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Certification of Authorship: I certify that I am the author of this paper and that any assistance I received in its preparation is fully acknowledged and disclosed in the paper. I also have cited any courses from which I used data, ideas, or words, either quotes directly or paraphrased. I certify that this paper was prepared by me specifically for the purpose of this assignment as directed.

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A Comparative Analysis of Business Intelligence Tools: Power BI, Tableau, Qlik

Abstract:

1.0 Introduction:

Business intelligence (BI) tools play a vital role in modern data analytics in helping organizations be able to transform raw data into data that can drive insights and assists in making informed decisions. By being able to analyze which BI tool best suits the businesses needs and system requirements can assist them in becoming more efficient and effective. Power BI, Tableau, and Qlik are among the most widely used BI tools, and each one has unique strengths in various factors such as data visualization, scalability, cost, and security. This comparative analysis of these BI tools will also serve to help guide businesses and professionals in choosing the right BI tool for their data driven decision making processes.

1.1 Problem Statement:

A comparative analysis of BI tools is important because it allows businesses to choose which BI tools are best suited for their organization and their needs. Through feature evaluation, as BI tools offer different ways to visualize and interact with the data, being able to compare and report data can help to highlight the strengths and weaknesses within a company and allows them to make any necessary changes. Another reason why a comparative analysis is important is a cost benefit assessment, as various BI tools come with different pricing structures, licensing fees, and cloud based subscriptions, therefore by analyzing them can help a business get the best return on investment. Scalability and performance are also important to understand as each business will require a different volume of data to be assessed and understanding which BI tool is best for their data volume is crucial in order to make the best long term choice. Finally, being able to

understand the security options that each BI tool offers is critical in being able to protect sensitive data and to make sure industry standards and requirements are met.

1.2 Scope:

This research project will compare the BI tools of Tableau, Power BI, and Qlik. When looking at these we will focus on their ability to visualize data and information, their scalability, cost, and security. By performing this comparative analysis the findings will allow me to inform and give recommendations to organizations about which BI tool is best suited to them, and which they should invest in using.

1.3 Constraints:

Constraints for this research project include variables such as scope, quality, resources, budget, risk, and time. The scope of the project is the comparative analysis of the BI tools Power BI, Tableau, and Qlilk. Quality relates to the credibility of the research project and factors that can affect or influence this are if the project and final report follow the proper APA guidelines, and if the sources that are referenced are scholarly, and reviewed sources. Some of the resources that will be used in order to conduct the research and to form the final report will include the CUC academic library database, IEEE, and the textbook for the class. While there is no monetary budget for the research project, it will take a considerable amount of time to be completed. Along with this includes the time constraints, such as the due dates for the final report and for the assignments along the way for the project. Finally the risks associated with the project are the possible difficulties of finding enough sources to support and to research for the project.

1.4 Limitations:

The various risks with this research project includes balancing the time commitment needed to complete this project along with my other commitments, finding the necessary scholarly sources comparing the various BI tools, and not having access to the premium features from these tools can affect my ability to make a thorough comparison of them. In an effort to minimize the risk of having to balance time for this project and my other responsibilities I will set aside time on days where I have an hour or more of time available to sit and work on the project without other concerns. Then in order to minimize the risk of not being able to find enough scholarly sources I will cast a wide net using several scholarly databases, such as the CUC library, IEEE, and Google Scholar. Finally, to address the concern of not having access to the premium features of these BI tools I will review official documentation and reports about the tools from their companies, along with watching certain media that could help me learn about the software's premium features without paying for it.

1.5 Stakeholders:

For the research project of a Comparative Analysis of Business Intelligence Tools: Power BI, Tableau, Qlik, the stakeholders include, myself, my instructor, and potential business organizations. I am a stakeholder as I am responsible for conducting, and writing the research and paper for this project. My instructor is a stakeholder as she is the one providing me with this opportunity, guidance, and the support needed to conduct this project. Lastly, business organizations are the last stakeholder as this research project can provide value to them, through the recommendations it will give, it could guide them towards using the best Business Intelligence (BI) tool suited to them and their needs.

2.0 Method:

This research project employs the use of both qualitative sources that focus on specific numerical values such as the price of the BI tools or number of users, along with quantitative sources that focus on experts' experiences with the various tools. The data for this project was collected primarily from peer reviewed academic journals, academic journals and relevant websites, along with the majority of sources being within the past five years. A comparative framework was employed to assess the BI tools based on several key factors: Visualizations, scalability, cost and security.

3.0 Literature review

Definition of BI Tools:

Business intelligence tools are software applications that are designed to be able to collect, analyze, and visualize data in order to help businesses make informed decisions. Through the use of these tools businesses are able to then transform raw data into something meaningful, through the use of dashboards, data visualization, and predictive analysis. Key factors that are a part of BI tools include, data integration, the ability to extract data from various sources. Data analysis, being able to apply statistical and analytical techniques with the goal to uncover trends and patterns in the data. Data visualization, which includes the ability to create charts, graphs, and dashboards that make the data easy to understand and interpret. Reporting, which is the real time generation of reports in order to make informed and quick decisions. And Predictive analytics, which is the use of historical data in order to forecast possible future trends and outcomes. BI tools are a pivotal resource for companies when it comes to being able to make informed decisions and to improve efficiency and enhance overall performance.

History:

Business Intelligence (BI) tools have changed and evolved through the decades, as it began with the decision support system in the 1950s which made use of mainframe computers for data processing. Then in the 1980s through the rise of data warehousing businesses became able to centralize structured data for more efficient and effective querying, and at this time companies such as IBM and Oracle were the driving leaders. Then in 1989 analyst Howard Dresner was the first to coin the term "Business Intelligence" in order to describe the tools that support decision making. The early 2000s marked the emergence of self-service BI, which allows those without the technical expertise to analyze data, which made it much more approachable to more people through the use of popular tools such as Tableau, Qlikview, and later Microsoft's Power BI. Currently the modern BI era which began around the mid 2010s has been impacted significantly by the use of AI to analyze analytics to provide real time insights. Today, BI tools leverage AI and machine learning in order to assist businesses in making faster, smarter, and more data driven decisions.

Visualization capabilities:

Tableau is seen to be one of the best BI tools when it comes to data visualization. A journal by Batt et al. (2020) highlights how Tableau can manipulate data from excel to make time series plots, infographics and thematic maps. This is a comparative advantage that Tableau holds over other BI tools such as Power BI and Qlik, as the other two tools are limited in their visualization options when compared to Tableau. Although Qlik does have a feature called Qlik Sense which allows the user to interactively interact with its visualizations and to explore the data more dynamically. Gavrilov et al. (2019), depicts how through the use of Qlik Sense

information technology (IT) specialists were able to instantly update their data and visualization in order to reflect changing requirements.

The tools that are best suited for an organization can depend on the sources of the data that are being used, for example Power BI integrates well with Excel and Microsoft programs. Therefore it could be a good choice for an organization that uses Microsoft programs and systems. Another factor is how the organization will want the data portrayed as one tool can represent it in a way another can't. Such as with Qlik Sense which allows for an interactive and dynamic visualization of data.

Scalability:

Qlik offers a strong scalability due to its capabilities in memory processing, and the associative model, which allows the quick exploration of data without the need for a predefined query (Kasparova, 2023). While Tableau is scalable, in some cases it might require the need for additional server infrastructure in order to meet the user's needs (Arief at al., 2023). Power BI is suited for scalability but they are primarily useful for mid sized businesses, unless the organization decides to invest in their premium upgraded version of Power BI Premium, then it can provide more use to larger organizations (Mansoor & Dar, 2024).

The size of a company will play a large role in determining which BI tool will be best suited for them, as that can be a determinant in how much data and the workload that the system will need to be able to handle. Qlik offers the strongest scalability for businesses that will have an immense workload and data size while Tableau and Power BI tend to be more suited for mid to small size organizations unless they are invested in with their premium versions. Overall, all three BI tools have the ability to be scalable and to handle large amounts of data and workload.

Cost:

The most cost-effective BI tool is Power BI with a free desktop version, its Pro version is $10 per user, and then its premium version is $20 per user, both billed monthly. This pricing model makes it alluring to small and midsize businesses (Khalafi et al., 20250). Tableau is more expensive with their pricing set at $35 a user with their enterprise viewer plan, $70 a month as an enterprise explorer user, and $115 to be an enterprise creator, all of which are billed monthly (Tableau). This makes it more reasonable and effective for a deployment at the enterprise level (Beard & Aghassibake). Qlik, while offering flexible prices, has the potential to become expensive for a large-scale business because it has additional licensing fees (Brandao et al., 2016); their membership prices are $825 for a standard membership and $2500 for a premium membership (Qlik).

When deciding which BI tool to invest the company's resources and time into, the cost is an important factor as there are cheaper and more expensive options. The company needs to account for what their needs are and the best pricing plan for them that will meet their needs, and possible future needs. As having to make a switch later on can be costly and time consuming.

Security:

When it comes to business intelligence tools, security is a vital component. As data becomes increasingly important and continues to grow in the sensitive data that it holds. With this in mind the tools hold incredible amounts of data, where if stolen can cost the organization thousands, potentially millions of dollars, and can cause them to lose trust from their customers. This is why the ability to protect information while also ensuring compliance, is a vital part of BI

tool evaluation. The three tools of Tableau, Power BI, and Qlik offer a variety of security measures and frameworks in order to offer security for their system.

Power BI has the backing of Microsoft and their robust security infrastructure, which includes Azure Active Directory, which is a Microsoft system that increases security by implementing tools such as multi factor authentication, conditional access, and role based access control (Affeldt & Silva Junior, 2013). They also benefit from its Microsoft Information Protection (MIP), which provides security measures such as end to end encryption, and multi-factor authentication (Microsoft, 2023).

Tableau supports role based security as well as integrating enterprise authentication systems (Beard & Aghassibake, 2021). Their model for security also has a focus on flexibility and providing those who are administrators with a more granular level of control through their support for on premise or secure cloud deployment (Salseforce, 2023). While Qlik provides advanced security features such as section access for the controlling of data visibility at a more granular level as well (Monica LIA, 2015).

Security is potentially the most important factor to take into account when deciding which BI tool to use, because if the security is compromised the organization can lose possibly millions and can cause further harm by losing the trust of their customers by losing their data. But along with this companies have to incorporate into their decision which tool's security features are best suited to them in their current infrastructure, such as how a company that falls under the Microsoft branch might choose Power BI because of its connection and compatibility to other Microsoft systems and security features. Power BI could be a good choice for a company that wants a balance of user-friendliness and control, while Qlik can be the best choice for a company that needs to be highly customizable with their governance models and controls.

3.0 Unexpected Findings:

An unexpected finding from the research includes Tableau's ability to integrate effectively with Microsoft products such as Excel and Power BI. This was not always the case, which can contribute to its view as being a stand alone BI tool, but through time and updates its integration with other systems, primarily Microsoft programs has dramatically improved. Mulligan's work highlights this well, as this can be a critical benefit for their users who already use programs from the microsoft ecosystem. He noted that Tableau's integration with Excel provides a smooth data importation and advanced visualization abilities (Milligan, 2019).

Another unexpected finding is how while Qlik's associative data engine which provides its capabilities for its flexible and dynamic data exploration is a unique and captivating selling point, it can also be a double edged sword. This is because while encouraging free-form exploration, its users who are less experienced in data analysis in particular could get lost in the data and find it confusing to navigate. The tool can present a learning curve that can lead to difficulty in being able to leverage its potential, and can result in being a hindrance (Powell, 2018). This tool can be effective for more advanced analysts, but could also mean the company needs to invest more in training to ensure that their data analysts understand and can use Qlik effectively.

5.0 Discussion

The comparative analysis of the BI tools Power BI, Tableau, and Qlik provide insights for businesses that are critical in assisting managers in selecting which BI tool is best for their organization. The comparative analysis of Power BI, Tableau, and Qlik reveals that while all

three platforms are capable business intelligence solutions, their strengths cater to different organizational needs and user profiles.

Power BI is seen to provide a more seamless integration with other systems from the Microsoft ecosystem, which can make it the right choice for businesses that are already using systems such as Office 365 Azure, or SharePoint. It is also affordable and user friendly which makes it appealing to possible users who might be less technical than others. Power BI also provides very robust society and governance features, which make it reliable. Whereas Tableau excels in visualization and the user experience, by offering more capability with their dashboards and data exploration. It is very versatile in being able to connect data sources and deployment models which result in a high quality storytelling visual, this makes it very good at data interpretation and communication. Lastly, Qlik has a distinctive edge in that it offers an associative data engine and in memory processing. This allows for a more dynamic and responsive analysis of large and complex datasets. This can be important when the need to be able to quickly filter through data plays a large role. Qlik's features make it best suited to organizations that have a strong technical expertise and a need for customized analytics.

Overall, each BI tool has the capabilities for enterprise grade scalability, integration, and security. As such the decision on which tool is best depends on the specific needs and requirements of the organization, which can include factors such as integrating with existing infrastructure (Power BI), what level of visualization they need (Tableau), and the level needed to analyze analytics (Qlik).

6.0 Conclusion:

Each BI tool has its strengths and weaknesses as seen in this competitive analysis, each tool has its unique abilities. Power BI can be a good choice for businesses that fall within the Microsoft ecosystem and are looking to be cost-effective, which can make it the best choice for small to mid-sized businesses within the Microsoft ecosystem. Tableau can be ideal for organizations that want to prioritize an advanced data visualization capability, interactive dashboards, and large-scale data handling, which means it can be the best choice for enterprises that are data-driven, and have a need for storytelling through data. Qlik through its use of its associative data model can be the best choice for enterprises that need the highest level of scalability, and flexibility. Or for its dynamic form of data exploration, and multi source integration and end-to-end analytics solutions.

Ultimately the best choice for which tool to use falls to the needs of an organization such as their budget, current IT infrastructure, security needs, and current user proficiency. This comparative analysis provides a clear evaluation of BI tools and how their various features can influence the organizations that use them. The importance of choosing the most strategically aligned tool that enables the organization to drive meaningful insights and drive informed decision making is vital, and is the goal of this analysis.

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