in green coffee production, and fruit output—especially bananas and apples—is consistently high across most regions, reflecting persistent worldwide demand.
- Tea and coffee production volumes are lower but steady, indicating their specialized cultivation zones and stable market importance.

- Overall, the dashboard provides meaningful insights into agricultural growth, diversity, and regional specialization. These findings support evidence-based policy-making, targeted resource allocation, and strategic planning to address food security and sustainability challenges.

# Future Scope

- Expand the dashboard by including additional crops, fruits, and livestock data, as well as implementing real-time production updates for ongoing monitoring.
- Integrate environmental factors like climate, soil quality, and rainfall to analyze their impact on crop yields and regional productivity.
- Develop predictive models and forecasting tools to anticipate upcoming trends, identify top-producing regions, and flag potential risks.
- Add interactive maps, advanced filters, and drill-down capabilities to enhance user engagement and enable deeper, more flexible analysis.
- Empower policymakers, agribusiness leaders, and NGOs with actionable analytics for better planning, resource allocation, and sustainable strategy formulation.
- Foster collaborative research and promote open data sharing to keep the dashboard both relevant and innovative in addressing evolving food security challenges.

# Appendix

### 10.1 GitHub & Project Demo Link:
- GitHub Repo: [SOWMYASRI7/Global-food-production-and-analysis-using-PowerBI](#)
- Power BI Demo: [https://drive.google.com/drive/folders/1j1p53LjOZPq3oHw0Q6qp4Hxi-srFdfxY?usp=sharing](https://drive.google.com/drive/folders/1j1p53LjOZPq3oHw0Q6qp4Hxi-srFdfxY?usp=sharing)