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Pooling Business Intelligence and Dashboard Technology for Decisions Making in Higher Education Institutions

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ABSTRACT

With the growing importance of information in organisational management and the advancement of information technology, there are now business application systems that assist companies and institutions in making more informed decisions and increasing high organisational efficiency.

A company, for example, can use business intelligence, information, and environmental indicators to compare trends and forecast how they will change in the future. Today, business intelligence is one of the most important concepts for management and organisations seeking to lead in global markets and maximise the effectiveness of all of their business activities and processes.

The management of a large volume of data can be a time-consuming task if the information is not properly classified and made available when needed. This is especially true in higher education, where massive amounts of data and analytics go unreported during each session. Universities collect a massive amount of data every year, from the time a student enrolls to the time he or she completes a course. This data relates to admissions, student enrollment, courses, workshops, seminars, conferences, studios, attendance, financial resources, infrastructure development, and other topics. The most important responsibility is to compile data when this data needs to be expressed in an understandable format so that the Vice-Chancellor, Directors, Head of Department, Professor, and other high-ranking administrators can quickly understand the performance of ongoing tasks.

Business Intelligence (BI) has developed dashboard technology that visualises trends and patterns, allowing for a more reliable and strategic approach. This paper discusses the significance of Business Intelligence (BI) and dashboard technology in higher education institutions (HEI). It is a data-driven, mission-updated, and student-centered BI dashboard that will not only keep decision-makers informed, but will also assist them in strategic planning and decision-making.

Key Words - business intelligence, data model, data warehouse, dashboard technology, knowledge performance indicators, performance management, university management

1. INTRODUCTION

Today, business intelligence is one of the most important concepts for management and organisations seeking to become global market leaders and maximise the effectiveness of all their activities and processes. Banking, education, healthcare, government, manufacturing, and other industries all use business intelligence tools and methods. Every organisation must collect and process a large amount of data. Organizations today are driven by the quantity and quality of information they collect. Companies store information about their customers, employees, transactions, organisational knowledge, and other relevant sources. Whoever can quickly sort through data and turn it into useful reports may be the one who stays ahead in the business race.

Business intelligence (BI) is a set of techniques and tools that help in the analysis and transformation of unprocessed data into knowledge that can be used for business analysis and decision-making [1]. Organizations gather data from internal IT systems and external sources as part of the business intelligence (BI) process, prepare it for analysis, run queries against the data, and create data visualizations, BI dashboards, and reports so that business users can use the analytics results to make operational decisions and plan strategically.

The goal of business intelligence (BI) is to assist organisations in making better business decisions that increase revenue, improve operational efficiency, and provide a competitive advantage. BI is a group of reporting, analytics, and data management tools as well as various methods for collection and managing data.

A vast volume of data might be difficult to handle if the information is not delivered as needed and in an ordered fashion. As significant volumes of data and analytics pass each session by unnoticed, this is true for the entire higher education sector. Every day and every year, universities produce vast amounts of data, from student enrollment to course completion. Admission, student enrollment, classes, workshops, seminars, conferences, studio attendance, financial resources, infrastructure development, and other topics are covered. When this understanding must be presented in a straightforward manner so that the Vice-Chancellor and other senior officials can quickly understand how well the ongoing tasks are performing, the size of the task explodes.

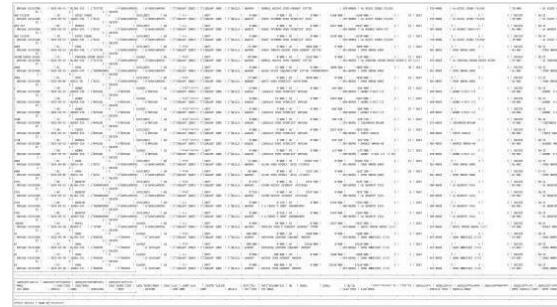
The image shows a screenshot of a raw data table. It has a very large number of columns, with headers that are small and difficult to read. The data rows are densely packed, showing a variety of numerical and text values. The table appears to be a direct export from a database or a log file, without any filtering or summarization.

Fig 1: Shows raw data format that manually filters out to produce meaningful actionable data.

Business Intelligence (BI) has developed dashboard technology that displays trends and patterns in a graphical style, allowing for a dependable and strategic approach to be used. It is a data-driven, student-centered, mission-focused BI dashboard. It will not only keep decision-makers informed, but it will also assist them in strategic planning and decision-making. The purpose of this research is to investigate the value of Business Intelligence (BI) and dashboard technology in higher education organizations. Here, the intended audience consists of Higher Education Institution stakeholders in search of strategies to feasibly enhance their data reporting processes.

Business intelligence (BI) is well-known as a set of tools that assist organisations in making better decisions by utilising computerised systems that are fact-based. BI is also known as Decision Support Systems (DSS) because the end goal of BI tools is to make data manipulation and visualisation easier in order to aid decision-making.

Higher education institutions face numerous challenges, particularly in terms of retaining students and keeping costs low. Many organisations are turning these problems into strengths by creating useful reports with BI tools and dashboard technology.

2. BACKGROUND

This section explains why our research is important and provides background information on how BI and data dashboards are used and the benefits they provide in higher education. Reviewing the existing research reveals that more needs to be done to develop HEI data dashboards, especially for day-to-day operations like scheduling and staffing for review management. Even though complex visualizations are great, many HEI still show their data with line graphs, bar graphs, or pie charts. [2].

Because of the evolution of dashboards, users can now interact with the graphs and charts that display their data. Metrics that were previously hidden can now be found by users. In a market where user satisfaction and financial success are key metrics, higher education institutions must focus on data

analytics to retain students and improve business procedures. How critical it is for BI to use a capable data analysis tool to achieve these objectives. Many higher education institutions already collect the data required to predict and analyze significant changes. However, they continue to extract this information from various databases and present it in separate reports, which is neither efficient nor helpful. Most common systems increase the likelihood of user error and make it more difficult for different departments to collaborate and learn from the reports they generate from a variety of data sources.

In today's world, it's critical to consider what data visualisation is and what it means for data analytics as a whole. As a result, data visualisation is merely regarded as a means of visually describing data. When we think of data visualisation, we can look at it and discuss it in a variety of ways. One of these reviews describes it as a method of displaying data that does not rely on spreadsheets but rather on visual tools [3]. It is a tool for detecting patterns, relationships, and other useful information that is difficult to see in a data table. This enables users to make quick decisions based on accurate information [4]. The primary goal of data visualisation is to display key metrics from a set of data tables in an understandable manner. However, if users are going to share data visualisations, they must be easily accessible. It must also be simple to maintain and quick to construct.

The History of Business Intelligence

In 1865, Richard Miller Devens coined the term "business intelligence" for the first time when describing how successful banker Sir Henry Furnese used a network of information to outcompete his competitors. Furnese had a network of businesspeople in Western, Central, and Northern Europe who could communicate with him faster than any of his competitors. This gave him the opportunity to put his knowledge to use and profit greatly.

The phrase was hardly ever used before the middle of the twentieth century. The term was first used in 1958 by researcher Hans Peter Luhn to describe the capacity to take relationships supported by facts that motivate people to act in favor of a specific business objective. Business intelligence is used today pretty much exactly as Luhn wrote it as "an automated system for sharing information between different parts of an organization."

Business intelligence, according to Howard Dresner's definition from 1989, is "the concepts and methods to enhance business decision-making by using fact-based support systems.

The term was not widely used in many industries until the 1990s, despite being used in a few

significant ways. The term was previously only used to describe enterprise reporting. These days, it also includes potent, user-friendly data analysis tools [5]. All the systems, tools, and procedures used to analyze business data are collectively referred to as "business intelligence" in modern term.

Business Intelligence (BI)

The definition of business intelligence varies among authors. They hold that being able to gather, process, and store data that all levels of an organisation can use to meet their own needs, mold the organisation for the future, and shape them from market threats constitutes business intelligence.

Market research, business intelligence, and intelligence organizations are all terms that are frequently used interchangeably. Business intelligence can be defined as the gathering of data about rivals and the business environment in order to establish and maintain a competitive advantage.

"Business Intelligence (BI) is a set of methodologies, processes, architectures, and technologies that transform raw data into meaningful and useful information used to enable more effective strategic, tactical, and operational insights and decision-making." – Forrester Research [6]. In order to help people throughout the organisation make better strategic and tactical decisions, it combines data analysis with a decision support system.

How the business intelligence process works

In a large data warehouse or smaller data marts, business intelligence data is typically kept. Specifically, this data, including text, sensor data, log files, and other unstructured or partially structured data types. Both historical information and data that is gathered in real time as it is being created from various source systems can be included in BI data. This means that the use of business intelligence tools can benefit both strategic and tactical decision-making [12]. Data from various source systems must typically be integrated, consolidated, and cleaned before being used in BI applications using data integration and data quality tools. This is done to ensure that business users and BI personnel are analyzing correct and consistent data.

Why business intelligence is important

The goal of business intelligence is to improve an organization's business operations by using relevant data. Businesses can successfully use BI tools and techniques to transform their acquired data into insightful understandings of their business processes and strategies. These insights can then be applied to

make wiser business decisions that increase productivity and revenue, thereby hastening the expansion of the business and boosting profits.

Without BI, businesses would struggle to utilise data-driven decisions. When making critical business decisions, executives and employees must rely on other factors such as accumulated knowledge, prior experiences, intuition, and gut feelings. These methods have the potential to result in good decisions, but because they are not supported by data, they are prone to errors and blunders.

Benefits of business intelligence

A successful BI programme generates numerous business benefits in an industry. For example, by doing things like merging data, checking notes, digitising statistics and other sources, and so on, Business Intelligence has helped the sports industry grow and change significantly. The analyst team performs various types of statistical analysis, advises managers on which players to trade and prioritise, and evaluates Sports Policies and Decision Making in Professional Sport. Tour and travel booking is another sector that heavily utilizes BI. Airlines and hotel chains use it to track flight capacity and room occupancy rates, set and modify prices, and plan employee schedules. Analytics and BI are used in healthcare organizations to help diagnose illnesses and other conditions, as well as to enhance patient care and outcomes. Business intelligence is used by some international and national QS university ranking systems to track overall student performance metrics and, among other things, spot students who might need help.

The key benefits of BI include:

- “speed up and improve decision-making;
- optimize internal business processes;
- increase operational efficiency and productivity;
- Highlights business problems that need to be addressed;
- identify emerging business and market trends;
- develop stronger business strategies;
- drive higher sales and new revenues; and
- gain a competitive edge over rival companies”.

BI projects also provide more targeted business benefits, such as making it easier for project managers to track the progress of business projects and for organizations to compile competitive intelligence. Business intelligence is frequently used by the BI, data management, and IT teams to learn

more about various aspects of technology and analytics operations.

Key Challenges of Pooling Business Intelligence

Unstructured Data

To solve problems with searchability and data evaluation, at least a basic understanding of the content is required. At the moment, business intelligence systems and technologies require well-organized data in order to be searched and structured. This type of structuring context is frequently provided by metadata.

Many organisations struggle with data quality. Even if a company has good BI architecture and systems, users will find it difficult to trust the numbers if the data is suspect or incomplete.

Poor Adoption

Many BI projects attempt to completely replace old tools and processes, but users frequently stick with the tools and processes they are familiar with. Many experts believe that the time required to create reports is the primary reason why BI projects fail. This could be because users prefer to use old tools rather than learn how to use new ones.

Inadequate user or IT training is another factor for the failure of a BI project. Inadequate training can lead to disappointment, which can result in project failure.

Lack of Stakeholder Communication

Furthermore, a lack of effective internal communication will result in the failure of business intelligence projects. Giving users false hope is one thing that could go wrong during implementation. Although business intelligence projects are occasionally marketed as quick fixes, they frequently turn out to be lengthy, stressful projects for all parties involved.

Project failure can also lead from breakdowns in communication between IT departments and end users. If they don't work together, the end might not satisfy everyone's needs and demands. This could lead to problems for everyone involved and a project failure.

Improper Planning

According to Gartner, a research and consulting firm, you should not buy all of your business intelligence products in the same place. Customers must find a product that meets their needs in terms

of price and capabilities because business intelligence products differ greatly.

Business intelligence is never considered a continuous process, but rather a collection of projects. Because users frequently request changes, having a process in place for reviewing and implementing changes is critical.

In addition to a predetermined approach that considers business objectives, IT requirements, and end user needs, some organizations use a "Change as needed" strategy for business intelligence. Gartner recommends assembling a group of individuals from these fundamental groups to create or modify a business intelligence approach.

Companies may attempt to avoid spending a significant amount of money on a business intelligence product by requesting dashboards that only display the most important information. Because this type of project is so specific, it rarely succeeds. A single, stand-alone custom dashboard may not be consistent with the overall business intelligence strategy or corporate objectives.

Many businesses struggle to create a single version of the true requirement in order to prepare for new business intelligence systems and software. KPIs (Key Performance Indicators) must be described in a standard manner, from the most general to the most specific level. If proper documentation is not provided and different definitions are used, users may encounter difficulties, and it may take time to resolve these differences.

Many universities are aware of the benefits of dashboards, which include making operational Key Performance Indicators (KPI) easier to analyze, which are more concerned with executive administration than program performance. Financial data and staff service quality are two examples of operational KPIs. Dashboards have aided HEI in a variety of ways in recent years, including making it easier to analyze financial data and key performance indicators. Dashboards are especially useful because they visually summarize a lot of information.

3. DISCUSSION

A data dashboard is a tool for managing information that monitors, analyzes, and displays key performance indicators (KPI), metrics, and key data points to assess the health of an organisation, department, or specific procedure. They can be modified to meet the requirements of a specific department or organisation [7]. A dashboard in the background connects to your data files, attachments, procedures, and APIs. Summaries, reports, tables, charts, and gauges are all used to display this data on the roof. A dashboard gives businesses a centralized location to track and analyze performance, making

it the best tool for managing multiple data sources. The amount of time businesses previously had to spend analyzing data and corresponding with customers is reduced by real-time monitoring.

How do data dashboards work?

Everyone uses data dashboards in different ways. Because not all business dashboards are used for the same tasks, users must understand which KPIs to track and why. To understand more about this, please answer the following questions:

Dashboards answers shat kinds of business questions?

A good data dashboard provides answers to important business questions. Dashboards, as opposed to more advanced business intelligence tools, are designed for quick analysis and information awareness. A question and answer format is the most common way to create a business dashboard.

Dashboards tracked what type of data?

A dashboard's responses to business questions vary depending on the company, department, and process. Most analytical dashboards are created to assist decision makers, executives, and managers in setting goals, making plans, and determining what happened and why. They can then apply what they've learned to discover new ways to understand things. This is done by an analytical dashboard based on what the user knows about the data it has collected over a period of time (i.e. last week, month, or year).

How are the dashboards interactive?

The data displayed on a dashboard in the form of summaries, reports, tables, charts, and gauges allows users to monitor how well their organization is performing in relation to industry standards and goals. Data dashboards enable you to see, track, and improve your business by allowing the most important information. Even numbers can be visually informative depending on how you design your dashboard by using symbols such as a red arrow pointing down to show a drop in revenue or admissions or a green arrow pointing up to show an increase in inquiries or website traffic.

How are data dashboards used in business intelligence and analytics?

Wikipedia shows, "Analytics is the discovery, interpretation, and communication of meaningful patterns in data. Especially valuable in areas rich with recorded information, analytics relies on the simultaneous application of statistics, computer

programming, and operations research to quantify performance. Analytics often favors data visualization to communicate insight [8].”

Dashboards are a type of data visualisation tool that helps users understand the analytics that are important to their company, department, or project. Dashboards enable non-technologists to participate in and understand the analytics process. They accomplish this by compiling data and making trends and events visible. Data dashboards provide unbiased performance metrics and are an excellent place to start a conversation. A dashboard is a business intelligence tool that displays data in an easy-to-understand format using images.

Several previous studies attempted to identify metrics that could be used to assess the performance of various parts of a higher education institution. Financial ratios, student dropout rates, admissions-to-application ratios, and tuition fees by year, for example, could be discovered and sent to accreditation boards. [9] went on to list the student affairs metrics: student hostel, attendance, and retention. However, these studies focus only on merging Business Intelligence and Dashboard Technology for making decisions in HEI.

Dashboards can be used for a variety of purposes, including displaying data. These dashboards are used to track how well goals or business standards are met, allowing academic administrators to see what is going on in their institute. However, data visualisation on dashboards shows how well or poorly goals are met, so stakeholders can see why [10]. These studies have nothing to do with academic programme management because they are primarily concerned with getting people to use business intelligence (BI) dashboards in university settings [11].

As the amount of data produced by universities has increased, new methods for combining data from various sources and using it to make decisions after thorough analysis must be developed.

Improves the Decision-Making Process

Every year, universities generate a large amount of data, from the time students enrol to the time they receive their degrees. This makes it more difficult for the authority to determine how to use or apply the data. Dashboard technology can help in the following ways.

- The dashboard is a "Visual Reporting" tool. It compiles information about the University from various resources and shows it in an easy-to-understand format. This provides the most important people with the information they require to make important decisions.

- It focuses on the most important aspects of the University, such as teaching resources, academics, student evaluation, and so on, by collecting reliable data that can aid in better planning.
- The dashboard shows how well the University performed in different ways by comparing data from different years. This lets top experts predict future trends and set the goals of the University.

Track the Student's Admission and Retention with Active Dashboards

The number of students who stay at most universities and colleges is decreasing. Furthermore, the government provides less funding to universities for students who return to school. As a result, it is critical to plan how to retain students and how much it will cost. The University's leaders require high-quality, reliable data insight with exact facts for this.

Admission Management System

More numbers of students looking for admission in the academic institutes (Schools, Colleges, and Universities) are causing terrific pressure on the managerial body of the institutes to accomplish the admission process manually. It is difficult now to conduct the process accurately and promptly. Hence, the need for online admission is inevitable.

The purpose of the online admission system is to automate the institute's admission structure and its related procedures and functionality. The reason for this initiative is to provide a platform to the management and would-be students by providing a transparent, faster, and easy way of maintaining records and use them for further proceedings and reference. It organizes the entire admissions process and allows administrators to securely store academic, fee, and communication information about students online. The BI DSS framework (Dashboard) organizes this information so that it can be understood immediately and in real time.



Fig 2: “Shows the state-wise admission count and fee collection details”.

Student Information Management System

Student Information Management System (SIMS) is a fully computerised system or database used to store, retrieve, monitor, and analyse all data about students. The data is saved so that stakeholders with the appropriate roles can access it via a secure login, thereby protecting student data. Enrollment, admission, payment, and scholarship administration make the entire enrollment process quick, organised, and error-free. An educational organization's main goal is to help all students do better in school. This can be accomplished quickly by analysing each student's performance using good analytical tools, such as a dashboard. With this knowledge, effective and corrective actions can be taken to help them improve their performance and reach their full potential. If not done with the proper IT system, this could take a long time and be exhausting. The Student Information Management System (SIMS) assists the organisation in keeping track of all information about students in a comprehensive, organised, and efficient manner. Education ERP eliminates the need for teachers to spend a significant amount of time compiling student data. As a result, teachers can concentrate on their students and how to help them succeed in school. It tracks every student from the time they enrol until they graduate. By combining information from the student information system, worksheets, and other sources, administrators can use the business intelligence tool to create an interactive dashboard. All stakeholders can access more information on this secure dashboard.

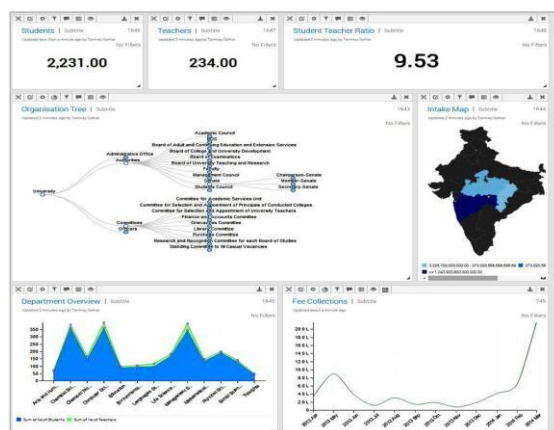


Fig 3: “The dashboard provides an overview of the entire organization, describing the number of students, number of teachers, organization tree, narrow regions of students, and most significantly preferred courses and trends in fee collection over the year”.

Active dashboards are important because they display important data such as the number of applications for university courses, the number of registrations, the number of students enrolled in each class, the amount of money raised, attendance, student performance, academic courses, and so on. Administrators can use this information to create solid plans for setting realistic goals.

Managing the Educational Methodology and Monitoring Student

How well students perform is also important. The key performance indicators in the University Dashboard help top officials and faculty understand how students are doing and how involved they are in school. They can also determine how effective the courses are.

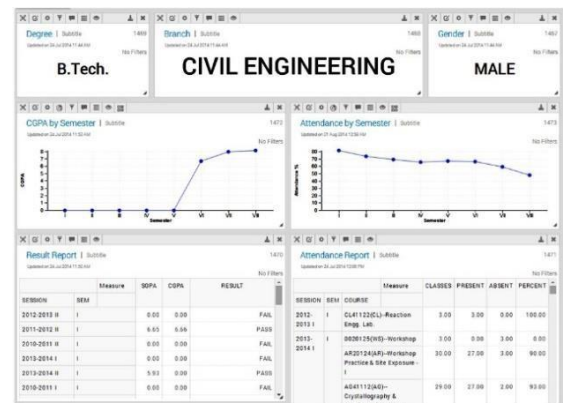


Fig 4: The dashboard illustrates the progress report of the student about his academic performance and attendance.

Pooling in Marketing Intelligence Tools

Because there is so much competition among institutes, it is difficult for management to meet all of the students' needs. This requires the use of smart communication and promotion tools, such as dashboards for higher education.

It assists institutes in identifying gaps and increasing the number of people who sign up. This data can also be used to plan marketing campaigns for specific audiences, such as social media campaigns and other online marketing.

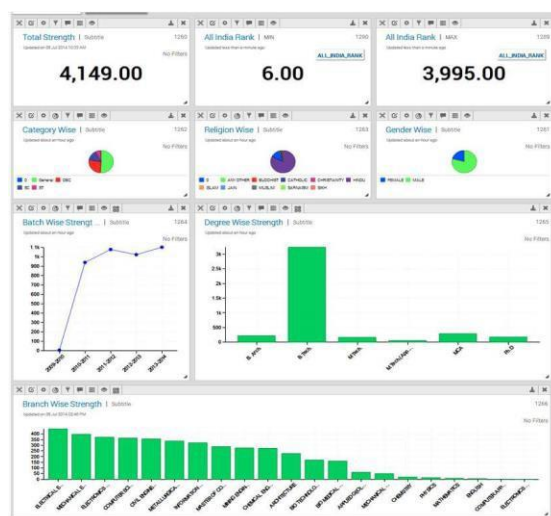


Fig 5: “The dashboard illustrates the total strength of students and helps in analyzing different categories such as religion, branch, and degree which formulate the entire strength. This helps in identifying the most preferred courses”.

Conclusion

“It can be concluded that, the Business Intelligence based Dashboard Technology for HEIs is an effective business intelligence tool to analyze university data. The authorities responsible for making decisions, can get a quick insight into various areas of the university at any point in time in single clicks. With this progressive features, authorities at higher education institutes can easily systemizes the applications and admission process to incorporate meaningful admissions, retention, evaluation, teaching and non-teaching staff performance, infrastructure development policies for powerful plus optimal decision making, and future BI marketing strategies”.

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Author Contribution

Author 1- Sharma

hemantsharma@gujaratuniversity.ac.in - Confirms sole responsibility for the following: study conception and design, and data collection.

Author 1- Sharma

hemantsharma@gujaratuniversity.ac.in - Prepared dashboard figures 1-5.

All authors do the data analysis part and interpretation of results and manuscript preparation.

Author 2 – Joshi hdjoshi@gujaratuniversity.ac.in - did the proofreading errors, and checks for grammar and syntax to make sure that this paper sounds natural and professional.

In the end, all authors reviewed the manuscript before submitting it to the journal.

Conflict of Interest

Here Author 1- Sharma

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‘The author declare that there is no conflict of interest’.

References

[1] CallMiner. (2020, September 5). What is Business Intelligence? Definition, Techniques, Tools and Tips from Experts. Callminer.Com. <https://callminer.com/blog/what-is-business-intelligence-definition-techniques-tools-and-tips-from-experts/>

[2] Simon, P. (2014, March). The visual organization: Data visualization, big data, and the quest for better decisions. Wiley. ISBN: 978-1-118-79438-8.

[3] Yuk, M. & Diamond, S. (2014). Data visualization for dummies. ISBN-13: 978-1118502891.

[4] Kirk, A. (2012). Data visualization [electronic resource] : A successful design process. Birmingham, UK: Packt Pub.

[5] Business Intelligence (BI): The Definitive Guide. (n.d.).

<https://www.microstrategy.com/en/resources/introductory-guides/business-intelligence-the-definitive-guide>

[6] Business intelligence. (n.d.). Wikipedia. https://en.wikipedia.org/wiki/Business_intelligence

[7] What is a data dashboard? (n.d.). <https://www.klipfolio.com/resources/articles/what-is-data-dashboard#:~:text=A%20data%20dashboard%20is%20an,of%20a%20department%20and%20company>.

[8] Analytics. (n.d.). En.Wikipedia.Org. <https://en.wikipedia.org/wiki/Analytics>

[9] Mitchell, J. J., & Ryder, A. J. (2013). Developing and using dashboard indicators in student affairs assessment. New Directions For Student Services, 2013(142), 71-81. doi:10.1002/ss.20050.

[10] Eckerson, W. (2010). Performance dashboards: Measuring, monitoring, and managing your business (2nd ed.). Hoboken, NJ: John Wiley and Sons.

[11]. Butler, L. M. (2007). Warning lights: New dashboard reports help institutions gauge their performance. New England Board of Higher Education. Retrieved from <http://files.eric.ed.gov/fulltext/EJ792690.pdf>.

[12] Margaret Rouse, M. (n.d.). Business Intelligence (BI). Searchbusinessanalytics.Techtarget.Com, <https://searchbusinessanalytics.techtarget.com/definition/business-intelligence-BI>

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