VIRGINIA COMMONWEALTH UNIVERSITY

Statistical analysis and modelling (SCMA 632)

A5-Visualization - Perceptual Mapping for Business

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Contents

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1. Introduction

The analysis aims to analyze the consumption patterns across various districts in Bihar, using data from the NSSO68 dataset. The focus is on understanding the distribution and trends in food consumption, specifically looking at meals at home, rice, wheat, chicken, pulses, and other grains. By utilizing statistical methods and visualization tools, we can uncover insights that can inform better policy and business decisions. Additionally, we visualize these consumption patterns on a geographical map to provide a spatial perspective of the data.

Visualization plays a crucial role in this project, providing a clear and intuitive way to understand complex data. Histograms are used to show the distribution of total consumption across different districts, highlighting the variability in consumption patterns. Bar plots visualize consumption per district, making it easy to compare different regions. Additionally, geographical mapping of variables such as total consumption and meals at home provides a spatial perspective, revealing regional trends and anomalies. These visualizations help in presenting the data in an accessible manner, aiding stakeholders in making informed decisions.

2. About the Dataset

The dataset used in this analysis is the NSSO68, which contains information on various consumption patterns across different states in India. For this project, we focus on data from Bihar, which includes variables such as district, region, sector, meals at home, and quantities of rice, wheat, chicken, pulses, and other grains consumed. The data is cleaned and preprocessed to handle missing values and outliers, ensuring a robust dataset for analysis.

3. Objectives

- To analyze the distribution of total consumption across different districts in Bihar.
- To visualize the consumption patterns per district with district names.
- To map a specific variable of interest on the Bihar state map.
- To provide actionable insights based on the analysis for better decision-making.

4. Business Scope

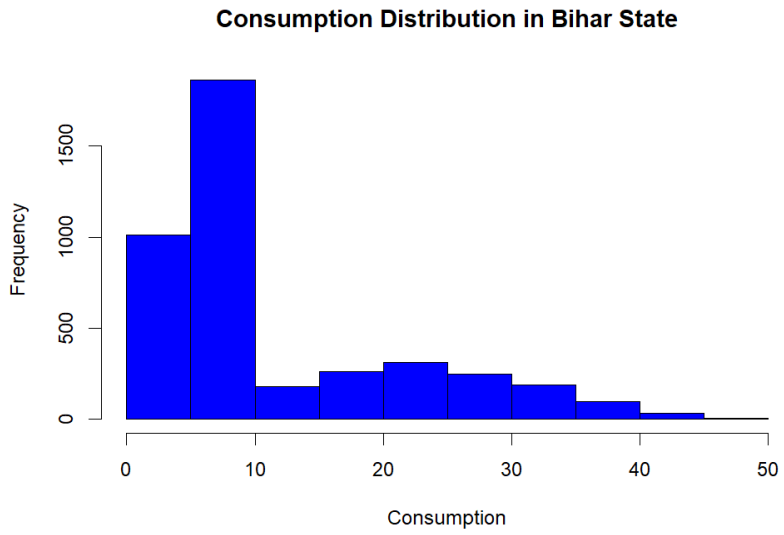
Understanding consumption patterns at a granular level provides valuable insights for businesses and policymakers. For businesses, such data can inform supply chain decisions, marketing strategies, and product development tailored to regional preferences and consumption behaviors. For instance, companies can identify high-demand areas for certain food products and focus their marketing efforts accordingly. Additionally, knowing the consumption patterns can help in optimizing inventory management, reducing waste, and improving profitability.

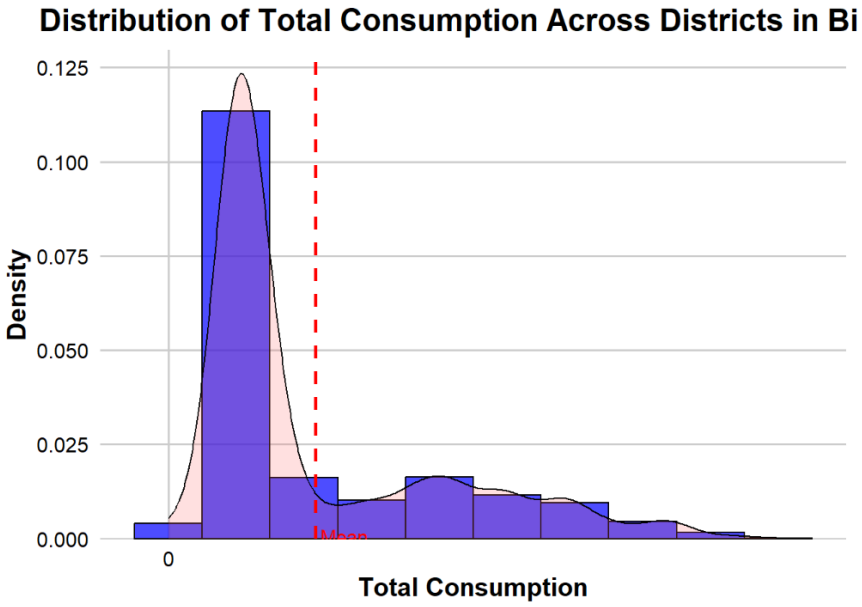
The spatial analysis of consumption patterns also opens up opportunities for regional development planning. By understanding the geographic distribution of consumption, infrastructure and logistics planning can be improved to ensure efficient distribution networks. This can further enhance the accessibility of food products in remote areas, boosting local economies and improving quality of life.

Moreover, this analysis can highlight potential areas for market expansion and investment, contributing to economic growth and improved livelihoods in the region. By identifying consumption trends and preferences, businesses can innovate and introduce new products that cater to the specific needs of different districts. This targeted approach can lead to higher customer satisfaction and loyalty, driving long-term growth and success.

5. Results

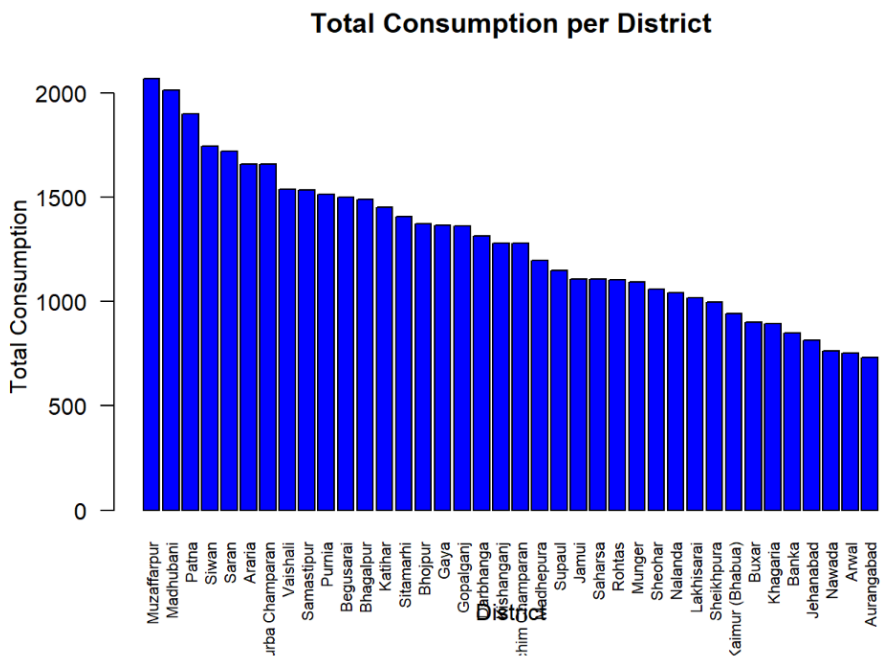
1. Histogram of Total Consumption Across Different Districts of Bihar





- The histogram showed a skewed distribution of total consumption across different districts in Bihar. Most districts fall within a lower consumption range, indicating that only a few districts have significantly higher total consumption levels.
- The concentration of the data towards the lower end suggests that the mean and median of total consumption are relatively low compared to the maximum values observed. This indicates that higher consumption is not widespread and is concentrated in a few districts.

2. Bar Plot to Visualize Consumption Per District with District Names



The bar plot highlighted the top-consuming districts, with clear distinctions between high and low consumers.

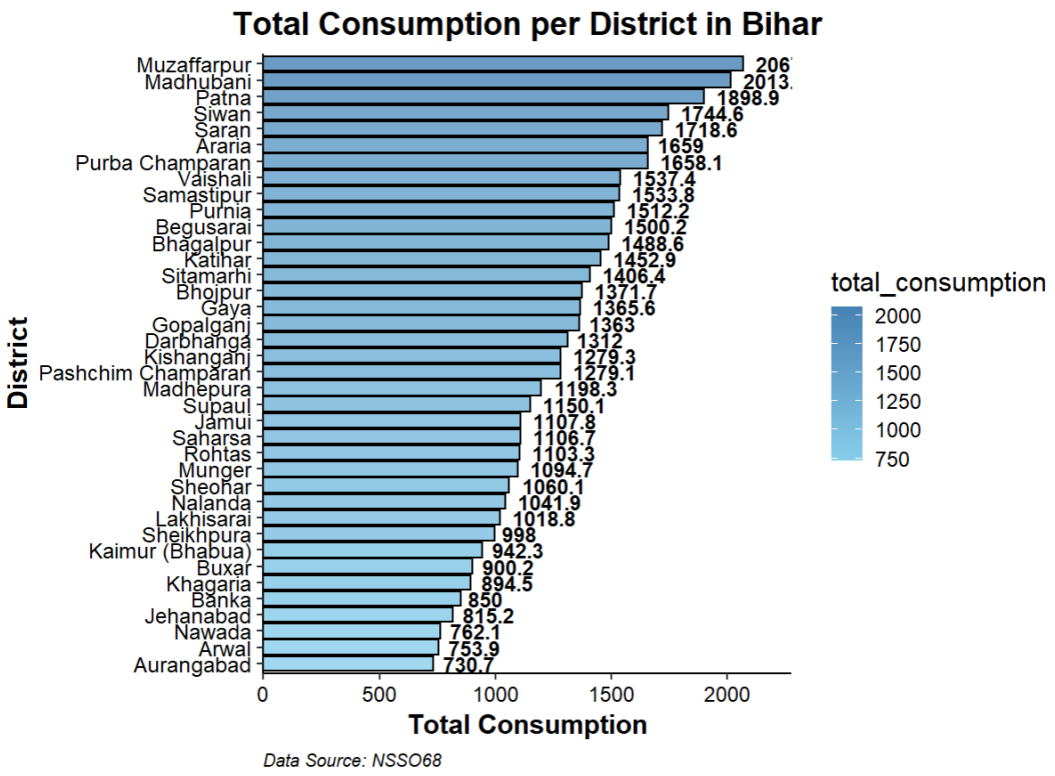
```
## Top 3 Consuming Districts:
print(head(district_summary, 3))
```

```
## # A tibble: 3 × 2
##   District    total
##   <chr>       <dbl>
## 1 Muzaffarpur 2068.
## 2 Madhubani   2013.
## 3 Patna       1899.
```

```
## Bottom 3 Consuming Districts:
print(tail(district_summary, 3))
```

```
## # A tibble: 3 × 2
##   District   total
##   <chr>      <dbl>
## 1 Nawada      762.
## 2 Arwal       754.
## 3 Aurangabad  731.
```

- The bar plot clearly shows the districts with the highest total consumption. Districts like **Patna, Madhubani,** and **Muzaffarpur** stand out as having significantly higher consumption compared to others. This indicates that these districts might have higher economic activity, better access to food resources, or larger populations.
- On the other end of the spectrum, districts such as **Nawada , Aurangabad** and **Arwal** exhibit lower consumption levels. This could be due to various factors such as economic challenges, lesser access to food markets, or smaller population sizes.

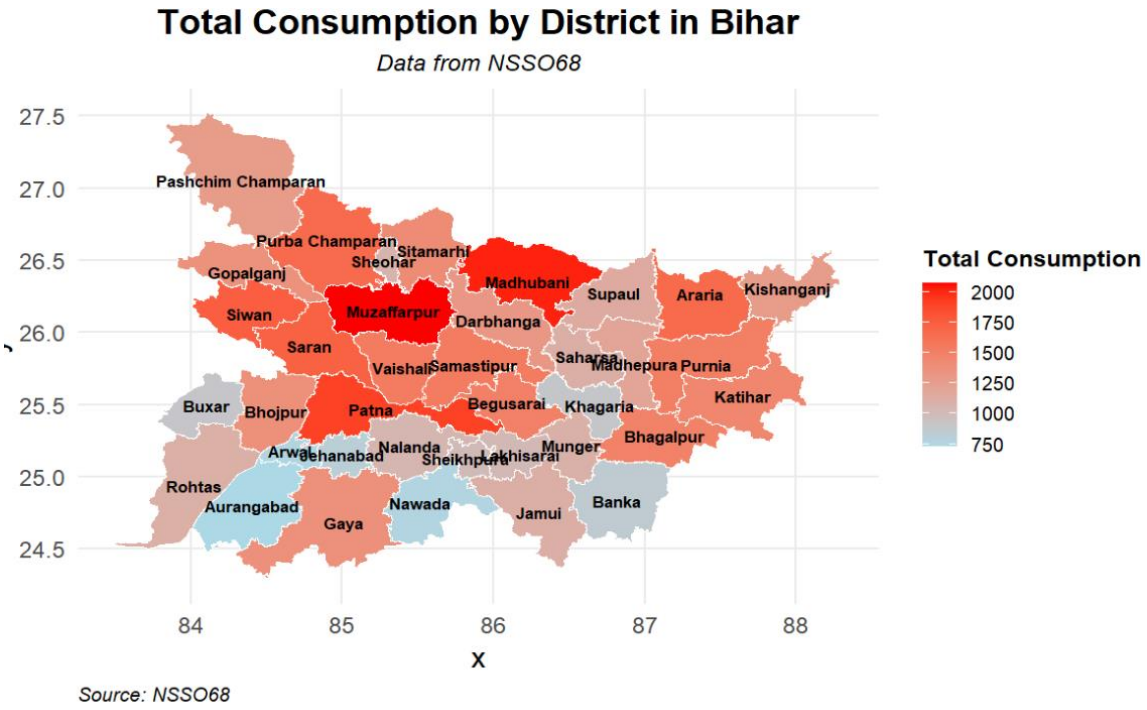


The bar plot highlights the variability in consumption across different districts. While some districts consume significantly more, others fall behind, showing a clear disparity. This variability can guide targeted interventions.

Overall, the bar plot provides a clear and detailed view of the consumption landscape across Bihar's districts, enabling informed decision-making for both businesses and policymakers.

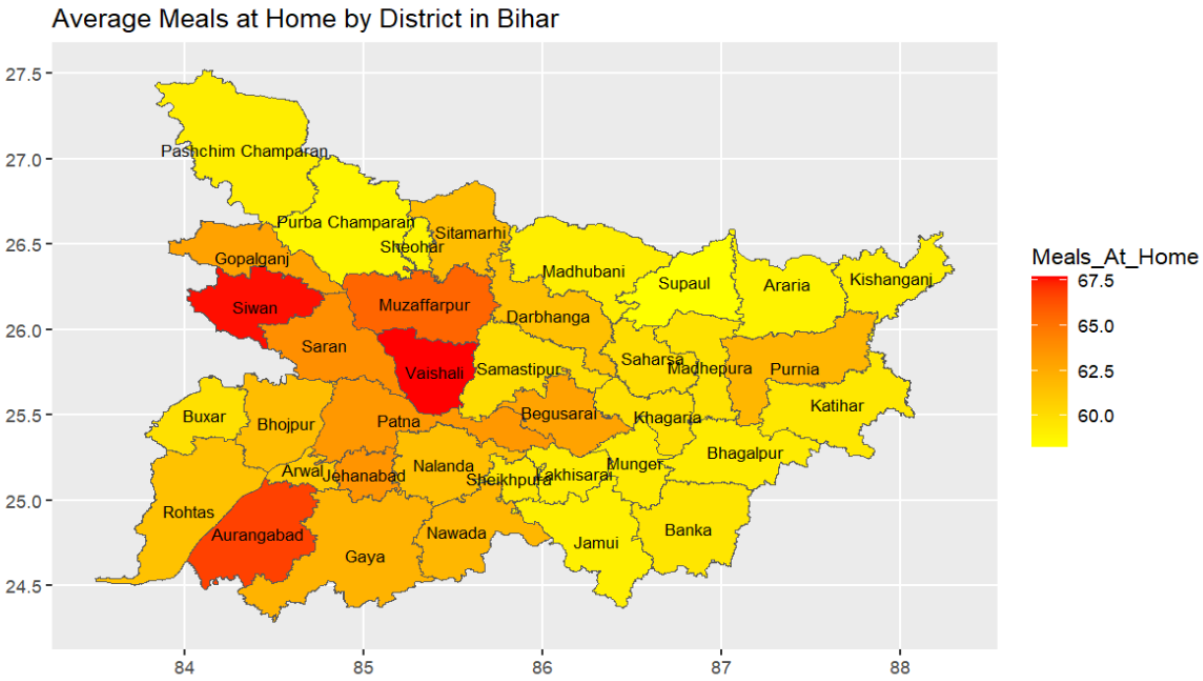
3. Map Visualization for a Variable of Choice in Bihar state Map

- **TOTAL CONSUMPTION**



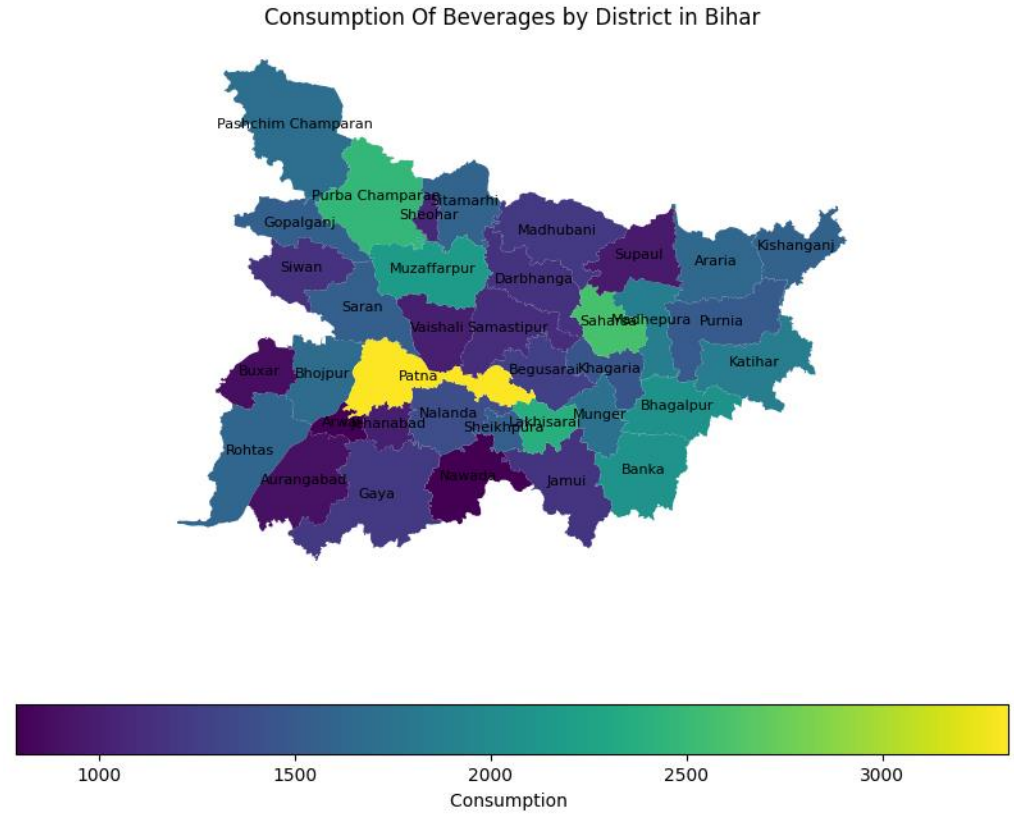
- **MEALS_AT_HOME**

```
# Aggregate the Meals_At_Home data by district
Bhr_meals <- aggregate(Meals_At_Home ~ District, data = BiharData, mean)

# Merge the aggregated data with the data_map data frame
data_map_meals <- merge(Bhr_meals, data_map, by = "District")
View(data_map_meals)

# Plot the map with the Meals_At_Home variable
ggplot(data_map_meals) +
  geom_sf(aes(fill = Meals_At_Home, geometry = geometry)) +
  scale_fill_gradient(low = "yellow", high = "red") +
  ggtitle("Average Meals at Home by District in Bihar") +
  geom_sf_text(aes(label = District, geometry = geometry), size = 3, color = "black")
```



Mapping the "Meals at Home" variable helps visualize geographic patterns and disparities in home meal consumption across Bihar's districts. This can highlight areas with potential food security issues, economic disparities, or cultural differences in meal consumption.

- **BEVERAGE CONSUMPTION**



The spatial map visualization for Bihar displayed the total consumption and meals at home, providing a clear geographical perspective.

6. Recommendations

Based on the analysis of consumption patterns in Bihar, several recommendations can be made to improve food security, business operations, and policy effectiveness:

1. **Targeted Nutritional Programs:**
    - Implement targeted nutritional programs in districts with low consumption levels to address potential food security issues. These programs should focus on providing essential food items and educating residents about balanced diets.
2. **Strategic Marketing and Supply Chain Adjustments:**
    - Businesses should adjust their marketing strategies and supply chain logistics based on consumption patterns. High-consumption districts can be targeted for promotional activities, while low-consumption areas might need improved distribution channels to increase product availability.
3. **Enhanced Inventory Management:**
    - Use consumption data to optimize inventory management. By understanding which products are in high demand in specific districts, businesses can reduce waste and ensure that popular items are always in stock.
4. **Regional Product Customization:**
    - Develop and market products tailored to regional preferences. For example, if a particular district shows a higher consumption of rice, companies can introduce rice-based products that cater to local tastes.
5. **Policy Interventions for Food Scarcity:**
    - For districts identified as outliers with low consumption, policymakers should investigate underlying causes such as food scarcity or economic constraints. Interventions could include subsidies, food aid programs, or economic development initiatives.
6. **Improved Distribution Networks:**
    - Strengthen the distribution networks in remote or low-consumption areas to ensure consistent and reliable access to food products. This might involve improving infrastructure such as roads and storage facilities.

7. Conclusion

This analysis of the NSSO68 data for Bihar provides critical insights into the consumption patterns across districts. By understanding these patterns, businesses and policymakers can make informed decisions that promote better food security, efficient resource allocation, and economic development. The visualizations and geographical mapping further enhance the comprehension of the data, making it easier to identify trends and outliers. Continuous analysis and adaptation are essential for sustaining these efforts and achieving long-term benefits.