The Role of Data Visualization in Business Intelligence: Analyzing Tool Adoption and Decision-Making outcomes in US Companies

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Abstract

In the modern business landscape, data visualization has become an indispensable element of business intelligence (BI), particularly within the context of US companies. The aim of this research paper is to examine how data visualization technologies might improve business intelligence and decision making in American businesses by examining adaptation, advantages and disadvantages. This research paper explores the transformative contribution of data visualization tools to improving business intelligence capabilities and their significant influence on the processes of decision-making. The study begins by examining the adoption of various data visualization tools and platforms, such as Tableau, Power BI, and Elkview within US companies. It delves into how these tools facilitate the conversion of complex data sets into visually intuitive formats, allowing stakeholders at all levels to grasp trends, patterns, and anomalies with greater ease. By integrating these visualization tools into their BI systems, companies can achieve a more nuanced understanding of their operational landscapes and market dynamics. The paper further evaluates the impact of data visualization on decision-making processes. Through an analysis of case studies and empirical data, it highlights several key benefits, including improved accuracy in data interpretation, enhanced ability to identify actionable insights, and accelerated decision-making timelines. The paper discusses strategies to overcome these challenges, such as ensuring

data integrity and investing in user training to maximize the efficacy of visualization tools. Overall, the findings underscore that while data visualization is not a panacea, it significantly augments the decision-making capabilities of US companies by making data more accessible and actionable. The integration of advanced visualization techniques into BI practices is increasingly seen as a strategic advantage, driving both operational efficiencies and competitive differentiation. As data continues to proliferate, the role of data visualization in shaping business strategies and outcomes will likely become even more pronounced, making it a critical area of focus for future research and development in the field of business intelligence.

Keywords: Business Intelligence, Data Visualization, Tableau, Power BI, Elkview.

1. Introduction

In the contemporary business environment, characterized by the rapid expansion of data and technological advancements, the function of data visualization in business intelligence (BI) has becoming more important [1, 2]. The development of sophisticated BI tools has transformed data visualization into a dynamic and interactive component of strategic decision-making [3-5]. As US companies navigate an increasingly complex and data-rich landscape, the ability to effectively visualize and interpret vast amounts of data is necessary to keep a competitive advantage. These tools range from traditional charting and graphing software to advanced interactive platforms that offer real-time analytics and predictive capabilities [6-8]. This research paper aims to explore the role of data visualization in business intelligence, focusing on its use by US companies and evaluating its impact on decision-making processes. The proliferation of visualization tools like Tableau, Power BI, and Elkview reflects a broader trend towards data-centric decision-making in business environments [9, 10]. According to recent industry reports, organizations are generating and collecting data at unprecedented rates, from customer interactions and operational metrics to market trends and financial indicators. By providing visual representations of data, with the aid of these technologies, patterns, trends, and anomalies that conventional reporting techniques might miss might be found [11]. Despite its value, the sheer volume and complexity of this data can be daunting. Conventional techniques for analyzing data, often reliant on static reports and manual processing, are no longer sufficient to extract meaningful insights efficiently. Herein lays data visualization's significance[12-14].

The term "data visualization" describes how information and data are represented graphically. Visualization can significantly enhance decision-making by improving data comprehension, reducing cognitive load, and enabling more precise and actionable insights [15]. Through the use of visual components like as dashboards, graphs, and charts, data visualization technologies assist in reducing complex datasets to more easily assimilated and useful insights. Users can delve deeper into data, examine various scenarios, and confidently make data-driven decisions with the help of interactive visualizations [16, 17]. This visual approach allows decision-makers to quickly grasp key metrics, identify trends, and make data-driven decisions. Effective data visualization is essential in the context of business intelligence because it may convert unstructured data into strategic knowledge that can propel an organization's success. Giving stakeholders a consistent language to use when discussing complex data can help them comprehend and act upon it more easily [18] . Over the past decade, there has been a significant evolution in data visualization technologies. Early visualization tools were often limited in functionality and required substantial technical expertise. However, recent advancements have led to the development of more sophisticated, user-friendly platforms that cater to a broader range of users within organizations.

Leading tools such as Tableau, Microsoft Power BI, and like have emerged as industry standards, offering features that enable interactive and real-time data exploration.

These tools have democratized access to data visualization, allowing not only data analysts but also business executives, managers, and other stakeholders to engage with data more effectively. The shift towards self-service BI has empowered users across various organizational levels to generate insights and make informed decisions without relying solely on specialized data teams. Amazon and other companies have revolutionized the retail sector by utilizing technology and data analysis to generate business intelligence [19, 20] . This democratization of data access is a key factor driving the widespread adoption of visualization tools among US companies. Data visualization has a significant influence on how decisions are made. In traditional decision-making frameworks, data is often presented in tabular or textual formats, which can be challenging to interpret and may lead to delays in insight generation. Poorly designed visualizations can lead to incorrect conclusions and misguided decisions [21]. Visualization tools address these challenges by presenting data in formats that are easier to understand and interact with. For instance, users can explore various dimensions, delve down into data, and alter views to suit their own requirements with interactive dashboards. The quality of the underlying data and users' capacity to correctly interpret visual results are prerequisites for data visualization efficacy [22].This interactivity enhances the ability to uncover insights that might be missed in static reports.

Moreover, real-time data visualization facilitates more agile decision-making. Any organization might gain from using BI to make better decisions [23-25]. The capacity to obtain and evaluate current information is essential in fast-paced business settings in order to react to operational problems, market shifts, and new opportunities. Organizations may monitor key performance indicators (KPIs) and other metrics in real time with visualization tools, which enables more proactive management and faster adjustments. But companies must ensure that these tools are compatible with other systems and that they provide value without overwhelming users with excessive data[26] . Despite the benefits, there are drawbacks to data visualization. The quality of the data is one important problem. Visualization tools' efficacy depends on how accurate and comprehensive the underlying data is. Poor data quality may have a detrimental effect on decision-making processes by producing false findings and deceptive visualizations. An further obstacle is the intricacy of visualization design. While tools have become more user-friendly, creating effective and meaningful visualizations still requires a degree of expertise. Confusion or misunderstanding can result from badly constructed visualizations that hide crucial insights or distort data. particularly for tasks with deadline constraints. It affects performance and has been connected to ineffective personal time management [27]. Another level of complexity is introduced by the growing amount and diversity of data. It can be difficult to integrate and visually represent data that businesses gather from various sources and in various forms. Ensuring that visualizations accurately reflect the nuances of the data while remaining accessible to users is an ongoing challenge[28-30].

This research paper seeks to address these aspects by examining how US companies utilize data visualization tools within their business intelligence frameworks and evaluating the consequent impact on their decision-making processes. The study will analyze the adoption trends of various visualization tools, assess their effectiveness in enhancing decision-making, and explore the associated challenges and limitations. This is how the paper is organized: An extensive summary

of the development of data visualization technologies and their uptake by US businesses is given in the first part. Examining case studies and actual data, the second portion assesses how these tools affect decision-making processes. The constraints and difficulties of data visualization are covered in the third section, along with solutions. Lastly, the conclusion summarizes the results and offers suggestions for further study and application in the business intelligence domain. In conclusion, data visualization is essential to contemporary business intelligence because it converts complicated data into insights that can be used to inform decisions. As US companies continue to leverage advanced visualization tools, understanding their impact and addressing associated challenges will be crucial for maximizing their potential. This study attempts to offer a thorough examination of these facets, advancing knowledge of how data visualization might improve corporate intelligence and aid in strategic decision-making.

2. Literature Review

Researcher Ibrahim A. Abu-AlSondosa stated in his paper in 2023 that how Business Intelligence Systems (BIS) impact strategic decision-making quality in top management. It finds that BI Management, BI Scope, Data Quality, and Data Visualization positively influence decision-making. Effective BI management and high-quality data and visualization tools are crucial, though BI Scope's interaction with Data Quality is not significant [1, 31].This review of the literature examines the function of data visualization in the context of business intelligence in the United States, with a particular emphasis on how US corporations use data visualization tools and how they affect decision-making. The goal of this review is to give readers a thorough grasp of how data visualization improves business intelligence (BI) processes and tackles related issues by looking at pertinent academic and industrial studies. The evolution of data visualization tools has significantly impacted business intelligence practices. Historically, data visualization was limited to basic charts and graphs embedded in spreadsheets. However, the advent of sophisticated tools such as Tableau, Power BI, and Qlik has revolutionized the field[32]. These tools offer advanced features like interactive dashboards, real-time data integration, and customizable visualizations, which have democratized data access and enabled more nuanced analyses [33, 34] .

For example, Tableau is well known for its user-friendly drag-and-drop interface, which enables users to build intricate representations without the need for sophisticated technical knowledge [35] . Power BI integrates seamlessly with Microsoft products, providing a comprehensive suite for data visualization and analysis [36, 37]. These tools have been widely adopted due to their user-friendliness and the ability to handle large datasets, making them popular choices among US companies [38] . Decision-making is greatly improved by data visualization, which turns unprocessed data into useful insights. According to Few (2012), effective visualization helps in simplifying complex data, making it easier for decision-makers to identify trends, correlations, and outliers. Interactive dashboards and visual analytics enable users to explore data dynamically, which facilitates a deeper understanding of business metrics and supports strategic decision-making [39] .In fast-paced business environments, the ability to access and analyze current data can lead to quicker and more informed decisions [40] [41]. For instance, real-time dashboards enable businesses to track key performance indicators (KPIs) and promptly modify their plans in response to real-time input [42].Several case studies illustrate the impact of data visualization on decision-making.. Similarly, research by Eckerson (2010) [43] demonstrates that organizations using advanced visualization tools experienced improved operational efficiencies and more agile responses to market changes.

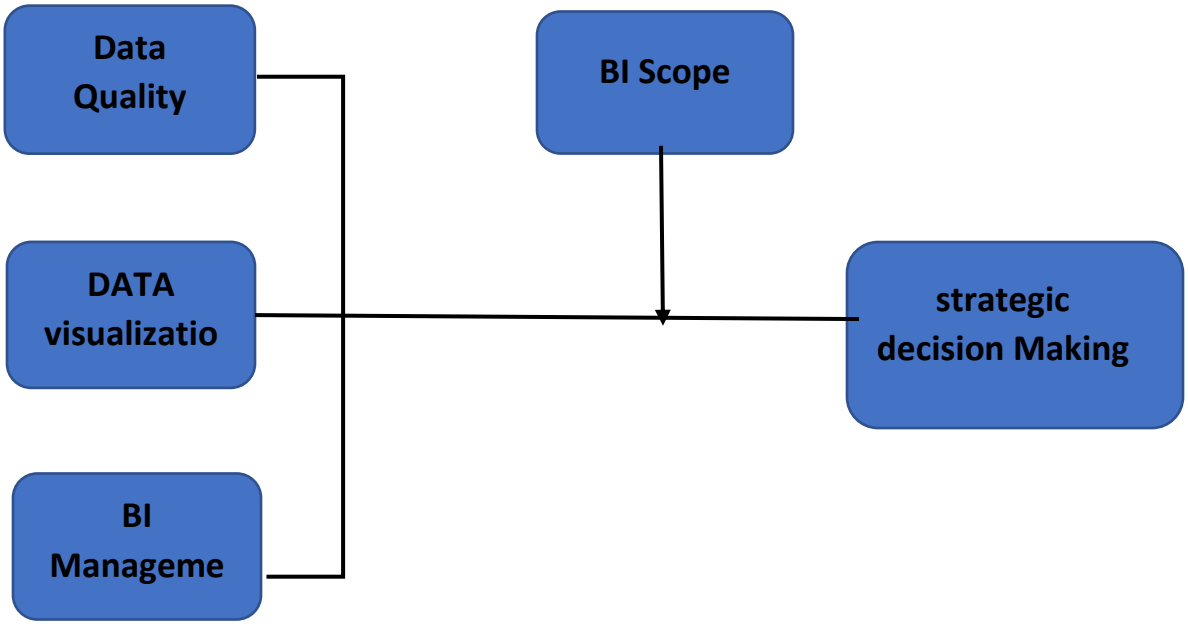

Figure 1: Theoretical framework for Visualization of Business Intelligence in decision-Making

Figure 1 gives the main model, which focuses on how the independent variables (data quality, data visualization, and business intelligence management) are connected to the dependent variable (strategic decision-making quality). It also explores BI Scope as a moderating variable, which may influence the strength or direction of these relationships. Specifically, the model investigates whether a broader and more integrated BI Scope enhances or alters the effects of Data Quality, Data Visualization, and BI Management on decision-making quality, providing insights into how different aspects of business intelligence systems contribute to effective making strategic decisions [44, 45].

Notwithstanding the advantages, data visualization has drawbacks. The quality of the data utilized in visualizations is one important problem. As noted by Knaflic (2015)[46], inaccurate conclusions and deceptive representations can result from poor data quality. For decision-making to be effective, data accuracy and integrity must be guaranteed. Even with advanced tools, creating visualizations that are both informative and accessible requires expertise and an understanding of data storytelling[47] .Another challenge is the potential for information overload. As the amount and diversity of data increase, users may be overwhelmed by the sheer amount of information presented through visualizations[48]. To address this, it is essential to focus on clarity and relevance, ensuring that visualizations highlight key insights without cluttering the user's view. The integration of data visualization into broader business intelligence strategies is crucial for maximizing its benefits. According to a study by Redman (2016) [49], successful BI strategies

involve not only the implementation of visualization tools but also the development of a data-driven culture within organizations. As noted by Sherman, R. (2014)[12, 50], BI tools should be selected and customized based on the specific needs of the organization, ensuring that they align with business objectives and workflows. This method improves the usefulness and relevance of data visualizations, increasing their ability to assist in strategic decision-making.

There are a few topics that need more study as data visualization technology develops. The effect of cutting-edge technology like machine learning and artificial intelligence (AI) on data visualization is one topic of study (Chae, 2019)[51]. Because these technologies automate data processing and offer predictive insights, they have the potential to improve visualization capabilities. Examining the function of data visualization in particular fields and situations presents another study opportunity. For example, understanding how visualization tools are utilized in sectors such as healthcare, finance, or retail can provide valuable insights into industry-specific challenges and best practices [52-54]. Longitudinal studies that track the adoption and effectiveness of visualization tools over time would be valuable in assessing their sustained benefits[55].The way US businesses handle and analyze data has changed as a result of data visualization, which is now an essential part of business intelligence [56]. The use of sophisticated visualization tools has improved decision-making by offering insights that are easier to reach and more useful. To fully reap the benefits of these tools, however, issues with data quality, visualization complexity, and information overload must be resolved. To better comprehend and capitalize on the function of data visualization in business intelligence, future studies should examine the effects of cutting-edge technology and sector-specific applications [57, 58].

3.Methodology

The study is to investigate the function of data visualization in business intelligence (BI) in the US, with a particular emphasis on how US businesses employ data visualization tools and assess how these tools affect decision-making. In order to accomplish the goals of the study, this methodology describes the research design, data collection strategies, and analytical approaches that will be used. To obtain a thorough grasp of the function and significance of data visualization in BI, this study will use a mixed-methods research design, integrating quantitative and qualitative techniques. The mixed-methods approach allows for a richer analysis by integrating numerical data with detailed, descriptive insights. The quantitative component will focus on gathering empirical data on the use of data visualization tools and their effects on decision-making processes. This will involve a survey distributed to a sample of US companies

3.1 Flow chart**:** The methodology of the research is systematic in that it takes six stages, as shown in Figure 1. The process starts by devising an overall survey that aims at identifying the evaluation criteria and then choosing pertinent data visualization tools which will be analyzed. Thereafter, information is obtained about the participating companies in the United States to determine how these tools are being actually used in business. The analysis stage compares the results of use of tools and their functionality in various departments of the organization. Thereafter, the study quantitatively and qualitatively gauges the effect of the tools on decision-making processes. The second to last phase entails analysis of the aggregated results in order to obtain meaningful trends and correlations. Lastly, research results are summarized and provided and end up with actionable knowledge concerning the usefulness or otherwise use of data visualization tools in boosting business intelligence capabilities. This systematic method aims at methodological rigor without

losing sight of the main purpose of the study, which is to comprehend the impact visualization technologies have on organizational decision-making.

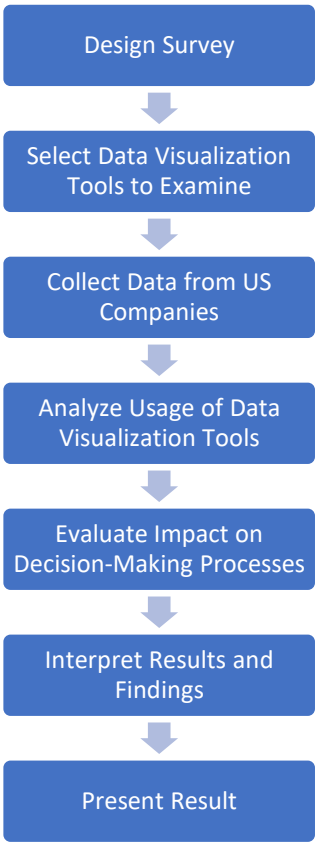

Figure 1: Research methodology flow chart

3.2 Survey Design: A structured questionnaire will be created to gather information about the kinds of data visualization technologies that are utilized, such as Tableau, Power BI, and QlikView. Usage context and frequency (e.g., marketing insights, financial analysis). influence on decision-making that is perceived (e.g., faster decision-making, greater accuracy). In order to gather a variety of answers, the survey will contain both closed-ended (likert scale ratings) and open-ended items. Both open-ended and closed-ended questions will yield qualitative and quantitative insights, respectively. The study will employ a stratified random sampling technique to guarantee a representative sample of US businesses of all sizes and in a variety of industries. Industry sectors (such as retail, healthcare, and finance) and company sizes (small, medium, and large) will determine the strata. 300 businesses will be the goal sample size in order to guarantee dependability and statistical validity.

3.3 Data Collection: Through the use of an online survey platform, the survey will be conducted electronically. Data analysts, business intelligence managers, and chief information officers (CIOs) are among the important decision-makers in the organizations who will receive invitations by email. We'll send follow-up reminders to boost response rates. The qualitative component will provide deeper insights into how data visualization tools are perceived and used within organizations. This will involve conducting semi-structured interviews and analyzing case studies.

3.4 Data Analysis: Quantitative data will be analyzed using statistical methods. Tools for analyzing data sets are statistical methods. The survey's results will be summarized using descriptive statistics (like means and standard deviations), and inferential statistics (like regression and correlation analysis) will look at the connections between the use of data visualization tools and perceived influences on decision-making. Effective presentation of the quantitative results will be achieved through the use of data visualization tools like charts and graphs. For the analysis, statistical software like R or SPSS will be used.

4.Results and Discussion

The study assesses the effectiveness of these tools in aiding decision-making, highlighting their role in simplifying complex data, identifying trends, and supporting strategic choices. The findings are then examined in terms of their implications for current business practices, offering insights into how companies can better leverage data visualization for improved outcomes. Additionally, the research points to areas needing further investigation, suggesting future research directions to deepen the understanding of data visualization's impact on BI and refine its application in business contexts. For this study, we reached out to 300 CEOs via email, inviting them to participate in a survey about the visualization tools their companies use. Out of the 300 companies contacted, 223 responded and completed the survey. This response rate of 74.33% indicates a high level of engagement and interest among the CEOs regarding the topic of data visualization tools. This substantial participation rate suggests that the findings from the survey are likely to be robust and representative of the current practices.

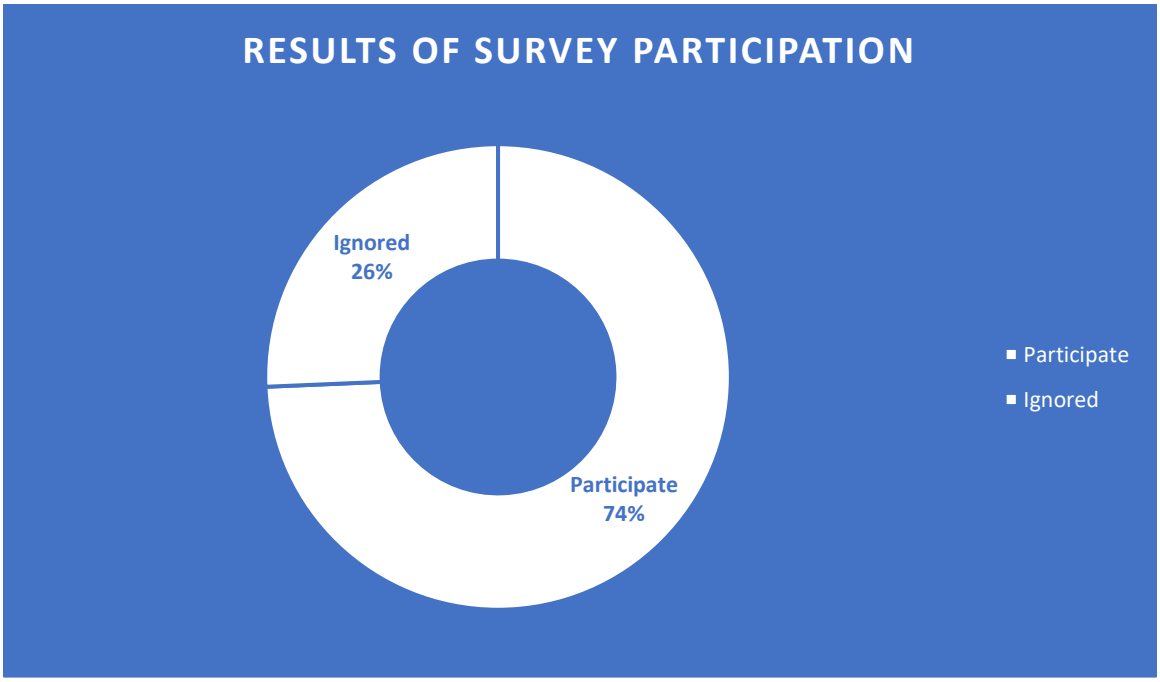

Fig. 2: Results of survey participation

A total of 300 businesses were contacted and 223 (response rate = 74.33%) responded and took part in survey as indicated in Figure 2. This high response rate indicates that CEOs are very interested in and engaged with data visualization tools. Conversely, 25.67% of the companies chose not to participate in the survey. The substantial engagement from the majority indicates that data visualization is a significant and relevant topic for many organizations, reflecting a keen interest in understanding its impact and application in business intelligence.

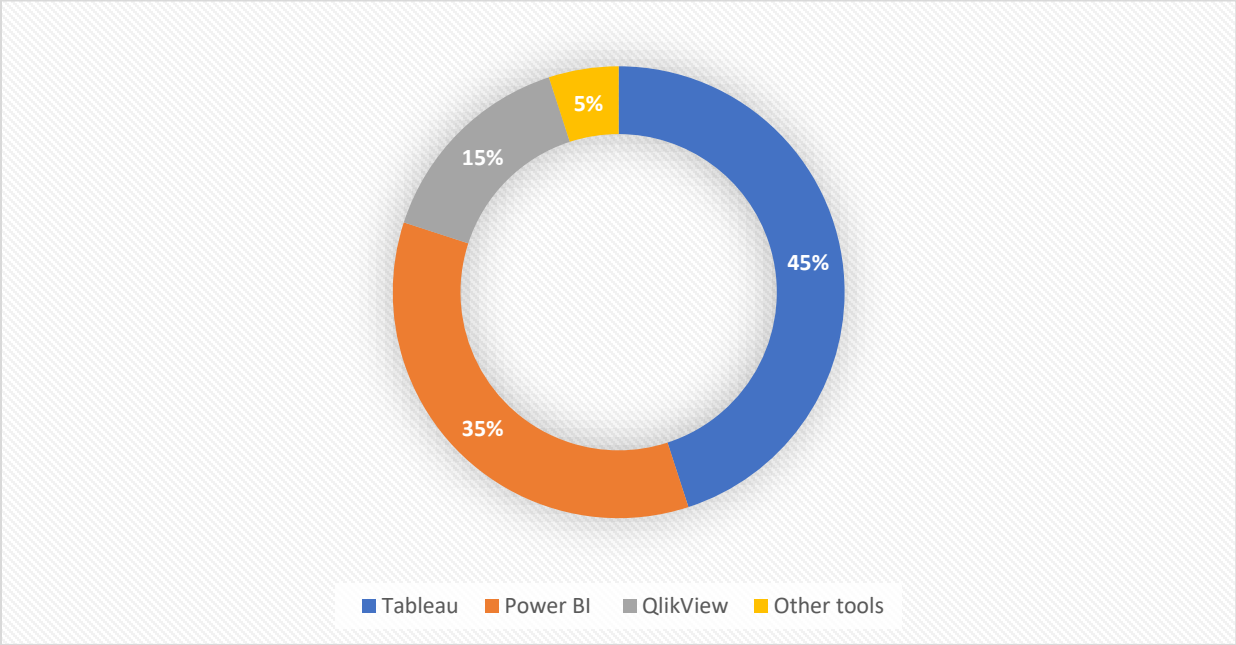

Fig. 3: Types of Data Visualization Tools Used by US Companies

As illustrated in Figure 3, Tableau (45%) is adopted at the highest rate currently occurring in U.S. companies, then Microsoft Power BI (35%) and QlikView (15%). Other tools, including Looker and Domo, account for the remaining 5%. Tableau's dominance can be attributed to its comprehensive features and user-friendly interface, while Power BI's integration with Microsoft products enhances its appeal.

4.1 Tableau: When using BI software, Tableau is a crucial tool for data analytics and visualization. Reporting is made simple with the drag-and-drop functionality. Without any prior programming expertise, learning Tableau is a simple task thanks to its user-friendly interface. Christian Chabot, Chris Stolte, and Pat Hanrahan founded Tableau in 2003. Similar to QlikView, Tableau is capable of in-memory processing. Analyzing data is done without establishing a connection to any data sources. The amount of memory that Tableau can analyze depends on that quantity. Tableau has the ability to connect to various data sources and retrieve data prior to conducting analysis. CSV, EXCEL, Oracle, SQL Server, IBM DB2, and ODBC are a few examples of data sources.

Additionally, cloud-based systems like Windows Azure, Google Big Query, and Big Data can access the data.

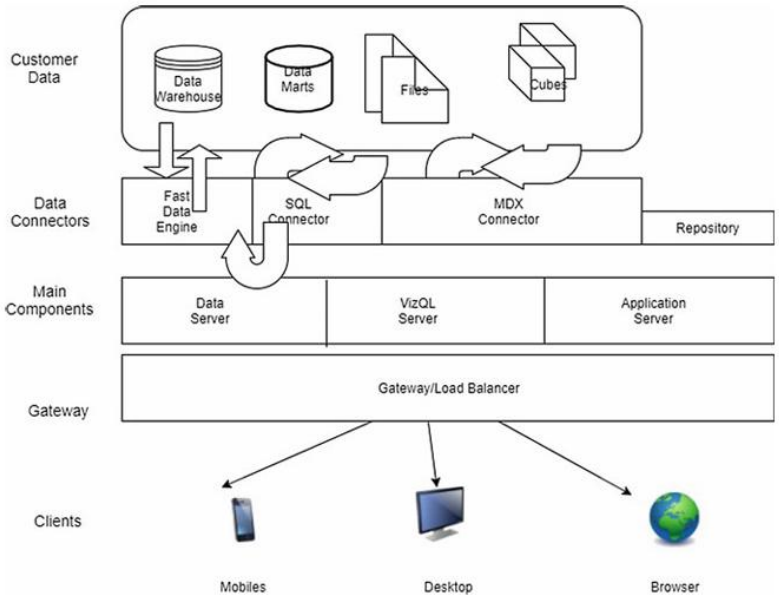

Fig. 4 Architecture of Tableau

Fig. 4 expresses Tableau's basic architecture. The following describes how the functionality works. The initial phase involves gathering information from various sources. Connecting data sources and application servers is the focus of the second step. The third stage involves creating the dashboard and integrating the load balancer and gateway. Ultimately, clients can share dashboards.

Tableau can present data in a number of different charts, including as waterfall, motion, bar, line, pie, cross tab, scatter, babble, bullet, box, tree, bump, and graph [59] .The product is not open source. Table 1 represents Tableau advantages and drawbacks.

Table 1: Advantages and drawbacks of Tableau

Advantages:	Drawbacks:
1. An extremely intuitive interface. 2. Simple integration with outside parties. 3. Dashboard report support for mobile devices. 4. User discussion boards and support staff. 5. Development at a low cost	1. First preparation of the data. 2. Not all statistical features are available in Tableau. 3. Financial Reporting Applications cannot be substituted with Tableau.

4.2 Power BI: With the use of self-service BI features in Microsoft's Power BI for business analytical services, end users can create reports and dashboards without the help of IT staff or database administrators. Along with cloud-based BI services dubbed Power BI administrative, Power BI also provides a desktop-based interface called Power BI desktop. Among its many functions are interactive dashboards, data warehousing, data preparation, and data discovery. The ability to load personalized visuals is the main advantage of this software. A few examples of the databases used by Power BI are: SQL Server, SQL Server Analysis Services, Access, Oracle, IBM DB2, Sybase, PostgreSQL, MYSQL, Teradata, SAP HANA, SAP Business Warehouse Server, Amazon Redshift, Impala, Excel, Text/CVS, Folder, JSON, XML, SharePoint Folder, Azure databases, Azure Enterprise, Sales force Reports, Google Analytics, Facebook, GitHub, and so forth [60] .Table 2 represents Power BI advantages and drawbacks.

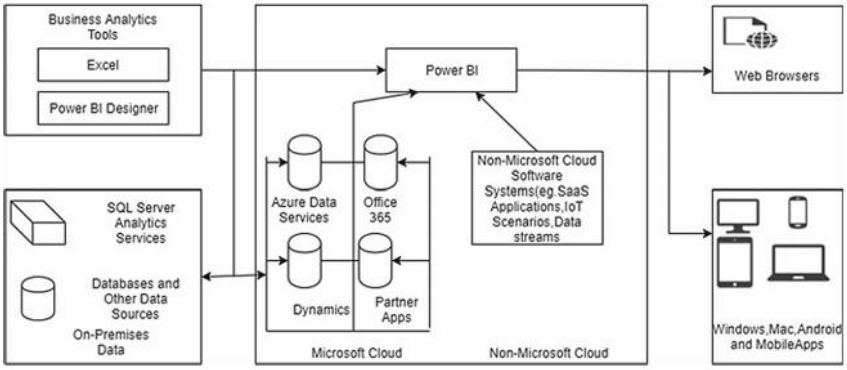

Fig. 5 Architecture of Power BI

Fig. 5 depicts a basic Power BI architecture that is broken down into three steps. Initially, compiling information from many sources. In the second stage, business analytics tools such as Excel and Power BI Designer are used to design and develop dashboards according to requirements. The last phase involves distributing dashboards to customers via mobile apps and online browsers.

Table 2: Power BI advantages and drawbacks.

Advantages:	Drawbacks:
1. The price is reasonable. 2. It is associated with a notable brand. 3. Microsoft is contributing resources to it. 4. Its ability to perceive reports are excellent. 5. It can access a wide range of databases.	1. Microsoft Excel control clients benefit the most from it. 2. It struggles to handle large amounts of information sources. 3. Granularity is not taken into consideration.

4.3 QlikView: Qlik is a Swedish software business that was founded in 1993 and offers BI products Qlik-Sence and QlikView. In essence, Quik—later renamed Qlik—is a PC-based program that stands for Quality, Understanding, Interaction, and Knowledge. These days, QlikView is facilitating business exploration. Since these tools are in-memory based, all data is loaded into the RAM. An easy-to-use self-benefit representation and disclosure tool for deconstructing, interpreting, and visualizing massive amounts of information is QlikView. The drag-and-drop dashboard, report, and visualization construction functionality is one of QlikView's primary benefits. There are three versions of QlikView: Desktop, Enterprise, and Cloud. Qlik-Sence is used for self-service visualization, and QlikView is used for guided analytics [61] .

QlikView is compatible with a wide range of data sources and formats, including DIF, HTML, QVX, databases, Web files, Excel, CSV, and XML files. It can also retrieve data from OLE DB and ODBC data sources. For one staff member, QlikView and Qlik-Sence are free of charge. One major benefit is that users may quickly retrieve their bookmarks, which are saved as current selections and preserved for later use. Charts are used as a data visualization tool in QlikView. Bar charts, line charts, combination charts, Radar charts, scatter charts, grid charts, pie charts, funnel charts, block charts, gauge charts, Mekko charts, pivot charts, and straight tables are among the various chart kinds. Massive datasets can be easily included into Qlik View, and its user interface is adept at providing a ladder to data sources that point to real-time data visualization. Data from multiple sources can be combined, and source-specific APIs enable quick access to the data. End executives can use add-ons to visualize data in their browsers. Applications for QlikView include project management, market analysis, customer assistance, manufacturing control, financial systems, human resource administration, stock inventories, and purchasing [62] .Table 3 represents QlikView advantages and drawbacks.

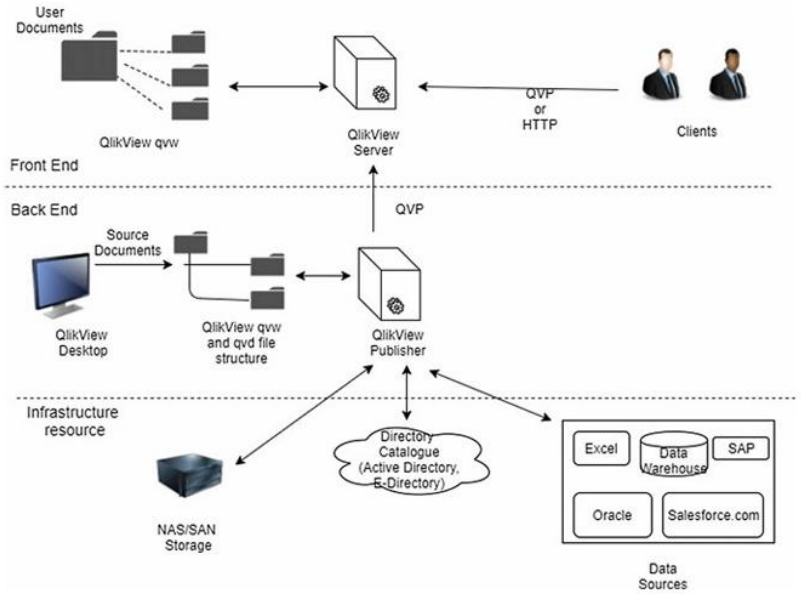

Fig. 6 Architecture of QlikView

Fig. 6 depicts a basic QlikView architecture. The following is an explanation of the working process. The first stage is to integrate data into QlikView by extracting information from particular sources. Pre-processing is carried out in the second step by eliminating erroneous data fields and

locating outliers. Stage three involves providing users with dash board visualization components that can be dropped and dragged. Dashboards can be shared with higher level department personnel and other customers in the end.

Table 2: QlikView advantages and drawbacks.

Advantages:	Drawbacks:
1. The primary benefit of QlikView and QlikSence is their in-memory technology. 2. We are able to produce reports in PDF and Excel formats. 3. Provides associative search functionality. 4. Huge pool of consultants and partners. 5. Strong mobile applications. 6. Reliable dashboard features. 7. Easier to develop on than legacy and traditional BI platforms. 8. Firm integration.	1. Large datasets can be accessed, depending on how the system is configured. 2. Demand a developer with training. 3. There is no central security. 4. Difficult to integrate analytics. 5. The UI is outdated

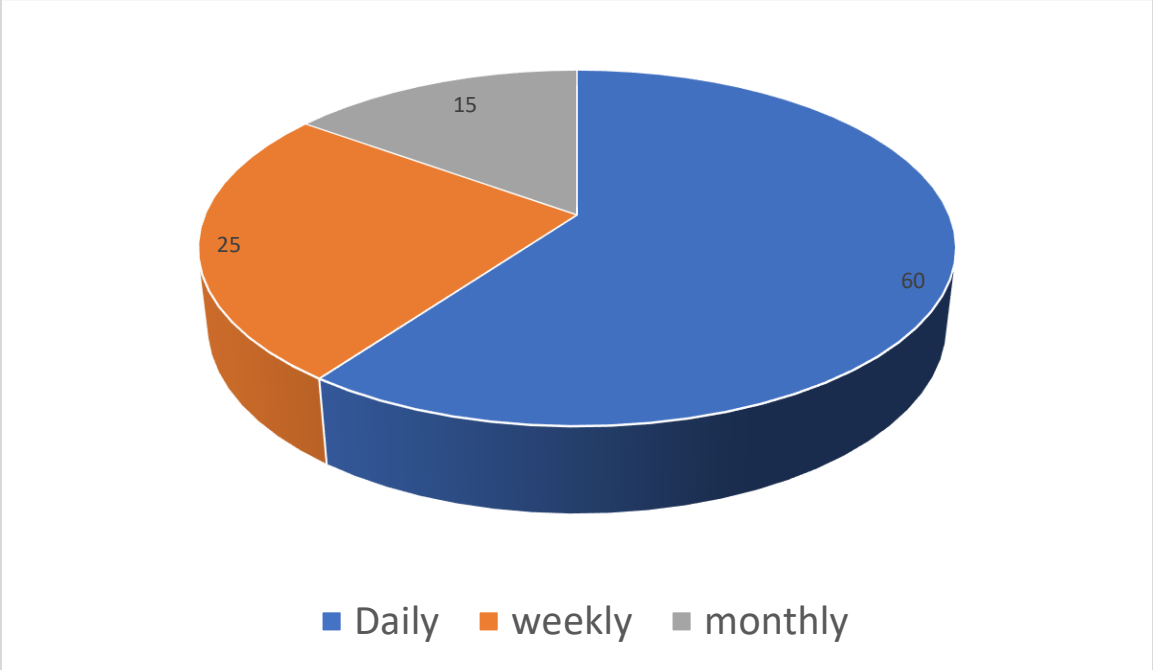

Fig. 7: Frequency of Data Visualization Tool Usage

The results in Fig. 7 shows that data visualization tools are commonly used across companies, with 60% reporting daily use, indicating they rely on these tools for regular, ongoing data analysis.

Another 25% use them weekly, showing their value in periodic reviews and decision-making. The remaining 15% use data visualization tools monthly, suggesting they are important but not central to daily operations. This distribution highlights that while most companies frequently engage with data visualization, the intensity of use varies, reflecting different levels of reliance on these tools for insights and decision support.

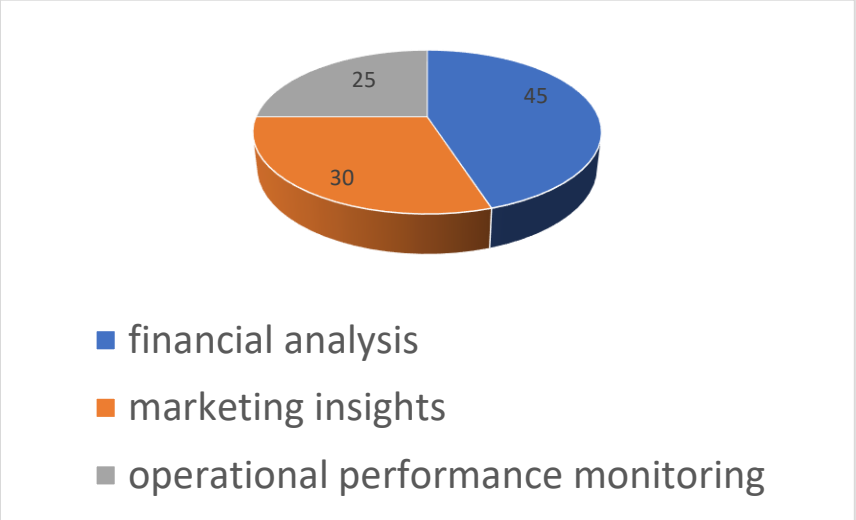

Fig. 8: Decision-Making Effects of Data Visualization

The results in Fig. 8 shows that companies use data visualization tools primarily for these purposes: financial analysis (45%), marketing insights (30%), and operational performance monitoring (25%). This distribution shows that data visualization is heavily relied upon for strategic decision-making in finance, helping track and interpret financial data. It is also crucial for gaining marketing insights, enabling businesses to analyze campaign performance and customer trends. Additionally, data visualization is used for monitoring operational performance, helping companies optimize their processes. Overall, these applications highlight the extensive use of data visualization in both strategic and operational contexts to drive informed decision-making.

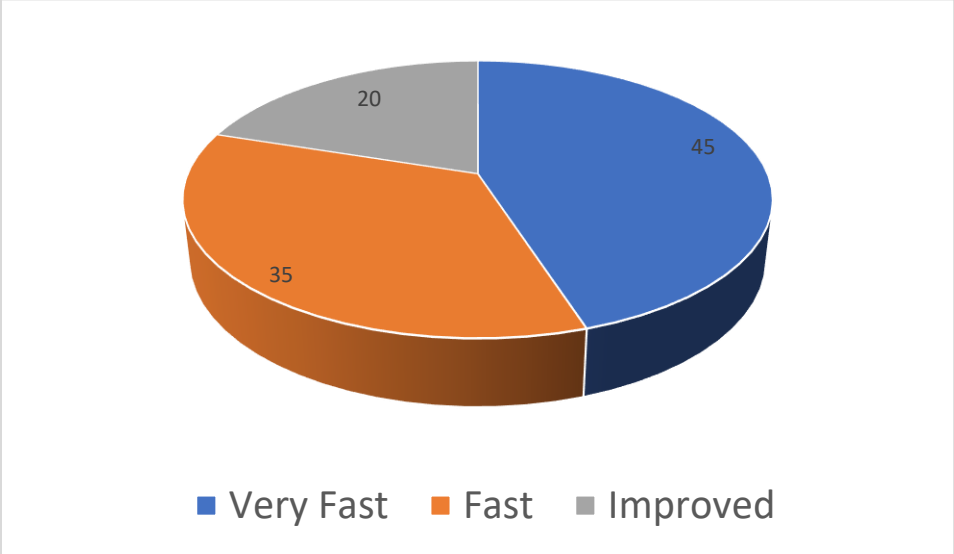

Fig. 9: Decision-Making Experiences with Data Visualization Tools

The results in Fig. 9 shows that 45% of respondents believe that data visualization tools significantly enhance decision-making accuracy. Furthermore, 35% report faster decision-making processes, and 20% note improved communication of insights across teams. The data suggest that data visualization tools are instrumental in improving both the speed and quality of decision-making.

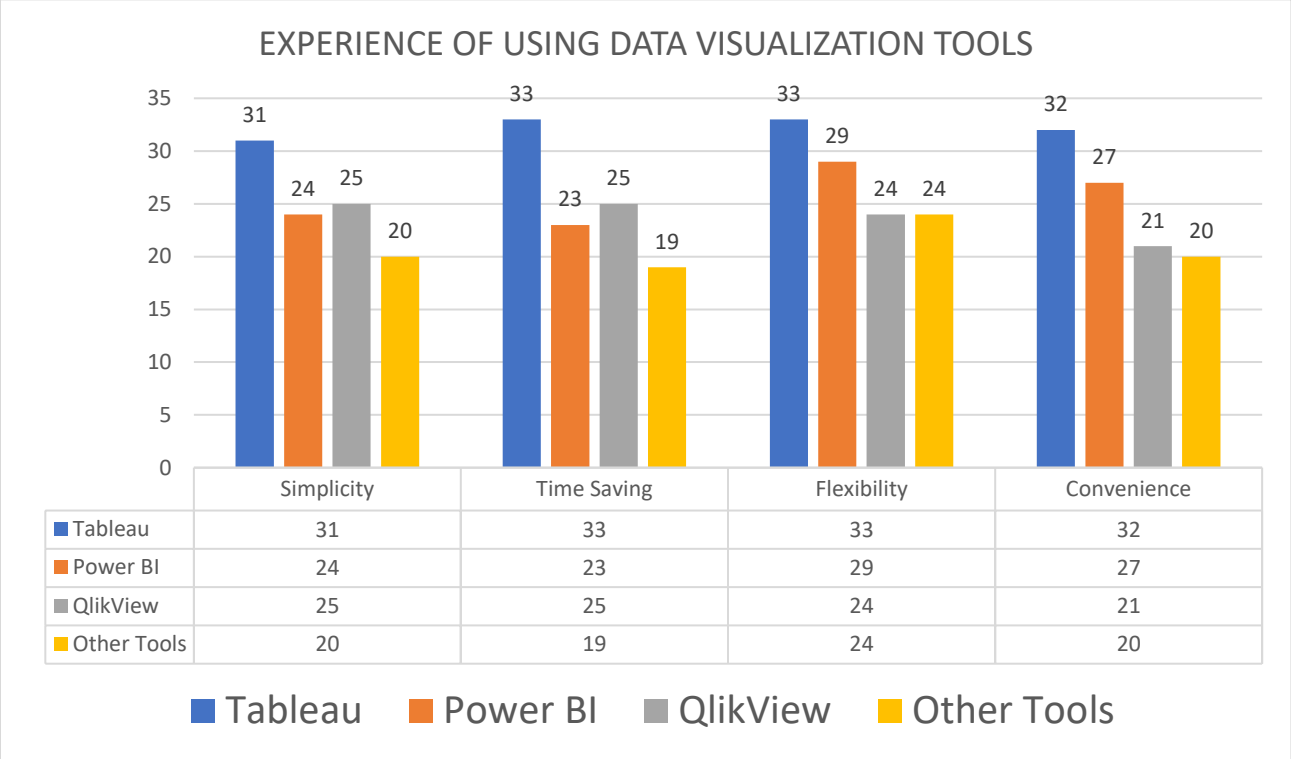

Fig. 10: Experiences with Data Visualization Tools

Key findings of the survey revealed in Fig. 10 indicate that the study measured the user experience with the data visualization tools on the four dimensions simplistic, saves time, flexibility and convenient. Tableau, Power BI, QlikView, and so on were evaluated by the respondents according to the following criteria. The survey aimed to gauge how each tool performs in terms of ease of use (simplicity), efficiency in reducing time spent on tasks (time saving), adaptability to different needs (flexibility), and overall ease of access and use (convenience). We can see from the figure that Tableau is the best data visualization tool compared to others. According to the user experience, its simplicity is the highest at around 31%, and time-saving, flexibility, and convenience are also the highest at 33%, 33%, and 32%, respectively. Then Power BI and QlikView are in a close position. This comprehensive evaluation helps in understanding the strengths and areas for improvement of each tool in enhancing user experience and effectiveness.

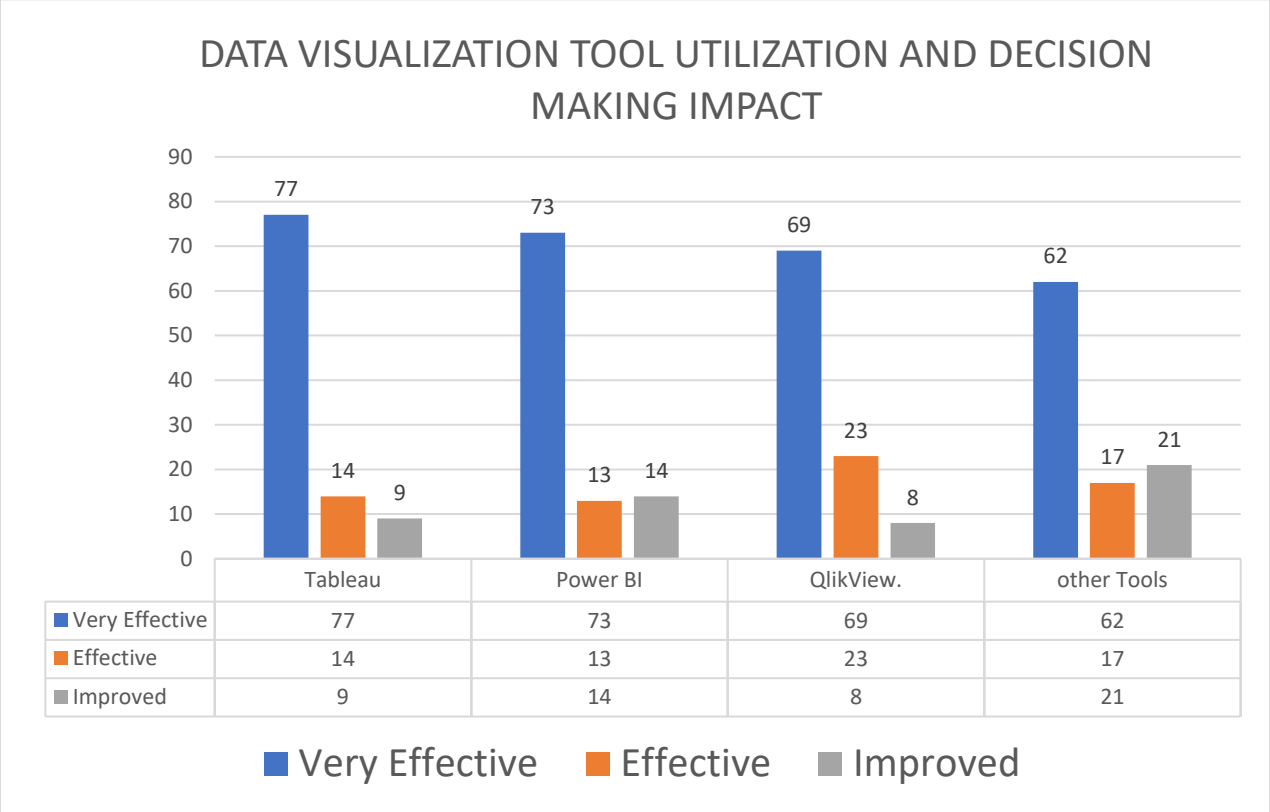

Fig. 11: Data Visualization Tool Utilization and Decision-Making Impact

The results in Fig. 11 shows that data visualization tools significantly impact decision-making, with an average utilization rate exceeding 70%, underscoring their effectiveness. Among these tools, Tableau stands out as the most impactful, reflecting its superior capabilities in translating complex data into actionable insights. Power BI and QlikView also demonstrate strong performance, positioning themselves as robust alternatives. However, other data visualization tools, while beneficial, show potential for enhancement to match the effectiveness of Tableau, Power BI, and QlikView. This suggests that while the current suite of tools offers valuable support in decision-making, there remains an opportunity for improvement and optimization in other tools to further elevate their impact. Overall, the high utilization rate of these tools highlights their critical role in data-driven decision-making processes.

The findings indicate that data visualization tools play a crucial role in enhancing business intelligence. Companies that utilize these tools report significant improvements in decision-making accuracy and speed. The ability to visualize complex data sets in an intuitive manner allows decision-makers to identify trends, patterns, and anomalies that may not be apparent from raw data alone. The high frequency of tool usage and the diverse contexts in which they are applied underscore their importance in modern business environments. The prominence of Tableau and Power BI reflects their strong market positions and user satisfaction. The positive impact of data visualization tools on decision-making processes is evident from the survey results and case studies. The tools facilitate more accurate and faster decisions by providing clear and actionable insights. For instance, the financial services firm's use of Tableau for risk management highlights how data visualization can enhance risk assessment and management. Similarly, the retail

company's use of Power BI to analyze customer data demonstrates the value of data visualization in optimizing marketing strategies. The enhanced exchange of insights among teams further suggests that data visualization tools facilitate communication between decision-makers and data analysts. These tools facilitate the comprehension and action of stakeholders by presenting data in an aesthetically appealing manner.

5. Conclusion

The paper reveals the critical importance of data visualization tools in advancing business intelligence and decision-making among the organizations in the United States of America. With businesses operating in an ever more data-driven environment, software packages such as Tableau, Microsoft Power BI and QlikView have become essential in the conversion of highly complex data to clear and tactical analyses. Tableau comes up as the most convenient tool of various people because of its easy interface and its sophisticated features whereas Power BI is the most used tool because it is smoothly incorporated to Microsoft products. They have been commonly used in financial analysis, marketing campaigns and monitoring some operations so as to ensure that businesses are able to react to trends quickly as well as enhancing the accuracy of decision making. Their practical value is proved by the examples of real usage in the business community: the financial sector of working with Tableau has seen a decline in the number of risk situations, and retailers applying Power BI report the improved strategies and revenue growth. Nevertheless, issues related to data inconsistencies, challenges related to integration, and quality control raise concerns, which means that there must be even more robust data governance practices. Nevertheless, the advantages of data visualization cannot be overestimated including improved communication, accelerated insights and competitive advantage in a world where knowledge of data is the priority. Since companies will be dealing with more and more data with a greater level of complexity, there will always be a need to invest in such tools as we look at underlying data management issues that lead to success in the long term. The study confirms the fact that data visualization is not only beneficial, but required by any company that wants to stay competitive given the changeable nature of the current business environment.

6. Future Work

Future research on data visualization in business intelligence (BI) should focus on several key areas to advance the field: Advancements in Technology: Explore how AI and ML enhance data visualization through predictive analytics and automated insights, and how these technologies can improve decision-making. Industry-Specific Applications: Investigate the use and impact of data visualization tools across different sectors to identify best practices and challenges, offering tailored recommendations for each industry[63]. Data Integration Solutions: Study advanced methods for improving data integration and accuracy, including new data governance frameworks and technologies to address integration issues[12]. Evaluate how training programs and user experience design affect the efficiency of data visualization tools and how these elements affect tool use and decision-making efficacy. These research directions aim to deepen the understanding of data visualization's role in BI and help organizations leverage these tools more effectively.

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