# A Study of Business Intelligence Tools from Users' Perspectives

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### Abstract

Business Intelligence (BI) has always been important for the enterprises. The enterprises can gain a competitive advantage from implementing BI. BI assists decision-makers to make decisions better by providing the information they need at the right time. The features of BI tools are slightly varied depending on the focus of BI software vendors. This article aims to discuss the main features as well as advantages and disadvantages of various BI tools from users' points of view. The study reveals that the advantages of these BI tools are the ability to connect internal and external data sources, the ability to provide interactive dashboards with drag-and-drop interfaces, the ability to share and collaborate for dashboards and reports, and the ability to control access and sharing permission. Most BI tools are cloud-based; therefore, users can access these tools from any browser with an internet connection. The disadvantages of BI tools vary among these tools which include slow performance and difficulty in extracting or exporting data. The article also highlights the improvements of these BI tools recommended by users such as improving performance for live connection, supporting various file formats, and disclosing price information on the website. This study can benefit enterprises, BI software vendors, and academic staff.

Keywords: business intelligence tools, business intelligence features, advantages, disadvantages

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#### 1. Introduction

Nowadays, some organizations need to access and manage massive amounts of data; therefore, they need proper Business Intelligence (BI) tools to provide realtime information for dashboard and visualization reports [1]. BI tools can also give decision-makers access to the information they need as much as possible. Business intelligence is one of the important components of the Internet era and the development of intelligence commercialization, which combines data mining analysis, data visualization, data practice, and infrastructure [2]. In the past, the earliest traditional business intelligence's main functions were to share information among organizations. Later, business intelligence has been further developed, becoming a computer model that can make decisions and transform them into evaluation and analysis. In recent years, business intelligence technology has made great progress, mainly reflected in more convenient and efficient analysis and platform security and stability. On the one hand, the traditional business intelligence model in the past was mainly a top-down method, and the overall reporting cycle was long and inefficient. On the other hand, modern business intelligence is easy to use and can realize certain interactivity.

There are many BI tools available in the market such as SpagoBI, Tableau, Pentaho, Qliksense, Jasper-

soft, and Jedox [1]. All these tools are very convenient and can help people quickly analyze and share data. Also, modern BI tools have the drag-and-drop function to allow users to easily understand data structure and visualize data. For example, the well-known JP-Morgan Chase Co. (JPMC) experienced a sharp increase in data volume in its early years, but bankers still used Excel and SQL server to sort out financial data, analyze reports, and predict risks [3]. Although these basic tools can achieve modeling and accurate analysis, there are still several problems. Firstly, when the amount of market data increases, the reporting efficiency is greatly reduced. Second, the degree of business automation is low, and the ability of data analysis is limited. In particular, the level of presentation of analysis results is limited, which makes it impossible for customers to clearly understand and judge. Therefore, JPMC decided to implement Tableau Prep to import and organize data, then use Tableau Desktop for analysis, and finally use Tableau Server or Tableau Online for data sharing and management control. This results in the improvements to the work efficiency of enterprises.

According to this actual case, an advanced BI tool plays an important role in optimizing strategic decision-making for an enterprise and can help the enterprise in various aspects [2]. First, most of the intelligent tools and platforms can simplify the analysis processes and can easily view and analyze data without mastering professional technology, which greatly

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reduces the adaptation time of enterprise employees to the new system. Secondly, it is very difficult to directly analyze the trend or rule of original data discovery. People are sensitive to differences in patterns or colors. With this reform, enterprises can analyze market data more efficiently, and greatly improve their profit rate and work efficiency. Thirdly, sharing opinions to promote decisions and judgments is one of the main advantages of business intelligence. Part of BI tools allow users to make notes directly in the software and can also remind users of data changes and work changes after docking through e-mail and notification, which improves the efficiency of enterprise work docking. Fourthly, the compatibility of BI tools is also a very practical part. Part of BI tools can be used in conjunction with Excel and other software familiar to users. Thus, the problem that a large amount of data needs to be converted is solved.

This paper is to explore various BI tools, identify main features, advantages, and disadvantages of these tools from users' points of view. Users' recommendations for improvements are also investigated. The results can assist academic staff to select the business intelligence tools for their business intelligence courses, assist organizations in the selection process of BI tools, and provide insights for BI software vendor in further improvement of BI tools.

### 2. Literature Review

Various enterprises including financial services and similar related industries need to face the situation of data investigation by relevant regulatory authorities. This requires BI tools to meet the following functions [3]. First, the enterprise can establish a controllable and safe management tool through the IT department to ensure data quality and consistency. Second, the enterprise can clean up and improve the data and then import BI tools to play the role of data protection. Lastly, the data can be safely kept and archived when the relevant regulatory authorities access the encryption policies and procedures, and the process of compliance can be automated. Therefore, enterprises can improve their corporate strategies through more advanced intelligent tools and find out existing marketing opportunities more quickly and efficiently. Simultaneously, enterprises can further explore customers with investment demand and potential, optimize the quality of enterprise projects and provide better services for customers. In addition, a practical tool can help enterprises solve many problems and efficiently help enterprises to complete transformation and optimization.

The functions of intelligent tools can be displayed not only through ready-made enterprise data and KPIs, but also by introducing relevant market environment and operational problems and putting forward different optimization strategies and schemes. In this way, it can help decision-makers to improve their efficiency and find the best solution [4]. Meanwhile, there will be market competition in the operation of enterprises and organizations. Intelligence tools can combine past databases and solutions to track and compare the updated performance and market data in realtime. Based on the analysis of these data, a comparative analysis with competitors can be made and used for effective business decisions. Furthermore, intelligent tools can analyze customer behavior and track performance and operational data through a realtime database. To help enterprises clearly identify new business opportunities and market trends faster, and quickly adapt to the changes of new markets, and enhance the competitiveness and profit rate of enterprises [5].

According to [6] and [7], the important features of BI tools are discussed next. First, the ability to connect internal and external data sources into a single point of access to real-time information with mobile access ensures decision-makers have the most current information. Having complete knowledge of real-time data ensures that the best decisions can be made for the benefit of the organization to make the task easier to be done. Whenever new tools come out in the market, they can also be used together as multiple tools to analyze data. Furthermore, automated data analytics is also a big part of the tools. Predictive analytics is one of the most popular features of BI tools as it can play a key role in helping businesses optimize their operations and development. It is intended to generate forecasts about future performance by using mathematical models to analyze current and past data and look for correlations, trends, and patterns to generate accurate predictions about what future datasets might develop in the future.

Next, the dashboard BI tools provide an interactive dashboard, an easy-to-use visualization with drag-and-drop capabilities, and simple indicators in a workspace to create visual dashboards and live reports [6-7]. Dashboard Templates are also one of the requirements of the BI tools. Using interactive dashboard templates can help users quickly generate sales reports or track the performance of marketing campaigns. Templates are especially useful for users who are not comfortable creating their dashboards from scratch or for casual users who spend more time analyzing data than building dashboards. Lastly, sharing the reports is one of the most important features of BI tools. The main objective of modern reporting solutions is to improve communication between teams by empowering everyone to work with data, even without technical skills. Standard sharing options include manual export and emailed reports. However, the cloud-based nature of the self-service BI tool takes the sharing experience one step further by providing other extremely useful options. For example, automatic reports are sent to custom recipients or groups cess to information. Also, the reports should allow users to export to other common formats such as PDF, PNG, Excel, etc. without damaging charts or graphs.

## 3. Research Methodology

The research is exploratory. The users in this study are undergraduate students in a business intelligence course. The total of twenty-four students was divided into four groups. Each group consists of six students. These students as a group of users were asked to explore and experience different BI tools mainly on personal computers. The BI tools which have a free trial or a free license were selected for this study. These BI tools are namely Qlik Sense, Google Data Studio, Dundas BI, and Domo. The study intends to answer the following questions.

R1: What are the main features of each BI tool?

R2: What are advantages and disadvantages of each BI tool?

R3: What are the recommendations of each BI tool from users' perspectives?

The collected data were analyzed and discussed by three researchers. Two of them had working experience in IT field, while another researcher earned a degree in Information Systems. This methodology followed the content analysis with investigator triangulation [8] to reduce the bias from the researchers.

# 4. Discussion

#### 4.1 Qlik Sense

Qlik Sense is an analytic tool that generates custom reports for businesses and provides highly detailed and user-friendly dashboards [9]. Thus, it can be used to generate insights into business processes. It can be used by individuals, small businesses, and large enterprises. Main features of Qlik Sense consist of Enterprise-level security, Smart Search feature, Progressive Creation, Drag-and-drop visualizations, Managed Data Connections, Fast and Reliable Connections, Shared Object Library, Rapid Development Environment, Real-time Access, Powerful Open and Standard APIs, Data storytelling functionality, Manageability, Self-service simplicity, Scalability, and Multi-source data integration including big data. Qlik Sense's visualization is displayed in Figure 1.

Advantages, disadvantages, and user recommendation for software improvements of Qlik Sense are described in Table 1.

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#### 4.2 Google Data Studio

Google Data Studio is the reporting tool from information that has a lot of numbers [10]. It makes a lot of numbers come out as a picture for easy understanding. Google Data Studio connects to the information that comes from Google and not Google such as Google Sheets, YouTube Analytics, Search Console, and so on. It presents information by using data to create graphs, charts, heat maps, tables, maps, etc. to help visualize data clearly and beautifully as shown in Figure 2. In addition, users can edit the report in real time as well.

Advantages, disadvantages, and user recommendation for software improvements of Google Data Studio are described in Table 2.

## 4.3 Dundas BI

Dundas BI is a flexible, end-to-end business intelligence platform that simplifies the entire analytics process and empowers everyone to visualize and analyze data [11]. Dundas BI is most commonly used to create dashboards and scorecards. Dundas BI can also use standard or ad hoc reports. Dundas BI transform raw data into actionable insights in the form of dashboards, reports, and visual data analytics. Dundas BI's visualization is displayed in Figure 3.

Advantages, disadvantages, and user recommendation for software improvements of Dundas BI are described in Table 3.

# 4.4 Domo

Domo is an integrated platform that delivers business intelligence leverage at cloud scale in record time [12]. Domo allows for connecting, combining, transforming, querying, and optimizing data. Domo also inspire data storytelling by transforming raw data, creating curated data stories, exploring data, and building live visualizations as shown in Figure 4.

### 5. Results and Discussion

Advantages, disadvantages, and user recommendation for software improvements of Domo are described in Table 4.

### 6. Conclusion

In conclusion, data visualization of BI is very important for cross-regional collaboration between teams and departments. A growing number of industries and related enterprises will eventually combine BI tools and applications into all aspects. From the study of these four BI tools discussed earlier, the advantages of these BI tools are the ability to connect internal and external data sources, the ability to provide interactive dashboards with drag-and-drop interfaces, the ability to share and collaborate for dashboards and reports,



Figure 1: Qlik Sense's visualization [9]



Figure 2: Google Data Studio's visualization [10]

Advantages	Disadvantages	Recommendation
1. With API support, the software can connect with a very wide range of systems. The dashboards seem to be quite good, and they can be integrated into other systems.	1. There is no option for report delivery. The extensions need to be certified by Qlik.	1. Software should have better visualization options on charts.
2. Data integration and linking are made easy due to the associative model.	2. It was dreadfully slow and awkward.	2. Software should have better control over total lines in the pivot and straight tables without the need to download extensions to accomplish this task.
3. With the augmented graphics and data discovery features, Qlik Sense helps in spreading data literacy. This implies that users regardless of their skill set and capabilities can learn to intuitively draw meaningful insights from data and hence, learn to comprehend data.	3. There are some issues on the client side like some features malfunctioning in iOS, qvf, and qvw files not being saved separately, etc.	3. Software should take less time to margin reports and have reusability of existing data to make it easier for coding.
4. There are options for system- guided analytics like the Insight Advisor. Also, geographical and advanced calculations can be applied to the data to give data new contexts and analyze it from different points of view.	4. Sometimes more than usual memory space is used while working in the analysis mode, slowing the processing and hindering the proper functioning of the application.	4. Software should support real online analytical processing (OLAP).
5. The software provides flexible and robust security provisions.	5. Issues in loading data in the script or data load editor have been encountered. Problems related to ODBC connections, exporting data from the sheet, script's debug mode, etc. have been noted.	5. Software should have an incremental data load solution for better time-saving.
6. Qlik Sense is compatible with all sorts of devices like desktops, tablets, laptops, and mobile phones. This makes creating and analyzing the applications much more eased up.	6. The Qlik Management Console also does not work ideally in some situations. Some generally reported issues are that large-sized files (greater than 10 GB) cannot be imported into the QMC running on Internet Explorer. If multiple files are to be executed at the same time, the status of execution freezes and hangs and the user has to delete tasks and initiate them again. Also, selecting multiple users is a very slow process.	6. Software should implement inbuild versioning, backup, dependency analysis, and regression testing.
7. The centralized hub acts as a platform for collaboration and sharing information, data, reports, and applications with other users.	7. The storytelling feature has limitations as some languages like Japanese, Chinese, etc. are not supported entirely.	7. Software should have core functionality delivered by extensions (Telemetry, CLI).
8. For an individual as well as team users, self-service creation is very beneficial, especially for non- technical users in creating apps, spreadsheets, visualizations, and BI solutions with the help of machine- guided analytics.	8. Glitches in the working of Qlik Engine also show through improper loading, reloading, execution, error messaging, keeping data intact while transitioning, in ODBC connections, etc.	
9. Custom application development is possible by the virtue of embedded analytics having open standard APIs and development tools.	9. Issues in Qlik Sense Repository are faced in removing folders, and not being able to read local files as the URL entered will not work even after setting up a database connection.	
10. The capability of data scaling is also very beneficial to users who need to use a large amount of data from big data sources. Also, such efficient scalability allows many users to work on the same application at a single time.		

Table 1. Advantages, disadvantages, and user recommendation for software improvements of Qlik Sense

Table 2. Advantages, usadvantages, and user recommendation for software improvements of Google Data Studio			
Advantages	Disadvantages	Recommendation	
1. Cloud-based and completely	1. Reports can be read-only online.	1. Should support Excel format files	
managed			
2. Tight integration with Google's	2. Lack of real-time updates in the	2. Should improve speed for the live	
ecosystem	dashboard	connection	
3. Easy to use	3. No on-premise deployment option	3. Should support comprehensive	
		functions such as computing the sum	
		of columns considering both rows and	
		columns	
4. Access and sharing controls	4. Lack of native connector support for		
	cloud-based data sources		
5. Support for live connections			

Table 2. Advantages.	disadvantages.	and user rec	ommendation	for software	improvements o	f Google	Data Stud	di



Figure 3: Dundas BI's visualization [11]

Advantages	Disadvantages	Recommendation
1. Enabling business to analyze data,	1. Big data cache.	1. Adjusting and improving the Big
identify patterns, and predict trends in		data cache, as speed and result of
business.		large reports is sometimes an issue.
		Random bugs are encountered
		sometimes when analyzing numerous
		data.
2. Enabling business to make more	2. Not specify pricing plan.	2. Disclosing the price information
informed decisions and implement		for each package that is available.
best practices.		
3. Easy to create a wide range of	3. Has certain limitations when used with	3. Adding a few more types of filters
report types by leveraging built-in	Linux OS.	for working on data like a sliding
formulas or using drag-and-drop		calendar range filter.
items.		
4. Quickly recovering data by	4. Use of data cubes requires prior	4. Adjusting and deducting the
restoring recently or accidentally	knowledge of data structures.	limitations when used with Linux OS.
deleted dashboards, reports, folders,		
and files from the recycle bin.		
5. Improving employee productivity	5. 3D charts require additional scripting	5. Developing the use of data cubes to
and ensuring data security by	and are not supported out-of-the-box.	be easier, as easy as a person who
designing, scheduling, and		does not have knowledge of data
distributing professional work emails		structures can use it.
from templates in the platform.	( Herrinterferenzen herrenferine	( Developing 2D shorts for sting has
6. Allowing access from any browser,	6. User interface can be confusing.	6. Developing 3D charts function by
without needing to download a		providing scripting function and
separate desktop application and		support for out-or-tile-box.
7 Supporting a wide variety of	7 Reduced performance with Internet	7 Developing the program
industries such as banking and	7. Reduced performance with internet	7. Developing the program
finance, clean tech, construction	Explorer.	with Internet Explorer
education government healthcare		with internet Explorer.
high tech hospitality insurance		
manufacturing mining non-profit oil		
and gas, pharmaceutical, retail.		
telecom, transport and logistics, as		

Table 3. Advantages, disadvantages, and user recommendation for software improvements of Dundas BI

Table 4. Advantages, disadvantages, and user recommendation for software improvements of Domo

Advantages	Disadvantages	Recommendation
1. Integrating on-premises data into the cloud system: The software is extremely flexible and user-friendly. Users can access data from their phones or anywhere with an internet connection	1. Difficult to extract or export data when users want to do their own analysis or send data to other users of different BI programs.	1. Should provide more teaching material for new users.
2. Beautiful interface: Visualizations are clean and very business presentable. It is easy to use with the drag-and-drop function.	2. Lack of improvement as the venture capital appears to invest more into sales and marketing than product support and customer service.	2. Should add an installed version for Windows and MacOS.
3. Integrating automated data discovery: Get AI-powered insights into data with Insights, Domo's deep learning, and descriptive stats module.		3. Should mention cost of using Domo.
<ol> <li>Integrating natural language queries: Users can ask questions about data in natural language and get an instant response with text bots.</li> <li>Creating powerful alerts that help users manage by exception and keep users apprised of key changes in data.</li> <li>Users can receive alerts via web, email, or any mobile device.</li> </ol>		4. More advertisement.



Figure 4: Domo's visualization [12]

and the ability to control access and sharing permission. Most BI tools such as Google Data Studio, Dundas, and Domo are cloud-based; therefore, users can access these tools from any browser with an internet connection. This would make these tools flexible and easy to access. The disadvantages of BI tools vary among these tools. For example, some desktop tools are slow and some cloud-based tools are slow when using Internet Explorer. Some tools are difficult to extract or export data. Many users recommend that the performance of the tools should be improved for live connection. The tools should be able to support various file formats, especially the common one like Excel. Also, the price information for each package of these BI tools should be disclosed on their websites. In the future, BI tools that add predictive analytics functions will become more and more popular as enterprises are increasingly interested in analyzing trends and forecasting data for competitive advantages. Therefore, BI software vendors should be continuously integrating new technologies and innovations into the BI tools to ensure that the tools are more efficient and effective. Enterprises have various requirements in terms of functionality, security, availability, and investment budget so they should select the BI tools which best answer their needs.

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