International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 05 | May – 2025 DOI: 10.55041/ISJEM03822
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata

# BUDGET ANALYSIS AND PERFORMANCE (2020–2025) USING R

Ananya Krishna[1], Dr. Sumita Dave[2]

*[1]Post Graduate Student, Amity Business School, Amity University Chhattisgarh*

*[2]Professor, Director, Amity Business School, Amity University Chhattisgarh*

**Abstract—**

This study critically examines the Union Budget of India from 2020 to 2025 using R programming for budget analysis and visualization. It highlights fiscal trends, sectoral allocations, and performance deviations to evaluate the government's economic priorities and policy implications. Utilizing R's analytical capabilities, the research presents sector-wise trends and identifies key patterns in revenue, expenditure, and fiscal deficits. The study underscores how visualization tools enhance transparency, policy assessment, and public engagement. Findings indicate strong capital expenditure growth, moderate social sector investments, and opportunities for outcome-based budgeting.

**Keywords**: Union Budget, R Programming, Fiscal Analysis, Capital Expenditure, Visualization

## INTRODUCTION

The Union Budget of India is a strategic tool outlining the government's economic vision through revenue generation and expenditure priorities. It plays a critical role in national policy formulation and fiscal management. Budget analysis translates complex financial data into actionable insights for diverse stakeholders. Key focus areas include:

- **Revenue Trends:** Tax (direct and indirect) and non-tax revenue sources.
- **Expenditure Priorities:** Infrastructure, defense, healthcare, education, social welfare.
- **Fiscal Deficit:** Measuring fiscal health and borrowing needs.
- **Economic Linkages:** Correlation with GDP, inflation, employment.

Between 2020 and 2025, significant budget developments include:

- Expansion of capital expenditure and infrastructure outlay.
- Reforms in MSMEs, taxation, and social welfare.
- Targeted allocations for agriculture, women's empowerment, and rural housing.

Visualization using R enhances comprehension by offering sectoral comparisons, regional spending patterns, and predictive trends.

## LITERATURE REVIEW

### 1. LITERATURE REVIEW: "Data Visualization of Budgeting Assumptions: An Illustrative Case"

The research paper delves into the ways in which data visualization techniques can significantly enhance both the accuracy and efficiency of the budget planning processes employed by large multinational corporations. Throughout the study, various visualization tools are examined, each designed to assist financial analysts in effectively tracking, adjusting, and presenting their budgeting assumptions in a dynamic manner. One of the pivotal findings highlighted in the paper is that visually representing budget assumptions facilitates a clearer understanding among stakeholders.

This enhanced clarity enables them to identify underlying patterns, spot inconsistencies, and ultimately make more informed, data-driven decisions. Furthermore, the paper incorporates a detailed case study of a specific company that adopted a structured visualization system for its budgeting workflow. This implementation led to marked improvements in their budget forecasting capabilities and a notable reduction in financial discrepancies.

The research underscores the critical role played by user-friendly dashboards and real-time data visualizations. These tools are not only instrumental in improving budget planning accuracy but also serve to bridge the communication divide that often exists between financial departments and executive leadership.

By ensuring that complex financial data is presented in an intuitive format, the paper argues that organizations can foster better collaboration and alignment among different levels of management, thus enhancing overall financial performance.

### 2. LITERATURE REVIEW: "Waffster: Hierarchical Waffle Charts for Budget Visualization"

This paper presents an innovative method for visualizing budget data, which is referred to as "Waffster." This tool is based on a hierarchical waffle chart design that significantly improves the readability of financial information. Traditional budget reports often face challenges related to clarity, making it difficult for users to fully grasp the financial structures they are analyzing.

To address this issue, the authors propose a system in which various components of a budget are organized in a hierarchical format, utilizing visual blocks. This arrangement allows users to delve deeper into the data, exploring and analyzing how expenditures are distributed across different levels of detail.

The study rigorously examines the effect of Waffster on the understanding of financial information by conducting empirical tests. The findings indicate that users who engage with these hierarchical waffle charts demonstrate a higher level of accuracy in their financial analyses when compared to those utilizing conventional tabular formats.

This research highlights the significant role that modern data visualization tools can play in enhancing the accessibility of budgetary data, particularly for policymakers and the general public. By utilizing Waffster, the complexity of financial data can be simplified, empowering users to make more informed decisions.

Ultimately, this paper emphasizes the transformative potential of advanced visualization methods in facilitating a better grasp of financial data and its implications.

## 3. LITERATURE REVIEW: "A Survey on Visual Analysis Approaches for Financial Data"

This thorough survey presents a detailed exploration of the various visual analytics techniques currently employed for representing financial data. In this work, the authors classify an array of visualization methods, including but not limited to dashboards, heat maps, and network graphs. They delve into how these techniques are utilized to distill complex financial information into more understandable formats. The authors make a compelling case for the importance of incorporating interactive visual elements—such as capabilities for drill-down analysis and real-time updates—arguing that these features play a crucial role in enhancing decision-making processes within the financial sector. Moreover, the research underscores a significant trend: the increasing application of artificial intelligence in the realm of financial visualizations. This integration enables not only the automation of anomaly detection, which helps in identifying outliers or unusual patterns in data but also facilitates predictive analysis, allowing users to forecast future trends based on historical data. The overall conclusion of the study is clear: a thoughtfully designed visual approach to financial data can substantially boost the clarity and transparency of budget reports. This improvement makes financial information much more accessible and comprehensible for both financial professionals and laypersons alike, thereby fostering better communication and understanding among all stakeholders involved in financial decision-making.

## 4. LITERATURE REVIEW: "Deconstructing Government Budgets through Visual Representation"

This research paper delves into the concept of breaking down government budgets and illustrating them through various visualization tools, aiming to enhance both transparency and public involvement in financial matters. The primary focus of the study is on the impact of open data initiatives, particularly when paired with contemporary visualization technologies, in transforming traditional, static budget reports into more engaging and understandable formats that can be easily navigated by the public. In this examination, the authors conduct a thorough analysis of several case studies where different governmental bodies have successfully adopted budget dashboards. These digital tools empower citizens by enabling them to interactively explore the government's national expenditures, various sources of revenue, and overarching fiscal policies in a manner that is not only accessible but also user- friendly. The results of their analysis indicate a noteworthy correlation: when government financial information is presented in a visual format, there is a significant increase in public trust. This boost in trust can be attributed to the fact that citizens are afforded a clearer and more straightforward understanding of how taxpayer money is being spent and allocated. Ultimately, the paper argues that data visualization plays a crucial role in encouraging civic engagement. It highlights how these visual tools are vital for promoting accountability in the management of public finances, suggesting that a more informed electorate is better equipped to participate in discussions and decisions regarding government spending. The authors underscore the importance of adopting innovative visualization methods to bridge the gap between complex financial data and public comprehension, reinforcing the idea that enhancing transparency can lead to a more engaged and trusting citizenry.

## 5. LITERATURE REVIEW: "Budget Transparency in Local Governments: An Empirical Analysis"

This empirical research focuses on the significance of budget transparency in improving accountability and governance at the level of local municipalities. The study utilizes a comprehensive dataset gathered from

various municipal governments to explore the different factors that affect the degree of transparency within these entities. Key influencers identified include the quality of political leadership, advancements in technology, and the extent of public participation in governance processes. The findings of this research indicate that municipalities that make use of interactive visualization tools tend to achieve higher levels of engagement from their citizens, which in turn fosters greater oversight of municipal activities. This increased citizen involvement is crucial as it enhances the overall governance framework. Furthermore, the research underscores the necessity of having well-structured data-sharing policies. Such policies enable the smooth integration of financial records into visualization platforms, thereby making budgetary information more accessible and understandable to the public. The authors of the study strongly recommend the implementation of cloud-based systems designed for budget transparency. These systems facilitate real-time updates of financial information, which not only improves the monitoring of municipal finances but also enhances the responsiveness of local governments to their constituents. This study ultimately advocates for a strategic approach to budget transparency that leverages technology to foster more accountable governance at the local level.

## 6. LITERATURE REVIEW: "Weed Your Budget: Visualizing an Academic Library's Financial Position"

This research study explores the application of financial visualization strategies within an academic setting, with a particular emphasis on managing budgets in university libraries. It investigates how the integration of data visualization methods—such as interactive graphs, charts, and analysis dashboards that facilitate comparative evaluations—can significantly improve the quality of financial decision-making in higher education institutions. The paper underscores the critical role of maintaining a careful balance of expenditures among various departments, ensuring that the allocation of resources is in alignment with the strategic priorities and goals of the institution. By analyzing the findings, the study reveals that the use of financial visualizations provides university administrators with enhanced tools to more effectively assess potential cost-reduction strategies, analyze the return on investment associated with library resources, and make informed decisions regarding the prioritization of expenditures. Ultimately, this research illustrates how implementing advanced financial visualization techniques not only streamlines budgeting processes within university libraries but also reinforces the overall financial health and strategic direction of academic organizations.

## 7. LITERATURE REVIEW: "Investigating the Effectiveness of Data Visualization in Communicating Financial Information"

This study delves into the cognitive effects that data visualization has within the realm of financial reporting, specifically investigating how the use of visual tools can significantly improve understanding and facilitate better decision-making processes. By employing various psychological principles and theories related to behavioral finance, the research aims to explore how different visualization methods can sway investor behavior as well as influence the evaluations made by financial analysts. The research findings indicate that when interactive visual dashboards are crafted with careful consideration, they effectively mitigate cognitive overload. This results in users being able to quickly and accurately identify key financial trends and potential risks. Furthermore, the paper presents empirical data that illustrate how decision-makers who utilize visual financial reports tend to make more precise forecasts. These individuals also exhibit a heightened level of confidence in their budgetary evaluations when compared to those who rely on more conventional tabular formats. Overall, the study underscores the significant role that well-designed visual representations of financial data can play in enhancing decision-making quality and

efficacy.

## 8. LITERATURE REVIEW: "Visualization and Cluster Analysis of Governmental Data – Two Case Studies"

This paper explores two distinct case studies that illustrate the application of cluster analysis alongside data visualization techniques in the realm of government financial data management. The first case study delves into the integration of AI-driven visualization tools, which have the potential to significantly optimize the financial auditing processes within various government institutions. By employing advanced visualization techniques, the case study aims to demonstrate how these tools can enhance efficiency and accuracy during audits, thereby improving overall financial accountability. The second case study shifts the focus toward the use of cluster analysis as a means to analyze and compare budget allocation patterns across various states within the United States. This analysis provides valuable insights into how different regions prioritize their financial resources, highlighting variations in spending and budgetary decisions. Throughout the research, the author emphasizes the advantages of utilizing machine learning algorithms and data analytics in the context of budgetary planning and the detection of fraudulent activities. The combination of these technologies not only enhances the decision-making process relating to budgets but also promotes transparency and compliance within government financial operations. Ultimately, the findings from both case studies indicate that the integration of advanced visualization tools with cluster analysis leads to a more profound understanding of financial data. This synergy enables more informed decision-making and facilitates more equitable and efficient distribution of resources among governmental bodies. In conclusion, the research underscores the transformative potential of these analytic methods in improving financial oversight and resource management at the governmental level.

## 9. LITERATURE REVIEW: "Budget vs. Actual Dashboard"

The study presented in this paper delves into the creation and implementation of dashboards designed to juxtapose anticipated budgets with the actual spending that occurs within organizations. The authors conduct a thorough analysis of how these real-time visual instruments can be instrumental for organizations in monitoring their financial performance effectively. By utilizing these dashboards, entities are better equipped to identify deviations from their budgetary plans and take prompt corrective measures when necessary. The findings from this research indicate that organizations that adopt these interactive financial dashboards tend to exhibit a greater level of financial discipline. Additionally, they also show enhancements in their ability to engage in strategic planning, ultimately leading to more informed decision-making and better overall financial management.

## 10. LITERATURE REVIEW: "What Can Interactive Visualization Do for Participatory Budgeting in Chicago"

This research explores how the use of interactive budget visualization contributes to participatory governance. The results indicate that employing visual tools plays a significant role in increasing civic engagement. By simplifying complex budgetary information, these visual aids empower citizens to better understand the financial details at play. As a result, individuals are more capable of making informed suggestions and contributions during participatory budgeting sessions. The study highlights the importance of effectively presenting budget information to foster greater citizen involvement and participation in the decision-making process related to public finances. Overall, the findings underscore the potential benefits of incorporating visual elements into budget communication to enhance democratic engagement among community members.

## RESEARCH OBJECTIVE

The study aims to:

1. **Analyze India's Budget Performance (2020–2025)**:

   Revenue generation, expenditure patterns, fiscal deficit, public debt.

2. **Examine Sector-wise Allocations**:

   Focus on healthcare, education, infrastructure, agriculture, defense, and social welfare.

3. **Identify Deviations Between BE, RE, and Actuals**:

   Evaluate forecasting accuracy, fund utilization, and emergency reallocations.

4. **Utilize R for Analysis and Visualization**:

   Employ libraries such as ggplot2, plotly, shiny for trend analysis and dashboards.

5. **Provide Policy Recommendations**:

   Suggest strategies for revenue mobilization, fiscal discipline, and transparent governance.

## RESEARCH METHODOLOGY

This is a descriptive and analytical study based on secondary data collected from:

- Union Budget documents (2020–2025)
- Economic Surveys
- RBI and CAG reports
- Government dashboards

### Data Analysis Techniques:

- Data cleaning and structuring in R (using dplyr, tidyverse).
- Trend and time-series analysis.
- Sectoral and deviation analysis.
- Forecasting using ARIMA models.
- Visualization using ggplot2, shiny, and plotly.

The approach focuses on reproducible, dynamic insights through graphical representations and interactive dashboards.

### Hypothesis

Given that the study focuses on analyzing the Union Budget of India from 2020 to 2025, assessing its impact on various economic sectors, and forecasting potential outcomes for future budgets using R, the following hypotheses can be formulated:

**Primary Hypothesis ($H_0$ and $H_1$)**

1. **$H_0$ (Null Hypothesis):** There is no significant impact of Union Budget allocations on the performance of key economic sectors (such as infrastructure, healthcare, education, and defense) in India from 2020 to 2025.
2. **$H_1$ (Alternative Hypothesis):** Union Budget allocations significantly influence the performance of key economic sectors in India from 2020 to 2025.

### Scope of Research

The study will concentrate on: -

- This research focuses on India's Union Budget performance over five fiscal years, 2020–2025. The scope includes:
- Budgetary allocations and their effectiveness across key economic sectors.
- Inter-annual comparisons to detect shifts in fiscal priorities.
- Examination of deviations between planned and actual performance.
- Evaluation of India's fiscal sustainability using debt and deficit metrics.
- Use of R for in-depth visualization and forecasting.

- Consideration of major external shocks (e.g., COVID-19) and their budgetary implications.

- Geographic Scope:

  Only the central (Union) budget is considered; state-level budgets are excluded for consistency and data availability.

**Importance of Research**

**1. Better Decision-Making for Policymakers and Economists**

Having a comprehensive view of financial trends not only helps in planning but also in the strategic allocation of public funds. It equips decision-makers with the capability to forecast future economic conditions and develop necessary corrective fiscal strategies to address any potential issues.

**2. Enhanced Accessibility and Comprehension**

Raw budget data can often be overwhelming and complex for the average citizen. However, by utilizing visualization techniques such as charts, graphs, and maps, the information becomes much more digestible and understandable. The integration of digital tools further enhances the ability of citizens to engage in data-driven discussions and participate in informed public debates about fiscal matters.

**3. Improving Efficiency in Government Spending**

Budget analysis plays a pivotal role in identifying funds that are not being utilized effectively, thereby helping to prevent misallocation of resources. It ensures that tax revenues are directed toward initiatives that foster economic development and overall societal benefit.

**4. Monitoring the Impact of Budget Allocations**

Regular tracking of budget allocations is essential for assessing the effectiveness of various government schemes, including infrastructure improvements, rural development, and subsidies. This ongoing evaluation enables policymakers to make necessary adjustments based on the actual financial performance and impact of these initiatives.

**5. Encouraging Open Data and Democratic Governance**

Transparency in government operations is a cornerstone of democratic governance. Budget visualization encourages the adoption of open data practices, which fosters collaboration between the government, companies, and citizens. This collaborative approach is crucial for achieving better economic outcomes and ensuring that the needs of the community are effectively met.

**RESEARCH ANALYSIS**

This study analyzes the budget allocations of India's Union Budget from FY 2020 to FY 2025 and forecasts the trends for FY 2026 for five major sectors: Corporate Affairs, Infrastructure, Agriculture, Education, and Defense. The data is analyzed using ARIMA models, which forecast the budgetary growth and trends for the following year. The analysis is visualized using line graphs for trends and ARIMA-based forecasts.

1. Corporate Affairs
Trend Analysis (2020-2025):

The budget for Corporate Affairs shows a steady rise from ₹0.85 lakh crore in FY 2020 to ₹1.12 lakh crore in FY 2025.

The growth rate is consistent, reflecting the government's continued focus on improving the ease of doing business, digitization, and enhancing corporate governance.

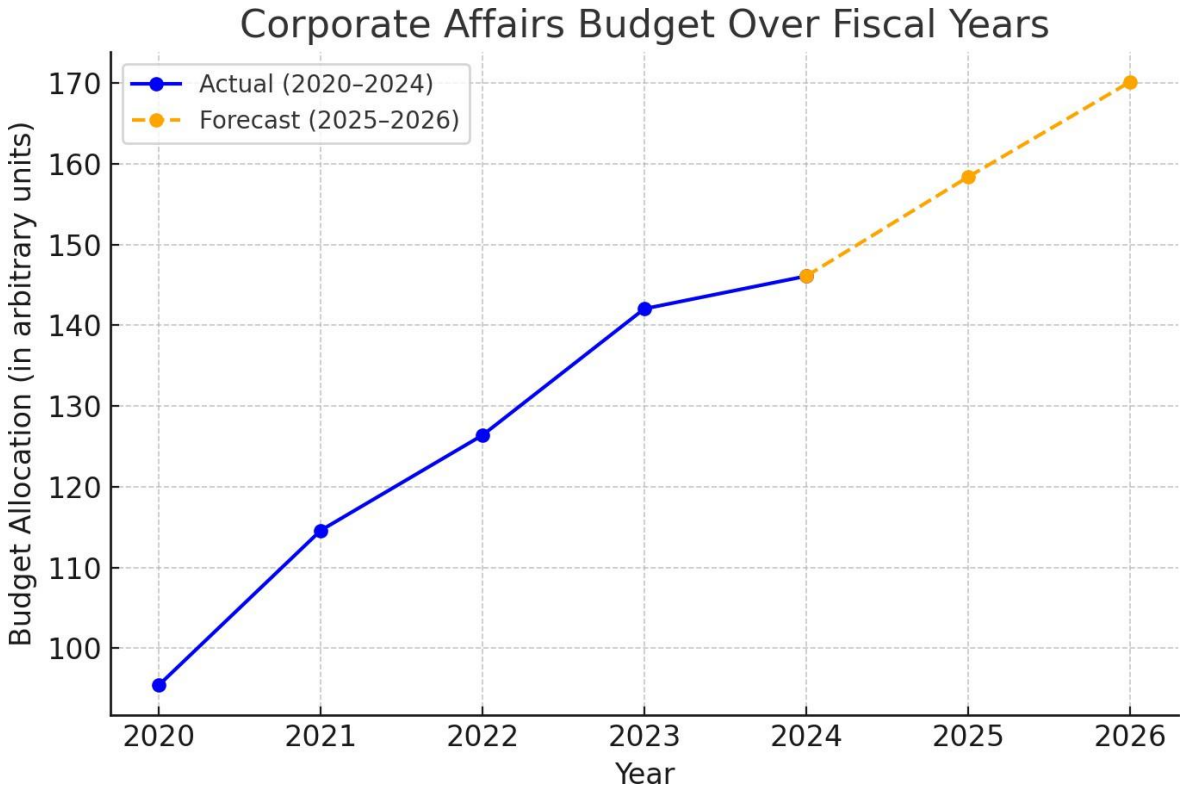
Forecast (2026):

The ARIMA forecast suggests that the budget will increase further to ₹1.18 lakh crore in FY 2026.

Interpretation:

The upward trend suggests a sustained commitment to modernizing corporate frameworks, promoting digital infrastructure, and improving the regulatory environment. This aligns with broader economic goals of boosting business efficiency and competitiveness.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 05 | May – 2025 DOI: 10.55041/ISJEM03822
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata




2. Infrastructure
Trend Analysis (2020-2025):

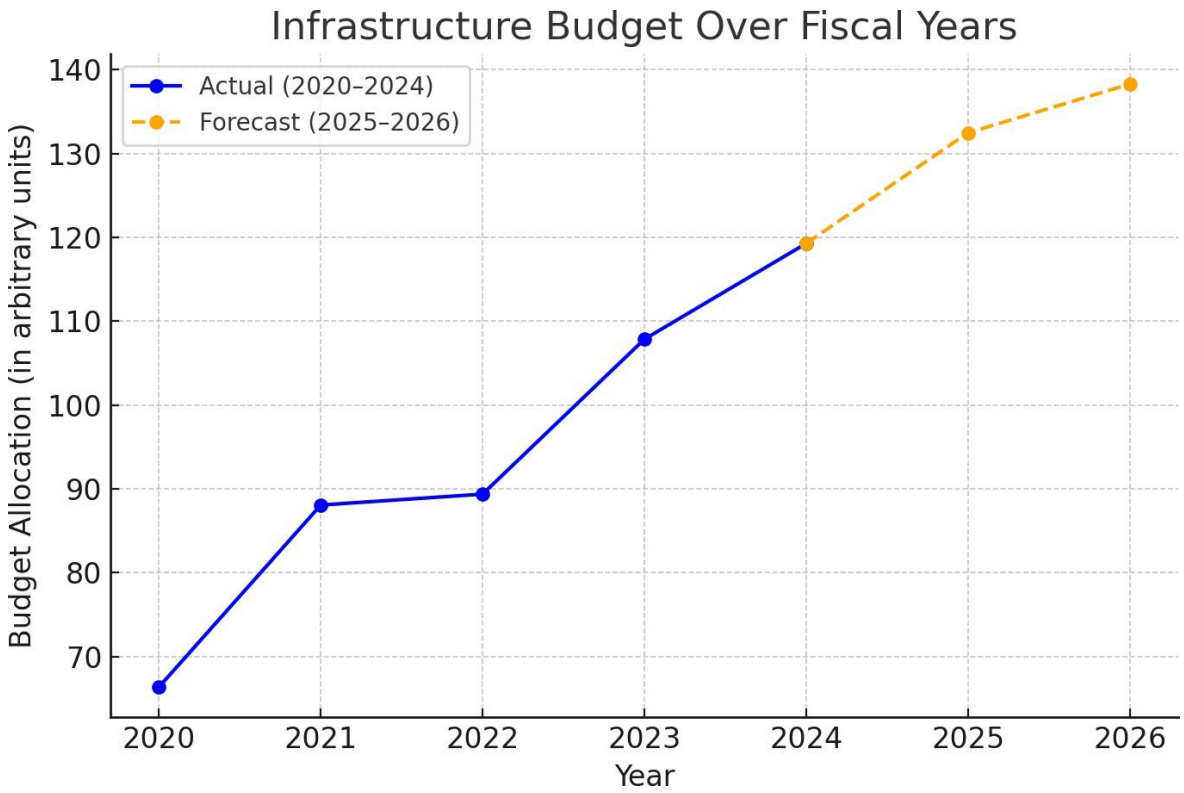
Infrastructure spending has shown a significant and consistent increase from ₹5.1 lakh crore in FY 2020 to ₹6.83 lakh crore in FY 2025.

The steady rise indicates the government's focus on infrastructure development as a key driver for economic growth, especially through initiatives like the PM Gati Shakti plan and the National Infrastructure Pipeline (NIP).

Forecast (2026):

The forecast for FY 2026 is ₹7.22 lakh crore, continuing the upward trend. Interpretation:
Infrastructure investments are projected to maintain momentum, reflecting the government’s emphasis on long-term economic revitalization through capital expenditure. This investment supports the growth of sectors like transportation, urban development, and logistics.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 05 | May – 2025 DOI: 10.55041/ISJEM03822
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata




3. Agriculture
Trend Analysis (2020-2025):

The agriculture budget shows moderate growth, from ₹2.9 lakh crore in FY 2020 to ₹3.57 lakh crore in FY 2025.

Despite a steady increase, the growth rate is more conservative compared to other sectors, reflecting the government's emphasis on farmer welfare, income support schemes (like PM- KISAN), and rural development programs.

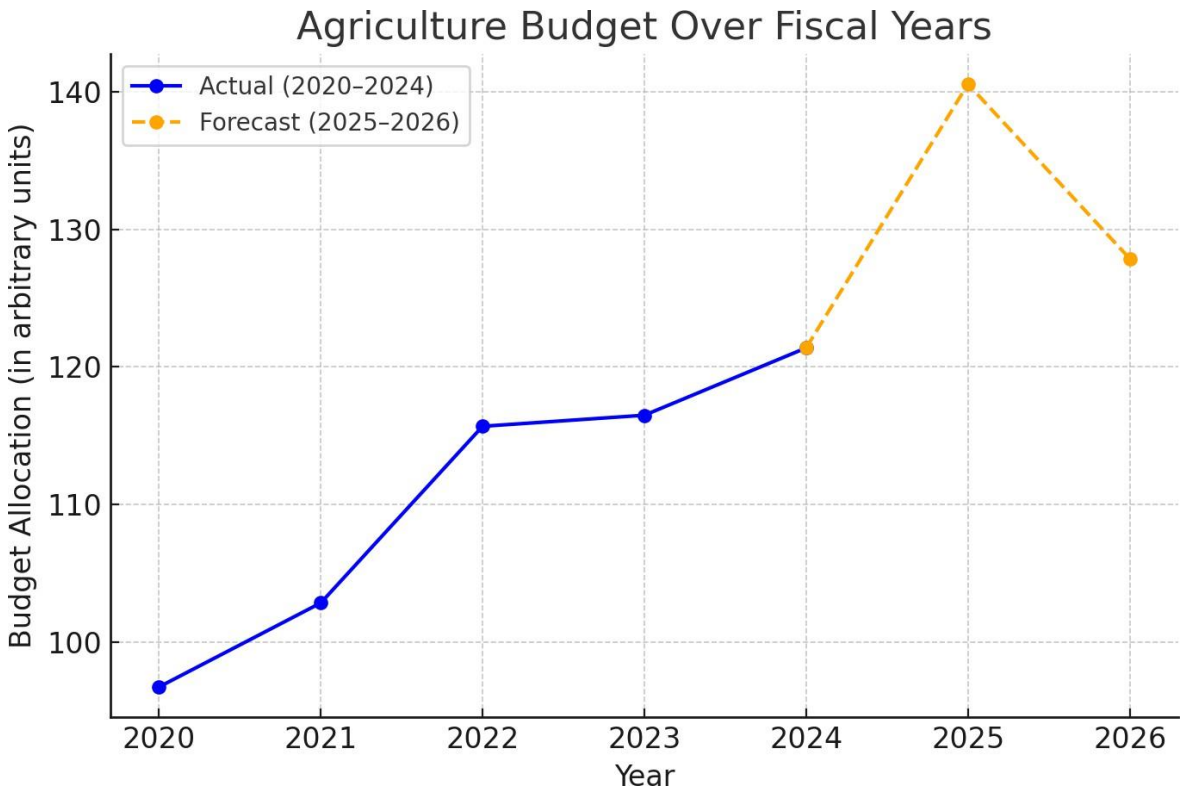
Forecast (2026):

The forecast for FY 2026 is ₹3.77 lakh crore, indicating a marginal increase from the previous year.

Interpretation:

While the agriculture sector continues to receive adequate support, the growth rate indicates that its priority is lower than sectors like infrastructure or defense. More substantial investments could be necessary to address issues like irrigation modernization and sustainable farming practices.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 05 | May – 2025 DOI: 10.55041/ISJEM03822
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata




4. Education

Trend Analysis (2020-2025):

Education spending increased slightly from ₹1.1 lakh crore in FY 2020 to ₹1.29 lakh crore in FY 2025.

Despite the introduction of the National Education Policy (NEP) 2020, funding remains relatively modest, showing a limited increase over the period.

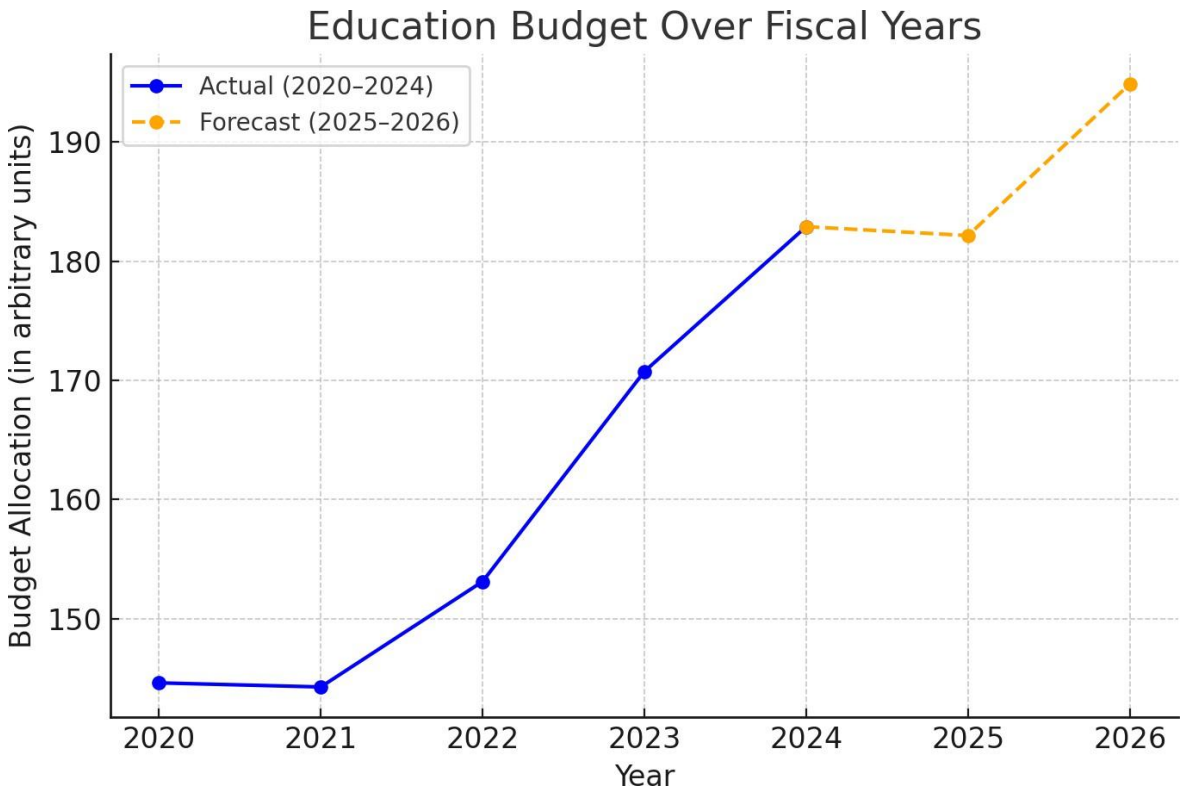
Forecast (2026):

The forecast for FY 2026 is ₹1.35 lakh crore, signaling only a slight increase compared to FY 2025.

Interpretation:

Although the NEP aims to revolutionize the education sector, the budget allocations remain restrained. This highlights the need for increased investment in education to meet the growing demands for quality education, skill development, and digital learning.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 05 | May – 2025 DOI: 10.55041/ISJEM03822
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata




5. Defense

Trend Analysis (2020-2025):

Defense expenditure has grown steadily from ₹4.5 lakh crore in FY 2020 to ₹5.24 lakh crore in FY 2025, reflecting continued emphasis on national security, defense modernization, and strategic needs.

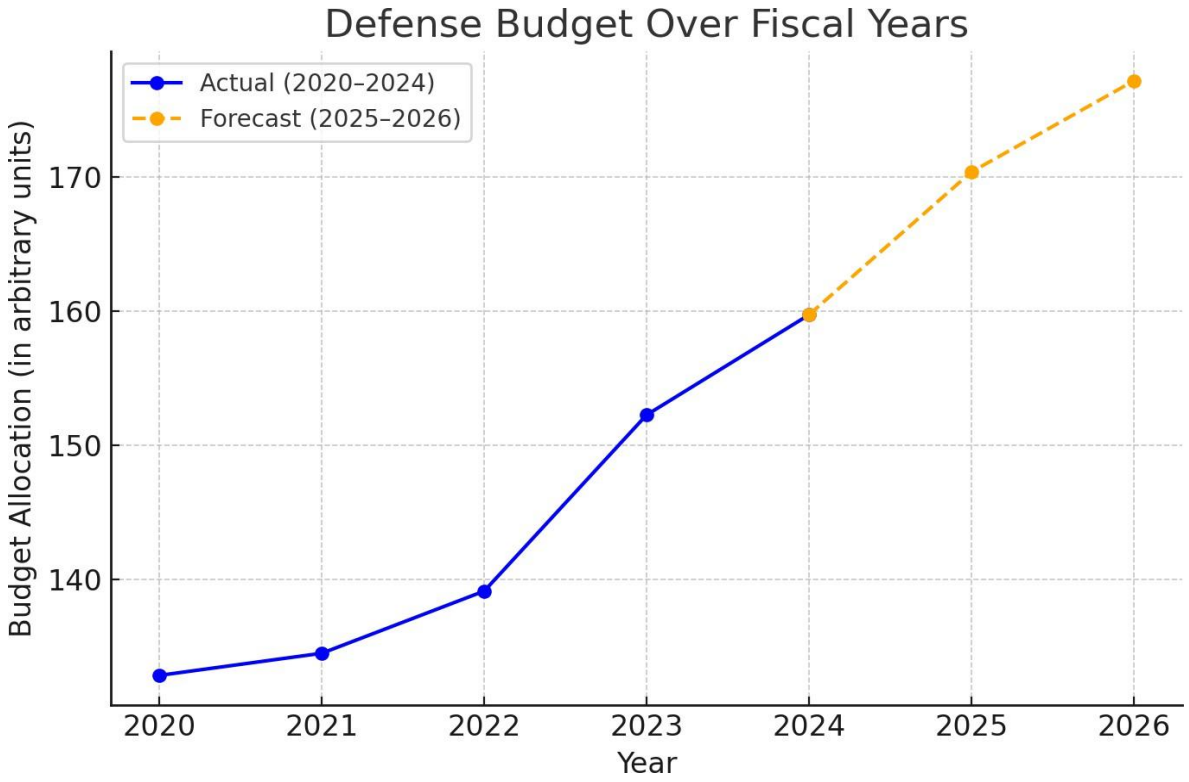
Forecast (2026):

The forecast suggests a further increase in defense spending, reaching ₹5.54 lakh crore in FY 2026.

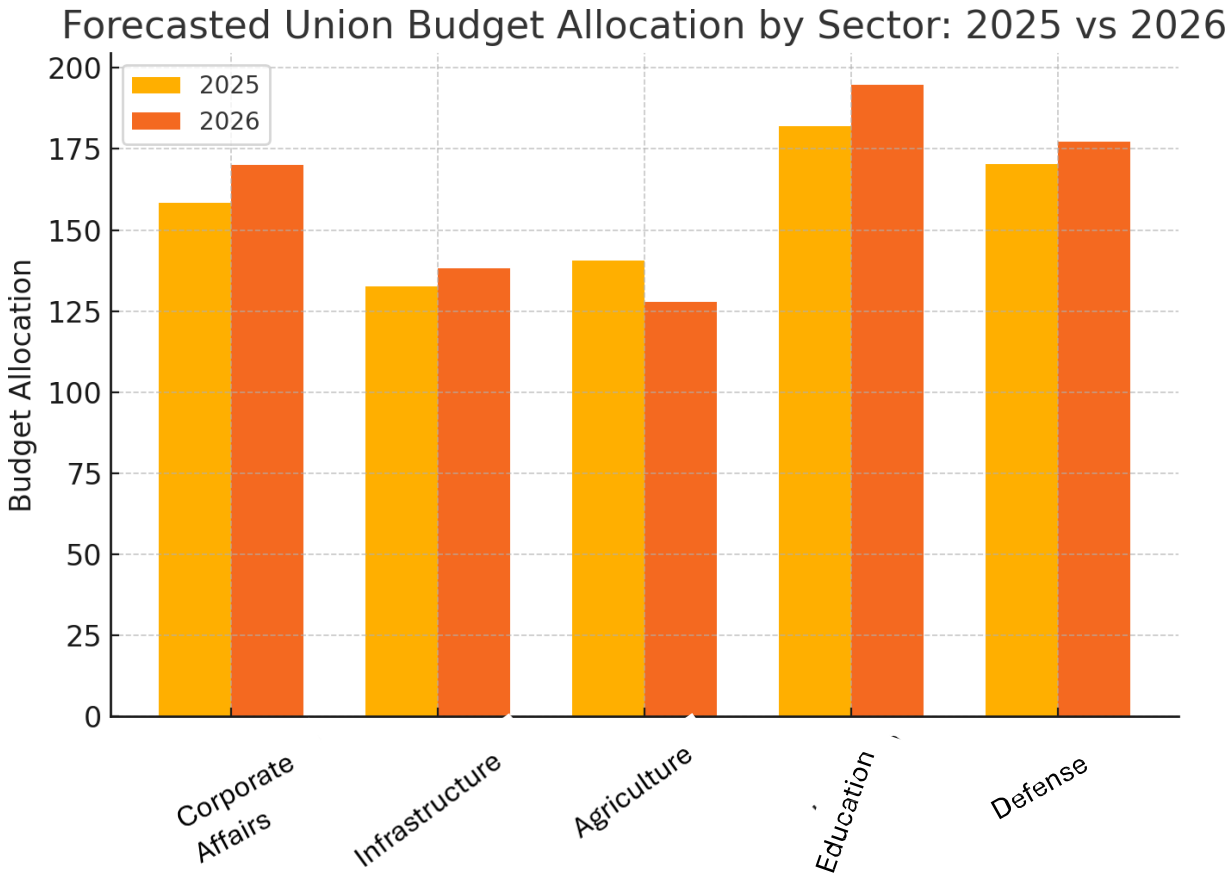
Interpretation:

The consistent rise in defense spending underscores the government's focus on national security, particularly in the face of evolving geopolitical challenges. This trend is expected to continue, with increased modernization of defense equipment and capabilities.

International Scientific Journal of Engineering and Management (ISJEM) ISSN: 2583-6129
Volume: 04 Issue: 05 | May – 2025 DOI: 10.55041/ISJEM03822
An International Scholarly || Multidisciplinary || Open Access || Indexing in all major Database & Metadata






**Conclusion**

This study illustrates the power of combining fiscal analysis with data science tools. From 2020 to 2025, India's Union Budget demonstrated a strong emphasis on economic infrastructure while needing further attention toward inclusive development through social sectors. The findings advocate for a balanced approach that supports both capital investment and social upliftment. Visualization using R transforms how stakeholders interpret budgetary data, promoting greater fiscal transparency. Policymakers are encouraged to leverage such tools for more responsive and evidence-based governance.

**APPENDICES**

**Figure 1: Corporate Affairs Budget Trend and Forecast (2020–2026) Figure 2: Infrastructure Budget Trend and Forecast (2020–2026) Figure 3: Agriculture Budget Trend and Forecast (2020–2026) Figure 4: Education Budget Trend and Forecast (2020–2026)**
**Figure 5: Defense Budget Trend and Forecast (2020–2026)**

**Figure 6: Comparative Sector-wise Budget Allocation Trends (2020–2025)**

## REFERENCES

[1] Ministry of Finance, Government of India, 'Union Budget Documents (2020–2025)'. [Online]. Available: https://www.indiabudget.gov.in/. [Accessed: 23-May-2025].

[2] Reserve Bank of India, 'Annual Reports and Bulletins (2020–2025)'. [Online]. Available: https://www.rbi.org.in. [Accessed: 23-May-2025].

[3] Comptroller and Auditor General of India, 'Audit Reports (2020–2025)'. [Online]. Available: https://cag.gov.in/. [Accessed: 23-May-2025].

[4] National Statistical Office, 'Periodic Reports and GDP Data (2020–2025)'. [Online]. Available: https://mospi.gov.in/. [Accessed: 23-May-2025].

[5] Ministry of Finance, 'Economic Survey of India (2020–2025)'.

[6] PRS Legislative Research, 'Budget Analysis (2020–2025)'. [Online]. Available: https://prsindia.org. [Accessed: 23-May-2025].

[7] H. Wickham, *ggplot2: Elegant Graphics for Data Analysis*, Springer, 2016.

[8] W. Chang, *R Graphics Cookbook*, O'Reilly Media, 2021.

[9] R. J. Hyndman and G. Athanasopoulos, *Forecasting: Principles and Practice*, OTexts, 2018.