INT217-INTRODUTION TO DATA MANAGEMENT

PROJECT REPORT

(Project Semester January-April 2025)

Analysing NFSA Distribution Mechanisms:

Submitted by

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Course Code INT217

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Declaration

I Shambhavi Kumari , student of INTRODUCTION TO DATA MANAGEMENT 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   Signature

Registration No. 12322701

Certificate

This is to certify that Shambhavi Kumari bearing Registration no. 12322701 has

completed INT217 project titled, "**Analysing NFSA Distribution Mechanisms**"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.

Signature of the Guide

Signature of the Head of Department

Acknowledgement

I would like to express my sincere gratitude to my guide Sandeep Kaur for his/her invaluable support and guidance throughout the project. I also extend my thanks to the Head of the Department, faculty members, and my peers for their encouragement and feedback.

Table of Content

1.Introduction

This project focuses on analyzing the distribution mechanisms of the **National Food Security Act (NFSA)**, a major public welfare initiative in India aimed at providing subsidized food grains to approximately two-thirds of the country's population. The dataset explores various operational aspects and objectives related to NFSA, including distribution efficiency, regional disparities, beneficiary coverage, and delivery performance. By evaluating the data across multiple objectives, the analysis aims to uncover patterns, gaps, and potential improvements in the food distribution system under NFSA.

2. Source of dataset

 Based on the content and structure, the dataset appears to be compiled from multiple NFSA-related records, likely gathered from various government portals. These may include the official National Food Security Act (NFSA)https://ndap.niti.gov.in/India's open government data platform — and records from state or district-level Public Distribution System (PDS) databases. While the dataset provides detailed insights into the distribution mechanisms under NFSA, the exact source is not explicitly mentioned in the file. Further confirmation may be available through additional notes or references found within the 'HOME PAGE' or other related sheets in the Excel file.

3.DATASET PREPROCESSING

To preprocess in Excel:

1. **Remove Empty Rows/Columns:** Delete fully empty rows and columns.

2. **Rename Columns:** Replace "Unnamed" headers with meaningful names.

3. **Handle Missing Values:** Fill missing data or delete rows/columns with blanks.

4. **Convert Data Types:** Ensure numeric columns are set as "Number" format.

5. **Normalize/Standardize (if needed):** Use formulas for normalization or standardization.

4. ANALYSIS ON DATASET (Objective-wise)

The dataset contains monthly public distribution system data across Indian states, with 3,027 records and the following key columns:

Key Columns for Analysis:

1. **Food grains allocated**

2. **Ration cards issued**

3. **Transaction for ration cards**

4. **Aadhaar authenticated Transactions & (%)**

5. **ePoS vs Manual distribution of food grains**

6. **Distribution of food grains (Total)**

Objective 1: . Analyze the Efficiency of Aadhaar-Based Authentication

Goal: Evaluate the effectiveness and adoption of Aadhaar-based authentication in ration distribution by comparing the percentage of authenticated transactions across states and years.

 State-Wise Pie Chart: This chart would show the percentage of authenticated transactions for each state. Each slice of the pie would represent a state, with the size of the slice corresponding to the proportion of authenticated transactions in that state. It gives a clear, easy-to-digest view of how each state is performing.

 Year-Wise Pie Chart: A pie chart for each year could show the distribution of authenticated versus non-authenticated transactions across all states. This would give an overall picture of Aadhaar adoption in ration distribution for that particular year.

Objective 2: Study the Year-on-Year Trends in Ration Card Issuance

Line Chart (Year-on-Year Trends): A line chart can show the growth or decline in the number of ration cards issued across years. The x-axis would represent the years, and the y-axis would represent the number of cards issued, helping to visualize trends over time.

Stacked Bar Chart (State-Year Performance): A stacked bar chart can show the number of ration cards issued by each state for each year. This allows for both yearly comparisons and the distribution of ration cards across states in each year, making it easier to see state-level trends over time.

Objective 3: **Compare Manual vs ePoS Distribution Methods**

Goal: Quantify the shift from manual distribution to ePoS systems and analyze which states are leading or lagging in digital adoption.

Line Chart (Yearly Trends): A line chart can show the year-on-year shift from manual to ePoS transactions across all states. The x-axis represents the years, and the y-axis shows the percentage of ePoS transactions, which allows us to track the overall trend in digital adoption over time. Calculate Percentage: For each year, apply the above formula to calculate the percentage of ePoS transactions.

Plot the Data: Use the calculated percentages to plot the line chart, where:

- **X-axis: Represents the years.**

- **Y-axis: Represents the percentage of ePoS transactions.**

Objective 4: **Perform a Regional Comparison of Food Grain Allocation**

Goal: Compare food grain allocation across states and identify disparities or regional trends in government support and distribution efforts.

A donut chart visually shows how much food grain each state receives out of the total allocation. Each part of the ring represents a state, and the size of that part shows the percentage of total food grains given to that state. The center space can be used to display the total or average allocation.

Objective 5: Detect Anomalies in Distribution vs Allocation Objective

Goal: : Identify any unusual or suspicious patterns where distributed quantities exceed allocated food grains, which could signal data entry issues or systemic problems.

To detect anomalies in distribution vs allocation, compare the quantity of food grains distributed to the quantity allocated for each state and time period. If the distributed amount is greater than the allocated amount, it indicates a potential anomaly.

Objective 6: Examine how electronic Point of Sale (ePoS) adoption has increased over the years across different states.

To examine how electronic Point of Sale (ePoS) adoption has increased over the years, we analyze the percentage of total transactions conducted through ePoS systems across various states and time periods. A rising trend in this percentage indicates successful digital integration in the Public Distribution System (PDS). States with consistently high ePoS usage reflect better infrastructure, training, and

governance, while those with low adoption may face challenges such as poor internet connectivity, lack of devices, or resistance to technology.

iv. Visualization

Visualizations help to illustrate complex data patterns. The following visual tools were used:

- **Bar Chart**

- **Pie Chart**

- **Doughnut Chart**

- **Line Graph**

- **Figure 1: Analyze the Efficiency of Aadhaar-Based Authentication**

  Graph Used: Pie chart

  To evaluate Aadhaar-based authentication in ration distribution, we calculate the **percentage of authenticated transactions** for each state and year. This metric is computed as the ratio of authenticated transactions to total transactions. By comparing these percentages across states and over time, we can identify trends and regional variations, assessing whether authentication is improving or facing challenges in specific areas.
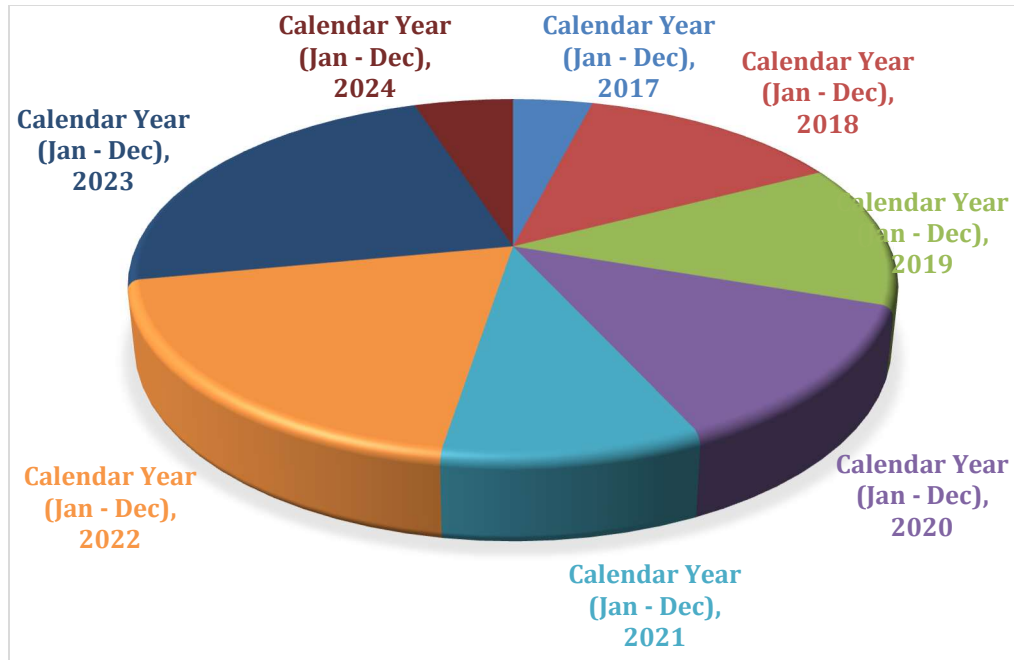
Figure 2: Study the Year-on-Year Trends in Ration Card Issuance

Description: To study the year-on-year trends in ration card issuance, we would track the number of ration cards issued across different states and over different time periods. This analysis involves calculating the growth or decline in the issuance of ration cards, identifying the percentage change in the number of cards issued from one year to the next. By comparing the yearly data, we can assess demand trends, such as whether there is an increase in the issuance of ration cards in certain states, which may indicate growing demand or population growth. Conversely, a decline might indicate factors like improved distribution systems or demographic changes..
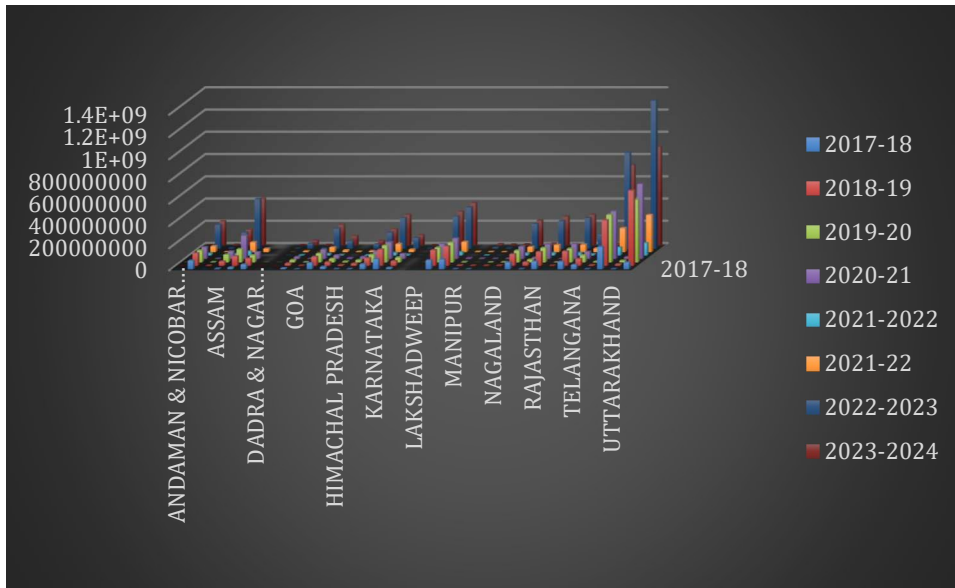
Figure3 : **Compare Manual vs ePoS Distribution Methods**

Description: To compare the manual versus ePoS distribution methods, we need to analyze the shift in the number of transactions conducted manually versus through the ePoS system over time, across different states. The key metric here would be the percentage of transactions using ePoS compared to manual methods. By calculating the proportion of ePoS transactions each year, we can quantify the digital adoption rate in each state. This analysis will help identify which states are leading in ePoS adoption and which ones are lagging. We can also track trends over time to assess the overall progress of digitization in ration distribution systems.
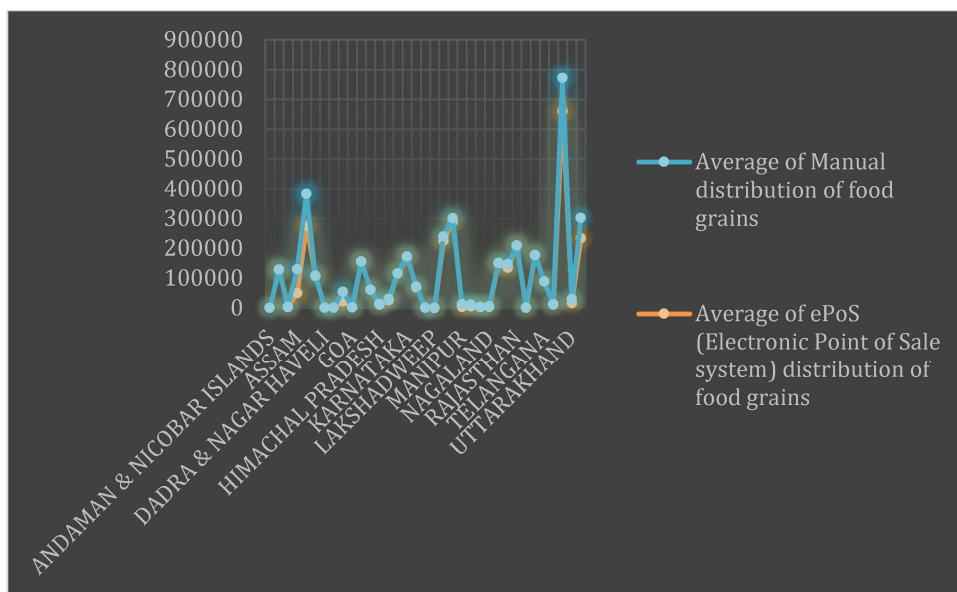
Figure4: Perform a Regional Comparison of Food Grain Allocation

Description: To perform a regional comparison of food grain allocation, we need to gather data on the total food grains allocated to each state across different time periods. The key metric for this analysis is the **per capita food grain allocation**, which can be calculated by dividing the total food grains allocated to a state by its population. This metric will allow us to identify disparities in food grain distribution, highlighting states with higher or lower allocations relative to their population size. Additionally, by analyzing changes over time, we can identify trends in government support and distribution efforts, as well as any regional patterns, such as areas with consistently high or low allocations.
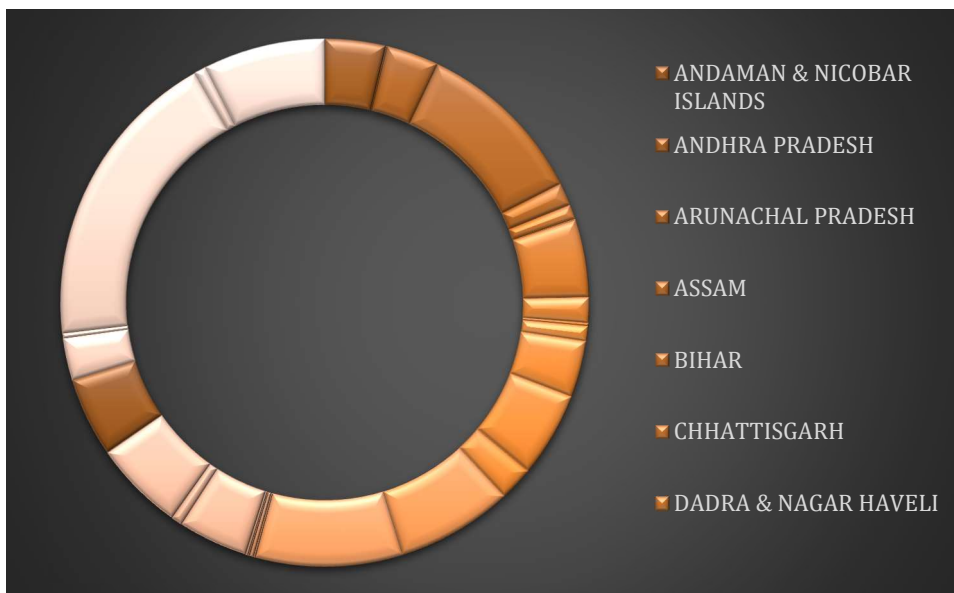

Figure 5: Detect Anomalies in Distribution vs Allocation

Description: For visualization, a **bar chart** can be used to compare the allocated and distributed food grain quantities side by side for each state, making it easy to spot any over-distribution. A **donut chart** can show the proportion of states with normal versus anomalous distribution, giving a clear overview of how widespread the issue is. Additionally, a **heatmap** can visually highlight states and years with anomalies using color intensity, helping quickly identify problem areas that may require further investigation.
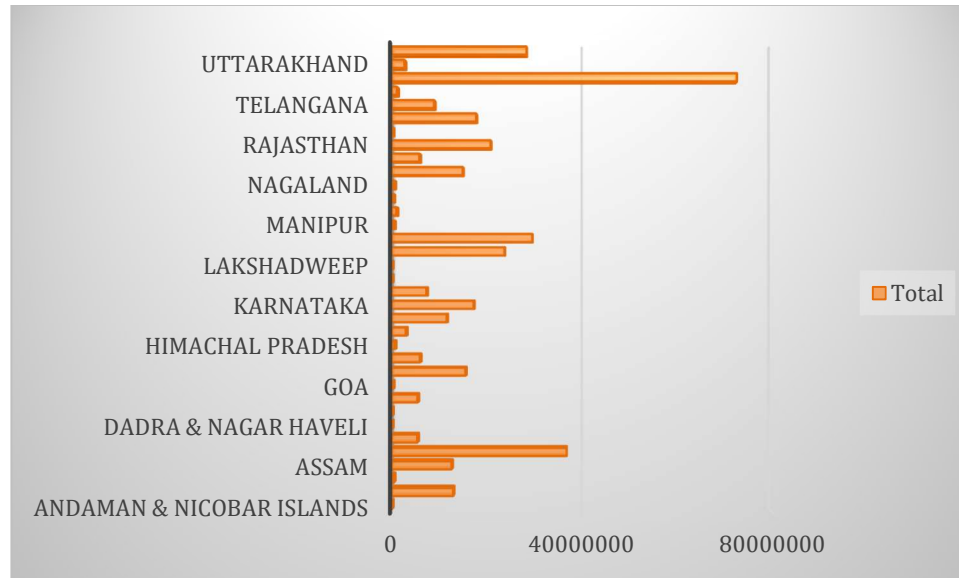
Figure 6: Examine how electronic Point of Sale (ePoS) adoption has increased over the years across different states.

Description: To examine how **electronic Point of Sale (ePoS)** adoption has increased over the years, we analyze the percentage of total transactions conducted through ePoS systems across various states and time periods. A rising trend in this percentage indicates successful digital integration in the Public Distribution System (PDS). States with consistently high ePoS usage reflect better infrastructure, training, and governance, while those with low adoption may face challenges such as poor internet connectivity, lack of devices, or resistance to technology.
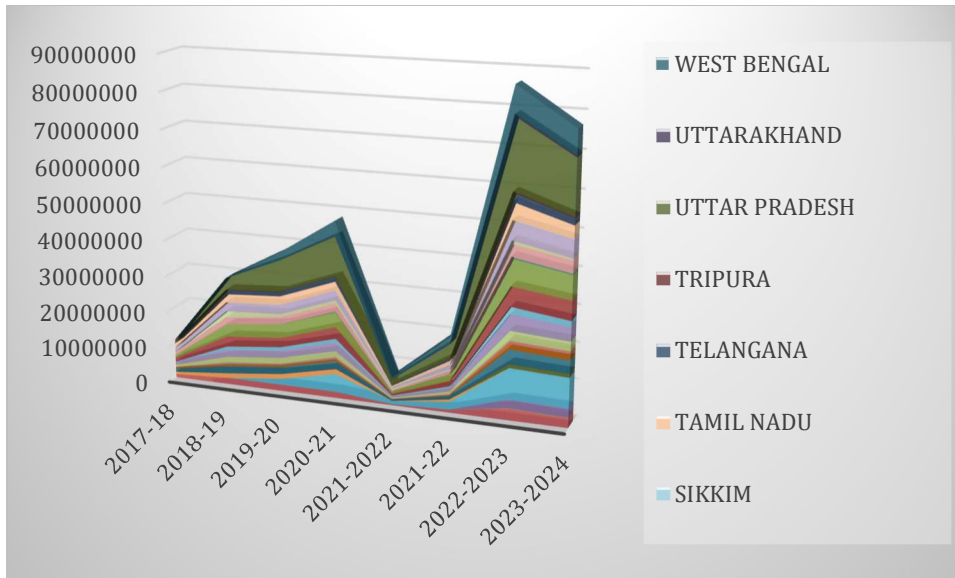
Figure 7: Analyzing NFSA Distribution Mechanism Dashboard

Description: The dashboard provides a comprehensive analysis of India's National Food Security Act (NFSA) distribution mechanisms through various visualizations. It tracks monthly and annual trends in allocated food grain quantities nationally and across different states. Users can filter data by month and state to compare allocation and distribution, identify trends over time, and assess state-specific performance. The dashboard includes charts showing average monthly allocation, total monthly allocation, annual allocation, distribution by state, and the representation of states in the data. Interactive slicers enable focused analysis on specific time periods and regions, making it a valuable tool for understanding and evaluating the NFSA's implementation across India.

5. **Conclusion**

The dashboard's design facilitates a comparative analysis of allocation versus actual distribution at the state level, which is crucial for assessing the effectiveness of the supply chain and identifying potential leakages or inefficiencies in the system. The ability to filter data by specific months allows for the examination of seasonal variations in demand and supply, potentially informing adjustments to allocation strategies to better match local needs. The visual representation of data through various chart types, such as line graphs, bar charts, and pie charts, enhances understanding and makes complex information more accessible to a wider range of stakeholders, including policymakers, administrators, and researchers. The identification of states with consistently high or low allocation and distribution volumes can prompt further investigation into the underlying socio-economic factors, logistical challenges, or policy implementations that contribute to these disparities. Ultimately, the insights gleaned from this dashboard can contribute to a more data-driven and equitable approach to food security management under the NFSA, leading to improved targeting of beneficiaries and a more efficient and transparent distribution process across the nation. The potential for integrating this analytical tool with real-time data feeds could further enhance its utility for dynamic monitoring and proactive intervention in the food grain distribution ecosystem.

6. **Future scope**

Looking ahead, this NFSA distribution analysis dashboard holds significant potential for future development and expanded utility. Integrating predictive analytics could enable forecasting future food grain requirements based on historical trends, demographic shifts, and potential external factors like climate patterns or economic changes, allowing for proactive resource allocation and minimizing shortages or surpluses. Incorporating real-time data feeds from the distribution network could provide a dynamic view of stock levels, transportation logistics, and beneficiary access, facilitating immediate identification of bottlenecks and enabling timely interventions.

Furthermore, the dashboard could be enhanced by incorporating socio-economic indicators and vulnerability mapping to identify regions and populations most at risk of food insecurity, allowing for more targeted and needs-based allocation strategies. Integrating

feedback mechanisms from beneficiaries and local administrators could provide valuable qualitative data to complement the quantitative analysis, offering a more holistic understanding of the on-ground impact of the NFSA.

The application of machine learning algorithms could automate the identification of anomalies or inefficiencies in the distribution process, flagging potential instances of fraud or mismanagement. Expanding the dashboard to include nutritional outcome data could provide a more comprehensive assessment of the NFSA's impact beyond just distribution quantities. Ultimately, by embracing advanced analytical techniques, real-time data integration, and a broader range of relevant indicators, this dashboard can evolve into an even more powerful tool for ensuring food security and optimizing the effectiveness of the NFSA in India.

7.RECOMMENDATIONS

1. **Based on the insights and potential future scope of this NFSA distribution analysis dashboard, here are some recommendations:**

2. **Implement Predictive Analytics: Integrate forecasting models to predict future food grain demand at regional and national levels, considering factors like population growth, seasonal variations, and potential external shocks. This will enable proactive allocation and resource planning.**

3. **Integrate Real-Time Data: Establish pipelines for real-time data feeds from the food grain distribution network, including stock levels at depots, transportation status, and beneficiary offtake. This will provide a dynamic and up-to-date view of the distribution process, facilitating timely interventions for any disruptions.**

4. **Incorporate Vulnerability Mapping: Overlay socio-economic vulnerability data and food insecurity maps onto the dashboard to identify the most at-risk populations and regions. This will enable more targeted and equitable allocation of resources based on actual need.**

5. **Develop Beneficiary Feedback Mechanisms: Integrate channels for collecting feedback from beneficiaries and local administrators, such as surveys or reporting tools accessible through mobile platforms. This qualitative data can provide valuable context to the quantitative analysis and highlight areas for improvement in service delivery.**

6. **Apply Anomaly Detection: Implement machine learning algorithms to automatically identify unusual patterns or anomalies in the distribution data, which could indicate inefficiencies, leakages, or potential fraudulent activities. This will enhance the integrity and accountability of the system.**

7. **Expand Data Integration:** Incorporate nutritional outcome data (where available) to assess the impact of the NFSA on food security and nutritional well-being beyond just the quantity of food distributed. This will provide a more holistic evaluation of the program's effectiveness.

8. **Enhance User Interface and Accessibility:** Ensure the dashboard is user-friendly and accessible to a wide range of stakeholders with varying levels of technical expertise. Consider mobile accessibility for field-level administrators.

9. **Strengthen Data Governance and Security:** Implement robust data governance frameworks and security measures to ensure the accuracy, reliability, and privacy of the sensitive information being analyzed and displayed.

10. **Promote Inter-Departmental Collaboration:** Facilitate data sharing and collaboration between relevant government departments and agencies using the dashboard as a central platform for information and coordination.

11. **Conduct Regular Training and Capacity Building:** Provide training to users at different levels on how to effectively utilize the dashboard and interpret the insights generated for informed decision-making.

12. **By implementing these recommendations, the NFSA distribution analysis dashboard can evolve into an even more powerful and impactful tool for ensuring food security and optimizing the effectiveness of the program in reaching those most in need across India.**

8.References

[1] Department of Food & Public Distribution, Government of India, "National Food Security Act, 2013 - Official Data and Reports," [Online]. Available: https://dfpd.gov.in/ (Accessed: April 15, 2025).

[2] National Informatics Centre (NIC), "Open Government Data Platform - India," [Online]. Available: https://ndap.niti.gov.in/dataset/7115 https://ndap.niti.gov.in/dataset/7115(Accessed: April 15, 2025). (Likely source for raw data).

[3] Ministry of Agriculture & Farmers Welfare, Government of India, "Agricultural Statistics at a Glance," (Accessed: April 15, 2025). (Potential source for related agricultural data).

[4] S. Suryanarayana and R. Kumar, "Analyzing Food Security and Public Distribution System in India using Statistical Methods," Indian Journal of Agricultural Economics, vol. 70, no. 3, pp. 301-315, July-September 2015. (Example of a relevant academic study).

[5] P. K. Joshi et al., "The National Food Security Act 2013: Implications for Food and Nutrition Security in India," IFPRI Discussion Paper 1325, International Food Policy Research Institute, Washington, D.C., 2014. (Example of a relevant research report).

data-using-python
[Accessed: April 10, 2025].

DATASET LINK:

https://ndap.niti.gov.in/dataset/7115

LINKEDIN:

https://www.linkedin.com/posts/shambhavi-kumari-980420297_lpu-cse-datascience-activity-7317957341692248064-y8NW?utm_source=share&utm_medium=member_desktop&rcm=ACoAAEfJh3ABqhG-G43spbIEHGZhNNCsPlFIMrM