INTRODUCTION TO DATA MANAGEMENT

PROJECT REPORT

(Project Semester January-April 2025)

Interactive Dashboard for Crop Production Analysis

Submitted by

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Course Code : INT217

Under the Guidance of

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CERTIFICATE

This is to certify that Ayushi Rai bearing Registration no. 12311497 has completed INT217 project titled, **“** ***Interactive Dashboard for Crop Production Analysis*****”** under my guidance and supervision. To the best of my knowledge, the present work is the result of his/her original development, effort and study.

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Date: 10-04-2025

DECLARATION

I, Ayushi Rai, student of BTech under CSE/IT Discipline at, Lovely Professional University, Punjab, hereby declare that all the information furnished in this project report is based on my own intensive work and is genuine.

Date: 10-04-2025

Registration No.: 12311497 Name of the student: Ayushi Rai

ACKNOWLEDGEMENT

I would like to express my sincere gratitude to my faculty and department for their guidance and support throughout the completion of this minor project titled "Interactive Dashboard for Crop Production Analysis."

I also thank Lovely Professional University for providing the necessary resources and environment to carry out this work successfully.

Ayushi Rai
B.Tech CSE

Contents

1. Introduction

Agriculture plays a pivotal role in the Indian economy, contributing significantly to employment, food security, and overall development. Understanding patterns in crop production across various states and seasons is crucial for informed policy-making, improving efficiency, and ensuring sustainable agricultural practices. However, due to the massive and complex nature of agricultural data, deriving meaningful insights can often be challenging without the support of effective analytical tools.

In this project, a comprehensive Excel-based dashboard titled **"Interactive Dashboard for Crop Production Analysis"** has been developed to visually explore and analyze district-wise, season-wise crop production data in India. The main aim of this dashboard is to simplify large volumes of data into interactive, easy-to-understand visual formats that help users draw conclusions and identify patterns efficiently.

The dashboard enables users to:

- Observe the year-wise trend in crop production.
- Compare production levels across states and seasons.
- Visualize the contribution of each state to national production.
- Identify top-performing crops and states using dynamic charts.
- Track crop dominance in specific regions using comparative analysis.

The interactive design allows users to apply slicers and filters to focus on specific seasons, years, or crops, enhancing the ability to customize insights based on different parameters. Excel's capabilities, including pivot tables, charts, slicers, and formatting tools, have been leveraged to build a user-friendly interface that meets the project's analytical objectives.

This project not only demonstrates the power of Excel in data visualization but also reinforces the importance of interactive dashboards in the field of data science. It reflects how data-driven solutions can support agriculture-related research and decision-making, providing a strong foundation for future developments in predictive analytics, real-time monitoring, and policy planning.

2. Source of Dataset

The dataset used in this project has been sourced from the official Government of India open data platform — data.gov.in. This portal provides a wide range of publicly available datasets from various sectors such as agriculture, health, finance, education, etc., for the purpose of encouraging research, analysis, and data-driven decision-making.

The dataset selected for this project is titled **"District-wise, Season-wise Crop Production Statistics"**. It provides comprehensive information on crop production across various districts in India, categorized by agricultural seasons such as Kharif, Rabi, and Zaid. The data includes details like state, district, crop, season, area of cultivation (in hectares), and total production (in tonnes). This makes it an ideal dataset for analyzing crop patterns, yield efficiency, and production dominance across regions.

🔗 **Dataset Link:** https://www.data.gov.in/catalog/district-wise-season-wise-crop-production-statistics-0

Key features of the dataset:

- **Attributes:** State, District, Crop, Season, Year, Area (in hectares), Production (in tonnes)
- **Coverage:** Multiple years across all major agricultural regions of India
- **Format:** CSV
- **Purpose:** To support analytical tasks related to crop output trends, regional performance, seasonal crop patterns, and productivity comparison

This dataset has been downloaded in .CSV format and cleaned using Excel for further analysis and visualization in the project dashboard.

3. Sample Dataset

	A	B	C	D	E	F	G	H
1	State_Name	District_Name	Crop_Year	Season	Crop	Area	Production	Yield
2	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Arecanut	1254	2000	1.59
3	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Other Kharif pulses	2	1	0.50
4	Andaman and Nicobar Islands	NICOBARS	2000	Kharif	Rice	102	321	3.15
5	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Banana	176	641	3.64
6	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Cashewnut	720	165	0.23
7	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Coconut	18168	65100000	3583.22
8	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Dry ginger	36	100	2.78
9	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Sugarcane	1	2	2.00
10	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Sweet potato	5	15	3.00
11	Andaman and Nicobar Islands	NICOBARS	2000	Whole Year	Tapioca	40	169	4.23
12	Andaman and Nicobar Islands	NICOBARS	2001	Kharif	Arecanut	1254	2061	1.64
13	Andaman and Nicobar Islands	NICOBARS	2001	Kharif	Other Kharif pulses	2	1	0.50
14	Andaman and Nicobar Islands	NICOBARS	2001	Kharif	Rice	83	300	3.61
15	Andaman and Nicobar Islands	NICOBARS	2001	Whole Year	Cashewnut	719	192	0.27
16	Andaman and Nicobar Islands	NICOBARS	2001	Whole Year	Coconut	18190	64430000	3542.06
17	Andaman and Nicobar Islands	NICOBARS	2001	Whole Year	Dry ginger	46	100	2.17
18	Andaman and Nicobar Islands	NICOBARS	2001	Whole Year	Sugarcane	1	1	1.00
19	Andaman and Nicobar Islands	NICOBARS	2001	Whole Year	Sweet potato	11	33	3.00
20	Andaman and Nicobar Islands	NICOBARS	2002	Kharif	Rice	189	511	2.70
21	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Arecanut	1258	2083	1.66
22	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Banana	213	1278	6.00
23	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Black pepper	63	14	0.21
24	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Cashewnut	719	208	0.29
25	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Coconut	18240	67490000	3700.11
26	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Dry chillies	413	29	0.07
27	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Dry ginger	47	133	2.81
28	Andaman and Nicobar Islands	NICOBARS	2002	Whole Year	Sugarcane	5	40	8.00
29	Andaman and Nicobar Islands	NICOBARS	2003	Kharif	Rice	52	90	1.73
30	Andaman and Nicobar Islands	NICOBARS	2003	Whole Year	Arecanut	1261	1525	1.21

4. Dataset Preprocessing

Before performing any analysis or creating visualizations, the dataset underwent a thorough preprocessing phase to ensure data quality, accuracy, and consistency. Preprocessing is a crucial step that directly impacts the outcome and reliability of the insights drawn from the data.

Steps Taken for Preprocessing:

1. **Data Cleaning:**
    - Eliminated rows containing completely blank or null values.
    - Standardized text entries (e.g., uniform naming for seasons and states to avoid duplication).
    - Checked and corrected spelling inconsistencies in crop and district names.
2. **Handling Missing Values:**
    - Rows with missing production or area values were removed to avoid inaccuracies in yield calculations.
    - Ensured all columns had meaningful and interpretable values before proceeding.
3. **Data Type Conversion:**
    - Converted numerical columns like *Area* and *Production* to appropriate data types (float/int).
    - Ensured categorical fields (like Season, State, Crop) were in text format.
4. **Derived Column Creation:**
    - Created a **Yield** column by calculating production per hectare using the formula:

$$\text{Yield (tonnes/hectare)} = \frac{\text{Production}}{\text{Area}}$$

    - This column was used in multiple objectives to analyze efficiency.
5. **Data Formatting for Excel:**
    - Final cleaned dataset was saved in .xlsx format.
    - Pivot tables and charts were created on separate sheets.

- Relevant slicers (State, Crop, Season, Year) were applied for interactivity in the dashboard.

This preprocessing ensured that the data used in the dashboard was structured, reliable, and ready for accurate visual representation and meaningful insights.

5. Dashboard

Interactive Crop Production Dashboard

The above dashboard visually represents key insights extracted from the dataset, such as:

- **State-wise Crop Production**: A bar chart showcasing the contribution of each state to national production.
- **Year-wise Trends**: Line graphs to understand how production has changed over the years.
- **Season-wise Crop Output**: Charts reflecting crop output variations across seasons.
- **Top Performing Crops/States**: Highlighting the top 5 or 10 crops and states based on total production.
- **Crop Dominance by Region**: Maps and visuals showing which crops dominate specific regions.
- **Dynamic Slicers**: Interactive filters for users to view specific season, year, state, or crop data.

This dashboard was built using Microsoft Excel, with PivotTables, PivotCharts, and slicers to make it interactive and insightful.

6. Analysis on dataset

Objective 1: Visualize the Contribution of Each State to National Crop Production

i. General Description:

This objective focuses on identifying how much each state contributes to the total crop production in India. By visualizing state-wise percentage contributions, it becomes easier to highlight top-performing states and those needing agricultural improvements.

ii. Specific Requirements:

Calculate and display the percentage contribution of each state to total production.

Use **Pivot Table** and **Pivot Chart** in Excel for dynamic representation.

Add **slicers** for interactive filtering based on crop, year, and season.

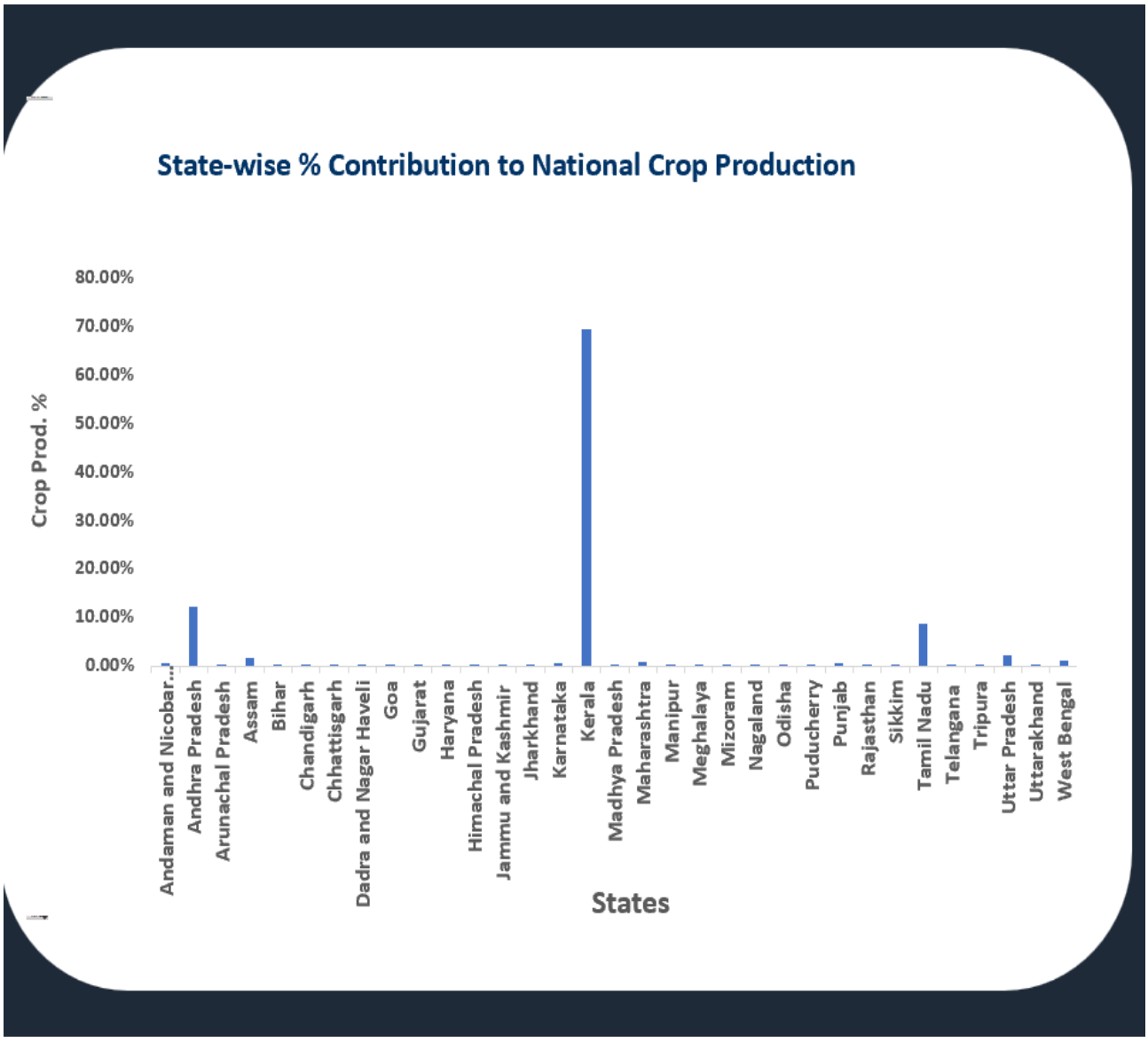
Format the chart using Excel design tools for readability and clarity.

iii. Analysis Results:

The analysis revealed that **Madhya Pradesh** shows the highest percentage contribution to national crop production, followed by other agriculturally active states like Uttar Pradesh and Maharashtra. States with lower contributions were also clearly identifiable, allowing insights into regional imbalances in productivity.

iv. Visualization:

A **bar chart** titled *"State-wise % Contribution to National Crop Production"* was created. Slicers were integrated for year, crop, and season to make the chart interactive. The visalization updates dynamically with user input and helps observe trends over time.


State-wise % Contribution to National Crop Production
Crop Prod. %
80.00%
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Andaman and Nicobar...
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chandigarh
Chhattisgarh
Dadra and Nagar Haveli
Goa
Gujarat
Haryana
Himachal Pradesh
Jammu and Kashmir
Jharkhand
Karnataka
Kerala
Madhya Pradesh
Maharashtra
Manipur
Meghalaya
Mizoram
Nagaland
Odisha
Puducherry
Punjab
Rajasthan
Sikkim
Tamil Nadu
Telangana
Tripura
Uttar Pradesh
Uttarakhand
West Bengal
States

Objective 2: Year-Wise Production Trend Visualization

i. General Description:

This objective aims to display how crop production has changed over the years. Analyzing year-wise trends helps in understanding the long-term growth, decline, or stability in agricultural output, and can highlight the impact of policies, weather conditions, and technological advancements.

ii. Specific Requirements:

Aggregate total crop production for each year using a Pivot Table.

Plot a line chart showing year-wise production trends.

Enable dynamic filtering using slicers for crop, state, and season.

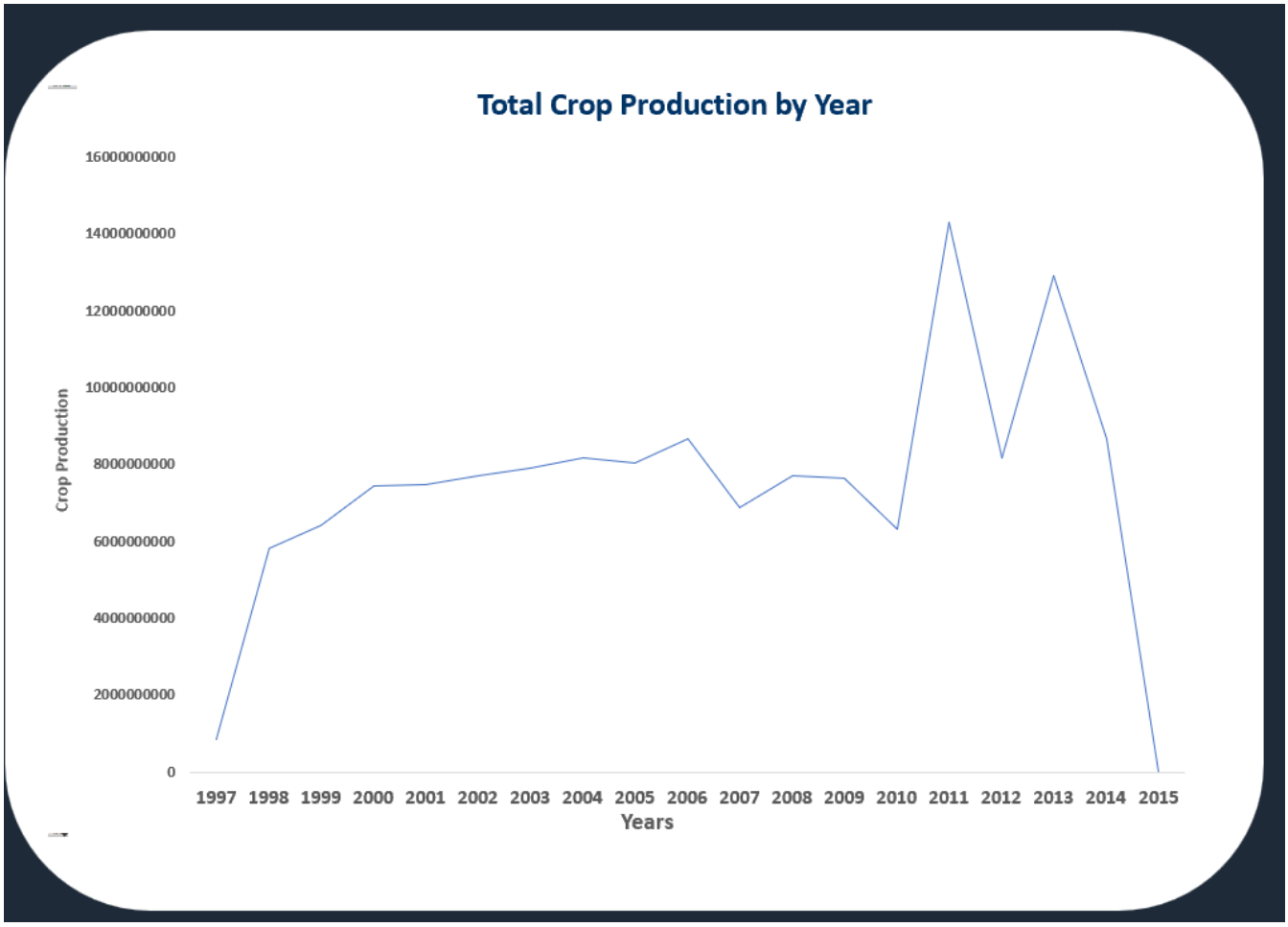
Apply consistent formatting (gridlines, titles, and axis labels) to enhance clarity.

iii. Analysis Results:

The line chart showed fluctuations in production across the years. Notably, there were visible peaks around certain years like 2011 and 2013, indicating high production periods, while dips suggested potential impacts of droughts or policy changes. The latest year in the dataset shows a sharp drop, likely due to incomplete data or recent disruptions.

iv. Visualization:

A line chart titled “Total Crop Production by Year” was created. Slicers were added for crop, state, and season. This visualization allows users to observe production behavior across different timeframes interactively.


Total Crop Production by Year
16000000000
14000000000
12000000000
10000000000
8000000000
6000000000
4000000000
2000000000
0
Crop Production
1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015
Years

Objective 3: Season-Wise Crop Output Dashboard

i. General Description:

The objective focuses on analyzing crop production based on the agricultural seasons: **Kharif, Rabi, Zaid**, and others. Season-wise analysis helps identify the dependency of certain crops on seasonal conditions and facilitates better resource allocation and crop planning.

ii. Specific Requirements:

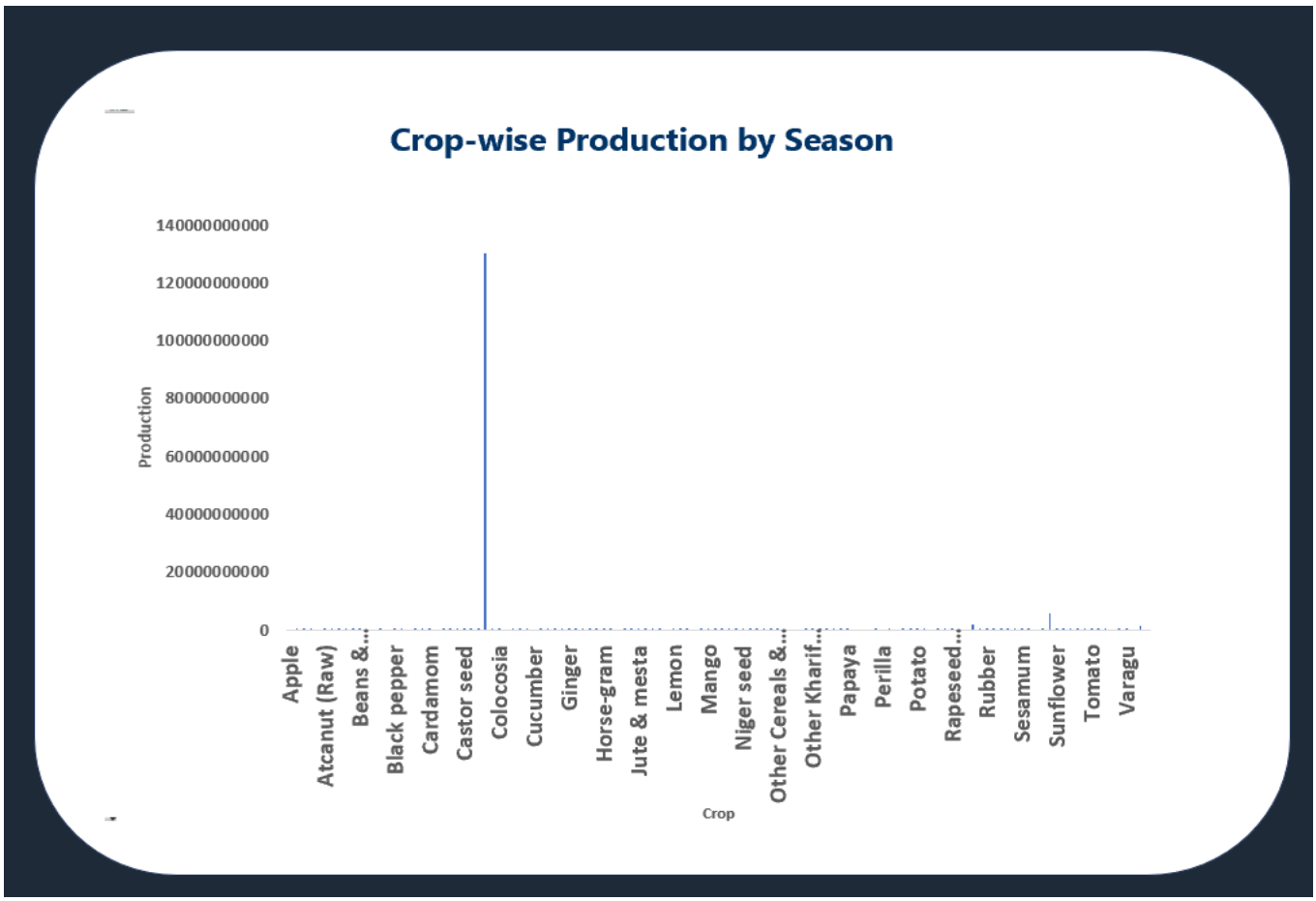
- Filter data using a **Pivot Table** to display season-wise crop production.
- Use **slicers** for dynamic filtering by **State**, **Year**, and **Crop**.
- Represent the season-wise production using **bar/column charts**.
- Make the dashboard interactive so users can switch between seasons and crops.

iii. Analysis Results:

The season-wise dashboard revealed that **Kharif crops** dominate in terms of volume, especially in states with heavy monsoons. **Rabi crops** showed higher production in northern states during winter months, while **Zaid** crops contributed relatively less and were grown in specific regions. This breakdown allows stakeholders to understand regional dependencies on different crop cycles.

iv. Visualization:

A **clustered column chart** was created showing crop output by season. The dashboard includes slicers for crop, state, and year, allowing real-time interactive filtering. Each season's data is clearly represented, and chart formatting was applied to enhance readability and visual appeal.


Crop-wise Production by Season
140000000000
120000000000
100000000000
80000000000
60000000000
40000000000
20000000000
0
Production
Apple
Atcanut (Raw)
Beans &...
Black pepper
Cardamom
Castor seed
Colocosia
Cucumber
Ginger
Horse-gram
Jute & mesta
Lemon
Mango
Niger seed
Other Cereals &...
Other Kharif...
Papaya
Perilla
Potato
Rapeseed...
Rubber
Sesamum
Sunflower
Tomato
Varagu
Crop

Objective 4: Compare Production Efficiency Between States

i. General Description:

This objective emphasizes the analysis of **crop production efficiency**, defined as **production per hectare (yield)**. Instead of just focusing on the total output, comparing yield allows us to understand how efficiently each state utilizes its available land.

ii. Specific Requirements:

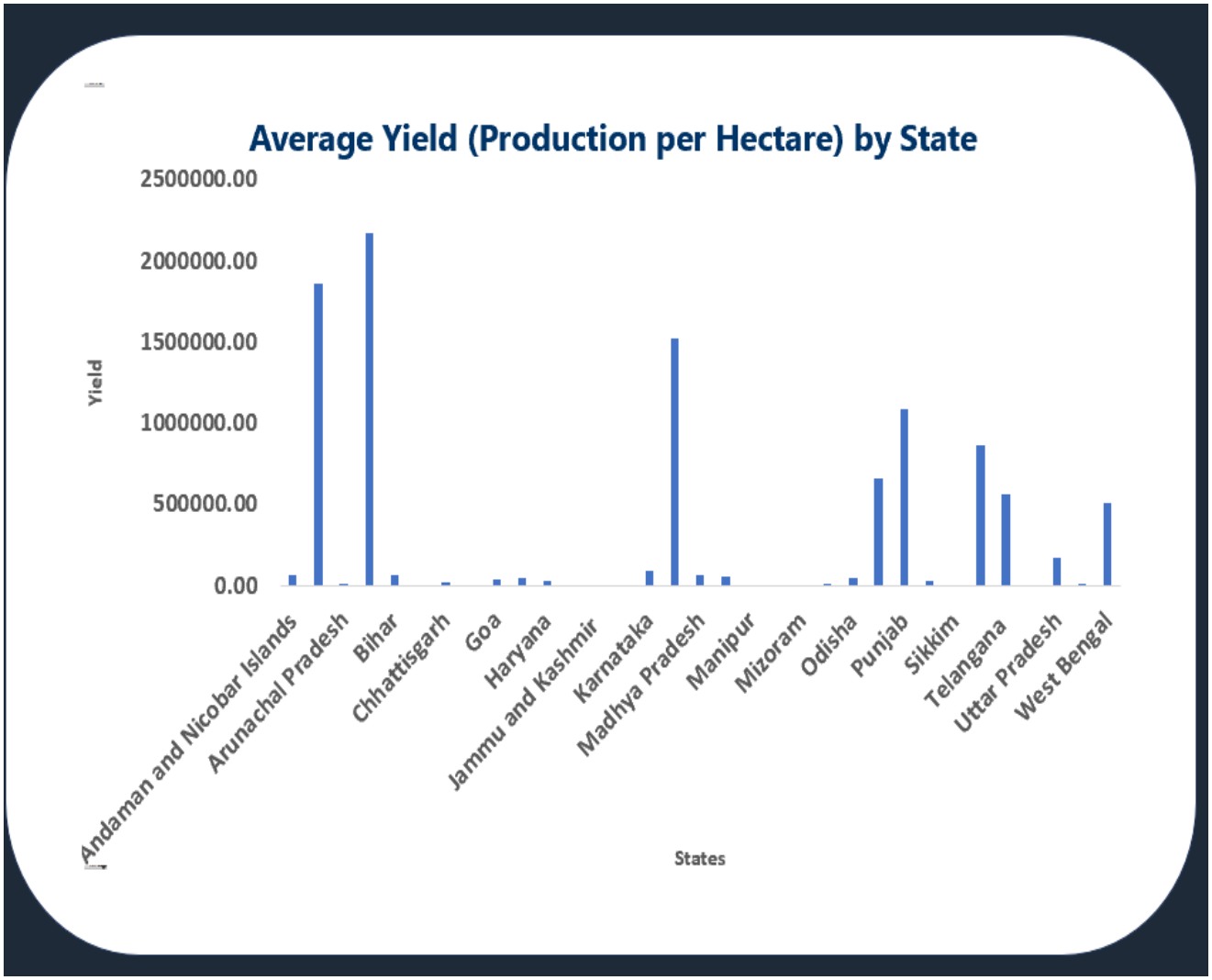
- Create a **calculated column** or use available fields to derive **yield (Production ÷ Area)**.
- Build a **Pivot Table** grouped by **State** and **Crop**, showing yield values.
- Use **bar charts** for visual comparison.
- Integrate **slicers** for filtering based on **Crop** and **Year** to make the chart interactive.

iii. Analysis Results:

The analysis revealed that while some states like **Punjab and Haryana** may have moderate production volumes, their **yield is significantly higher** due to efficient agricultural practices. In contrast, states with large agricultural areas but lower production show inefficiencies in land use. This comparison helps identify states that serve as benchmarks in productivity.

iv. Visualization:

A **horizontal bar chart** was used to compare yield (production per hectare) across selected states. Slicers for **crop** and **year** allow dynamic switching, making the chart adaptable and insightful for specific use cases. Color formatting and axis labels were customized for clarity and a professional look.


Average Yield (Production per Hectare) by State
2500000.00
2000000.00
1500000.00
1000000.00
500000.00
0.00
Yield
Andaman and Nicobar Islands
Arunachal Pradesh
Bihar
Chhattisgarh
Goa
Haryana
Jammu and Kashmir
Karnataka
Madhya Pradesh
Manipur
Mizoram
Odisha
Punjab
Sikkim
Telangana
Uttar Pradesh
West Bengal
States

Objective 5: Map Crop Dominance by Region Using Charts

i. General Description:

This objective focuses on identifying the **dominant crops** grown in different regions (districts or states). It helps in understanding the **regional specialization** in agriculture and guides strategic decisions on **crop planning, logistics, and subsidies**.

ii. Specific Requirements:

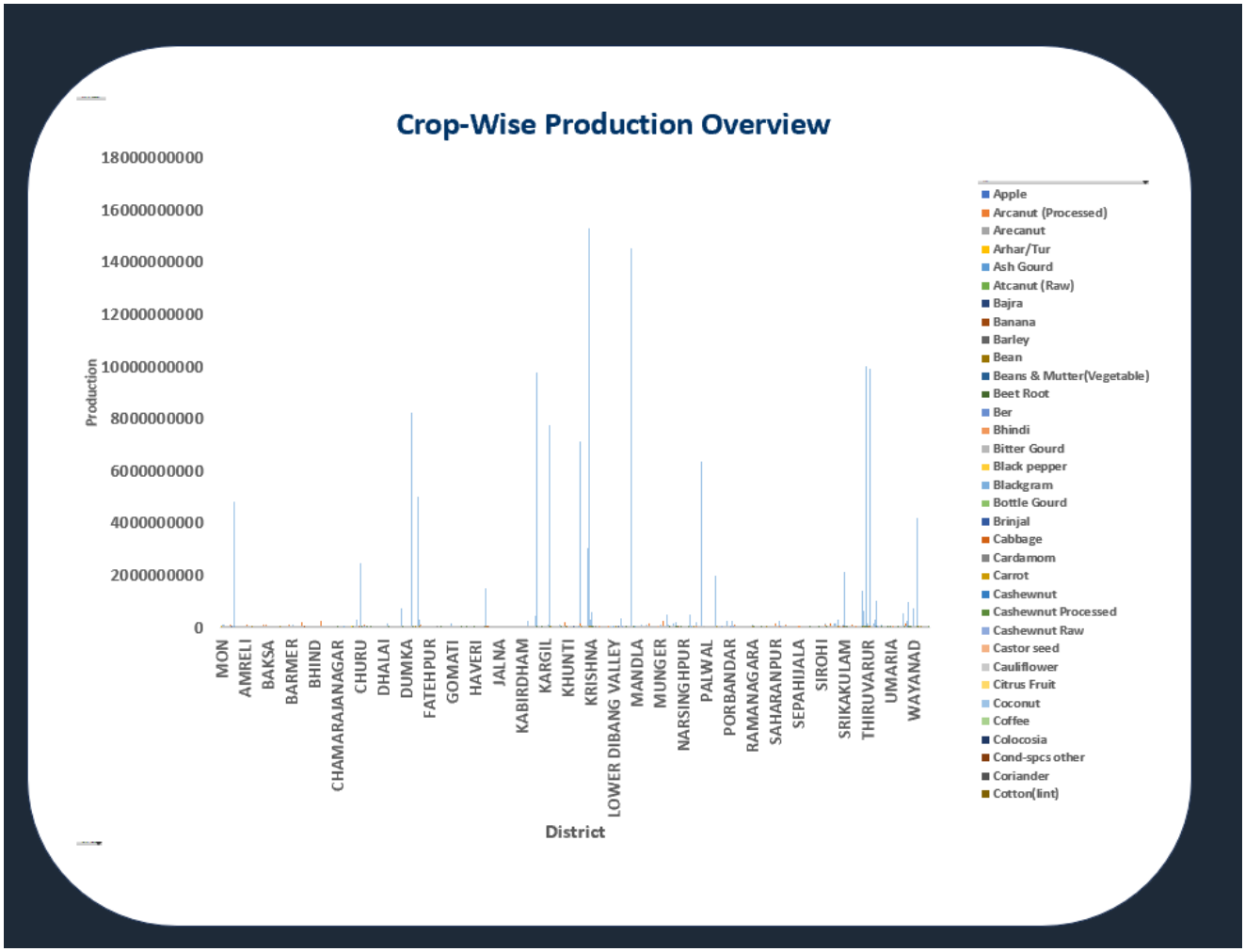
- Create a **Pivot Table** with **District** (or State) on rows and **Crop** on columns.
- Use **production** as the value field (summed).
- Apply a **Clustered Column Chart** to display comparative crop production across regions.
- Add **slicers for State and Year** to explore dominance in specific areas and time frames.

iii. Analysis Results:

The results highlighted regional patterns like **rice being dominant in eastern districts**, **wheat in northern plains**, and **cotton in some western regions**. Such visualization also helps spot **diverse agricultural practices** within a state and aids in **regional crop-specific policy making**.

iv. Visualization:

A **Clustered Column Chart** was used where each group of bars represents crop types in a particular region. The use of **slicers for State and Year** enables dynamic filtering to analyze crop dominance over time and space. Consistent color coding for each crop enhances readability.


Crop-Wise Production Overview
18000000000
16000000000
14000000000
12000000000
10000000000
8000000000
6000000000
4000000000
2000000000
0
Production
MON
AMRELI
BAKSA
BARMER
BHIND
CHAMARAJANAGAR
CHURU
DHALAI
DUMKA
FATEHPUR
GOMATI
HAVERI
JALNA
KABIRDHAM
KARGIL
KHUNTI
KRISHNA
LOWER DIBANG VALLEY
MANDLA
MUNGER
NARSINGHPUR
PALWAL
PORBANDAR
RAMANAGARA
SAHARANPUR
SEPAHIJALA
SIROHI
SRIKAKULAM
THIRUVARUR
UMARIA
WAYANAD
District
Apple
Arcanut (Processed)
Arecanut
Arhar/Tur
Ash Gourd
Atcanut (Raw)
Bajra
Banana
Barley
Bean
Beans & Mutter(Vegetable)
Beet Root
Ber
Bhindi
Bitter Gourd
Black pepper
Blackgram
Bottle Gourd
Brinjal
Cabbage
Cardamom
Carrot
Cashewnut
Cashewnut Processed
Cashewnut Raw
Castor seed
Cauliflower
Citrus Fruit
Coconut
Coffee
Colocosia
Cond-spcs other
Coriander
Cotton(lint)

Objective 6: Top 10 Crops/States by Production

i. General Description:

This objective adds a comparative view of the top 10 contributors to crop production—either by crop type or by state—helping users identify the highest-performing categories at a glance.

ii. Specific Requirements:

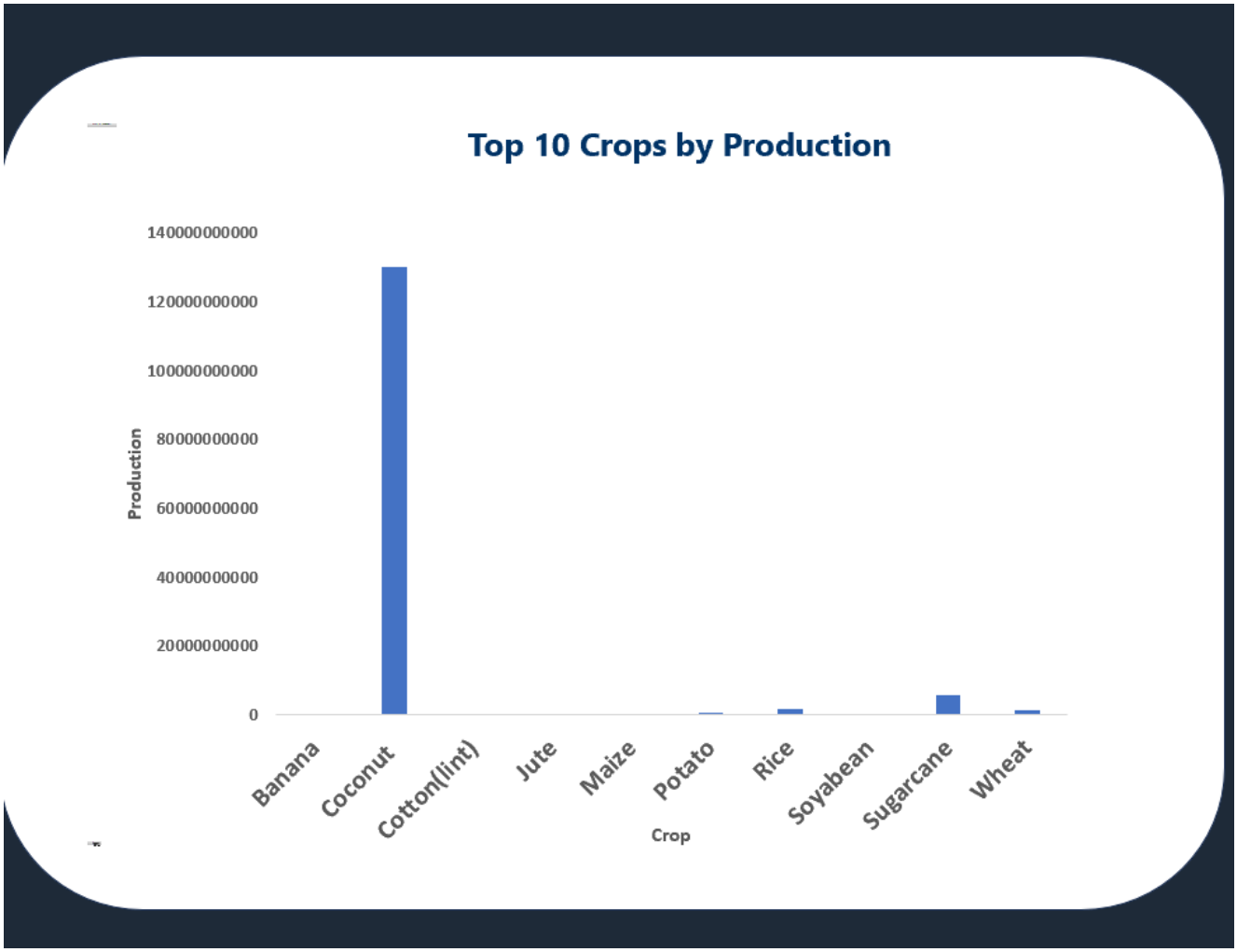
- Display only the top 10 crops or states based on production.
- Use slicers to allow filtering by year and season.
- Make the chart dynamic and easy to interpret.

iii. Analysis Results:

The analysis reveals which crops or states consistently lead in production across different time frames and seasons. This insight helps in identifying dominant contributors and understanding regional specialization.

iv. Visualization:

A dynamic bar chart was created showing the top 10 crops or states by production. It is connected to slicers for filtering by season and year to make the analysis interactive and context-sensitive.


Top 10 Crops by Production
140000000000
120000000000
100000000000
80000000000
60000000000
40000000000
20000000000
0
Production
Banana
Coconut
Cotton(lint)
Jute
Maize
Potato
Rice
Soyabean
Sugarcane
Wheat
Crop

5. Conclusion

The project titled **"Interactive Dashboard for Crop Production Analysis"** was aimed at simplifying the interpretation of complex agricultural datasets by providing clear, visual insights into crop production patterns across India. By utilizing tools such as **Microsoft Excel Pivot Tables, Charts, and Slicers**, the project successfully transformed raw data into an interactive, user-friendly dashboard.

This dashboard enables users to analyze and compare data across **multiple dimensions** such as **state, year, season, and crop type**, allowing for granular insights into agricultural trends. Users can easily:

- **Visualize each state's contribution** to the overall crop production across selected years, helping to identify high-performing regions.
- Track **year-wise production trends** to observe growth patterns or fluctuations over time.
- Filter data based on **seasons (Kharif, Rabi, Zaid)** to understand seasonal crop outputs, enhancing season-specific planning and research.
- Compare **production efficiency (yield per hectare)** between states for any given crop and year, useful for policy makers and agricultural bodies.
- Identify **top-performing crops and states** using ranked visualizations, highlighting dominant crops in different areas.
- Analyze the **relationship between cultivated area and production**, helping to understand how land usage affects yield.

By maintaining professional formatting, using a relevant color palette, and integrating slicers across all charts, the dashboard not only looks visually appealing but also ensures **data interactivity and decision-making efficiency**.

This project demonstrates how **Excel-based dashboards** can be a powerful tool in the field of data science for agriculture, empowering users with **real-time insights** and promoting **data-driven agricultural planning**. The approach used in this project is scalable and can be expanded to incorporate more complex datasets or predictive analytics in future iterations.

6. Future Scope

The current version of the "Interactive Dashboard for Crop Production Analysis" provides valuable insights into crop production trends, season-wise output, regional dominance, and state-wise efficiency. However, there are several areas where the dashboard can be enhanced for greater impact and functionality:

Real-Time Data Integration
Incorporating live datasets through APIs or web scraping can make the dashboard dynamic, allowing users to view the most recent crop production statistics instead of relying on static historical data.

Automated Refresh Mechanism
Automating the data refresh process will ensure that the dashboard stays up to date with minimal manual intervention, which is especially useful when dealing with frequently updated agricultural databases.

Interactive Geo-Mapping
Integrating geographical maps to visually represent district or state-level crop dominance would enhance spatial understanding and make the dashboard more engaging.

Advanced Filters and Drill-Down Analysis
Future versions can include more advanced slicers, allowing users to drill down by crop type, district, or specific time periods for deeper insights.

Predictive Analysis
By linking this dashboard with a predictive model (built using Python or R), users could forecast future production levels based on historical trends and seasonal patterns.

Web-Based Dashboard Version
Converting this Excel dashboard into a web-based interactive dashboard using tools like Power BI, Tableau, or Dash (Python) could allow broader accessibility and richer visualization capabilities.

Mobile Compatibility
Designing the dashboard layout to be responsive and mobile-friendly would enable users to explore insights on the go.

User Documentation and Help Guide
Adding a help tab or tooltip documentation inside the dashboard can guide new users in interacting effectively with all components.

By incorporating these enhancements, the dashboard can evolve into a more powerful decision-support tool for researchers, farmers, policy makers, and agricultural analysts.

7.Linkedln:

Ayushi Rai • You
C++ || C || Python || 4 ⭐ in Python on HackerRank || SQL || HTML || CSS
1d • Edited •

🌾 📊 Exploring Crop Production through Data Visualization in Excel :
Sharing a dashboard I recently created to analyze agriculture production trends across India.

This dashboard provides insights into:
📍 State-wise crop production
🗓️ Year-wise trends
🌱 Season-wise outputs
🏆 Top 10 crops by yield and production
📊 Comparative yield analysis across regions
🔍 Designed with an earthy theme and interactive filters to support better decision-making in the agricultural sector.
📌 Tools Used: Excel Pivot Tables, Slicers, Custom Chart Formatting, Dashboard Design
#lpu #scse

You and 33 others 7 comments

8. References

[1] Government of India, Ministry of Agriculture and Farmers Welfare, , [Online]. Available: https://www.data.gov.in/catalog/district-wise-season-wise-crop-production-statistics-0 [Accessed: Apr. 2025].

[2] Microsoft, *"Create a PivotTable to analyze worksheet data"*, Microsoft Support. [Online]. Available: https://support.microsoft.com/en-us/excel [Accessed: Apr. 2025].