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Winter Semester 2022-23

CSE3502 - Information Security Management

Final Report

Under the Guidance of

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Data Analytics in Business Intelligence

Abstract:

Decision making is critical and crucial for any organization doing business. The challenges faced by them in decision making are plan failure, lack of preparation, resource failure, and risk-taking capability. Business intelligence helps gather essential information from a wide variety of unstructured data and convert them into actionable information that allows firms to make informed policy decisions and improve business efficiency and productivity. Business Intelligence contains many components such as Real-time monitoring, Dashboard development and reporting, Benchmarking, Implementation BI software, like Power BI, Performance management, Data and text mining & Data analytics etc. Data analytics can be used in a variety of ways in business intelligence, including identifying trends and patterns, to forecast future outcomes, and to optimize business processes. It can also be used to improve customer relationship management, by providing insights into customer behavior and preferences. There are many different tools and techniques available for data analytics but no matter which tools and techniques are used, the goal of data analytics in business intelligence is to turn data into actionable insights that can inform decision making and drive business growth. In this paper we sought to find out how data analytics fits in with decision making using Business Intelligence through research of various papers.

Keywords:

Introduction:

In today's fast-paced and data-driven world, businesses are constantly looking for ways to gain an edge over their competitors. One of the most powerful tools at their disposal is data analytics, which has emerged as a crucial component of business intelligence. Data analytics involves collecting, processing, and analyzing large amounts of data to identify patterns and trends that can be used to make informed decisions.

There are various techniques used in data analytics, including statistical methods, machine learning algorithms, and artificial intelligence. These techniques can help businesses identify hidden correlations between data sets, predict future outcomes, and optimize operations for maximum efficiency. Business intelligence systems have traditionally relied on reporting and dash boarding tools to deliver data insights, but the rise of data analytics has introduced a new level of sophistication.

Predictive analytics is one of the most powerful techniques used in data analytics. It involves using statistical algorithms to identify patterns in historical data and predict future outcomes. This can be used to optimize operations, improve customer satisfaction, and increase revenue and profits. Machine learning is another technique that has gained popularity in recent years. It involves using algorithms to learn from data and make predictions or decisions based on that learning.

Implementing data analytics in business intelligence is not without its challenges. One of the biggest challenges is ensuring data quality, as inaccurate or incomplete data can lead to flawed insights and decisions. Another challenge is the need for skilled data analysts who can interpret and make sense of the data. Additionally, there are potential risks associated with data breaches and cyber attacks, which can compromise sensitive business information.

Despite these challenges, the benefits of data analytics in business intelligence are clear. By leveraging the power of data analytics, businesses can gain a competitive advantage in their respective industries, optimizing operations, improving customer satisfaction, and ultimately increasing revenue and profits. Moreover, the widespread adoption of cloud computing has made it easier than ever for businesses to access and analyze large amounts of data. Cloud-based data analytics platforms offer scalable and cost-effective solutions for businesses of all sizes, enabling them to store, process, and analyze data without having to invest in expensive hardware or software.

This research article aims to provide a comprehensive overview of data analytics in business intelligence, exploring the various techniques used and their applications in real-world scenarios. It will also examine the challenges and opportunities that come with implementing data analytics in business intelligence, ultimately highlighting the impact of data analytics on organizational performance.

Literature Survey:

[1]This research paper investigates the implications of big data analytics on business intelligence. The study aims to identify the ways in which big data analytics can enhance business intelligence, as well as the challenges and limitations associated with their implementation. The research methodology involves a qualitative analysis of interviews conducted with business intelligence experts and practitioners.The paper highlights the potential benefits of big data analytics in business intelligence, such as improved decision-making, greater operational efficiency, and increased revenue. However, the study also highlights several challenges, including the need for specialized skills and expertise, data quality issues, and the cost of implementation. The study concludes by emphasizing the importance of carefully considering the potential benefits and limitations of big data analytics in the context of business intelligence, and developing appropriate strategies for their implementation.

[2] The paper discusses the importance of business intelligence in the era of big data. The paper highlights the challenges and opportunities presented by big data analytics, data mining, and machine learning for businesses seeking to gain insights into their operations and customers. The authors also discuss the different techniques and tools available for analyzing big data and how these can be used to extract useful information and knowledge for business decision-making. Additionally, the paper provides examples of how big data analytics, data mining, and machine learning have been successfully used in various industries to improve performance, reduce costs, and enhance customer satisfaction.

[3]The research paper "Big Data Analytics and Business Intelligence in Industry" provides an overview of the current state of big data analytics and business intelligence in industry. The authors discuss the challenges faced by businesses in adopting big data analytics and business intelligence, as well as the benefits that can be achieved through these technologies.The paper highlights the importance of data quality, data integration, and data analysis in the big data analytics process. The authors also discuss the various tools and techniques that are commonly used in big data analytics and business intelligence, including data mining, machine learning, and natural language processing. This paper also provides case studies from various industries, including healthcare, finance, and transportation, to demonstrate how big data analytics and business intelligence can be used to improve business processes, customer experiences, and decision-making.

[4]The paper discusses the importance of big data analytics in modern business intelligence systems. The authors explain the concepts of big data, business intelligence, and analytics, and how they can be used to gain insights and improve decision-making processes.The paper also discusses the challenges involved in implementing big data analytics in business intelligence systems, such as data quality, data integration, and data governance. The authors provide solutions and best practices to address these challenges.The paper concludes by emphasizing the

need for businesses to adopt big data analytics in their decision-making processes to stay competitive in today's rapidly changing business landscape.

[5]In this paper, the authors explore the advantages and challenges associated with deploying Big Data Analytics in the cloud for Business Intelligence. The authors highlight the benefits of cloud-based BI solutions, including increased flexibility, scalability, and cost-effectiveness. Companies can access data and analytical tools from anywhere, at any time, and scale their cloud platforms to meet the demands of large volumes of data. Additionally, by leveraging the cloud, businesses can reduce infrastructure costs and make more informed decisions backed by data-driven insights.

However, the authors also emphasize the challenges associated with deploying Big Data Analytics in the cloud. Security concerns arise with data stored on a third-party platform, requiring companies to ensure data protection against unauthorized access, breaches, and cyber-attacks. Technical expertise is required to deploy Big Data Analytics in the cloud, which may not be available in-house, requiring companies to invest in additional training or external expertise. Finally, bandwidth and latency can affect the performance of cloud-based BI solutions, requiring companies to ensure that their network infrastructure can handle the demands of Big Data Analytics in the cloud.

[6]The paper discusses the various components of Big Data Analytics, including data acquisition, storage, processing, analysis, and visualization. The authors also explore the different types of data that can be analyzed using Big Data Analytics, including structured, semi-structured, and unstructured data. By analyzing these different types of data, organizations can gain valuable insights into customer behavior, market trends, and other factors that can impact business performance.

The paper also highlights the challenges associated with deploying Big Data Analytics in organizational decision-making processes, including data quality, data privacy, and data security. The authors suggest that organizations need to develop appropriate data governance policies and establish data management protocols to ensure that the data is accurate, secure, and compliant with relevant regulations. Finally, the authors provide examples of how Big Data Analytics can be used to improve organizational decision-making processes, including customer segmentation, market trend analysis, and predictive analytics.

[7]This research paper examines the importance of Business Intelligence and Analytics (BIA) in the banking industry sector. The paper highlights the potential benefits of BIA in enhancing decision-making processes, reducing operational costs, and improving customer satisfaction. The authors discuss the different components of BIA, including data acquisition, storage, processing, analysis, and visualization, and explore the different types of data that can be analyzed using BIA.

Furthermore, the paper applies the Technology-Organization-Environment (TOE) framework to examine the factors that influence the adoption and usage of BIA in the banking industry. The authors suggest that the adoption and usage of BIA in the banking industry are influenced by technological factors, such as data quality and availability, organizational factors, such as top management support and organizational culture, and environmental factors, such as regulatory compliance and competitive pressure.The paper provides several examples of how BIA can be utilized in the banking industry to improve decision-making processes. The authors also highlight the challenges associated with deploying BIA in the banking industry, including data privacy, security, and regulatory compliance.

[8]In this paper, business intelligence is compared to business intelligence without data mining. First, the concepts of business intelligence (BI) with and without data mining are introduced. Without data mining, business intelligence is just a typical decision support system. A decision system created using the ideas of data warehousing, online analytic processing, and data mining is known as business intelligence with data mining. Second, using information gathered along 10 performance measures, a comparative analysis of BI without DM and BI with DM is carried out. The comparison is performed using a paired sample t-test. The average of all performance indicators after data mining is greater than it was before. In one direction, the mean difference is present.

[9]During the last 20 years, the concept of business intelligence and analytics (BIA), which was first introduced in 1989, has become quite popular in both academia and the IT practitioner community.Technology, methods, procedures, and software used in business intelligence analysis (BIA) are those that (1) evaluate crucial business data and (2) assist an organisation in understanding its market and company.

Business intelligence (BI) is a word that has historically been used to refer to ideas and techniques for enhancing corporate decision-making via the use of fact-based support systems. The underlying infrastructures, tools, databases, applications, and processes are also included in BI. The main goals of BI are to make it possible for users to interact with and access a variety of data easily, to allow for the modification and transformation of that data, and to provide business managers and analysts the tools they need to do the necessary investigations and take action.

[10]Business analytics is a broad term that encompasses all techniques, steps, tools, applications, skills, and organizational frameworks required to analyse historical or present data in order to monitor and forecast company performance. Business analytics is naturally forward-looking and centers its analyses on diagnosis, forecast, and prescription duties, whereas business intelligence was historically more focused on data integration and reporting descriptive analytics Big data is a perfect partner for these activities since only sizable datasets with potentially rich content allow for full decision models to support them. Big data's recent growth has inevitably brought both new opportunities and problems to the field of business analytics.

The submissions to the track also reveal this change. We utilised our track database to analyse the keywords in all papers to the many track iterations that were accessible to us in order to analyse the papers submitted in this track over the years.

[11]Today's business practises across sectors are actually determined by the ongoing transformation in information technology. Yet, the Fourth Industrial Revolution has brought to a blurring of the boundaries between the physical, digital, and biological domains due to the fusion of technology. It increases the value of data and makes it crucial to conducting business (Beltran, 2018). Data has become a company's most valuable intangible property, particularly in the retail sector.

It is said that there is still disconnect between the technology that is now accessible and how businesses use it to boost customer satisfaction and corporate performance. This is where the idea of business analytics enters the picture. The way BA creates BI and how these technologies affect organizational performance have previously been validated by several researchers. Yet, even though several research studies have shown that BA produces BI, the outcomes might vary depending on the circumstances and the place. Moreover, the precise effects of each BA capability on the major performance indicators of marketing, finance, and business process performance are not sufficiently explored in the current studies.

[12] This paper presents a framework that integrates data analytics and business intelligence for stock market trading. The paper proposes a practical framework that consists of several components, including data acquisition, preprocessing, analysis, and visualization. The authors provide a case study that demonstrates how the proposed framework can be used to analyze stock market data and make future investment decisions using the historical stock market of companies, to help the investors in making future trading decisions. The framework proposed the techniques and tools to collect data, transform, store, analyze and present them to the end-user, in this case the investor.

The authors highlight the importance of stock market trading and the challenges associated with processing and analyzing large volumes of financial data. The paper builds upon existing literature in the areas of data analytics, business intelligence, and stock market trading. The authors provide suggestions for future research to address the limitations of the proposed framework, including the need for high-quality data, the complexity of the data analysis process, and the potential for bias in the machine learning models.

[13]The paper begins by introducing the concept of big data analytics and explaining how it is used for business operations and risk management. They then provide an overview of recent developments in this field, including the use of machine learning and artificial intelligence algorithms for predictive analytics and decision-making.

The authors also discuss the challenges and limitations associated with big data analytics, including data quality issues and the need for specialized skills and expertise. They highlight the

importance of developing effective data management strategies and leveraging the latest technologies to overcome these challenges. Finally, the authors provide a set of recommendations for businesses looking to improve their big data analytics capabilities, including investing in training and education for employees, partnering with experts in the field, and adopting a data-driven culture within the organization.

[14]The article "Big Data Analytics and Business Intelligence in Industry" provides a comprehensive study of the use of big data analytics and business intelligence in industry. The authors highlight the importance of these technologies in improving decision-making and enhancing business performance. Big data analytics can help organizations extract valuable insights from large amounts of data, while business intelligence solutions can provide executives with real-time information about the performance of their organization.

The authors discuss the challenges and opportunities associated with implementing big data analytics and business intelligence solutions. They note that organizations face a number of challenges when implementing these solutions, such as the need for skilled professionals and the need to address data quality issues. However, the authors also point out that there are significant opportunities associated with these technologies, such as the ability to extract valuable insights from large amounts of data and improve organizational performance. The authors emphasize the importance of continued research and development in the field of big data analytics and business intelligence to further advance these technologies and overcome the challenges associated with their implementation.

[15]The article aims to explore the potential of big data analytics in the field of marketing. The authors provide a comprehensive study of the existing studies on big data analytics, business intelligence, and marketing mix, and examine the interrelationships between these areas. The authors argue that big data analytics can help companies gain insights into customer behavior, preferences, and needs, which can then be used to optimize their marketing mix strategies.

The authors identify three key areas where big data analytics can be applied to improve business intelligence for marketing: customer segmentation, personalized marketing, and product design. The authors argue that by analyzing large amounts of customer data, companies can identify different customer segments with specific needs and preferences. This can help companies tailor their marketing strategies to each segment, providing a more personalized experience for customers. Additionally, big data analytics can be used to create personalized marketing campaigns that target specific customers with relevant content, increasing the likelihood of conversion.

Ethical Considerations in Business Analytics

As the use of data analytics becomes increasingly widespread in various fields, it raises important ethical considerations that must be addressed. In this section, we will discuss some of the key ethical considerations in data analytics that are relevant to the field.
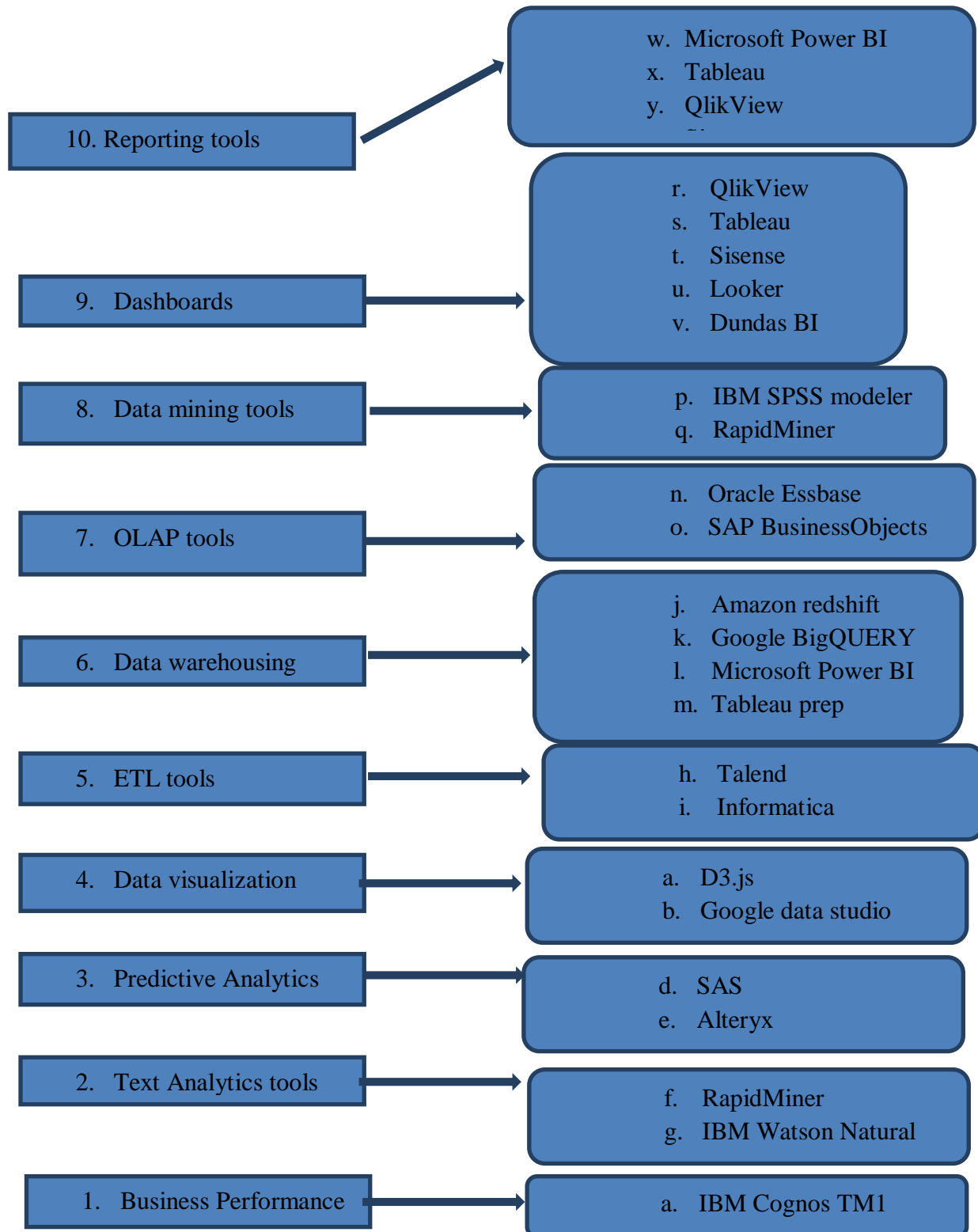
- ❖ **Privacy**: Data analytics often involves collecting and analyzing large amounts of personal and sensitive data. Ethical considerations arise when organizations use this data without obtaining appropriate consent or when they use it for purposes beyond the scope of the original consent. Organisations must ensure that they have appropriate safeguards in place to protect individuals' privacy rights.

- ❖ **Bias**: Data analytics can be subject to bias, which can impact the accuracy and fairness of the insights. Bias can arise from a variety of factors, including sample selection, data collection methods, and algorithm design. Organisations must take steps to identify and mitigate bias in their analytics processes.

- ❖ **Transparency**: Organizations must be transparent about the data they collect, how they use it, and how they make decisions based on it. This transparency enables individuals to understand the data analytics process and make informed decisions about their participation.

- ❖ **Accountability**: Organizations must be accountable for their use of data analytics. This accountability involves being transparent about their analytics processes, responding to requests for information, and accepting responsibility for the outcomes of their decisions.

- ❖ **Security**: Organizations must ensure that they have appropriate safeguards in place to protect data from unauthorized access, use, or disclosure. Data breaches and other security incidents can have serious consequences for individuals and organizations, and must be prevented whenever possible.

- ❖ **Ownership**: Data ownership is a complex issue that can impact the ethical considerations in data analytics. Organisations must ensure that they have appropriate consent and legal rights to use the data they collect and that they are not infringing on the intellectual property rights of others.

- ❖ **Social Responsibility**: Organisations must consider the broader social implications of their use of data analytics. They must take steps to ensure that their analytics processes do not harm individuals or society as a whole and that they contribute to positive outcomes.

Challenges and Limitations of Business Analytics

Business analytics has become a critical function for organisations across industries, as it enables them to derive valuable insights from the vast amounts of data they generate and use it to make informed decisions. However, like any other field, business analytics also faces certain challenges and limitations that must be acknowledged and addressed. In this section, we will discuss some of these challenges and limitations that are relevant to the field of business analytics.

- o **Data Quality**: The accuracy, completeness, and consistency of data can impact the accuracy and reliability of analytics results. Poor data quality can arise from errors during data collection, processing, and storage, which can lead to biased or inaccurate insights.

- o **Data Integration**: Organisations often have data stored in multiple sources such as different databases, legacy systems, and external sources. Integrating this data can be a complex and time-consuming task, and failure to do so effectively can lead to incomplete or inaccurate insights.

- o **Lack of Skilled Professionals**: Business analytics requires a unique skill set that combines statistical analysis, programming, and business knowledge. Organizations often struggle to find professionals with these skills, which can limit their ability to implement effective analytics programs.

- o **Limited Resources**: Business analytics programs require significant investment in terms of technology, data infrastructure, and human resources. Organizations with limited resources may struggle to implement effective analytics programs.

- o **Ethical and Legal Issues**: Business analytics involves collecting and analyzing personal and sensitive data, which can raise ethical and legal concerns related to privacy, security, and data ownership. Organizations must ensure that they comply with all relevant regulations and ethical standards.

- o **Overreliance on Analytics**: While analytics can provide valuable insights, organisations must also consider other factors, such as intuition and judgment, when making decisions. Overreliance on analytics can lead to ignoring important information that may not be captured by data.

- o **Limited Predictive Power**: Analytics can provide predictions based on historical data, but it may not always be accurate for the future. Unexpected events, changes in the market, and other external factors can impact the accuracy and reliability of predictions.

Taxonomy of the tools

10. Reporting tools
- w. Microsoft Power BI
- x. Tableau
- y. QlikView

9. Dashboards
- r. QlikView
- s. Tableau
- t. Sisense
- u. Looker
- v. Dundas BI

8. Data mining tools
- p. IBM SPSS modeler
- q. RapidMiner

7. OLAP tools
- n. Oracle Essbase
- o. SAP BusinessObjects

6. Data warehousing
- j. Amazon redshift
- k. Google BigQUERY
- l. Microsoft Power BI
- m. Tableau prep

5. ETL tools
- h. Talend
- i. Informatica

4. Data visualization
- a. D3.js
- b. Google data studio

3. Predictive Analytics
- d. SAS
- e. Alteryx

2. Text Analytics tools
- f. RapidMiner
- g. IBM Watson Natural

1. Business Performance
- a. IBM Cognos TM1

Tools used in Business Intelligence:

1) Microsoft Power BI:

Microsoft's Power BI is a suite of cloud-based business intelligence services designed to convert raw data into valuable insights by utilizing intuitive visualizations and tables. This tool offers a user-friendly interface with impressive drag-and-drop features and self-service capabilities, enabling users to analyze data and make informed business decisions.

Power BI consists of various data visualization and business intelligence tools, including software services, apps, and data connectors. With Power BI, users can import datasets and generate shareable reports, dashboards, and apps for data visualization and analysis. It is flexible enough to be deployed on both on-premise and on-cloud platforms.
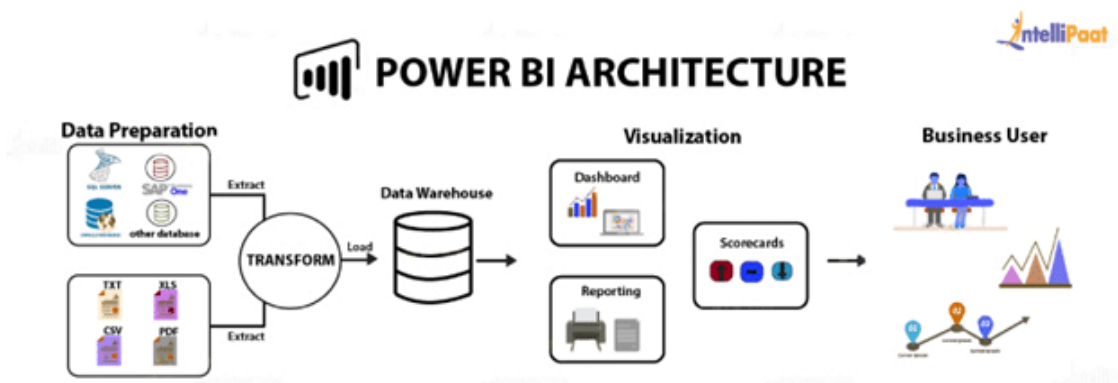
Fig1.1: Architecture of Power BI[16]

Key Features of Power BI:

1) Data Connectivity: Power BI has a vast data connectivity feature that can connect to over 100 data sources, including cloud-based data sources such as Azure, Google Analytics, and Salesforce. Power BI also has a feature called Power Query that allows users to connect to various data sources and transform data into a usable format.
2) Data Modeling: Power BI has a user-friendly data modeling feature that allows users to create data models with drag-and-drop functionality. Power BI also supports data modeling with DirectQuery and Live Connection for real-time data analysis.
3) Visualization: Power BI provides users with a broad range of visualization options, including custom visuals and the ability to integrate third-party visuals. Power BI's Smart Visualizations feature automatically creates visualizations based on the data imported, making data exploration and analysis easier.
4) Natural Language Querying: Power BI's Q&A feature is powered by natural language processing and machine learning algorithms, allowing users to ask questions in natural

language and receive answers in the form of visualizations. Users can also type in a question and receive a response without having to create visualization.

5) <u>Collaboration</u>: Power BI allows users to collaborate and share reports and dashboards with their team members and stakeholders with ease. Users can share reports through email, publish them to the Power BI service, and embed them into websites or SharePoint sites.

6) <u>Customization</u>: Power BI provides users with the ability to customize reports and dashboards with several options such as custom visuals, color themes, and templates. Users can also create custom measures and calculations using the DAX language.

7) <u>Mobile Access</u>: Power BI has mobile apps for iOS, Android, and Windows devices, allowing users to access their reports and dashboards on the go. The mobile apps have a user-friendly interface that provides a seamless user experience.

8) <u>Data Security</u>: Power BI has built-in security features, including role-based access control and data encryption, to ensure that sensitive data is protected. Power BI also complies with various industry standards, such as SOC 1, SOC 2, and ISO 27001.

9) <u>Integration with other Microsoft Products</u>: Power BI seamlessly integrates with other Microsoft products, such as Excel, SharePoint, and Teams. Users can import data from Excel and use it to create reports and dashboards in Power BI. They can also publish their Power BI reports to SharePoint and embed them in Microsoft Teams.

10) <u>AI-Powered Insights</u>: Power BI's AI-powered insights feature uses machine learning algorithms to automatically identify trends, anomalies, and outliers in data. Power BI also has a feature called Quick Insights that automatically creates insights based on the data imported, making it easier for users to gain insights from their data.

<u>Limitations of Power BI</u>:

➤ Limited Data Capacity
➤ Limited Customization Options
➤ Lack of Advanced Analytics
➤ High Learning Curve
➤ Limited Integration with Non-Microsoft Tools
➤ Limited Security Options

In this review article, we triedPower BI and obtained few results that showcase its capabilities. Specifically, we have included three figures that demonstrate how the application performs when using a sample dataset.

Figure 1.2: This sample image of a report in Power BI showcases the platform's user-friendly interface and the ability to generate insightful reports easily.

Figure 1.3: This sample data loading image in Power BI highlights the software's seamless integration with various data sources, enabling users to quickly access and analyze data.

Figure 1.4: This sample data visualization in Power BI illustrates the software's interactive and visually appealing features, allowing users to gain insights from their data easily.
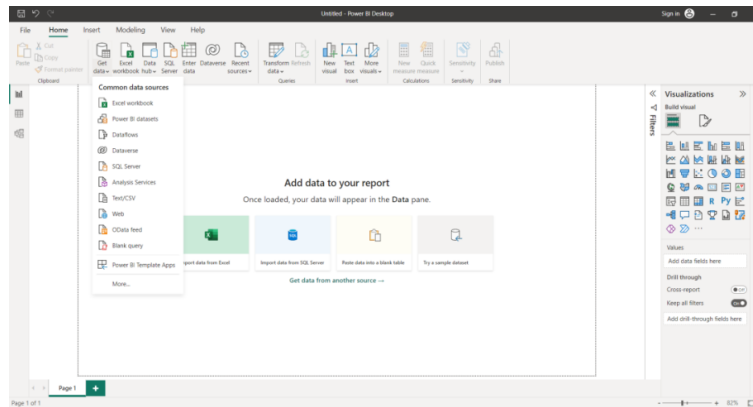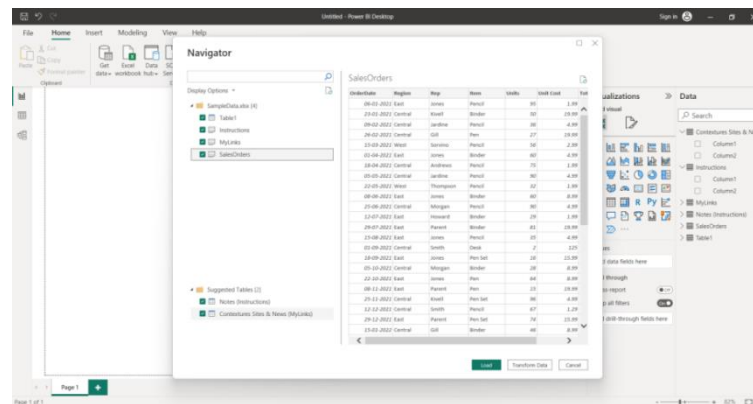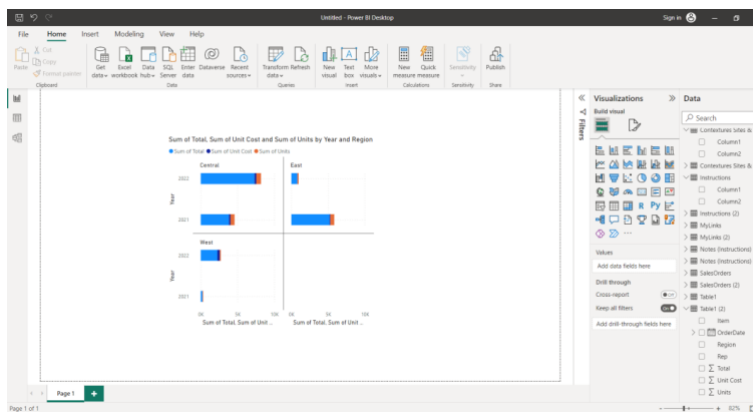

Fig1.2: Sample image report

Fig1.3: Data Extraction

Fig1.4: Data Visualization

2) Tableau:

Tableau is a widely-used Business Intelligence tool that enables users to visually analyze data with ease. It is renowned for its ability to create interactive, shareable dashboards that can accurately depict trends, variations, and densities of data through graphs and charts. Tableau can connect with various data sources, including files, relational databases, and Big Data sources, to extract and process data seamlessly. One of the unique features of Tableau is its ability to perform data blending, allowing users to combine data from multiple sources into a single visualization.

Many businesses use it for reporting, analyzing customer data, and understanding market trends. Academic researchers use Tableau to analyze research data, while government organizations use it for analyzing public data, such as census data. It is a powerful tool that can provide insights into complex data sets, empowering businesses and organizations to make informed decisions based on data-driven analysis.
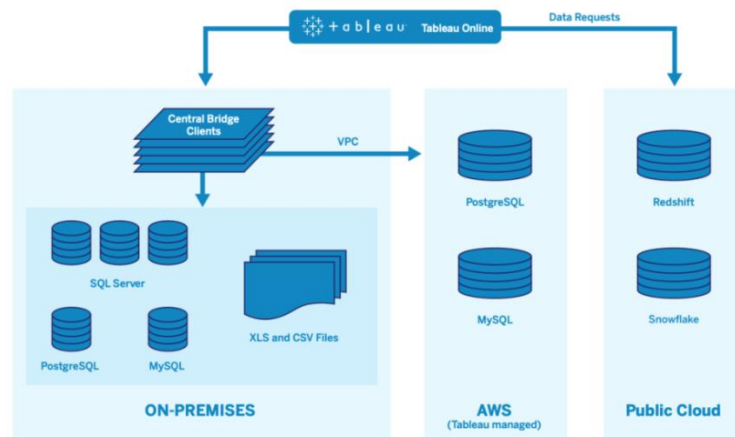

Fig2.1: Architecture of Tableau [17]

Key Features of Tableau:

1) Data Connection: Tableau has a wide range of data connections available, from simple spreadsheets to cloud-based data sources such as Amazon Web Services and Microsoft Azure. This allows users to easily connect and access their data, regardless of where it is stored.
2) Drag and Drop Interface: Tableau's drag-and-drop interface is intuitive and user-friendly, making it easy for users to create visualizations quickly. Users can simply drag and drop data fields onto the visualization canvas to create charts, graphs, and other visualizations.
3) Data Blending: Tableau's data blending feature allows users to combine data from multiple sources into a single visualization. This is useful when working with data that is stored in different systems or in different formats. With data blending, users can create more powerful and insightful visualizations.

4) <u>Real-Time Collaboration</u>: Tableau's real-time collaboration features enable teams to work together seamlessly. Multiple users can work on the same project simultaneously, with changes appearing in real-time. This allows teams to collaborate more effectively and produce better results.

5) <u>Interactive Dashboards</u>: Tableau's interactive dashboards enable users to explore data and drill down into specific areas of interest. Users can interact with the data in real-time, changing filters and adjusting parameters to see the impact on the visualizations.

6) <u>Mapping Capabilities</u>: Tableau's mapping capabilities allow users to create location-based visualizations, enabling them to analyze data by geographic region. Users can create maps that display data points by location, or create heat maps that show the density of data in different areas.

7) <u>Predictive Analytics</u>: Tableau supports advanced analytics and predictive modeling, enabling users to gain deeper insights into their data. With predictive analytics, users can identify trends and patterns in their data, and make predictions about future outcomes.

8) <u>Mobile Compatibility</u>: Tableau is designed to be mobile-friendly, allowing users to access and interact with their data on the go. Users can view and interact with dashboards on their mobile devices, and receive automatic updates when new data is available.

9) <u>Data Storytelling</u>: Tableau's data storytelling feature allows users to create compelling narratives around their data, helping to communicate insights to others in an engaging and impactful way. Users can create a storyline around their data, using visualizations to support their narrative and help others understand the insights they have uncovered.

Limitations of Tableau:

- ➢ Limited data processing capabilities
- ➢ Limited customization options
- ➢ High cost
- ➢ Performance issues with large datasets
- ➢ Limited support for real-time data
- ➢ Poor After-Sales Support
- ➢ Poor BI Capabilities & Poor Versioning

In this review article, we tested Tableau's capabilities and present our findings through three figures, each showcasing the application's performance when analyzing a sample dataset.

Figure 2.2: This basic view of a workbook in Tableau showcases the platform's user-friendly interface, allowing users to easily organize and access their data.

Figure 2.3: This image illustrates the connectors and servers for data integration in Tableau, providing users with a seamless process for accessing and analyzing their data.
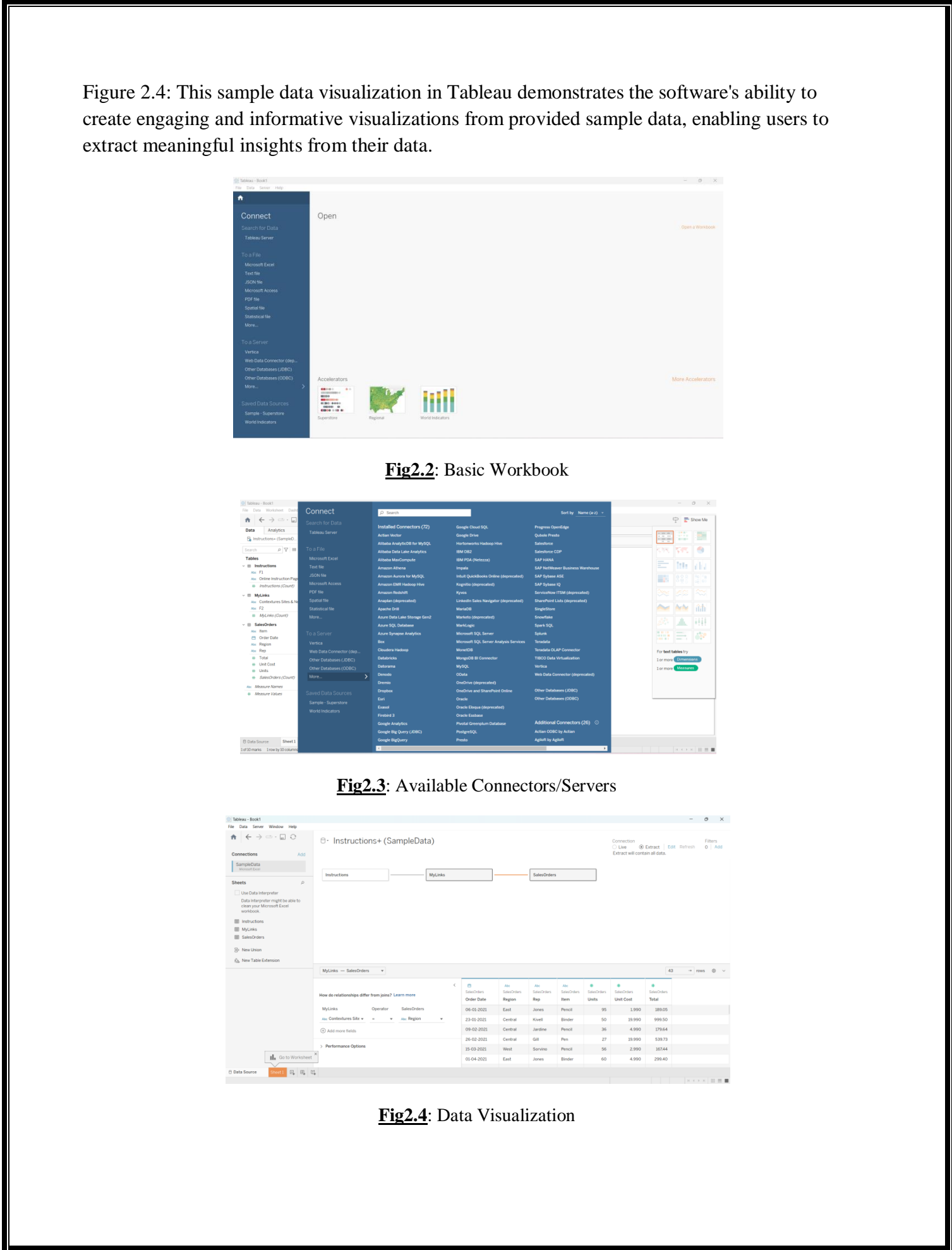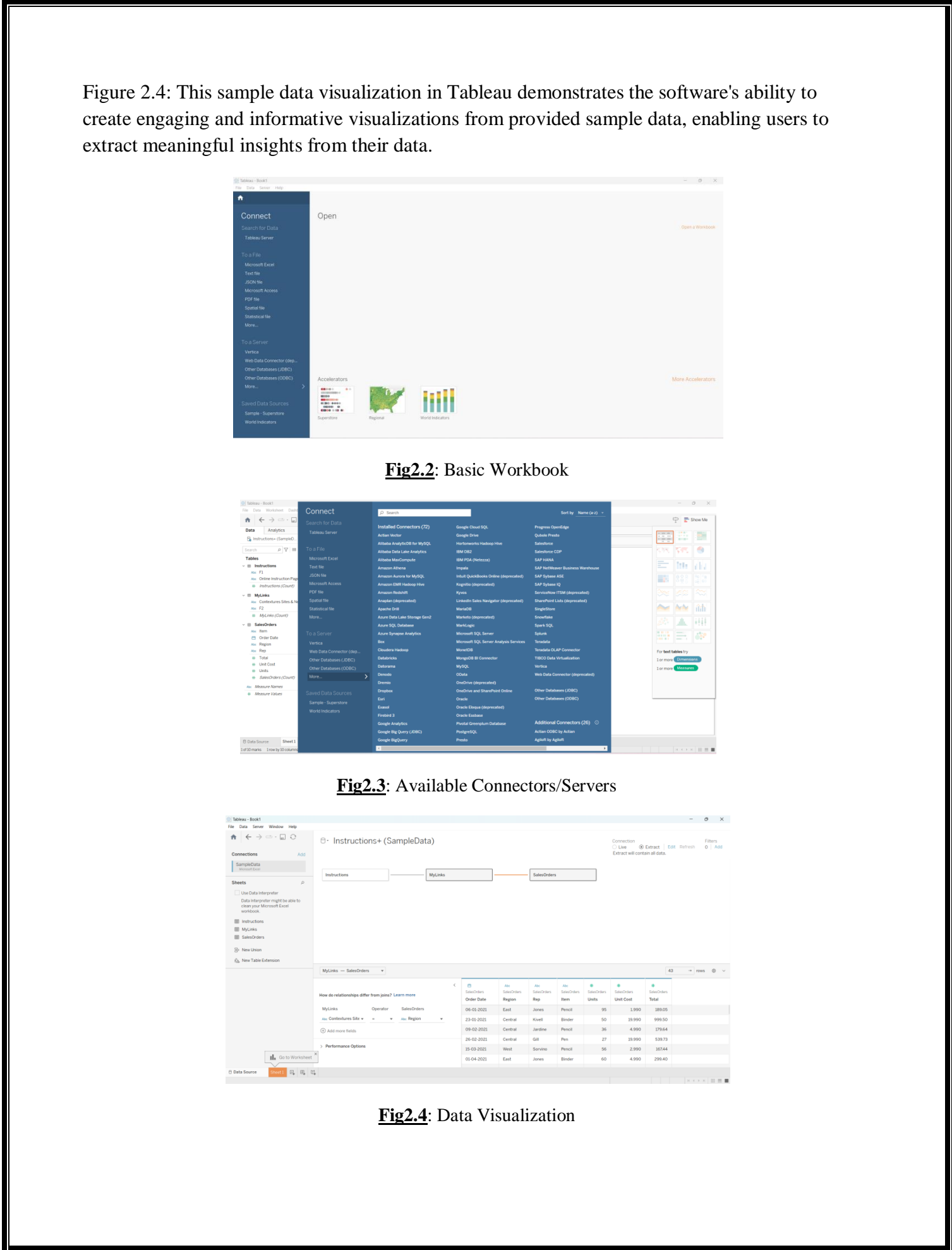
Figure 2.4: This sample data visualization in Tableau demonstrates the software's ability to create engaging and informative visualizations from provided sample data, enabling users to extract meaningful insights from their data.

Fig2.2: Basic Workbook

Fig2.3: Available Connectors/Servers

Fig2.4: Data Visualization

3) QlikSense:

QlikSense is a powerful data analytics and visualization software developed by Qlik. It allows users to easily create interactive and dynamic dashboards, reports, and visualizations that enable them to gain insights from their data. QlikSense uses a patented in-memory data indexing technology that allows for lightning-fast data retrieval and processing. It can handle a wide variety of data sources, from spreadsheets and databases to cloud-based data warehouses and big data platforms.

With QlikSense, users can explore their data in a self-service manner, without relying on IT or data analysts to run queries or build reports. The software offers a user-friendly drag-and-drop interface that enables users to create customized visualizations, charts, and graphs, as well as the ability to share and collaborate on their findings with others in real-time.
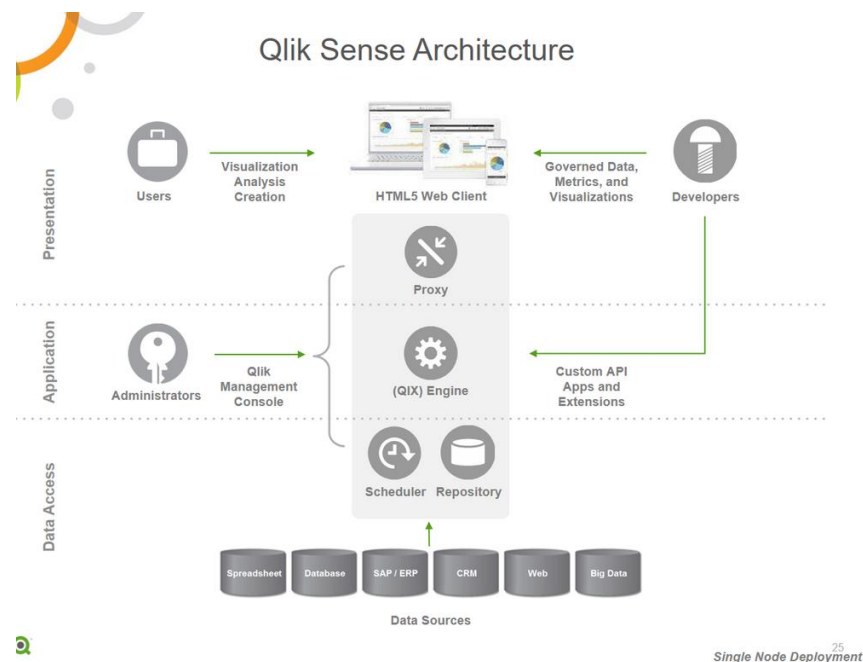

Fig3.1: Architecture of QlikSense [18]

Key Features of QlikSense:

1) Self-Service Data Exploration: QlikSense allows users to easily explore and analyze their data using a drag-and-drop interface. Users can quickly create custom visualizations and dashboards without relying on IT or data analysts.
2) Associative Data Model: QlikSense uses an associative data model that allows users to explore data from any angle. The software automatically creates associations between data points, enabling users to quickly identify relationships and patterns.

3) <u>In-memory Data Indexing</u>: QlikSense uses an in-memory data indexing technology that enables fast data retrieval and processing. This allows users to interact with large datasets in real-time.
4) <u>Data Connectivity</u>: QlikSense can connect to a wide range of data sources, including spreadsheets, databases, cloud-based data warehouses, and big data platforms.
5) <u>Collaboration</u>: QlikSense allows users to share their insights and collaborate with others in real-time. Users can share visualizations, charts, and dashboards with others, and receive feedback and comments.
6) <u>Mobile Access</u>: QlikSense is optimized for mobile devices, allowing users to access their data and insights from anywhere.
7) <u>Security</u>: QlikSense provides enterprise-level security features, including role-based access control, data encryption, and multi-factor authentication.
8) <u>Customization</u>: QlikSense offers a high degree of customization, allowing users to tailor their visualizations and dashboards to their specific needs.
9) <u>Natural language Search</u>: QlikSense includes a natural language search feature that allows users to type in questions in plain English and receive answers in the form of charts and visualizations.
10) <u>App Integration</u>: QlikSense can be integrated with other applications, including Salesforce, Microsoft Dynamics, and SAP, allowing users to access data from multiple sources within a single interface.

<u>Limitations of QlikSense:</u>

- ➢ Steep learning curve
- ➢ Limited support for complex data transformations
- ➢ High cost for enterprise-level features
- ➢ Limited scalability
- ➢ Lack of built-in predictive analytics features
- ➢ Limited support for real-time data streaming

In this review article, we tested QlikSense's capabilities and presented our findings through three figures, each showcasing the application's performance when analyzing a sample dataset.

Figure 3.2: This image depicts the basic home page view of QlikSense, including its user-friendly guide for beginners, providing an easy-to-navigate platform for data analysis.

Figure 3.3: This visualization of a sample dataset in QlikSense showcases its ability to select and analyze specific features, enabling users to gain meaningful insights from their data.

Figure 3.4: This image displays the analyses offered by the "Insight Adviser" feature in QlikSense, available for premium accounts only, providing advanced data analysis capabilities for more in-depth insights.
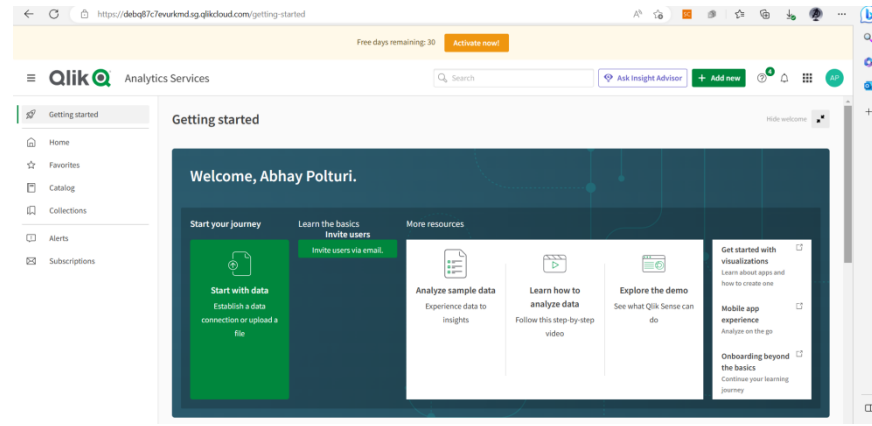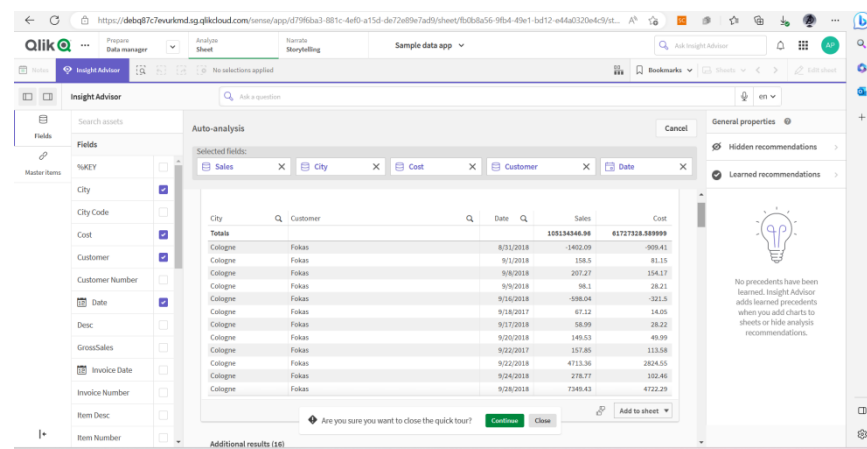

Fig3.2: User-friendly Home Page
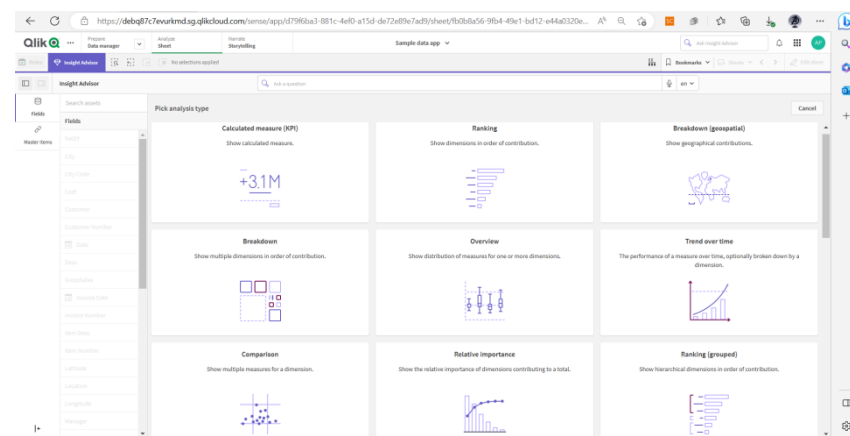

Fig3.3: Feature Selection

Fig3.4: Data Visualization Insights

4) Dundas BI:

Dundas BI is a business intelligence (BI) and data analytics platform that enables organizations to quickly and easily visualize and analyze their data. It provides a complete set of tools for building interactive dashboards, reports, and analytics applications that can be accessed on any device.The platform is designed to be highly customizable, allowing users to create tailored visualizations that match their specific business needs. It features an intuitive drag-and-drop interface, making it easy for users to create and modify dashboards without requiring programming knowledge.

Dundas BI also includes a wide range of data connectors and integrations with other data sources, making it easy to connect to various data sources such as databases, spreadsheets, and cloud services. Additionally, the platform includes a robust security framework and governance features, ensuring that sensitive data is protected and compliant with relevant regulations.
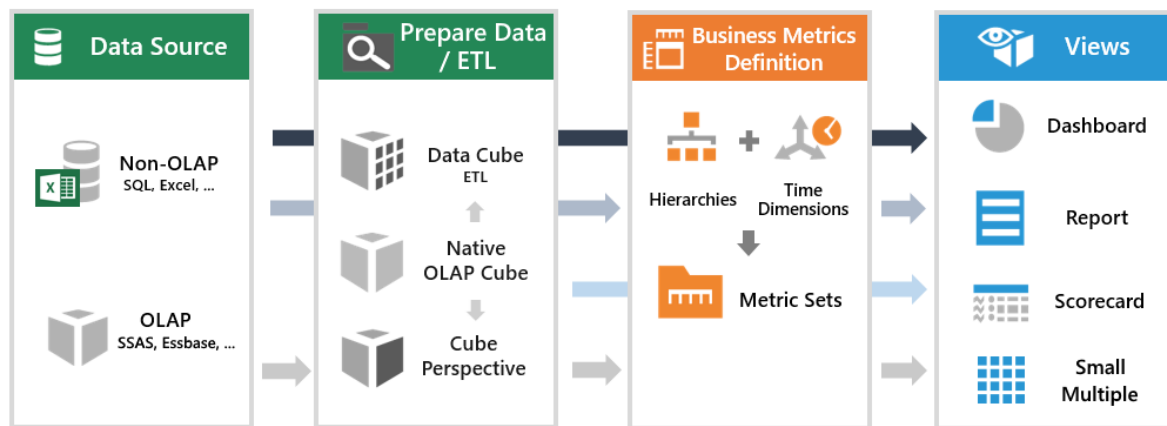

Fig4.1: Architecture of Dundas BI [19]

Key Features of Dundas BI:

1) Flexible Dashboard Design - Dundas BI's drag-and-drop interface allows users to quickly create and modify dashboards to match their specific business needs. It also includes a variety of pre-built templates and visualizations for faster dashboard creation.
2) Customizable Visualizations - Dundas BI allows for highly customizable visualizations, including the ability to create custom charts, graphs, and maps. Users can also add interactivity and drill-down capabilities to their visualizations.
3) Data Integration - Dundas BI supports a wide range of data sources, including databases, spreadsheets, and cloud services. It also includes connectors to popular business applications like Salesforce, SharePoint, and SAP.
4) Ad-Hoc Reporting - Dundas BI's ad-hoc reporting capabilities enable users to quickly create custom reports and data sets without requiring IT or programming support.

5) Data Analytics - Dundas BI includes advanced analytics capabilities such as predictive modeling, data mining, and machine learning. This allows users to gain deeper insights into their data and identify patterns and trends.
6) Mobile Access - Dundas BI provides mobile access to dashboards and reports, allowing users to access their data from anywhere, at any time.
7) Collaboration - Dundas BI includes collaboration features that allow users to share insights and work together on data analysis in real-time. Users can also create and share notes and annotations within dashboards.
8) Security - Dundas BI includes a robust security framework that provides granular control over access to data and features. It also includes support for data governance and compliance with relevant regulations.
9) APIs and Embedding - Dundas BI includes APIs that allow for easy integration with other applications and the ability to embed dashboards and visualizations within other applications.
10) Scalability - Dundas BI is highly scalable, making it suitable for organizations of all sizes. It includes features such as load balancing and caching to ensure optimal performance, even with large datasets and high user volumes.

Limitations of Dundas BI:

- ➢ Steep learning curve
- ➢ Limited support for complex data transformations
- ➢ High cost for enterprise-level features
- ➢ Limited scalability
- ➢ Lack of built-in predictive analytics features
- ➢ Limited support for real-time data streaming

In this review article, we were only able to access the trial version of Dundas BI and were unable to provide sample data or screenshots of the full tool as it requires a premium paid account and an active subscription to access all features. Nonetheless, we were able to explore the trial version of Dundas BI and provide an overview of its key features and capabilities.

Figure 4.2: The start page of the Dundas BI trial provides a user-friendly interface for quick and easy setup. The page offers a step-by-step guide, enabling users to quickly connect their data sources and begin analyzing their data.

Figure 4.3: The analyze page of the Dundas BI trial offers powerful data analysis capabilities, allowing users to explore and analyze their data in real-time. The page provides various data visualization tools, such as charts, graphs, and tables, enabling users to create meaningful and informative data reports.

Figure 4.4: The create dashboard page of the Dundas BI trial offers an intuitive interface for creating visually appealing and interactive dashboards. Users can easily drag and drop widgets to create customized dashboards that suit their specific data analysis needs.

Figure 4.5: The interaction page of the Dundas BI trial provides users with interactive data exploration capabilities. The page enables users to drill down into their data and gain deeper insights through advanced data visualization and exploration tools. Additionally, users can collaborate and share their insights with team members for improved decision-making.
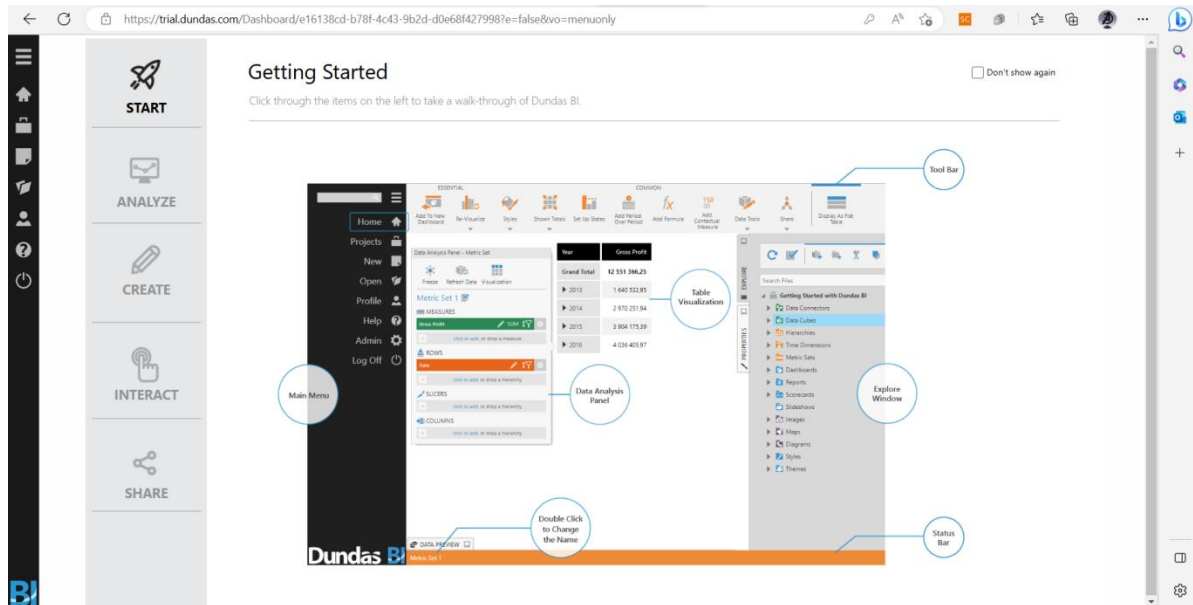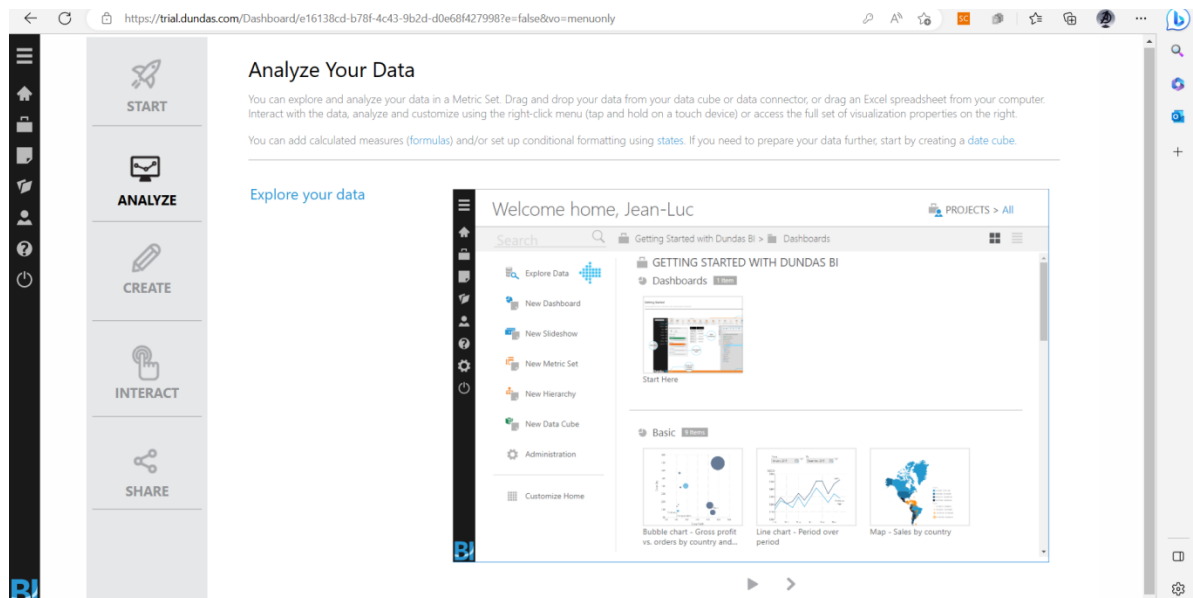

Fig4.2: Start Page
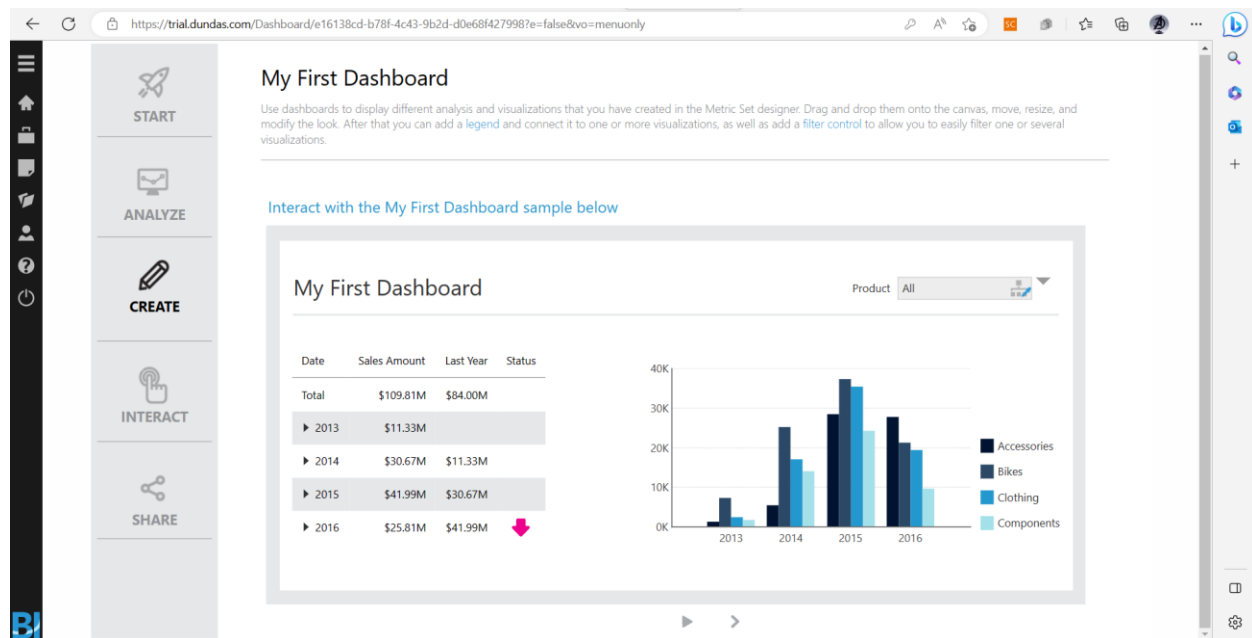

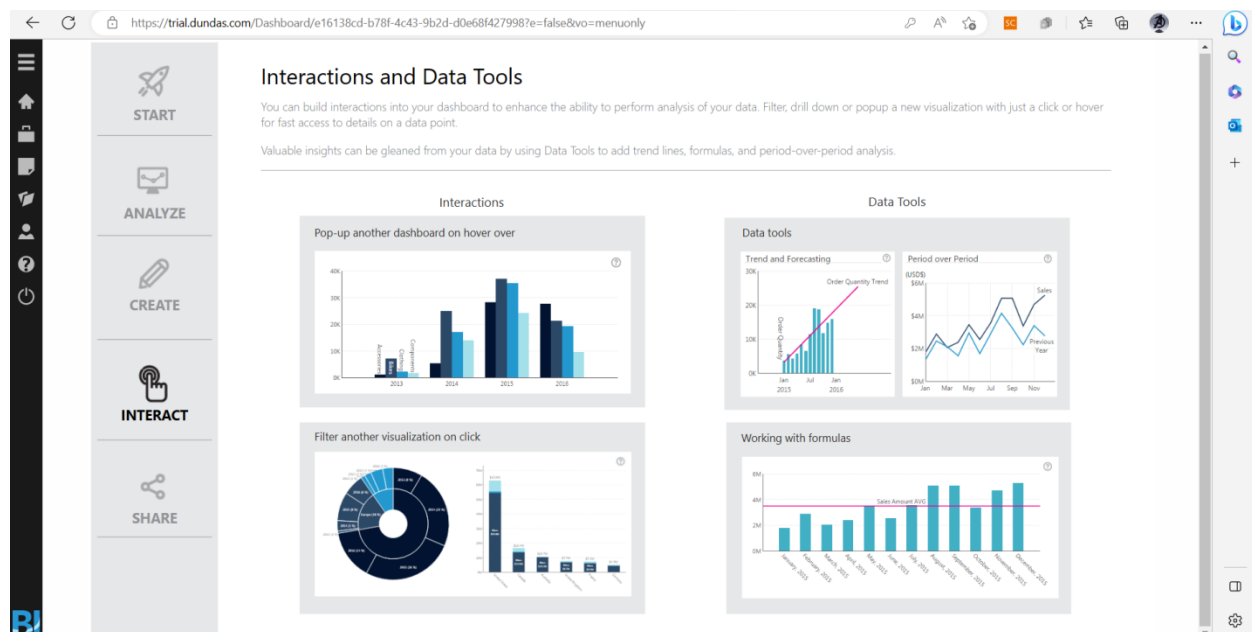**Fig4.3**: Analysis Page

Fig4.4: Creating Dashboards

Fig4.5: Data Visualization & Dashboard Interaction

5) Sisense:

Sisense is a business intelligence platform that enables businesses of all sizes to analyze and visualize complex data sets. It offers a range of tools and features, including data preparation, analytics, visualization, and reporting, that allow users to gain insights and make informed decisions based on their data. Sisense is known for its ease of use and its ability to handle large and disparate data sets, making it a popular choice for companies that need to work with complex data. Its platform is widely used in various industries, including finance, healthcare, retail, and manufacturing.

Sisense has established itself as a leading player in the BI market. Its platform offers a range of benefits, including data integration from various sources, advanced analytics capabilities, and customizable data visualization. Additionally, Sisense is highly scalable, making it suitable for businesses of all sizes, and it offers robust security features that allow users to control access to data and features.
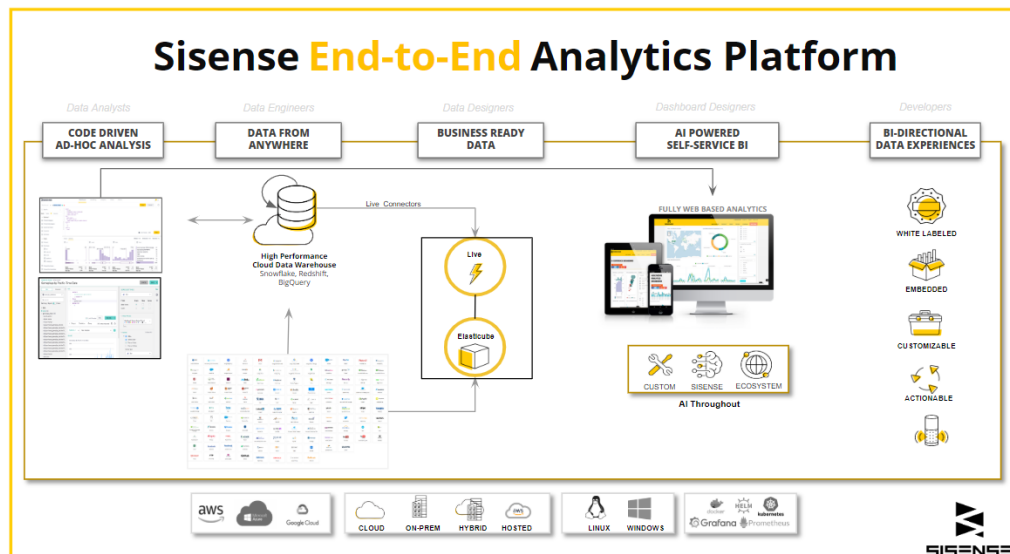
Fig4.1: Architecture of Sisense [20]

Key Features of Sisense:

1) Data Integration: Sisense allows businesses to connect and integrate data from a wide range of sources, including databases, spreadsheets, and cloud services. This enables users to work with all their data in one place.
2) Elastic Data Modeling: Sisense's Elastic Data Modeling technology enables users to quickly and easily prepare data for analysis, without requiring extensive coding or IT support.

3) <u>Advanced Analytics</u>: Sisense offers advanced analytics capabilities, such as predictive modeling, data mining, and machine learning, allowing users to gain deeper insights into their data.

4) <u>Customizable Dashboards</u>: Sisense provides a range of customizable dashboards and visualizations, allowing users to create and share insights tailored to their specific needs.

5) <u>Collaboration</u>: Sisense includes collaboration features that enable users to share insights and work together on data analysis in real-time.

6) <u>Mobile Access</u>: Sisense offers mobile access to dashboards and reports, allowing users to access their data from anywhere, at any time.

7) <u>Scalability</u>: Sisense is highly scalable, making it suitable for businesses of all sizes. Its technology is designed to handle large and complex data sets.

8) <u>Security</u>: Sisense provides a robust security framework that offers granular control over access to data and features, ensuring that sensitive data is protected.

9) <u>APIs and Embedding</u>: Sisense offers APIs that allow for easy integration with other applications, and the ability to embed dashboards and visualizations within other applications.

10) <u>Customer Support</u>: Sisense provides comprehensive customer support, including online resources, forums, and dedicated account managers, to help businesses get the most out of their data.

Limitations of Sisense:

- ➢ Steep Learning Curve
- ➢ Limited Data Visualization Options
- ➢ Limited Native Integration
- ➢ Limited Data Cleansing Features
- ➢ Limited Native Machine Learning Capabilities
- ➢ Limited Support for Big Data
- ➢ Limited Geospatial Analytics
- ➢ Limited Mobile Functionality

As we did not have access to Sisense or its trial version, we are unable to provide screenshots or analysis of the tool's features. However, we have included a sample figure (Fig5.2) of a Sisense data visualization dashboard for reference. This dashboard showcases Sisense's ability to provide visually appealing and informative data representations, allowing users to gain insights and make informed decisions based on their data.
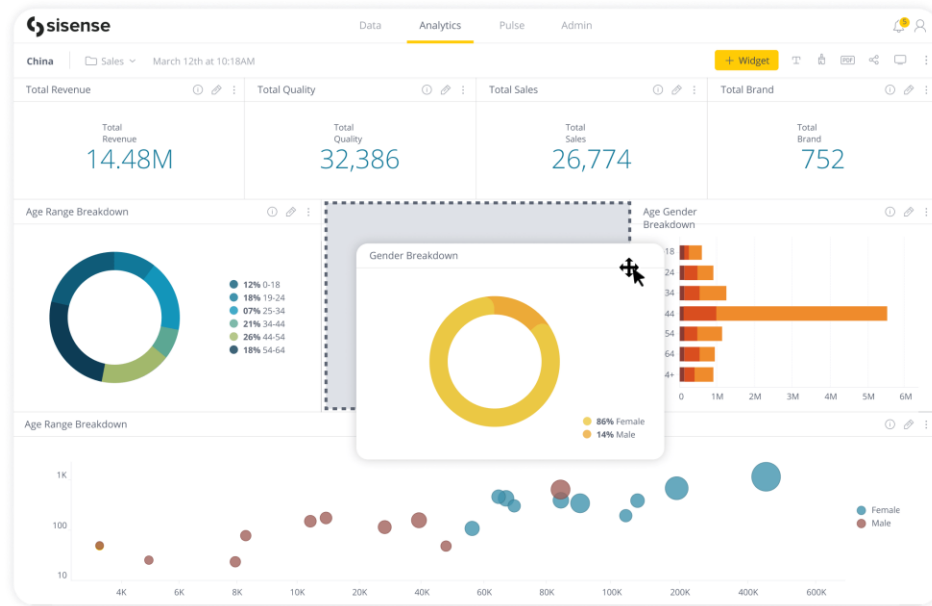
Fig5.2: Data Visualization [21]

6) Looker:

Looker is a cloud-based business intelligence platform that helps businesses gain real-time insights into their data. It allows users to connect and analyze data from various sources, including databases, spreadsheets, and cloud services. With Looker, businesses can easily create reports, dashboards, and visualizations to help them make data-driven decisions.

One of Looker's standout features is its user-friendly interface and its ability to handle complex data modeling and analysis tasks. The platform is flexible and customizable, making it suitable for businesses of all sizes and industries. Looker also offers a range of integrations and plugins, making it easy for businesses to connect to their existing tools and data sources.
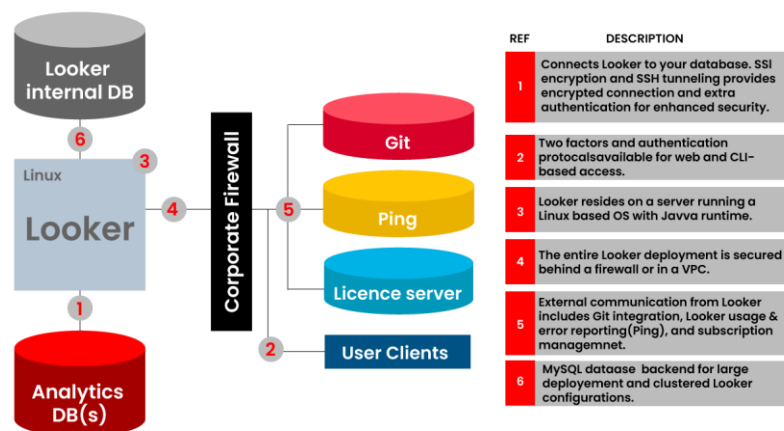
Fig5.1: Architecture of Looker [22]

Key Features of Looker:

1) <u>Data Modeling and Analysis</u>: Looker provides powerful data modeling and analysis tools that allow users to easily create and modify data models, perform complex calculations, and generate insights.
2) <u>Real-Time Data Exploration</u>: Looker enables users to explore and analyze data in real-time, allowing businesses to make timely and informed decisions.
3) <u>Customizable Dashboards and Reports</u>: Looker provides users with the ability to create custom dashboards and reports, allowing businesses to easily visualize and communicate their data insights.
4) <u>Automated Data Refresh</u>: Looker automates the data refresh process, ensuring that users always have access to the most up-to-date data.
5) <u>Data Collaboration and Sharing</u>: Looker provides robust collaboration and sharing features, allowing users to easily share insights and collaborate on data analysis projects.
6) <u>Predictive Analytics</u>: Looker offers advanced predictive analytics capabilities, including machine learning and AI algorithms, enabling businesses to make more accurate predictions and forecasts.
7) <u>Mobile-Friendly Interface</u>: Looker's mobile-friendly interface allows users to access and analyze data from any device, making it easy to work on-the-go.
8) <u>Integration with Third-Party Tools</u>: Looker integrates with a wide range of third-party tools and platforms, including Salesforce, Google Analytics, and Amazon Web Services, making it easy to connect to existing data sources.
9) <u>Data Security and Governance</u>: Looker offers robust data security and governance features, ensuring that businesses can maintain data privacy and compliance.
10) <u>Customer Support and Training</u>: Looker provides comprehensive customer support and training resources, including online courses and webinars, helping users get the most out of the platform.

Limitations of Looker:

- ➤ Cost
- ➤ Steep Learning Curve
- ➤ Limited Visualization Options
- ➤ Data Source Limitations
- ➤ Limited Data Size
- ➤ Limited Integration, Collaboration & Customization
- ➤ Dependence on SQL
- ➤ Limited API

As we do not have access to Looker or its trial version, we cannot provide screenshots or analysis of the tool's features. However, it is known for its ability to create interactive and dynamic data visualizations, providing users with the ability to gain insights and make informed decisions based on their data. Figure6.2 here is a sample image of its Data Visualization feature

Fig6.2: Data Visualization [23]

Case Studies of Tools in BI:

1) Power BI:

CASE STUDY-I: **Walmart pvt. Ltd.** [24] [25]

Walmart has not publicly released any case studies on their use of Microsoft Power BI, they are known to use the tool for their data analytics and business intelligence needs. Based on reports and articles, this is what can be figured.

Company Background:

Walmart is one of the world's largest retail corporations, headquartered in Bentonville, Arkansas, USA. The company was founded in 1962 by Sam Walton and has since grown into a global retail giant, operating over 11,000 stores in 27 countries under various banners, including Walmart, Sam's Club, and Flipkart. Walmart is known for offering a wide range of products at competitive prices, including groceries, electronics, apparel, and household goods. However, the company has also taken steps to address these concerns, such as increasing wages for its workers and investing in renewable energy.

Business Problem:

Walmart faces a significant challenge of managing and analyzing a vast amount of data generated from its sales operations, customer interactions, and inventory management. The company needs to make sense of this data to make informed decisions that drive its overall performance. Walmart needs to optimize inventory levels across its thousands of stores, warehouses, and distribution centers, while keeping track of seasonal trends, market demand, and supplier performance. The analysis of this data can provide valuable insights that help optimize product offerings, pricing, promotions, and customer service. Furthermore, Walmart needs to track its sales data, which is a critical component of its business operations. Sales data analysis can reveal which products are selling well, which stores are most profitable, and which marketing campaigns are most effective. By understanding the performance of its sales, Walmart can optimize its product offerings, marketing strategies, and overall revenue generation.

Solution:

Walmart could potentially use Microsoft Power BI to analyze their data. They would first integrate their data sources, which could include sales data from their point-of-sale (POS) system, customer data from their loyalty program, and inventory data from their supply chain system. This would allow them to get a complete view of their business operations.

They could then create a series of dashboards and reports using Power BI to visualize their data. Some of the key metrics they could focus on could include sales by store, product category, and

customer demographics. They could also analyze their sales trends over time, including seasonal patterns and any changes in customer behavior.

Results:

Using Power BI, Walmart could gain valuable insights into their business operations, enabling them to make data-driven decisions and improve their performance. They could potentially identify areas where they could improve their inventory management, optimize their pricing strategy, and target their marketing efforts more effectively.

CASE STUDY-II: **Coca-cola** [26] [27]

Company Background:

Coca-Cola is a global beverage company that produces a wide range of products, including carbonated soft drinks, bottled water, juice, and sports drinks. The company operates in more than 200 countries and has a market cap of over $250 billion. Coca-Cola, one of the world's largest beverage companies, uses Microsoft Power BI to analyze and visualize their data, gaining insights that help them make informed business decisions and drive growth.

Business Problem:

The massive amounts of data generated by Coca-Cola come from diverse sources, including point-of-sale systems, production lines, warehouses, distribution centers, and online and offline customer engagement. To make sense of this data and gain valuable insights, the company needs to consolidate and integrate it, which can be a challenging task due to the data's variety, volume, and complexity.

Coca-Cola needs to analyze its data to identify trends, patterns, and opportunities that can improve its business processes, customer experiences, and bottom line. For instance, sales data analysis can reveal which products are selling well, which markets are profitable, and which promotions are most effective. Customer data analysis can help understand their preferences, needs, and behavior, and optimize engagement strategies. Supply chain data analysis can improve inventory management, reduce waste, and minimize delivery times.

Solution:

Coca-Cola is using Microsoft Power BI to gain insights into their data. They have integrated their data sources, which include sales data from their point-of-sale (POS) system, customer data from their loyalty program, and supply chain data from their logistics systems. This allows them to get a complete view of their business operations. They have created a series of dashboards and reports using Power BI to visualize their data. Some of the key metrics they focus on include sales by product, sales by region, and customer demographics. They also use Power BI to

analyze their sales trends over time, including seasonal patterns and any changes in consumer behavior.

Results:

Using Power BI, Coca-Cola has gained valuable insights into their business operations. They have identified areas where they can optimize their supply chain, streamline their product offerings, and target their marketing efforts more effectively. For example, they have used Power BI to identify which products are selling well in which regions, allowing them to adjust their marketing strategies accordingly.

Coca-Cola has also used Power BI to improve their sales forecasting, enabling them to better predict demand for their products and adjust their production accordingly. This has helped them to reduce waste and improve their overall efficiency.

CASE STUDY-III:**Centrica** [28]

Company Background:

Centrica is a British multinational energy and services company that provides energy solutions to homes and businesses. The company operates in multiple countries and has a workforce of over 25,000 employees. As a large energy provider, Centrica generates a vast amount of data from various sources, including smart meters, customer feedback, and service data.

Business Problem:

Centrica faced several challenges in managing and analyzing its data. The company needed a way to integrate data from different sources, visualize it, and gain insights that could help it optimize its business processes, improve customer experiences, and drive growth. The company also needed to ensure that its data was accurate, timely, and secure.

Solution:

To overcome these challenges, Centrica implemented Power BI. The company created a centralized data platform that integrated data from various sources, providing a single source of truth for all users. The platform was designed to ensure that the data was accurate, timely, and secure.

Centrica used Power BI to create a series of dashboards and reports that visualized its data, enabling users to gain insights quickly and efficiently. The dashboards provided real-time insights into the company's energy usage, customer feedback, and service data. The reports were customized for different departments, allowing users to access the data that was relevant to their specific needs.

Results:

The implementation of Power BI at Centrica has brought significant benefits to the company. By providing a single source of truth for all users, it has enabled the organization to make quick and informed data-driven decisions, thereby improving operational efficiency and productivity. The tool has also facilitated cross-functional collaboration and communication, resulting in a more cohesive and agile decision-making process.

Moreover, Power BI has enabled Centrica to identify potential areas for improvement across its business units and take timely corrective measures to address them. This has not only improved customer satisfaction but also increased profitability. The real-time insights provided by Power BI dashboards have empowered Centrica's decision-makers with the ability to optimize their operations and enhance their services, thereby enabling them to stay ahead in the competitive energy market.

2) Tableau:

CASE STUDY-I: **JP Morgan** [29]

Company Background:

JP Morgan is a global financial institution that provides a wide range of financial services to corporations, governments, institutional investors, and high-net-worth individuals. It is one of the largest banking institutions in the world, with operations in more than 100 countries. The company has a history of over 200 years and has grown through mergers and acquisitions, expanding its business lines to include investment banking, asset management, private banking, and commercial banking.

Business Problem:

JP Morgan faced the challenge of processing, analyzing, and visualizing large data sets to gain insights and make informed business decisions in the rapidly changing financial industry. The company had to deal with vast amounts of data from various sources, including financial transactions, customer feedback, and market data. The challenge was to extract meaningful insights from this vast and complex data to improve decision-making, identify potential risks, and drive innovation. Additionally, traditional data analysis methods were not able to keep up with the speed and complexity of the financial industry, leading to slower and less accurate analysis.

Solution:

To address this challenge, JP Morgan adopted Tableau, a data visualization tool that provides interactive visualizations and business intelligence solutions. The company evaluated several other data analysis tools before finalizing Tableau as their business intelligence solution. JP Morgan chose Tableau because of its flexibility, user-friendliness, and efficiency, allowing the company to streamline their data analysis process and gain valuable insights in real-time. Tableau was integrated into JP Morgan's working environment, and the data analysts were

trained to use the tool effectively, allowing them to harness the power of the tool and make more informed decisions.

Results:

Tableau has enabled JP Morgan to analyze large data sets efficiently and gain insights into various business areas. The tool has been used in several departments, including finance, risk management, and compliance. JP Morgan's data analysts have used Tableau's interactive visualizations to explore the data and identify trends and patterns quickly. The tool has also helped the company to create reports and dashboards that provide valuable insights and improve decision-making.

Tableau has helped JP Morgan to automate several manual processes, reducing the time and effort required for data analysis. The tool has also helped the company to identify inefficiencies and areas for improvement. JP Morgan has been able to improve its customer service and reduce risk by using Tableau to analyze customer feedback and detect potential fraud.

CASE STUDY-II: **Lenovo, India** [29]

Company Background:

Lenovo is a multinational technology company headquartered in Beijing, China, with operations in over 60 countries. The company designs, develops, manufactures and sells personal computers, smartphones, tablets, workstations, servers, electronic storage devices, and IT management software. Lenovo was founded in 1984 by a group of Chinese engineers, and since then, it has become a leading player in the global technology industry. The company is known for its innovative products, efficient supply chain management, and strong distribution network, making it a trusted brand in the technology industry.

Business Problem:

Lenovo India faced significant challenges in creating reports for its various divisions and regions. The process was inefficient, requiring a team of 8 to 10 people to manually adapt reports for different departments. This process was time-consuming and tedious, with the analytics team spending six to seven hours creating just one weekly report. To compound the issue, creating 30 or more reports was an overwhelming task that required a significant amount of resources and effort from the team.

Solution:

Lenovo India deployed an eight-core instance of Tableau Server, which they quickly scaled up to a 16-core server. The executives introduced Tableau in Lenovo India as a means to analyze and govern data on a selected set of business use cases and scenarios to help in decision-making. However, Tableau quickly became an integral part of the company's functioning. The company experienced a cultural shift where the approach to business and growth was more data-centric and data-driven.

Lenovo India's BI Analytics & Visualization team created an interactive and flexible Tableau sales dashboard for departments to use for ad-hoc analysis and reporting. Tableau has increased Lenovo's efficiency by 95%, with approximately 3000 users using it in about 28 countries by now. Lenovo's e-commerce team was able to analyze customer engagement patterns to improve brand perception and increase revenues. The human resource department converted 100 static reports into dynamic and interactive Tableau dashboards, giving users and analysts a new perspective into solving matters. The team is easily able to connect to data sources like Amazon Web Services and Hortonworks Hadoop Hive.

Lenovo supports self-service analytics, where every user can conduct an individual analysis on the set of data concerning their domain of activity and suiting their site roles. Every Tableau user has identification credentials stored in the local identity store of Tableau using which they can access and work on Tableau dashboards using a single sign-on process. Lenovo experienced lucrative growth in e-commerce by using Tableau to analyze customer experience by fetching data from Lenovo's unified customer intelligence platform; LUCI Sky.

Results:

Tableau's implementation has led to significant results for Lenovo India. With Tableau, time spent on creating reports is much lesser than creating reports manually. Teams were able to deliver reports much faster, sometimes even reporting on a daily or hourly basis. The time saved is used in carrying out analysis and drawing insights from the information. Tableau has increased Lenovo's efficiency by 95%, with approximately 3000 users using it in about 28 countries by now.

Lenovo's e-commerce team was able to analyze customer engagement patterns to improve brand perception and increase revenues. The human resource department converted 100 static reports into dynamic and interactive Tableau dashboards, giving users and analysts a new perspective into solving matters. Tableau has also helped Lenovo in analyzing customer experience and improving it, leading to increased revenue growth.

CASE STUDY-III: **Lufthansa** [29]

Company Background:

Lufthansa is a leading German airline and one of the largest airlines in Europe. The company was founded in 1953 and is headquartered in Cologne, Germany. Lufthansa operates a vast network of flights, serving over 200 destinations in more than 80 countries worldwide. The airline offers a range of services, including passenger transportation, cargo transportation, and aircraft maintenance. Lufthansa has a strong focus on safety and innovation, and it has won numerous awards for its services and operations.

Business Challenge:

Despite its success, Lufthansa faced significant challenges with its reporting process, which was decentralized across different departments. The lack of a centralized reporting system made it difficult to get a clear overview of the company's operations and performance, as each department had its own reporting system. Moreover, the data preparation process was time-consuming, and it left little time for data analysis and interpretation. This affected the quality and timeliness of reporting, which was manually done, leading to delays and inefficiencies. These challenges hindered Lufthansa's ability to make data-driven decisions and optimize their operations, resulting in missed opportunities and increased costs.

Solution:

To overcome these challenges, Lufthansa turned to Tableau, a business intelligence tool that allowed them to centralize their reporting process and gain deeper insights into their operations. Tableau was initially deployed in the sales department but was soon a part of the entire firm spreading across departments. Within a month, the number of Tableau users reached 80 Tableau Desktop users, and currently, more than 500 people are using Tableau reports and analyzing via Tableau Server and dashboards.

The Tableau solution allowed Lufthansa to connect to all sorts of data sources used by the company, such as Oracle, Teradata, SAS, etc. The reporting processes were automated and standardized across the enterprise to ensure uniformity, and key performance indicators were implemented throughout the group. Tableau increased the autonomy of users by the virtue of self-service analysis for specialist departments and enabled the company of a more efficient day-to-day analysis of their business and related activities.

Results:

The implementation of Tableau has resulted in a significant increase in the company's efficiency by 30%, as data preparation and report generation time have reduced significantly. The data preparation to data analysis ratio, which was 80:20 earlier, has changed to 60:40, which is a positive change due to Tableau. The time saved from fast data preparation is utilized in self-service data analysis, pattern discovery, drawing insights and report generation. All of which is crucial in a company's growth by taking premeditated decisions based on facts.

Tableau has also enabled Lufthansa to gain deeper insights into their operations, allowing them to make better decisions based on data-driven insights. The company has been able to identify patterns and trends that were previously hidden, allowing them to make more informed decisions and stay ahead of the competition.

3) QlikSense:

CASE STUDY-I: **Jaguar Land Rover** [30]

Company Background:

Jaguar Land Rover is a British multinational automotive company that specializes in designing, developing, and manufacturing premium vehicles. The company is headquartered in Coventry, United Kingdom, and operates in more than 100 countries around the world. Jaguar Land Rover was formed in 2008 when India's Tata Motors acquired the British luxury car brands Jaguar and Land Rover from Ford. The company's product portfolio includes luxury sedans, sports cars, SUVs, and off-road vehicles, including the Jaguar XE, XF, and XJ, and the Land Rover Discovery, Range Rover, and Defender models. Jaguar Land Rover is known for its focus on innovation and sustainability, and it is committed to achieving a net-zero carbon emissions target across its supply chain by 2039.

Business Problem:

Jaguar Land Rover faced several business problems related to data silos and inefficient reporting. The company had a large amount of data stored across multiple systems, making it difficult to consolidate and analyze information in a timely manner. This resulted in slow decision-making and a lack of visibility into key business operations. The company also had challenges in identifying supply chain bottlenecks and production inefficiencies, which led to delays and increased costs. Additionally, the lack of integrated reporting made it difficult to track and measure key performance indicators (KPIs) across the organization. All of these issues impacted the company's ability to remain competitive in the automotive industry, and there was a need for a more efficient and streamlined approach to data analysis and reporting.

Solution:

After implementing QlikSense, Jaguar Land Rover was able to address the challenges they faced with data silos and inefficient reporting. QlikSense allowed the company to consolidate data from various sources into a single platform, enabling more efficient analysis and decision-making. The platform also provided real-time visibility into key business operations, allowing the company to identify supply chain bottlenecks and production inefficiencies more quickly and effectively. QlikSense's advanced analytics capabilities enabled Jaguar Land Rover to create predictive models that helped them anticipate potential problems before they occurred. Additionally, the integrated reporting provided a more comprehensive view of KPIs across the organization, allowing for more informed decision-making. By using QlikSense, Jaguar Land Rover was able to improve its operational efficiency and reduce costs, ultimately enabling the company to remain competitive in the automotive industry. This gave them the reputation as the leading Change Data Capture (CDC) vendor.

Results:

Jaguar Land Rover achieved significant results after implementing QlikSense. The company was able to overcome its data silos and gain a single view of its data, leading to more efficient analysis and decision-making. The platform's real-time visibility into key business operations allowed the company to quickly identify supply chain bottlenecks and production inefficiencies. The advanced analytics capabilities of QlikSense enabled Jaguar Land Rover to create predictive models that helped anticipate potential problems before they occurred. The integrated reporting provided a more comprehensive view of KPIs across the organization, allowing for more informed decision-making. Additionally, QlikSense allowed the company to reduce costs and improve operational efficiency, ultimately enabling them to remain competitive in the automotive industry.

CASE STUDY-II: **Brady Corporation** [31]

Company Background:

Brady Corporation is a US-based multinational company that specializes in manufacturing and marketing high-performance identification solutions. Founded in 1914, the company is headquartered in Milwaukee, Wisconsin, and operates in over 50 countries across the world. Brady Corporation's products and services include safety and facility identification, labeling and printing systems, wire markers, lockout/tagout devices, and software solutions. Its customers come from various industries such as aerospace, defense, electronics, oil and gas, telecommunications, and transportation. With a mission to provide innovative solutions that increase safety, security, productivity, and performance, Brady Corporation has established a strong reputation for quality and reliability over the years.

Business Problem:

Before using QlikSense, Brady Corporation faced several business problems. They had disparate data sources and multiple legacy systems that made it difficult to access and analyze data in a timely manner. They lacked a centralized reporting system that could provide insights into their business performance, and this led to a lack of data-driven decision making across the organization. The manual processes for data extraction and manipulation were time-consuming and prone to errors, resulting in delays and inconsistencies in their reporting. Brady Corporation realized the need for a modern, user-friendly analytics platform that could integrate with their existing systems and provide a single source of truth for their data. They required a solution that could help them analyze sales, inventory, and supply chain data to improve their operations and make better decisions.

Solution:

After identifying the business problems, the use of QlikSense helped Brady Corporation to solve them in several ways. With the help of QlikSense, the company was able to improve their data analysis process by bringing together data from different sources and creating a single source of truth. This helped them to gain a better understanding of their customers and their business operations, which enabled them to make data-driven decisions. The use of QlikSense also helped to improve their inventory management process by providing real-time visibility into inventory levels and identifying potential shortages or surpluses. Additionally, QlikSense allowed the company to create personalized dashboards for different departments, making it easier for employees to access and analyze data specific to their roles.

Results:

Brady Corporation experienced significant improvements in their business operations after implementing QlikSense. They were able to gain better insights into their sales performance, customer behavior, and inventory levels, which enabled them to make more informed business decisions. The company was also able to increase their operational efficiency by automating several manual processes and reducing the time spent on data analysis. The use of QlikSense also led to improved collaboration between teams, as they were able to share insights and collaborate on data in real-time.

After implementing QlikSense, Brady Corporation saw significant improvements in their business operations. Here are some of the results:

1. **Increased efficiency**: QlikSense allowed Brady Corporation to access and analyze their data in real-time, which helped them identify inefficiencies in their processes and make data-driven decisions to improve them. This resulted in a significant increase in efficiency across the organization.
2. **Improved sales performance**: QlikSense provided Brady Corporation with insights into their sales performance, enabling them to optimize their sales processes, identify new sales opportunities, and forecast future sales trends. As a result, they were able to increase their sales and revenue.
3. **Better inventory management**: With QlikSense, Brady Corporation gained better visibility into their inventory levels and stock movements, enabling them to optimize their inventory management processes. This led to a reduction in stock-outs, improved order fulfillment times, and lower inventory holding costs.
4. **Enhanced customer satisfaction**: By analyzing customer data, Brady Corporation was able to gain insights into customer preferences and behavior. This allowed them to tailor their products and services to better meet customer needs, resulting in improved customer satisfaction.

CASE STUDY-III: **Rockford Health System** [32]

Company Background:

Rockford Health System (RHS) was a non-profit healthcare provider based in Rockford, Illinois, United States. RHS was founded in 1885 as Rockford Hospital, and it grew over the years to become a comprehensive healthcare provider offering a wide range of medical services, including emergency care, surgery, pediatrics, cardiology, oncology, and more. In addition to its flagship hospital, RHS also operated several outpatient clinics, a cancer center, and a physician group practice, serving patients in the Rockford area and beyond.

In 2017, RHS merged with a larger healthcare system, Mercyhealth, to form a new integrated healthcare network serving northern Illinois and southern Wisconsin. The new organization operates under the Mercyhealth name and continues to provide high-quality healthcare services to the community.

Business Problem:

Before using Qliksense, Rockford Health System faced several business problems related to data analysis and decision-making. These problems included difficulty in accessing real-time data, inefficient data processing, and limited visibility into operational and financial performance. As a result, the organization was unable to identify critical issues in a timely manner, which impacted patient care and staff productivity. Additionally, it was challenging to analyze and report on data related to key performance indicators (KPIs) and metrics, which made it difficult to assess the effectiveness of its programs and initiatives.

Rockford Health System recognized that it needed a more streamlined and efficient approach to data analysis in order to make informed decisions and improve patient care. This led the organization to explore business intelligence tools like Qliksense, which promised to provide real-time insights and analytics. By implementing Qliksense, Rockford Health System hoped to solve its data-related challenges and improve decision-making capabilities.

Solution:

After identifying their business problems, Rockford Health System implemented QlikSense as a solution. With QlikSense's advanced data analytics and visualizations, they were able to gain a better understanding of their patients' needs, optimize their operations, and improve overall efficiency.

For example, they were able to identify the specific areas where patients experienced the longest wait times and make necessary adjustments to improve their experience. They also used QlikSense to analyze patient data and identify trends that could help them better manage chronic conditions and improve patient outcomes.

By using QlikSense, Rockford Health System was able to streamline their operations, reduce costs, and improve patient care. The platform's ability to quickly access and analyze data allowed them to make data-driven decisions in real-time, leading to improved outcomes for both patients and the healthcare system as a whole.

Results:

Rockford Health System (RHS) reported significant improvements after implementing Qlik Sense. They were able to analyze data in real-time, which allowed them to make informed decisions faster. With the use of Qlik Sense, RHS achieved the following results:

1. **Reduced patient wait times:** RHS was able to use Qlik Sense to identify bottlenecks in their patient care process and address them. This helped to reduce patient wait times, leading to better patient satisfaction.
2. **Improved patient outcomes:** With real-time data analysis, RHS was able to identify patients who were at risk for readmission or complications. They were able to intervene in a timely manner, resulting in improved patient outcomes.
3. **Increased revenue:** By analyzing patient data and identifying areas for improvement, RHS was able to streamline their operations and reduce costs. This, in turn, led to increased revenue.
4. **Improved employee productivity:** With easy access to data, RHS staff were able to make informed decisions quickly, which helped to improve their productivity.
5. **Improved data accuracy:** The QlikSense dashboard helped to eliminate data inconsistencies and errors by providing a single source of truth for data.
6. **Faster and better decision making:** With access to real-time data and interactive dashboards, decision-makers were able to quickly identify trends and patterns, make informed decisions, and respond more effectively to changing conditions.
7. **Cost savings:** By streamlining processes and reducing the need for manual reporting, QlikSense helped Rockford Health System to reduce costs and increase efficiency.

4) **Dundas BI:**

CASE STUDY-I: **SAVYVA GmbH** [33]

Company Background:

SAVYVA GmbH is a German software company that specializes in developing business intelligence solutions. The company was founded in 2000 and has a strong focus on data analytics. Their mission is to help businesses make informed decisions based on accurate and timely information. SAVYVA offers a range of software solutions designed to consolidate, visualize, and analyze data from various sources. Although primarily aimed at financial institutions and insurance companies, they also serve clients in other industries. The company has a team of highly skilled professionals with extensive experience in data analytics and

software development. They work closely with clients to understand their specific needs and develop customized solutions that are tailored to their unique requirements. SAVYVA is committed to providing high-quality software solutions and excellent customer service to its clients.

Business Problems:

SAVYVA GmbH is a software development company that specializes in creating and implementing software solutions for the finance industry. Prior to using Dundas BI, SAVYVA GmbH was facing several challenges related to data visualization and analysis. The company was struggling to create interactive dashboards and reports that could provide real-time data insights to their clients. Additionally, they were having difficulty integrating their various data sources and formats, which was leading to inefficiencies and errors in their data analysis process.

These challenges were particularly problematic for SAVYVA GmbH's clients, who relied on the company's software to make informed business decisions. Without the ability to access and analyze data quickly and accurately, SAVYVA GmbH's clients were at risk of making poor decisions that could negatively impact their business performance. SAVYVA GmbH recognized the need to find a solution that could help them address these challenges and provide their clients with the insights they needed to succeed in the competitive finance industry.

Solutions:

After identifying the issues, SAVYVA GmbH implemented Dundas BI to address their business problems. The solution allowed the company to consolidate data from different sources into a single, unified dashboard, providing real-time insights into key performance metrics. With Dundas BI, SAVYVA GmbH was able to gain a deeper understanding of its customers, analyze market trends, and identify opportunities for growth. The platform's flexibility also enabled the company to create customized reports and dashboards tailored to the specific needs of different departments, providing valuable insights into areas such as sales performance, inventory management, and customer engagement. As a result, SAVYVA GmbH was able to improve operational efficiency, increase revenue, and optimize customer satisfaction.
SAVYVA GmbH saw significant improvements in their data management and analysis capabilities. They were able to easily connect to various data sources, including their ERP system, and create customized dashboards and reports with real-time data. This allowed them to quickly identify areas for improvement and make data-driven decisions.
One specific example is how Dundas BI helped them streamline their order fulfillment process. By analyzing data from their ERP system, they were able to identify bottlenecks in their process and make adjustments to improve efficiency.

1. **Platform Extensibility: -**SAVYVA was able to improve the management of transfer pricing business processes by creating a custom Navigation experience for their final product with the help of Dundas BI. Users were able to switch between dashboards and views by clicking on various tiles.
2. **Narrative Reporting: -**Report Tiles, Entire Dashboards, and Scorecards Can Be Embed, Formatted, and Updated in CROSSVIEW's Online Document Report File Editor Thanks to the Programming Interfaces Provided by Dundas BI, SAVYVA Was Able to Enhance Narrative Reporting Component with the help of Dundas BI. Contracts and document files of any sort may be connected to financial, master, local, or country-by-country reports and exported to Word or PDF.
3. **Process and Transaction Flowcharting: -** With the help of Dundas BI's open, fully programmable, integrated BI platform, CROSSVIEW was expanded with features that let users import and visualize complicated and BPMN-based process diagrams for functional/RACI analysis. In keeping with CROSSVIEW's idea of linking everything together, the objects in Dundas BI may be connected to any part of a process, entity, or transaction diagram to provide quantitative support for otherwise qualitative explanations.
4. **Database Write Back: -** Users using Dundas BI may write back to the database to offer more context or to interact with other users viewing the same dashboard. SAVYVA took use of this feature by letting users manage master data, create value chains, and see and comment in real time on dashboard visualisations using table visualisations.

Results:

SAVYVA GmbH reported several positive outcomes after implementing the Dundas BI solution. Firstly, they were able to create custom dashboards for their clients that provided real-time insights into their business data, resulting in increased customer satisfaction and retention. The Dundas BI platform's flexibility and ease of use enabled SAVYVA to quickly create and deploy these dashboards, saving time and resources.

Moreover, the advanced analytics and reporting capabilities of Dundas BI allowed SAVYVA to perform in-depth data analysis, identify trends, and make data-driven decisions. This, in turn, led to increased efficiency and improved decision-making, resulting in better business outcomes for SAVYVA and its clients.

Furthermore, SAVYVA was able to leverage the self-service capabilities of Dundas BI, enabling their clients to easily access and analyze their data, empowering them to make informed decisions without the need for external support.

The implementation of Dundas BI enabled SAVYVA GmbH to enhance their services, improve customer satisfaction and retention, increase efficiency and improve decision-making.

After implementing Dundas BI, SAVYVA GmbH was able to achieve the following results:

1. **Improved Data Analysis:** With the help of Dundas BI, SAVYVA GmbH was able to analyze their data more efficiently and effectively. They were able to easily track their sales data and other business metrics, which helped them make more informed decisions.
2. **Increased Efficiency:** Dundas BI allowed SAVYVA GmbH to automate their reporting process, saving valuable time and increasing efficiency. This allowed them to focus on other important tasks and activities, such as developing new products and improving customer service.
3. **Better Decision Making:** With improved data analysis and reporting, SAVYVA GmbH was able to make more informed and data-driven decisions. They were able to identify areas of their business that needed improvement and take corrective action quickly.
4. **Increased Revenue:** By using Dundas BI, SAVYVA GmbH was able to identify opportunities for growth and optimize their sales and marketing strategies. This resulted in increased revenue for the company.

CASE STUDY-II: **Choice Logistics** [34]

Company Background:

Choice Logistics is a global logistics management company that offers customized solutions to improve the efficiency, reliability, and cost-effectiveness of its clients' supply chains. The company was founded in 1964 and is headquartered in New York City, with offices and operations in over 100 countries worldwide.

Choice Logistics specializes in critical parts logistics, providing expedited transportation, secure warehousing, and inventory management services to clients in industries such as healthcare, technology, and aerospace. The company also offers customized logistics solutions for events and exhibitions, including trade show logistics, freight forwarding, and on-site support.

Business Problems:

Choice Logistics, a leading provider of customized third-party logistics solutions faced a major challenge in providing real-time visibility into their customer service operations. The company struggled with analyzing large volumes of data scattered across multiple systems, making it difficult to make data-driven decisions. The existing reporting solution was outdated, manual, and unable to provide real-time insights into their customer service operations. The lack of visibility into their performance metrics made it difficult for the company to identify areas of improvement and take corrective actions. The company needed a solution that could consolidate and analyze data from multiple sources in real-time, providing comprehensive insights into their operations. This is where Dundas-BI came into the picture, providing a powerful solution to help them overcome these challenges.

<u>Solutions</u>:

After identifying the problems, Choice Logistics implemented Dundas BI to help address them. The solution provided the company with a centralized and standardized reporting system that allowed for real-time data analysis and decision-making. With Dundas BI, Choice Logistics could integrate data from multiple sources, providing the ability to cross-reference and create more in-depth analyses. The company was able to reduce the time required to create reports, enabling employees to focus on analyzing data and making decisions.

Dundas BI provided Choice Logistics with visualizations and dashboards, making it easier to identify trends and patterns. The solution also enabled the company to create custom reports tailored to the needs of specific users, which helped improve the accuracy and relevance of the data. Additionally, Dundas BI provided Choice Logistics with the ability to generate automated alerts and notifications, ensuring that critical information was delivered to the appropriate stakeholders in a timely manner.

<u>Results</u>:

Choice Logistics reported significant improvements in their business operations after implementing Dundas BI. Some of the notable results include:

1. **Improved data visualization:** With the help of Dundas BI, Choice Logistics was able to create dynamic dashboards with better visualization of data, allowing them to make informed decisions.
2. **Enhanced performance tracking:** The Dundas BI platform enabled Choice Logistics to track and monitor their performance against key performance indicators (KPIs) in real-time, which helped them identify areas for improvement and optimize their operations.
3. **Greater efficiency and productivity:** The implementation of Dundas BI helped Choice Logistics streamline their business operations, resulting in improved efficiency and productivity.
4. **Improved data accuracy and accessibility:** Dundas BI helped Choice Logistics to consolidate data from multiple sources and present it in a single dashboard. This made it easier for employees to access the information they needed and ensured data accuracy across the organization.
5. **Faster decision-making:** With real-time access to data, employees at Choice Logistics were able to make faster and more informed decisions. This resulted in increased productivity and better customer service.
6. **Better visibility into operations:** Dundas BI provided Choice Logistics with a detailed view of its operations, allowing the company to identify areas for improvement and optimize its processes. This resulted in reduced costs and increased efficiency.
7. **Improved customer service:** With Dundas BI, Choice Logistics was able to track and analyze customer data more effectively. This helped the company to identify trends and respond to customer needs more quickly, resulting in improved customer satisfaction.

<u>CASE STUDY-III</u>: **Neo@Ogilvy** [35]

<u>Company Background</u>:

Neo@Ogilvy is a global marketing and advertising agency that provides integrated marketing solutions to brands and businesses worldwide. It is a part of Ogilvy, which is one of the largest marketing and communication networks in the world, with a presence in over 160 cities. Neo@Ogilvy focuses on delivering innovative and effective digital marketing campaigns that help clients achieve their business goals. Their services include strategy and planning, digital media buying, search engine optimization, content creation, and social media management. With a team of over 2,500 marketing professionals across the world, Neo@Ogilvy has worked with some of the world's most well-known brands, including IBM, Nestle, and American Express.

<u>Business Problems</u>:

Neo@Ogilvy faced challenges in consolidating data from multiple sources to generate insights and reports for clients. They also struggled with data visualization and manual report creation, which led to delays in client deliverables and reduced efficiency in their operations. Additionally, data security and privacy were of utmost importance, and they needed a solution that would ensure compliance with industry standards and regulations while providing seamless access to data for authorized users. These challenges hindered their ability to provide timely and accurate insights to clients and impacted their overall productivity and growth as a company.

Neo@Ogilvy faced a number of challenges before implementing Dundas BI, such as the lack of real-time data analysis and difficulty in obtaining insights from their data. Their existing tools were not effective in managing the complex data sets and generating actionable insights, leading to significant delays in decision-making and affecting their ability to meet client needs.

Data was stored in various formats and scattered across multiple systems, making it difficult to consolidate and analyze. The company was also unable to track key performance indicators (KPIs) in real-time, which meant they had to rely on manual reports that took significant time to produce.

<u>Solutions</u>:

After identifying the challenges faced by Neo@Ogilvy, the implementation of Dundas BI helped the company in several ways. Firstly, the solution allowed the company to generate real-time reports and dashboards, which increased the accuracy and speed of decision-making. Dundas BI's ability to gather data from various sources enabled the company to create a centralized database that allowed for more accurate and timely reporting. Moreover, the platform's user-friendly interface allowed for easy exploration of data and the creation of custom dashboards, enabling quick and informed decision-making. The advanced data analytics features of Dundas BI helped Neo@Ogilvy gain deeper insights into their data, providing them with valuable

information that they previously did not have. The platform's ability to handle complex data sets and perform advanced calculations allowed Neo@Ogilvy to make more informed decisions and optimize their business operations.

Secondly, Dundas BI enabled the company to analyze data from various sources, including social media platforms, and derive insights from them, which helped to improve the effectiveness of their marketing campaigns. The platform's advanced data analytics features helped Neo@Ogilvy to analyze data and gain insights that were previously not possible. This helped the company to make data-driven decisions and optimize their marketing campaigns. Furthermore, Dundas BI allowed the company to collaborate and share data across teams, reducing silos and increasing transparency. Finally, the solution provided flexibility and customization options, allowing the company to tailor the solution to their specific needs. With Dundas BI, Neo@Ogilvy was able to create more efficient and effective data visualization and analysis processes, enabling the company to optimize their operations and improve their decision-making capabilities.

Results:

The implementation of Dundas BI provided Neo@Ogilvy with a comprehensive data analytics platform that enabled them to overcome their business challenges and achieve significant results. With the ability to consolidate data from various sources and create real-time, interactive dashboards and reports, the company was able to gain deeper insights into their data and make better-informed decisions. Additionally, the platform's self-service reporting functionality enabled business users to create their own reports and dashboards, reducing the time and effort required for report generation and analysis.

The positive results achieved by Neo@Ogilvy included enhanced data visualization capabilities, improved operational efficiency, and greater visibility into their data. These results helped the company to improve the quality of client deliverables, build stronger client relationships, and identify new opportunities for growth. Ultimately, the implementation of Dundas BI helped Neo@Ogilvy to become a more data-driven and competitive organization.

5) Sisense:

CASE STUDY-I: Profusion [36]

Company Background:

Profusion, a provider of data science and marketing services, was accustomed to producing sluggish, reactive reports for its clients. Dale Bradman, a data engineer, and Henrik Nordmark, the head of data science, decided to expand their internal use of Sisense and construct a new product, ProfusionBI, by incorporating Sisense when they chose to establish a BI platform that

their clients could access for a variety of use cases. Reports that used to take 20 days to produce now just take 20 minutes.

Business Challenge:

Profusion received a request from a London-based creative agency to improve their ticketing data communication with a global live event production business. The creative agency had two conditions - to clearly express financial investment and return through various marketing channels and an appealing interface and to make the data available for usage in other business tools from a single customer perspective.

The ticketing data had been shared through a complicated spreadsheet for many years, which was assembled by the creative agency. It included data from the UK over eight years, covering 16 tours and three brands. Profusion aimed to help the creative agency move away from manual and sluggish Excel-based reporting towards quick, proactive, and real-time improvement.

Solution:

To address this challenge, BlackRock decided to implement Sisense, a business analytics tool that could help the company gain valuable insights from its data. Sisense provided BlackRock with a unified analytics platform that could integrate data from various sources, including databases, spreadsheets, and cloud applications. This allowed the company to get a complete view of its data and analyze it in real-time.

Sisense also provided BlackRock with customizable dashboards, allowing the company to create its own data visualizations and reports. This made it easy for non-technical users to analyze data and gain insights. Additionally, Sisense provided BlackRock with advanced analytics capabilities, including descriptive, predictive, and prescriptive analytics, enabling the company to understand what had happened in the past, forecast future trends, and make informed decisions based on insights gained from its data.

Results:

Sisense was an obvious choice because Profusion had already been experimenting with it to simplify its own internal reporting. Both of the clients' needs were satisfied by Sisense.Due to its interactive front end, reporting took 20 days instead of 20 minutes, and choosing the audience for each campaign took just one minute. Due to these savings, limited agency resources may be used for marketing optimisation rather than management.Its strong in-memory querying capabilities made it possible to quickly filter a sizable client base.

Profusion required a solution that could be customised and white branded for its client platform. It decided to let Sisense deliver the programme through its cloud. By doing so, Sisense builds, runs, and maintains the server, saving Profusion the time and hassle of doing so while ensuring that clients have more access and scale.

<u>CASE STUDY-II</u>: **EfficientC** [37]

Company Background:

One of the main reasons hospitals and healthcare providers lose money is unpaid claims payments. Healthcare providers utilise claims scrubbers (data checking software) to assist decrease mistakes while processing claims, ensuring that claims that leave the door have the highest chance of getting paid, ideally the first time they are filed. In 2009, EfficientC, a software platform with denial avoidance technology that speeds up revenue generation for hospitals, was created by Lori Zindl, the CEO and creator of the claims processing business OS Healthcare. In order to help hospitals and other healthcare providers get their claims paid by insurers more quickly and with fewer claim denials, EfficientC combines the strengths of a clearinghouse and claims scrubber with the power of analytics.

Business Challenge:

In the US, the medical billing procedure is exceptionally difficult. If an insurance claim is rejected the first time, there is a 60% probability that it will also be rejected the second time, increasing the likelihood that it will never be paid. According to Becker's Hospital Review, the expense of rewriting a claim can average up to $118 each claim, which lowers profitability.

EfficientC had utilised a different embedded analytics product before moving to Sisense, but "discovered that it was inefficient and wouldn't grow." Getting our clients to embrace and use the dashboards was difficult, according to Lori Zindl. They sought a solution that would provide faster access to insights for both internal and external end users.

Solution:

Sisense also gives efficientC the flexibility and agility to quickly take on a variety of issues at scale. For instance, manually running a report for a client based on six months of data would generally take twenty minutes. The identical report, which is now automated, loads in 5–10 seconds on average, and significantly quicker for smaller datasets. Customers can accomplish more with less when the time to insight is shorter. During six months of deployment, one hospital client decreased claim denials by over 40%.

<u>CASE STUDY-III</u>: **Credit Clear** [38]

Company Background:

Credit Clear is an Australian-based fintech company that provides a digital debt collection platform for businesses. The company was founded in 2015 and is headquartered in Sydney, Australia. Credit Clear's platform offers a range of services, including payment reminders, payment plans, and payment processing, to help businesses collect outstanding debts from their customers in a more efficient and streamlined manner. The company's technology leverages

automation and artificial intelligence to deliver an improved customer experience while reducing the cost and time required for debt collection. Credit Clear primarily serves clients in the financial services, utilities, and telecommunications industries.

The company's mission is to simplify the debt collection process for businesses and create better outcomes for both businesses and their customers. Credit Clear's platform provides businesses with a faster, more effective, and less expensive way to collect outstanding debts. By reducing the administrative burden of debt collection, businesses can focus on their core operations and growth strategies. Additionally, the platform's user-friendly interface and personalized customer communication help to improve the customer experience and foster better relationships between businesses and their customers.

Business Challenge:

Credit Clear is a debt collection agency that aims to enhance collection outcomes for its tens of thousands of clients. However, with a fragmented data environment due to its purchase of conventional debt-collection companies, Credit Clear needed to consolidate its data in one place to make analytics and reporting easier. The company's big company clients were interested in the results of the collecting campaigns and wanted to learn more about their consumers from the data, identify the categories, and find possibilities to launch fresh campaigns so they could boost collection.

Solution:

To address these challenges, Credit Clear chose Sisense FusionTM Embed to make analytics and reporting simpler. Sisense consolidates and centralizes data in one place, accelerating access and improving data accuracy. The no-code/low-code solution provided by Sisense allows customer-facing employees to execute client reporting and analytics after just a few training sessions. By utilizing Sisense, Credit Clear's data scientists and engineers are given more time to work on high-value projects like developing sophisticated analytics and machine learning modules to accelerate the implementation of its data-driven strategy. Credit Clear empowered staff by teaching them how to utilize the platform, enabling them to respond to customer inquiries and study client data to offer more in-depth insights at scale.

Results:

By consolidating its data environment and using Sisense's analytics and reporting capabilities, Credit Clear was able to provide its clients with a less intimidating, pay-as-you-go digital experience to enhance collection outcomes. The data insights are used to inform Credit Clear's AI models, which produce superior outcomes that are then presented to clients via Sisense. Additionally, the use of Sisense allowed Credit Clear to centralize and access data more quickly and accurately, freeing up staff time to focus on high-value projects. The consolidation of data

also enabled Credit Clear to take a more comprehensive approach to managing their receivables, improving the company's overall offerings to clients.

6) **Looker:**

CASE STUDY-I: **ThredUp** [39]

Company Background:

ThredUp is an online consignment store that offers "practically new" items for sale, aimed at helping time-pressed individuals while promoting sustainable apparel practices. With its headquarters in San Francisco, the company has grown significantly over the years, which led to a need for a data management system that could handle its complexity. ThredUp's agility and adaptability allowed it to thrive, but its existing system lacked the strength and flexibility to keep up with its expansion.

Business Challenge:

ThredUp's business relies heavily on effective inventory management, from purchasing clothes to delivering them to customers. As a large-scale aggregator of one-off apparel products with a broad supply chain and a high number of SKUs, data is crucial to its operations. With its delivery center continuously compiling clothing, ThredUp's management needed to understand which types of inventory were the most valuable, how to ensure the best quality, and how to boost transaction volume. Before Looker, ThredUp's software engineers used ad hoc scripts to generate reports, which could handle straightforward information requests but fell short of executive expectations for a more controlled data analytics system.

Solution:

ThredUp turned to Looker, a business intelligence (BI) platform that could handle all three of its BI needs. The platform offered real-time statistics to anyone with an account login and allowed users to collaborate and explore a shared data repository iteratively. Looker also demonstrated compatibility with ThredUp's current data processing systems and the ability to modify those systems as the company expands. After several meetings, ThredUp executives came to view Looker as a committed, long-term partner who was entirely receptive to their demands.

Results:

With Looker in place, ThredUp was able to reduce the resources required to gain insights from its data. The platform accelerated the analysis process, providing the organization with a substantial amount of freedom to act on data-driven insights and improve financial performance. The company's functional groups benefited from improved collaboration, efficiency at the distribution center, and visibility for senior management to provide a strong foundation for

planned development. In conclusion, Looker's BI solution helped ThredUp optimize its operations and better serve its customers.

CASE STUDY-II: **HotelTonight** [40]

Company Background:

HotelTonight was founded in 2010 with the aim of making same-day unsold hotel inventory easy to book on mobile devices and creating a vibrant market for hotels looking to boost occupancy rates and increase revenue. They are a travel service that gathers precise data about hotel inventory and links potential customers with available rooms as soon as they are needed. To stay competitive, HotelTonight needed to be able to analyze their real-time data to make informed decisions.

Business Problem:

The fast-paced industry of travel required HotelTonight to have real-time data analytics. The sales, product management, and account management teams needed answers to logical inquiries such as the appropriate pricing range for a certain hotel in a particular area and how many rooms would be available for a specific event. The solutions were in the company's database, but no natural-language discovery method could access them.

Solution:

All three of ThredUp's BI needs were taken into account while deciding to work with Looker. The Looker platform proved its ability to offer complete, real-time statistics to anybody with an account login and to let users work together to explore a shared data repository iteratively. Looker also demonstrated its compatibility with ThredUp's current data processing systems and its capability to modify those systems as the company expands. Finally, after several meetings, ThredUp executives came to view Looker as a committed, long-term partner who was completely receptive to their demands.

ThredUp was aware that by putting the Looker BI platform in place, it could reduce the amount of resources required to get insight from its data. By accelerating the analysis process, the organisation gained a substantial amount of freedom to act on data-driven insights and enhance financial performance. With Looker's BI platform, ThredUp's staff members can rapidly generate real-time reports to support critical business decisions. This has improved ThredUp's collaboration across functional teams, increased efficiency at its distribution centre, and provided senior management with greater visibility into the organization's activities.

Result:

With Looker's BI platform, ThredUp has been able to gain a better understanding of its customers and their buying behaviour, resulting in more effective marketing and sales strategies.

ThredUp's inventory management has also improved as a result of Looker's BI platform, with the ability to monitor inventory levels in real-time and make data-driven decisions about which inventory to purchase and when to purchase it. This has helped ThredUp reduce inventory costs and improve its profit margins.

Additionally, Looker's BI platform has helped ThredUp identify inefficiencies in its supply chain and distribution processes, allowing the company to make improvements that have resulted in faster and more efficient delivery of products to customers. ThredUp has also been able to identify trends in its data that have led to the development of new product lines and business opportunities.

CASE STUDY-III: **Deolite** [41]

Company Background:

Deolite is a multinational corporation with expertise in various technological domains, including cloud computing, data engineering, and business intelligence. With a proven track record of delivering successful data solutions to their clients, Deolite was approached by a company seeking to migrate to the cloud but lacking the necessary skills. Deolite's team of cloud specialists recommended a multi-cloud solution with the adoption of Microsoft Azure and Google Cloud Platform, providing the best technical and economical fit for the client's needs. Once the data solution was successfully delivered, Deolite's BI team could begin working on the front end.

Business Problem:

Deolitehad a desire to transition to the cloud but lacked the expertise needed to manage the process. Our data engineering team provided assistance and suggested a multi-cloud solution using Microsoft Azure and Google Cloud Platform to best suit the client's technical and economic needs. Once the data solution was delivered, our BI team began working on the front end. After an initial analysis of the business requirements and user stories, we chose to start with Customer 360° reporting due to the client's frequently changing modification requests for their views and dashboards. The customer had already selected Google Looker as their primary business intelligence tool, but they faced challenges in connecting it to the cloud and setting up suitable governance.

Solution:

The issue is addressed by implementing a comprehensive Customer 360° dashboard with links to other relevant sections. The dashboard, which have been labeled "Customer Segmentation" for this case study, provided solutions to many queries and was divided into several sections. Anyone can easily enter the Explore mode to add new features or build calculations for additional views without needing any programming language experience or knowledge of SQL.

Result:

The Customer 360° dashboard solution allowed the client to gain deeper insights into their customer data and make more informed business decisions. With the implementation of suitable governance, the client was able to connect Google Looker to the cloud and utilize it effectively. The dashboard provided a comprehensive overview of customer segmentation and other important metrics, allowing the client to identify opportunities for growth and optimize their marketing campaigns.

The solution not only enabled the client to make data-driven decisions but also enhanced their efficiency by automating reporting processes. The client's team could now access real-time data and generate custom reports without relying on manual data entry, resulting in significant time and cost savings. Additionally, the solution was scalable and could be customized to meet the client's evolving business needs.

Comparative Analysis of the Tools:

Factors considered for the analysis are

(i) Data Connectivity (ii) Ease of Use (iii) Visualization (iv) Data Modeling and Analysis

(v) Collaboration (vi) Pricing (vii) Customization (viii) Support (ix) Security

1) Data Connectivity:

Microsoft Power BI and Tableau offer the widest range of data connectors, including connectors to popular cloud-based data warehouses and web services. Both tools offer simple and easy-to-use connectors that do not require any coding or technical knowledge. QlikSense also offers a good range of connectors but not as many as Power BI and Tableau. QlikSense requires some technical expertise to configure the connectors, and users may need to write scripts to access data from certain sources. In general, all six tools provide good connectivity options, but Power BI and Tableau stand out in terms of the number and ease of use of their connectors.

2) Ease of Use:

Microsoft Power BI, Tableau, and Looker are known for their user-friendly interfaces and easy-to-use drag-and-drop functionality. All three tools offer a high level of customization, including the ability to create custom visuals and dashboards. Power BI and Tableau have a more intuitive interface compared to Looker, which requires some initial training to use. QlikSense also has a user-friendly interface but requires some technical knowledge to make the most of its features. Dundas BI and Sisense require more technical expertise to use and may be better suited for users with a strong technical background.

3)Visualization:

All six tools offer a wide range of visualizations, charts, and graphs, but Tableau is known for its powerful visualization capabilities and its ability to create complex interactive dashboards. Tableau's drag-and-drop interface allows users to create sophisticated visualizations quickly, and it offers advanced data blending and geospatial analysis features. Power BI and QlikSense also offer a good range of visualizations, including heat maps, scatter plots, and treemaps. However, Dundas BI, Sisense, and Looker offer a more limited range of visualizations compared to the other tools. In general, Tableau, Power BI, and QlikSense are the best tools for creating sophisticated and interactive visualizations, while Dundas BI, Sisense, and Looker are better suited for simpler visualizations.

4) Data Modeling and Analysis:

Microsoft Power BI and Tableau offer advanced data modeling and analysis capabilities, including the ability to blend data from multiple sources and perform complex calculations. Power BI allows users to create relationships between tables, perform advanced calculations using DAX, and build complex data models. Tableau also offers similar capabilities, allowing users to blend data from multiple sources, perform calculations using its drag-and-drop interface, and create complex dashboards. QlikSense also offers advanced data modeling capabilities, including the ability to create data models using its scripting language. However, this may require some technical expertise to use. Dundas BI and Sisense offer similar data modeling and analysis capabilities, but they require more technical expertise to use. Looker is known for its advanced data modeling capabilities, but it requires more configuration and setup than the other tools.

5) Collaboration:

All six tools offer collaboration features, including the ability to share reports and dashboards with other users. Power BI and Tableau offer more advanced collaboration features, such as the ability to create and share content securely with other users and set up data alerts. QlikSense also offers collaboration features, but they are not as advanced as those of Power BI and Tableau. Dundas BI, Sisense, and Looker offer basic collaboration features, including the ability to share reports and dashboards, but they do not have the same level of advanced collaboration features as the other tools. In general, Power BI and Tableau are the best tools for collaboration, while QlikSense offers basic collaboration features that may be sufficient for some users.

6)Pricing:

All six tools offer different pricing models, ranging from free versions to enterprise-level pricing. Microsoft Power BI offers a free version, as well as a range of paid plans starting from $9.99 per user per month. Tableau offers a free trial and a range of paid plans starting from $70 per user per month. QlikSense offers a free version, as well as a range of paid plans starting from $30 per

user per month. Dundas BI and Sisense both offer custom pricing plans, which can make it difficult to compare their pricing to the other tools. Looker offers a free trial and a range of paid plans starting from $3,000 per month for up to 10 users. In general, Power BI and QlikSense are the most affordable tools, while Tableau and Looker are more expensive. Dundas BI and Sisense are more difficult to compare as their pricing is based on custom plans.

7) <u>Scalability</u>:

All six tools offer scalable solutions, but some are better suited for larger enterprises. Microsoft Power BI and Tableau are both known for their scalability, with the ability to handle large volumes of data and users. Power BI can scale to handle large datasets, and it also integrates well with other Microsoft tools such as Excel and SQL Server. Tableau is also scalable and can handle large datasets, and it offers the ability to scale horizontally by adding more servers. QlikSense can also scale to handle large datasets, but it requires more technical expertise to set up and maintain. Dundas BI, Sisense, and Looker are all scalable but may be better suited for smaller to medium-sized businesses due to their pricing models and feature sets.

8) <u>Security</u>:

All six tools offer different security features, including role-based access control, encryption, and authentication. Microsoft Power BI and Tableau offer advanced security features, including single sign-on, multi-factor authentication, and data protection. QlikSense also offers advanced security features, including dynamic data reduction and dynamic filtering. Dundas BI and Sisense offer similar security features but may require more technical expertise to set up and maintain. Looker also offers advanced security features, including role-based access control and data encryption, but it may require more configuration and setup than the other tools.

9) <u>Support</u>:

All six tools offer different levels of support, including documentation, forums, and customer support. Microsoft Power BI and Tableau offer comprehensive documentation, online forums, and customer support, including phone and email support. QlikSense also offers comprehensive documentation, online forums, and customer support, but it may take longer to get support compared to Power BI and Tableau. Dundas BI and Sisense offer similar levels of support, including documentation and customer support, but may require more technical expertise to use. Looker offers comprehensive documentation and customer support, but it may not have the same level of community support as the other tools.

Conclusion:

In conclusion, the six BI tools analyzed in this report, Microsoft Power BI, Tableau, QlikSense, Dundas BI, Sisense, and Looker, offer powerful capabilities that help businesses transform data into actionable insights. These tools have revolutionized the way organizations approach data analytics by making it more accessible and user-friendly. Moreover, the rise of cloud computing has made it easier for businesses to access these tools without significant IT infrastructure investment. Cloud-based BI tools offer greater scalability, flexibility, and cost-effectiveness, making them a popular choice for businesses of all sizes.

Choosing the right BI tool can be challenging, as each tool has its unique features and pricing models. Therefore, businesses must evaluate their needs, consider the strengths and weaknesses of each tool, and choose the one that best fits their requirements. Each tool has its own strengths and weaknesses, which should be considered based on the specific needs of the organization. For example, Microsoft Power BI is known for its ease of use and affordability, while Tableau is favored for its advanced visualization capabilities. Similarly, Looker is known for its ability to work with large datasets, while QlikSense is preferred for its associative data model.

A Critical Observation and Future Work:

The future looks bright for these BI tools, and it will be exciting to see how they will continue to evolve and innovate to meet the ever-changing needs of businesses. As data analytics continues to evolve, it will be interesting to see how these tools adapt and innovate to meet the changing needs of businesses in the future. Businesses that embrace these tools will be better positioned to succeed in the data-driven economy of the future.

A keen observation we've noticed in understanding all these tools is, the complexity of data analytics tools and techniques can be overwhelming for many users, especially those who are new to the field. This can create a significant barrier for businesses that want to leverage the power of data analytics but lack the necessary skills and expertise. Therefore, the development of tools that can provide data analysis without requiring a deep understanding of the underlying principles is essential to democratize access to data analytics and empower more users to make data-driven decisions. Such tools can help businesses of all sizes to unlock the full potential of their data and gain a competitive edge in their respective markets.

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