

The Role of Data Visualization in Decision Making: Case of D-mart

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ABSTRACT

Data visualization is crucial for informed decision-making in today's data-driven world. It transforms complex data sets into visually engaging representations, enhancing cognitive processes and fostering insights. The report explores the principles, tools, and impact of data visualization, highlighting its ability to streamline operations, identify market trends, optimize resource allocation, and mitigate risks. It provides an overview of various data visualization tools and types, ranging from basic charts and graphs to advanced interactive dashboards and geospatial visualizations. Organizations can leverage these tools to gain a competitive edge and make informed decisions that drive sustainable success. By harnessing the power of visual analytics, decision-makers can make informed choices that drive business growth and innovation.

Keywords: Data Visualization, Decision-Making, Visualization Tools, Charts, Graphs, Dashboards.

1. INTRODUCTION

Data visualization is a powerful tool for understanding complexity and discovering patterns in data sets. It transcends traditional tabular formats to present data in visually intuitive and digestible forms. The advent of advanced analytics techniques has ushered in a new era of data-driven decision-making. Data visualization serves as a universal language that transcends disciplinary boundaries, enabling the seamless exchange of information and the promotion of organizational alignment to common objectives. By fostering a culture of data literacy and exploration, organizations can harness the collective intelligence of their workforce, fostering innovation and driving continuous improvement.

1.1 Importance of decision-making

Data-driven decision-making is crucial in today's business environment, as it improves competitiveness, optimizes processes, and enhances customer experiences. This report explores the relationship between data visualization and decision-making, highlighting the importance of information. Decision-making helps achieve goals, solve problems efficiently, allocate resources, manage risks, foster innovation, resolve conflicts, enhance personal development, build trust and confidence, adapt to changing environments, and contribute to long-term sustainability. It also emphasizes the importance of considering environmental, social, and economic factors in decision-making. By leveraging data visualization, businesses can respond to market dynamics, identify growth opportunities, and mitigate risks.

1.2 Data visualization

Data visualization is a vital tool in data analysis, providing a visually appealing way to interpret complex datasets. It aids in identifying patterns, trends, and relationships within data, aiding in decision-making processes. It also aids in exploratory data analysis, allowing analysts to uncover hidden patterns and

structures. Data visualization also fosters effective storytelling and communication of findings, making complex data-driven narratives accessible to diverse stakeholders. The evolution of data visualization tools has been driven by advancements in technology and the availability of big data. Tools like Tableau, Excel, and Power BI offer immersive dashboards, interactive maps, and real-time visualizations. Machine learning and artificial intelligence have introduced innovative approaches to data visualization, such as generative adversarial networks and neural network-based models. However, data visualization also poses challenges, such as interpretation and design, and raises concerns about data literacy and ethical implications. Therefore, educating users about data visualization principles and fostering critical thinking skills is essential for mitigating these risks and promoting responsible data usage.

1.3 Types of data visualization

Data visualization uses various techniques to represent data visually, aiding in understanding patterns, trends, and relationships. Common types include charts, scatter plots, maps, histograms, box plots, heat maps, and interactive visualizations. The choice depends on the dataset and the insights desired.

- **Line graph**

A line chart is a crucial data visualization tool, presenting trends and relationships over time or across categories. Its effectiveness lies in its ability to convey temporal or sequential data with clarity and simplicity, facilitating comparisons between data sets. To maximize its utility, design considerations include appropriate scales, clear labeling, and attention to detail.

- **Column chart**

A column chart is a visual tool used to display data comparisons in a structured manner. It represents discrete categories, allowing easy identification of trends and patterns. It is versatile, adaptable to various types of data, and can accommodate multiple datasets simultaneously. It aids in understanding, decision-making, and storytelling.

- **Bar graph**

A bar graph is a visual representation of data, with bars representing categories and numerical values. It's useful for categorizing data, comparing values, and analyzing trends. Bar graphs are versatile, suitable for various disciplines, and can be used for sales figures, progress tracking, or illustrating demographic trends.

- **Pie chart**

A pie chart is a circular statistical graphic divided into slices to illustrate numerical proportions. It is used to visualize data distributions where categories are mutually exclusive and collectively exhaustive. Constructed by calculating proportions and translating them into angles, pie charts are effective but not suitable for large data sets or comparisons.

- **Funnel chart**

A funnel chart is a visualization tool used in sales, marketing, and business analytics to illustrate data reduction through stages. It represents lead generation, conversion, and retention. It helps identify areas for improvement, optimize performance, and can be customized with additional data for detailed analysis.

- **Heat map**

A heat map is a visual representation of data using colors to highlight patterns, trends, or anomalies. It's used in data analysis, statistics, and geography to visualize complex data, enabling quick comprehension and analysis. Heat maps are dynamic, allowing users to zoom in, filter, or interact with data points for deeper insights.

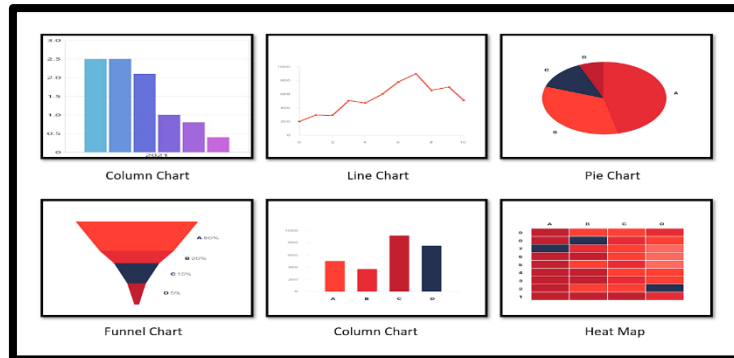


Figure 1: Column chart, Line chart, Pie chart, Funnel chart, Column chart, Heat map

- **Map-based plot**

Map-based plots use geographical data to represent spatial relationships and patterns, utilizing cartography, geospatial analysis, and data visualization principles. They use coordinates, GIS, and interactive features to represent data points, facilitating communication of patterns and trends across regions.

- **Waterfall chart**

A waterfall chart is a graphical representation used in finance, project management, and other fields to illustrate the cumulative effect of positive and negative values. It helps analyze financial statements, project budgets, and performance metrics by breaking down complex data into manageable segments and illustrating the flow of changes.

- **Scatter plot**

A scatter plot is a visualization tool for examining the relationship between two variables, with a three-dimensional plot allowing simultaneous exploration of three variables. Interpretation involves analyzing data points' distribution, with clusters indicating strong relationships and scattered points indicating weaker ones.

- **Pictogram chart**

A pictogram chart is a visual representation of data using symbols or icons to convey information. It's effective in overcoming language barriers and facilitating comprehension across diverse audiences. The choice of symbols, layout, and labeling are crucial for clarity and visual impact.

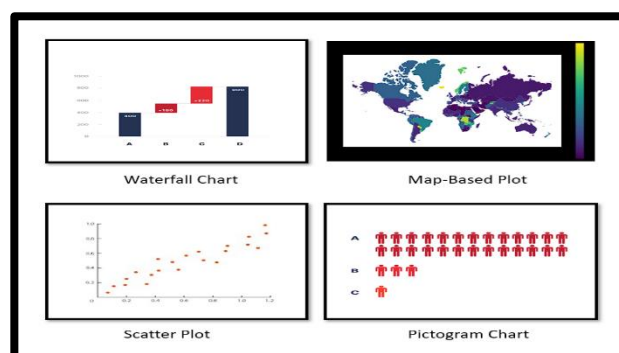


Figure 2: Waterfall chart, Map-based plot, scatter plot, Pictogram chart

1.4 Various Data Visualization Tools

Data visualization tools are crucial for transforming complex datasets into easily understandable visuals,

enabling effective analysis, interpretation, and communication of insights. Choosing the right tool depends on data nature, audience, and presentation requirements, allowing organizations and individuals to unlock valuable insights.

- **Tableau**

Tableau is a powerful data visualization tool that simplifies the process of turning raw data into actionable insights. It offers an intuitive drag-and-drop interface, robust data manipulation capabilities, and interactivity and storytelling capabilities. Users can create interactive dashboards and stories, share their visualizations, and collaborate on them. Tableau's features ensure data security and up-to-dateness, making it a versatile and user-friendly tool for data analysis and decision-making.

- **Power BI**

Microsoft's Power BI is a powerful business analytics tool that transforms raw data into interactive visualizations. It offers an intuitive interface, customizable charts, graphs, and tables, robust data modeling capabilities, seamless integration with Microsoft products, and advanced features for collaboration and sharing. Power BI empowers organizations to make data-driven decisions, driving business growth and innovation.

- **Excel**

Excel is a Microsoft spreadsheet application used for data analysis, organization, and visualization. It consists of a grid of cells organized into rows and columns, allowing users to store data like numbers, text, dates, and formulas. Excel offers built-in functions and formulas for calculations, and users can create charts and graphs to represent data visually. It supports data import and export from various file formats and collaboration features.

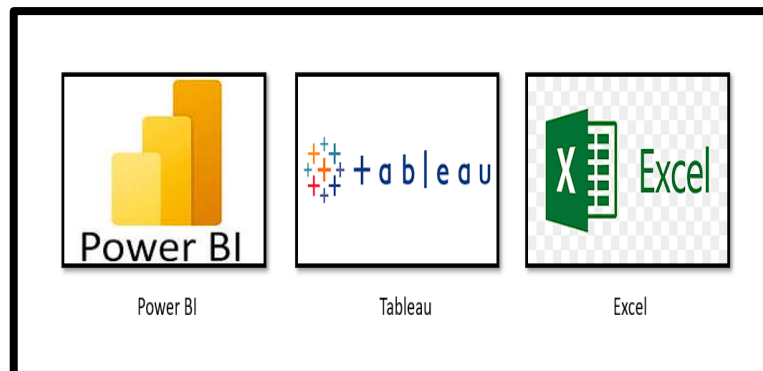


Figure 3: Power Bi, Tableau, Excel

- **Infogram**

Infogram is an online platform that allows users to create visually compelling infographics, charts, maps, and reports without advanced design or coding skills. It focuses on visual storytelling, transforming complex data sets into engaging stories. Infogram's intuitive drag-and-drop interface, customizable chart types, and seamless integration with popular platforms enhance its functionality.

- **Qlik Sense**

Qlik Sense is a robust data visualization and analytics platform that allows users to explore data intuitively. Its associative engine allows users to link data points across multiple sources, uncovering hidden insights. It also offers advanced analytics capabilities, promoting collaborative data discovery and sharing, making it a valuable tool for businesses.

- **Datawrapper**

Datawrapper is a user-friendly data visualization tool that allows users to create visually appealing charts

without technical expertise. It offers customizable chart types, advanced data analysis features, and responsive design. Datawrapper prioritizes data security and privacy, making it a trusted choice for sectors like healthcare, finance, and government. Its intuitive interface and accessibility make it a popular choice for professionals.

- **Sisense**

Sisense is a robust business intelligence software platform that simplifies data analysis and visualization. It handles large data sets from various sources, using In-Chip™ technology to speed up processing. It offers customizable charts, graphs, and dashboards, and advanced analytics like predictive modeling, machine learning, and natural language processing.

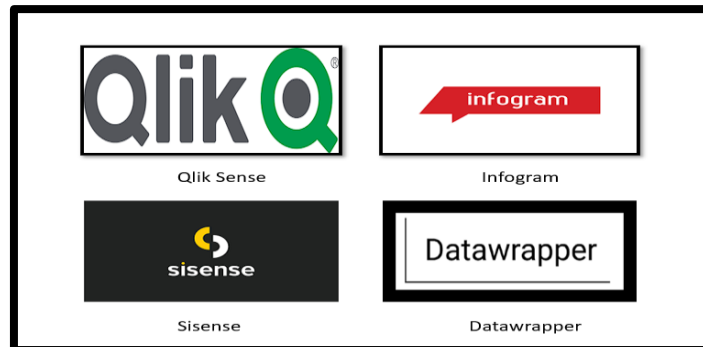


Figure 4: Qlik Sense, Infogram, Sisense, Datawrapper

2. RESEARCH OBJECTIVES

The primary objectives of this research paper are to:

- **To analyze the role of data Visualization in Decision-Making:** - The research paper delves into ways in which data visualization influences decision-making. This could involve discussing how visual representations help identify patterns, trends, and correlations that might not be evident in raw data alone.
- **To investigate the effectiveness of decision-making through data visualization:** - The paper would likely present findings on the effectiveness of using data visualization in decision-making processes. This will involve an example demonstrating how organizations or individuals have to do decision-making by incorporating visualization techniques.

3. LITERATURE REVIEW

This literature review examines the role of data visualization in data-driven decision-making, focusing on its efficacy, applications, and potential implications for organizations and individuals. It examines existing research and scholarship to highlight the significance of data visualization as a catalyst for informed choices in today's data-driven world.

1. A. Kirk's (2019) 'Data Visualization: A Handbook for Data-Driven Design' is a comprehensive guide for data visualization, focusing on principles, techniques, and audience needs. It covers topics like data exploration, graphical perception, color theory, and interactive visualization design. The book also explores storytelling's role in engaging audiences and provides actionable insights for professionals and students.[7]
2. Bertin's seminal work, "Semiology of Graphics," explores the language of visual communication through diagrams, networks, and maps. Published in 1983, it remains a foundational text in cartography and information design, offering insights into the principles governing effective data

visualization. Bertin's systematic approach continues to influence contemporary graphic theory and practice.[1]

3. "Show Me the Numbers" by Stephen Few, published in 2012 is a guide to designing tables and graphs for data visualization, emphasizing clarity, simplicity, and visual integrity. It provides practical advice on chart types, table organization, color, typography, annotations, labels, and best practices for facilitating insightful analysis and decision-making. Few's book is a valuable resource for anyone seeking to improve data visualization skills.[3]
4. 'The Big Book of Dashboards' by Wexler, Shaffer, and Cotgreave published in 2017 provides a guide on creating effective dashboards for real-world business scenarios. It emphasizes a user-centric approach, avoiding cluttered displays and focusing on layout, color choice, and interactivity. The book provides a systematic framework for informed decision-making.[11]
5. "Data Visualisation: A Handbook for Data Driven Design" by Kirk, A. (2016) is a comprehensive guide on data visualization, emphasizing its importance in contemporary contexts. It explores techniques, tools, and user-centric approaches for designing impactful visualizations. The book emphasizes clarity, coherence, and accuracy, while also discussing ethical considerations and potential bias. It serves as an indispensable resource for professionals and enthusiasts.[6]
6. Grant's 'Data Visualization: Charts, Maps, and Interactive Graphics' (2018) explores the intricacies of visualizing data, offering insights into creating compelling visual representations. Published by Chapman and Hall/CRC, the book serves as a comprehensive guide for professionals and enthusiasts alike, navigating the complex world of data visualization.[5]
7. Ware, C. (2019) offers a comprehensive guide to information visualization, emphasizing design principles rooted in perception. Through a blend of theory and practical insights, the book explores how to create effective visualizations that resonate with users. With a focus on enhancing understanding and communication, Ware's work serves as a valuable resource for designers and researchers alike.[10]
8. "How Maps Work: Representation, Visualization, and Design" by A. M. MacEachren, published in 2004 by The Guilford Press, explores the intricate processes behind maps, delving into their representation, visualization techniques, and design principles. It offers readers a comprehensive understanding of the complexities involved in creating and interpreting maps.[8]
9. Fisher and Meyer's 'Making Data Visual: A Practical Guide to Using Visualization for Insight' (2017) offers a comprehensive approach to data visualization. Through practical advice and examples, the book equips readers with essential skills for unlocking insights from data. Published by O'Reilly Media, Inc., it serves as a valuable resource for professionals seeking to harness the power of visualization in their work.[4]

4. METHODOLOGY

The methodology section of the research paper on the role of data visualization in decision-making is crucial for outlining the approach. It provides a structured approach for conducting the research, ensuring the reliability, validity, and replicability of the findings. In this section, we will detail the steps taken to investigate how data visualization impacts decision-making processes.

The steps used in the methodology are as follows: -

1. Data collection and synthesis
2. Data analysis and segmentation

3. Analysis

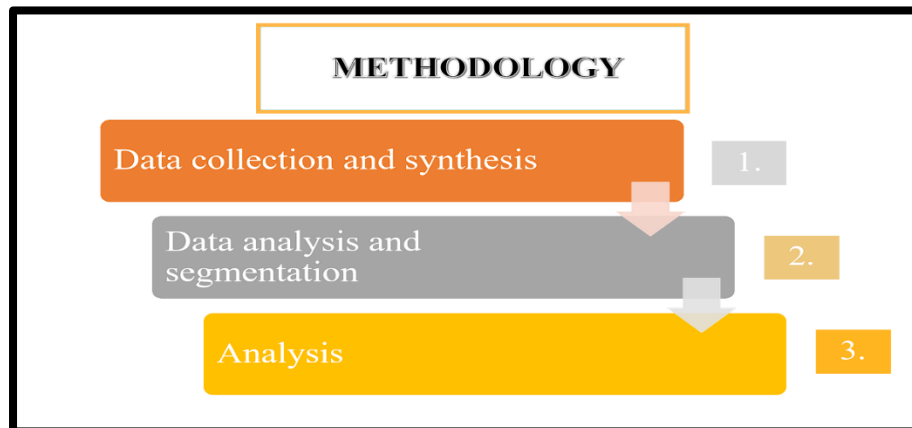


Figure 5: Steps of Methodology

4.1 Data collection and synthesis

Primarily relying on secondary data sources like publicly available databases, academic journals, frequently published research findings, and books. This study seeks to leverage existing knowledge and insights. Data collection involves the systematic gathering of relevant information from diverse sources. By integrating the data from diverse sources, this research aims to construct a clear understanding of how data visualization influences decision-making processes.

4.2 Data analysis and segmentation

The collected data from the chosen sources underwent meticulous categorization into various topics and items. This process involved delineating aspects such as data visualization types and tools, key findings extracted from the dataset, and discerning their subsequent impact. By structuring the data in this manner, a comprehensive analysis framework emerged, facilitating a deeper understanding of the underlying patterns and insights encapsulated within the dataset. This structured approach not only enhanced the clarity of the analysis but also paved the way for informed decision-making based on the discerned information.

4.3 Analysis

This research paper also covers an example of D-mart. This example was selected to show how data visualization can be effectively employed in a business scenario, demonstrating its practical applications and impact on decision-making processes. It becomes evident how data visualization transcends mere data presentation, becoming a catalyst for informed decision-making in the business realm. By visualizing intricate data sets, organizations gain clarity on market dynamics, enabling them to tailor strategies that resonate with their target audience and drive profitability. This exemplifies the transformative impact of data visualization, as it empowers businesses to navigate complexities, optimize processes, and ultimately enhance their competitive edge in today's dynamic marketplace.

5. ANALYSIS

In this exploration, we delve into the remarkable influence of data visualization, exemplified by examples that underscore its significance in shaping the contemporary landscape of business and innovation. Here in an example, we have taken the data of a D-Mart store where the sales of the store are analyzed. In this example, we will compare different aspects and prepare a visualization for each comparison, and in the end, a dashboard will be prepared in which data can be viewed in different matrices side by side at a time.

1. In figure 6, shows the comparison between the monthly sales and the monthly orders with the help of the combination of a column chart and line graph.

We can observe from this graph that the highest revenue was generated in the month of March with the maximum orders and the lowest revenue was generated in the month of November with low orders. The no. of orders increased till the month of March and then decreased gradually every month, then the orders rose in the months of July and August and then declined. But we can see that a very little bit of orders increased in the month of December.

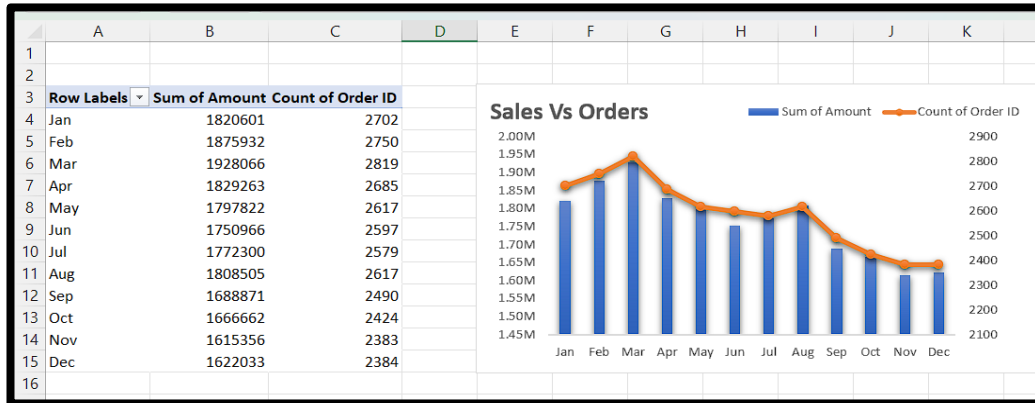


Figure 6: Sales vs orders

2. This figure 7, shows the percentage of orders made by males and females in a year with the help of a bar graph.

In this comparison, we can observe that female's sum amount is 64.05% and men's sum amount is 35.95%. A huge percentage difference of 28% can be seen. We can say that females are more likely to buy or order products than men.

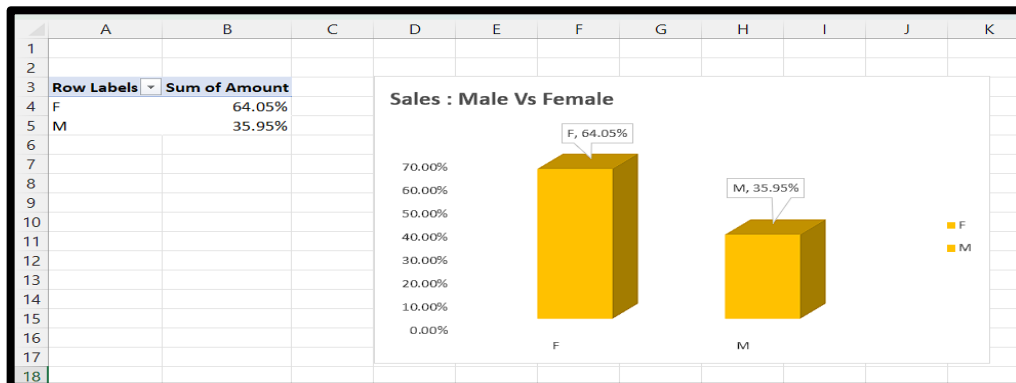


Figure 7: Male vs Female

3. In figure 8, we will compare the no. of orders placed in a year through different channels with the help of a pie chart.

In the pie chart, we can observe that the highest number of orders are received through Amazon with 11016 orders, the second highest number of orders are received through Flipkart with 6703 orders, and the third highest number of orders are received through Myntra with 7254 orders. We can also observe that the lowest number of orders are received through other channels with 1261 orders, which are other than the above six highest order-receiving channels.

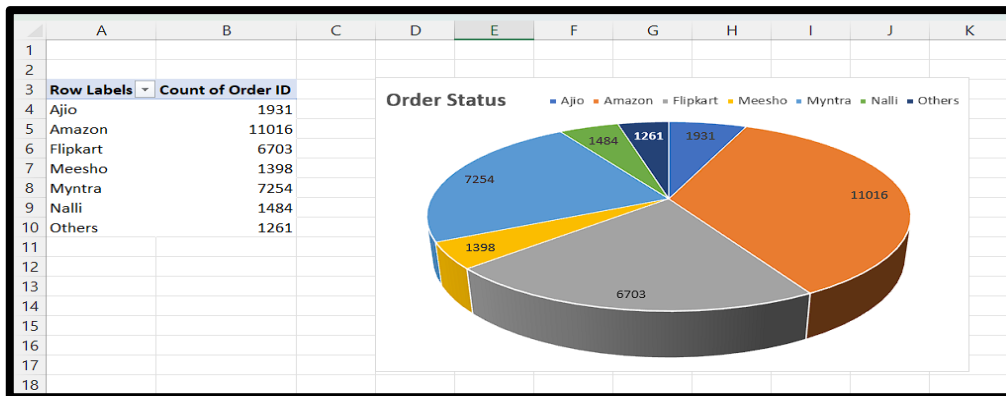


Figure 8: Order status of different channels

4. In this figure 9, shows the top 5 sales-generating states with the help of a bar graph.

We can observe that the top 5 sales-generating states are shown in which Maharashtra is the highest sales-generating state with 26.86%, then second is Karnataka with 23.77%, third is Uttar Pradesh with 18.91%, fourth is Telangana with 15.38% and fifth is Tamil Nadu with 15.08%.

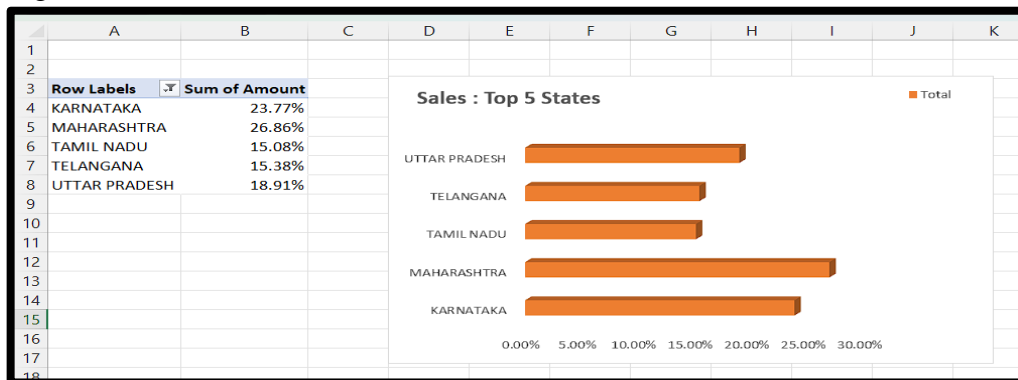


Figure 9: Top 5 sales-generating states

5. This figure 10, shows the total no. of orders placed by different age groups and gender with the help of a bar graph.

We can observe that as the age group increases the percentage of no. of orders also increases. In the old age group, the percentage of no. of orders is 13.70% for females and 5.91% for males, in the teenage group, the percentage is 21.13% for females and 9.20 for males, and in the young age group. the percentage is 34.59% for females and 15.47% for males. But a thing which is common in all three groups is that the females are more likely to order than the males and the difference between the number of orders by male and female is also increasing with the age group like in the old age group the difference is 7.79%, in the teenage group the difference is 11.93% and in the young age group, the difference is 19.12%.

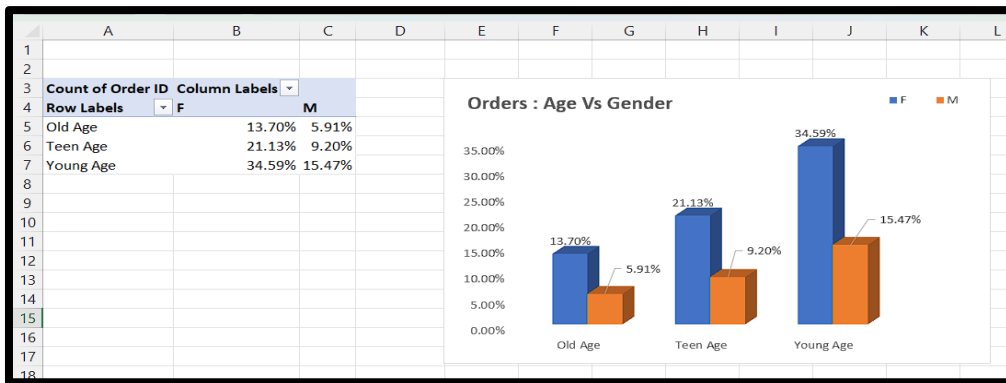


Figure 10: Age VS Gender

6. In figure 11, shows sales generated through different channels in a year with the help of the Doughnut chart.

In the doughnut chart, we can observe that the maximum number of sales is generated by Amazon with 36% (75,19,933), then second by Myntra with 23%, third by Flipkart with 22%, fourth by Ajio with 6%, fifth by Nalli with 5%, sixth by Meesho with 4% and seventh the lowest by others channel with 4% which include channel which is not shown in the chart.

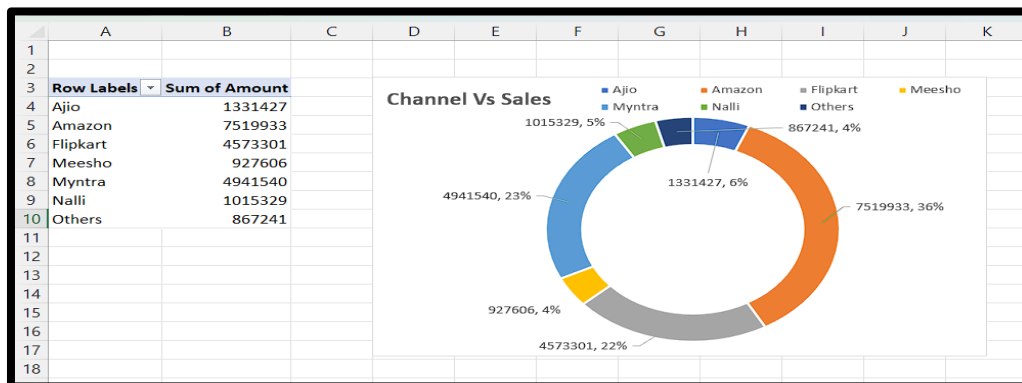


Figure 11: Channel VS Sales

In the final stage, a dashboard is prepared as shown in Figure 12, which gives a comprehensive overview of the data by combining all the visualizations. Through which data can be viewed in different matrices side by side at a time. It shows trends and changes in data over time and is easily customized.

We can see that all six visualizations are presented together and also be customized with the help of the given filters on the left side. The most important widgets and data components are effectively presented in a limited space and display a variety of metrics and key performance indicators in real time.

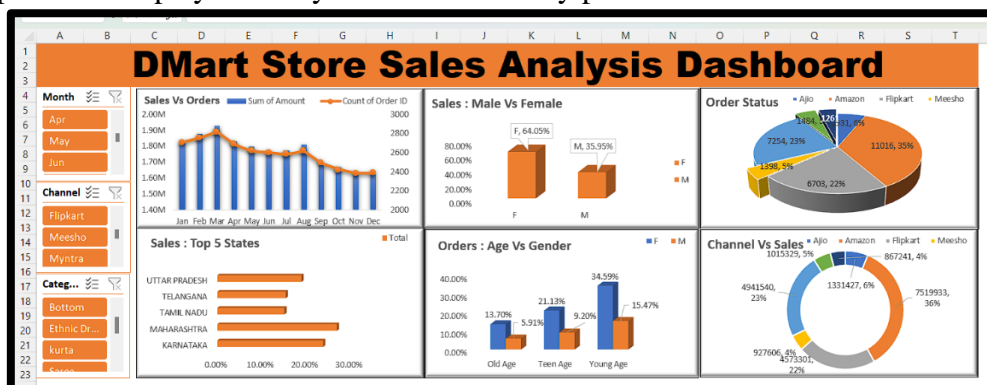


Figure 12: Dashboard

6. FINDINGS

The findings of this research paper reveal several significant insights into the role of data visualization in decision-making. Through the analysis and interpretation of the data collected, key patterns and trends have emerged, shedding light on the role of data visualization in decision-making. The findings provide valuable implications and offer actionable recommendations and avenues for further exploration.

- **Enhanced Understanding:** Data visualization significantly enhances decision-makers' understanding of complex datasets, enabling them to grasp patterns, trends, and relationships more intuitively compared to traditional data presentation formats.
- **Visualization Tool Effectiveness:** Different data visualization tools may vary in their effectiveness for supporting decision-making. Comparative studies could evaluate the strengths and weaknesses of various tools in different scenarios.
- **Increased Speed of Decision-Making:** Visualizations accelerate the decision-making process by presenting information in a format that is quickly comprehensible. Decision-makers can rapidly assess data patterns and make decisions more efficiently, leading to faster response times and greater agility.
- **Easy Comparisons:** Visualizations allow for easy comparison between different categories or groups within the data. This could include comparing sales performance between different regions, comparing the effectiveness of different marketing campaigns, or comparing demographic data across different periods.
- **Find Correlations and Relationships:** Visualizations can reveal correlations and relationships between different variables in the data. This can be especially useful for identifying factors that might be driving certain outcomes or behaviors.

7. IMPACT OF DATA VISUALIZATION

By providing decision-makers with clear, comprehensible representations of data, Data Visualization helps them make better decisions. It simplifies the complexity of information, enabling patterns, trends, and outliers to be identified more easily. This improved understanding allows decision-makers to make better choices and results in more precise and efficient decisions.

1. Individuals

- **Understanding:** Data visualization makes complex information easier to understand for individuals. Visual representations such as charts, graphs, and infographics help convey insights in a more intuitive and digestible manner.
- **Engagement:** Visualizations engage individuals more effectively than raw data or text alone. People are more likely to explore and interact with visualized data, leading to better comprehension and retention of information.
- **Decision-making:** By providing clear insights, data visualization empowers individuals to make informed decisions. Whether it's personal finance, health tracking, or career planning, visualized data helps individuals identify patterns and trends, enabling them to take appropriate actions.

2. Shareholders

- **Transparency:** Shareholders rely on accurate and transparent information to evaluate the performance and health of a business. Data visualization enhances transparency by presenting key metrics and performance indicators in a visually accessible format.
- **Communication:** Visualizations facilitate communication between management and shareholders by presenting financial and operational data concisely and understandably. Shareholders can quickly

grasp the company's performance trajectory and strategic direction.

- **Risk Management:** Visualizations enable shareholders to identify risks and opportunities more effectively. By visualizing market trends, financial ratios, and other relevant data, shareholders can assess the company's risk exposure and take appropriate actions to mitigate risks or capitalize on opportunities.
- 3. Business as a Whole**
- **Insights:** Data visualization enables businesses to derive actionable insights from large and complex datasets. By visualizing data, organizations can uncover trends, correlations, and anomalies that may otherwise go unnoticed, leading to more informed decision-making.
 - **Performance Monitoring:** Visualizations serve as powerful tools for monitoring business performance in real time. Dashboards and interactive charts allow managers to track key performance indicators and respond promptly to changes in market conditions or internal operations.
 - **Innovation:** Visualizations stimulate innovation by encouraging creative exploration of data. Businesses can use data visualization techniques to identify new market opportunities, optimize processes, and develop data-driven products and services that meet the evolving needs of customers

8. CONCLUSION

In conclusion, this research paper has illuminated the indispensable role that data visualization plays in the decision-making process across various sectors and industries. Through a synthesis of literature and empirical evidence, it is evident that effective data visualization enhances comprehension, facilitates communication, and fosters informed decision-making by providing insights into complex datasets. Moreover, the advent of advanced technologies has expanded the possibilities of data visualization, enabling interactive and dynamic representations that further empower decision-makers. As organizations continue to grapple with vast amounts of data, harnessing the power of visualization tools becomes paramount in navigating the complexities of the modern world. Thus, investing in data visualization not only improves decision-making processes but also contributes to organizational agility and competitive advantage in today's data-driven landscape.

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