A study on the role of interaction data visualization in managerial decision making at global logistics Nagpur

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***Abstract*—Interactive data visualization is becoming an essential technology for enhancing managerial decision-making in logistics organizations. With operational data on the rise in areas such as transportation, warehousing and inventory management, managers are faced with new challenges in putting this data to work. Interactive visualization systems convert raw business data into useful graphical formats, such as dashboards, charts, graphs, and real-time analytics, making manager decision-making faster and more realistic. The research examines the need of interactive data visualization for managerial decision-making at Global Logistics, Nagpur. The study investigates how visualization tool functionalities and use characteristics drive operational efficiency, strategy, communication and decision-making accuracy. A descriptive research design was employed that utilized primary and secondary data sources. The employees and managers were asked structured questionnaires to collect primary data. The secondary data was extracted from journals, research articles and reports of the company. The results show that operational monitoring, analytical capability, and decision-making time are improved by the use of the interface. The research findings demonstrate that visualization technologies adopted in the logistics sector positively impact managerial performance and organizational effectiveness.**

***Index Terms*—Data Visualization, Managerial Decision Making, Logistics Management, Interactive Dashboards, Supply Chain Analytics, Global Logistics.**

I. INTRODUCTION

In the current Digitized Global Economy, organizations generate huge volumes of structured and unstructured data through their operations, customer interactions, logistics activities and supply chain networks. Logistics businesses generally manage huge datasets associated with transportation scheduling, warehouse operations, shipment tracking, inventory management and customer delivery system. The conversion of raw data into information helpful for strategic and operational decision-making is often a problem for managers. Data visualization gives you an effective way to simplify the raw datasets for managerial improvement.

Data visualization refers to the representation of information in the form of charts, dashboards, maps, graphs, and infographics. With the help of interactive visualization systems, managers can dynamically analyze real-time data, detect patterns, monitor operational performance and make timely and informed decisions. Visualization enhances the speed of decision and quality of decision according to Karin Eberhard because it assists in understanding the issues easily and reduces cognitive complex Bility. Further Visualization assists managers to communicate in a complex world.

The logistics sector relies on technology-driven systems to operate efficiently and competitively. Transportation organizations in modern logistics use interactive dashboards and business intelligence tools to optimize transport routes, track deliveries, monitor warehouse activities, and improve customer service performance. According to Jahani, Jain, and Ivanov, the analytics and visualization technologies are becoming central components of supply chain and also logistics management. Because based on data-driven decision-making is supportive at the strategic, tactical, and operational levels.

Interactive visualization also facilitates communication among the managers by providing

operational information in a lucid manner. Real-time graphical interfaces help managers compare trends, identify bottlenecks in operation and predict future business conditions. According to Neri et al, user understanding, analytical performance, and effectiveness in managerial decision-making improved with customized visualization systems.

Global Logistics Nagpur is competitive logistics environment where decision making is necessary for operational success. The organization manages transportation services, warehousing operations and supply chain activities requiring constant monitoring and analysis. Interactive data visualization systems assess the operational data that managers use to enhance performance Thus, this study will focus on the interactive data visualization and how it helps management decision-making at Global Logistics, Nagpur.

II. LITERATURE REVIEW

Interactive data visualization has emerged as a key focus area for researchers in management, logistics, and business intelligence. According to the researchers, the use of visualization systems enhances the analytical understanding of users, minimizes complexity and facilitates managerial decision-making. Organizations environment significance of visualization technologies- Theory and empirical studies explain the significance.

As per Karin Eberhard (2021), the conversion of complex business information into visual representation enhances the understanding by the managers and improves management decisions. According to the author, visual systems help lower cognitive load and enable quicker interpretation of business data. The study moreover showed that organizations can benefit from the visualization as it enhances communication, analytical reasoning, and strategic management effectiveness. Research Paper by Springer

The study of Thomas Plank and Markus Helfert (2019) is on interactive visualization and big data management. Research shows managerial decisions can be supported and human-data interaction improved thanks to analytical interfaces and dashboards. In modern organizations, visualization systems are seeing greater implementation because they simplify the analysis of complex datasets. Visualization Studies.

The logistics and supply chain research has also discussed the Decision Support System (DSS) theory extensively. The decision support systems integrate analytical tools and visualization systems with the operational data to enhance the effectiveness of the managerial staff. The research papers focus on sustainable logistics management. It concludes that visualization dashboards helps managers in timely analysis of supply chain activities as well as better operational coordination.

The visualization importance in the managerial decision-making is greatly contributed by the cognitive load theory. According to Stefano Neri and colleagues (2022), a visualization (that is, a visualization dependent on users) reduces cognitive load. According to the authors, the use of graphs, colors, dashboards, and symbols in a model enhances managers' understanding and analytical performance. The study results showed that the systems help improve decision-making accuracy and monitor operations. Study of Visualization and Cognition

The advanced technologies that are used to derive meaning from data are elaborated in the Big Data Analytics Theory. The authors Hossein Jahani, Vinit Kumar Jain and Dmitry Ivanov (2023) mentioned that supply chain and logistics management are changing with the use of big data analytics and visualization technologies. Their study shows that visualization tools facilitate strategic, tactical and operational decisions through enhanced supply chain visibility and operational responsiveness. Analysis of large data sets in supply chain management

In the same way, they have shown that big data optimization technologies can greatly reduce logistics efficiency and forecasting ability and synchronizing through. Logistics organizations utilize visualization dashboards for predictive analytics and real-time monitoring, according to the study. As per the authors, managers can identify operational bottlenecks and improve resource utilization through interactive visualization. Optimization Research based on Big Data.

The visualization of supply chain is another emerging area of research. Mohsen Zafarzadeh, Magnus Wiktorsson and Jannicke Baalsrud Hauge (2021) studied how data-driven logistics technologies contribute to organizational value creation. The findings showed that visualization systems enhance

operational transparency and workflow optimization as well as supply chain coordination. Logistics Research using Data.

A significant contribution by Eduardo Dimara, Huahai Yang, and Melanie Tory (2021) focused on organizational data visualization needs. It has been found that managers often find it hard to make sense of large data sets through reports.

Their study concluded that interactive visualization improves decision making by allowing users to interpret trends, relationships, and operating patterns more easily. Study of graphical representations of organizational data.

This literature overview shows that data visualization in an interactive way enhances the making of decisions by managers, the monitoring of operations, the communication process and the designing of strategies in the logistics and business settings. Few studies focus on logistics players in regional markets, particularly Nagpur. Thus, the current research seeks to investigate the importance of interactive data visualization for managerial decisions at Global Logistics, Nagpur.

III. RESEARCH METHODOLOGY

Research methodology refers to the systematic procedure used for data collection, analysis, and interpretation to achieve the goals of research. Overall, the research study must be designed properly. Thus, it must follow a proper structure. The methodology used in the present study investigates the role of interactive data visualization in managerial decision-making at Global Logistics, Nagpur. The research employs qualitative and quantitative means to understand the way visualization tools affect efficiency, control over operations, and strategic decision-making by managers.

IV. RESEARCH DESIGN

A descriptive research design is adopted in present study Interactive data visualization has become a vital tool for the organization for managerial decision making. Therefore, descriptive research is appropriate because it describes and analyzes this role.

The design that explains helps in.

- Understanding the link between visualization systems and managerial success.
- Recognizing employee perceptions of interactive dashboards and analytics.
- The advantages of visualization technologies in operations.
- Examine the importance of data visualization in logistics management.

As per research design, the researcher collects factual information in a systematic manner and interprets managerial behaviour associated with visualization systems.

V. TYPE OF DATA

The study relies on both primary and secondary forms of data.

Primary Data

Through structured questionnaires and personal talks, primary data was collected from the employees and the managers of Global Logistics, Nagpur. Understanding was achieved by the primary data.

- What employees think about visualization systems.
- A dashboard help managers in effective decision making.
- Interactive data visualization: benefits and operational challenges.

Sources of Primary Data

- Structured Questionnaire
- Personal Interviews
- Employee Feedback

Secondary Data

The study makes use of both published and unpublished data to make theoretical and conceptual provisioning for the study.

Sources of Secondary Data

Scholarly Publications

Book.

Business Reports.

Websites.

Articles on Business Analytics.

Supply Chain and Logistics Publications

The use of secondary data aided in getting familiar with theories, research findings and concepts related to interactive data visualization and managerial

decision-making.

Sample Design.
Sampling Method
The Convenience Sampling Method was used for this study as the respondents were chosen because of their accessibility and availability in the organization.
Sample Size
Fifty respondents including managers and employees of Global Logistics, Nagpur were selected as a sample size.

VI. RESEARCH HYPOTHESIS

A hypothesis is a tentative statement developed to test the relationship between variables in a study.
Null Hypothesis (H0)
There is no significant relationship between interactive data visualization and managerial decision-making at Global Logistics, Nagpur.
Alternative Hypothesis (H1)
There is a significant relationship between interactive data visualization and managerial decision-making at Global Logistics, Nagpur.
Tools Used for Data Analysis
Percentage Analysis
Using percentage analysis, the responses of the employees were classified and the interpretation provided regarding the effectiveness of interactive visualization systems. We used tabular presentation to arrange the data we collected.
Tables
Graphs representing the employee and manager opinions regarding the visualizations created using the tools, are shown in pie charts.
Pie Charts
Descriptive analysis was utilized to illustrate employee perceptions, operational efficiency, and decision-making effectiveness regarding data visualization systems.

VII. LIMITATIONS OF THE STUDY

All research studies have some limitations that affect their scope and generalization. The present study has the following limitations.

- The research is restricted only to Global Logistics, Nagpur.
- Only 50 workers and managers are involved in the survey.
- The study relies on the accuracy and truthfulness of the opinions of respondents.
- We had no time to get into the details of all the departments.
- Some operational data and company information were confidential and not fully accessible.
- Results may differ from one logistics company to another based on implementation of technologies and management.

VIII. OBJECTIVES OF THE STUDY

The objectives of the present study “A Study on the Role of Interactive Data Visualization in Managerial Decision Making at Global Logistics, Nagpur”.

- To study the significance and impact of interactive data visualization in logistics management.
- To study the role played by interactive data visualization in managerial decision-making at Global Logistics, Nagpur.
- To assess whether the dashboard, chart and analytical tools improve operational efficiency.
- The aim is to find out how strategic planning and performance of business are supported by visualization systems.
- To assess the viewpoints of employees and managers on interactive visualization tools.
- To analyze how real-time graphics affect information transfer and coordination in the institution.
- To identify the obstacles that managers experience while using visualization technologies in logistics operations.

IX. CONCEPTUAL FRAMEWORK

The study’s conceptual framework establishes the link between interactive data visualization and managerial decision-making at Global Logistics, Nagpur. The framework is based on the idea that visualization technologies will help managers use complex logistics data more efficiently and improve organization performance. Actionable Insights through Dashboards will Graphs and Charts. Systems for Real-Time Analytic’s.
In a logistics organization, a manager is responsible

for the transportation schedule, inventory levels, warehouse operations, shipment tracking, customer service, and coordinating the activities of the supply chain. Conventional reporting techniques often hinder the quick-analysis of large amounts of data. Systems that create visualizations for data are beneficial as they convert the data into a format that is more easily understood and can even communicate the data as well as enhance analysts analytical ability.

The independent variable in this study is the interactive data visualization, while the dependent variable is the managerial decision-making effectiveness. Visualization systems help easily identify major problem areas which an organization can work to improve.

The decision support system (DSS) theory, cognitive load theory and big data analytics theory support the conceptual framework. The visualisation tools as explained by these theories help managers to better understand, reduce interpretive complexities and enhance decision making using data...

X. DATA ANALYTICS AND RESULTS

Data analysis is crucial for researchers as it helps them interpret collected data and extract useful information. For the current study, data has been collected from the employees and managers of Global Logistics Nagpur to find out the role of interactive data visualization in managerial decision making. Percentage analysis and graphical representation was used to analyze the collected responses.

The research looks at employee opinions on the impact of dashboards, charts, real-time analytics, reporting and other interactive visualisation tools on managerial performance and operational efficiency.

Table 6.1 Employee Opinion on the Effectiveness of Interactive Data Visualization

Response Category	Number of Respondents	Percentage (%)
Highly Effective	22	44%
Effective	18	36%
Neutral	5	10%
Ineffective	3	6%
Highly Ineffective	2	4%
Total	50	100%

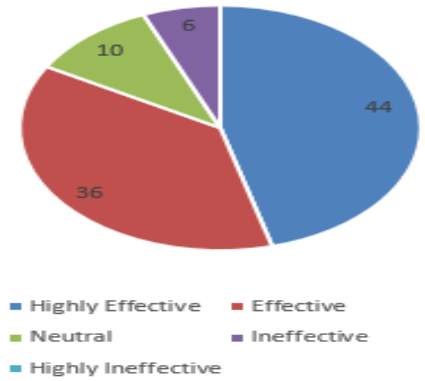

Fig 6.1 Employee Opinion on the Effectiveness of Interactive Data Visualization

Interpretation of the Pie Chart

The table and pie chart above show the employee and managerial opinion on whether interactive data visualizations are effective in managerial decision-making at Global Logistics Nagpur.

As many as 44% respondents feel that interactive data visualizations can effectively improve managerial decision making, the analysis states. According to these respondents, dashboards, graphical reports and real-time analysis help managers efficiently monitor logistics operations and make quick business decisions.

About 36% of respondents indicated visualization systems are effective at improving operations and communication within the business. Staff members noticed that interactive dashboards enhanced reporting accuracy, operational transparency, and workflow coordination.

Around 10% of respondents were neutral since they considered that the effectiveness of the visualization systems depends on managerial skills, training of employees, and usability of the system.

Just 6% of the respondents found the visualization systems ineffective, while 4% highly ineffective. Those respondents identified challenges including technical issues, lack of training, and difficulty interpreting advanced analytical dashboards.

The results reveal that the high percentage of employees and managers show positive perception of interactive data visualization systems. A proper implementation of visibility technologies can lead to better decision-making accuracy, operational performance monitoring, communication, and management efficiency.

XI. RESULT OF THE STUDY

As the data analysis reveals, interactive data visualization is crucial to managerial decision-making in Global Logistics, Nagpur. Most respondents agree that visualizations improve operational efficiency, reduce decision-making time and help in business planning. Thus, the study affirms the alternative hypothesis (H1): that interactive data visualization has a significant relationship with the effectiveness of managerial decision-making.

XII. DISCUSSION

The present study explored the effect of interactive data visualizations on the decision-making of managers at Global Logistics, Nagpur. Based on the study findings, interactive visualization systems help improve the efficiency of managers, operations monitoring, communication, and strategy formulation in the organization. Managers and employees had positive responses to dashboards, charts, graphs, and real-time analytical systems. They understood that these tools have made complex logistics data easier to handle, which, in turn, has improved decision quality.

Findings of the study are coherent with the research of Karin Eberhard, who explained that visualization helps managers better understand and reduces cognitive complexity. The present study found that managers do a better job of reading operational information with graphical information and interactive reporting. Study on Visualization and Decision-Making

According to the findings, Thomas Plank and Markus Helfert's work, which claims that interactive dashboards enhance business intelligence and managerial decision-making by facilitating large datasets. In the present study, the employees stated that visualization tools improve operational transparency and communication in logistics management. Study of interactive visualization

The results of the study also support Decision Support System (DSS) Theory, which states that if a manager receives information both visually and analytically, he is likely to make a better decision. Fahad H. Qaiser noted that visualization dashboards enhance logistics coordination and supply chain management. In like manner, the current study revealed that visualization systems help make operational decisions quickly and improve manager's responsiveness. Study of DSS

The research paper also confirmed Cognitive Load Theory, thus showing that interactive visualization systems reduce mental effort for processing information. Global Logistics, Nagpur managers can manage the transport schedules, inventories and operational activities through graphical interfaces rather than reports. This finding is similar to the study conducted by Stefano Neri et al. This study found that interactive visualization improves analytical performance and decision accuracy. Study of Visualization and Cognitive Analysis.

As a whole, the discussion provides evidence that interactive data visualization is an essential technological tool for improving managerial decision making and operational performance in logistics firms.

XIII. FINDINGS

Researchers found that interactive data visualization plays an important role in decision making by managers at Global Logistics, Nagpur.

Most of the respondents were in favor of the view that it helps in managerial decision making and efficiency. Business intelligence makes it easier for managers to understand various insights through dashboards, charts, etc. In a study, it was mentioned that visualization tools help in simplifying complex logistics data and increase understanding among employees and managers.

Visualization systems help enhance the communication and coordination between the departments. Graphs help managers identify issues with production bottlenecks, transportation delays, and inventories faster. In addition, the study found that real-time visualization leads to improved response time and strategic planning by the firm.

Moreover, a further finding is that visualization technologies enhance transparency in logistics operations and facilitate organizational oversight. Nonetheless, the research also noted a few challenges, including inadequacy of technical training, complexity of systems, and dependence on data quality.

The study findings reveal that interactive data visualization does positively impact managerial performance and organizational effectiveness in Global Logistics Nagpur.

XIV. CONCLUSION

The research study showed that interactive data visualization helps significantly in managerial decision-making at Global Logistics, Nagpur. Visualization systems like dashboards, graphs, analytical tools, and real-time reporting systems help managers. They can make sense of increasing operational data and make better business decisions.

The research shows operational performance and decision-making improve by the use of visualization technologies. Through visuals, managers can swiftly pinpoint logistics issues and make informed decisions based on them. The study shows that using interactive visualization will lower the complexity and enhance organizational performance.

The study findings revealed that the interactive data visualization significantly influences decision making effectiveness. Similarly, the findings revealed that the display of data significantly influences decision making effectiveness. As a result, the study proves that visualization technologies positively affect logistics management and managerial effectiveness.

XV. RECOMMENDATIONS.

According to the study, Global Logistics, Nagpur should not stop investing in more current interactive visualization and business intelligence systems for improved efficiency and decision-making quality. The firm must implement modern systems of dashboards for operational monitoring, along with analytical reporting.

The organization must conduct employee training regularly to enhance technical skills and visualization understanding among managers and staff. When employees are adequately trained in analytical tools, fewer operational errors are made.

The organization should also infuse visualization systems with predictive analytics and artificial intelligence technologies for improved forecasting, demand planning and logistics coordination. Improving data accuracy and the integration of systems will further enhance managerial decision-making.

Moreover, management should assist in establishing a data-driven organization capable of leveraging analysis and visualization technologies for decision making.

XVI. FUTURE SCOPE

The current analysis offers new avenues for research on interactive data visualization and logistics management. Future research can explore how interactive visualization systems can be combined with artificial intelligence, machine learning, and predictive analytics in logistics companies.

The researchers may conduct comparative studies between different logistics companies, industries, or geographies to see how visualization and managerial effectiveness vary. Future studies may also examine useful visualization systems in the supply chain, and their impact on satisfied customers.

The role of mobile visualization tools and cloud analytical systems is another field which warrants further research to enable remote managerial decision-making. Follow-up studies could examine the linkage between the usability of visualization, employees' skills, and productivity of organizations in a technology-driven logistic environment.

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