The integration of cloud computing technologies with BI systems - A literature review

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Abstract

Cloud computing has revolutionized the way businesses manage and analyze their data. With the advent of Business Intelligence (BI) tools, organizations can derive actionable insights from vast amounts of data to make informed decisions. The convergence of cloud computing and business intelligence presents a transformative opportunity for businesses to enhance their decision-making capabilities and drive strategic growth. By embracing these technologies and leveraging data-driven insights, organizations can navigate complexity, mitigate risks, and capitalize on emerging opportunities in the digital age. This paper provides a comprehensive review of the integration of cloud computing technologies with BI systems. It discusses the benefits, challenges, and emerging trends in utilizing cloud-based solutions for BI applications. Additionally, it explores various case studies and real-world examples to illustrate the practical implications of this integration. By synthesizing existing literature and industry practices, this paper aims to provide a literature review and comprehensive understanding of the use of business intelligence and cloud computing to enhance decision-making in businesses, it looks to inform practitioners and researchers about the evolving landscape of cloud-based BI solutions and its potential impact on organizational decision-making processes.

Keywords: Cloud Computing, Business Intelligence, BI, Cloud-based BI, Integration, literature Review, Case Studies.

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تكامل تقنيات الحوسبة السحابية مع أنظمة ذكاء الأعمال – مراجعة الأدبيات

الملخص

لقد أحدثت الحوسبة السحابية ثورة في الطريقة التي تدير بها الشركات بياناتها وتحللها. مع ظهور أدوات ذكاء الأعمال (BI)، يمكن للمؤسسات استخلاص رؤى قابلة للتنفيذ من كميات هائلة من البيانات لاتخاذ قرارات مستنيرة. يقدم التقارب بين الحوسبة السحابية والاستخبارات التجارية فرصة تحويلية للشركات لتعزيز قدراتها على اتخاذ القرار ودفع النمو الاستراتيجي. من خلال تبني هذه التقنيات والاستفادة من الرؤى القائمة على البيانات، يمكن للمؤسسات التنقل عبر التعقيدات وتخفيف المخاطر والاستفادة من الفرص الناشئة في العصر الرقمي. تقدم هذه الورقة مراجعة شاملة لتكامل تقنيات الحوسبة السحابية مع أنظمة ذكاء الأعمال. ويناقش الفوائد والتحديات والاتجاهات الناشئة في استخدام الحلول السحابية لتطبيقات ذكاء الأعمال. بالإضافة إلى ذلك، تستكشف دراسات الحالة المختلفة والأمثلة الواقعية لتوضيح الآثار العملية لهذا التكامل. من خلال تجميع الأدبيات والممارسات الصناعية الحالية، تهدف هذه الورقة إلى تقديم مراجعة للأدبيات وفهم شامل لاستخدام ذكاء الأعمال والحوسبة السحابية لتعزيز عملية صنع القرار في الشركات، كما أنها تتطلع إلى إعلام الممارسين والباحثين حول المشهد المتطور للحوسبة السحابية. حلول ذكاء الأعمال القائمة على المعلومات وتأثيرها المحتمل على عمليات صنع القرار التنظيمي.

الكلمات المفتاحية: الحوسبة السحابية، ذكاء الأعمال، ذكاء الأعمال القائم على السحابة.

Introduction

Decision-making is a critical aspect of any organization as it directly affects its performance and success. The ability to make informed decisions relies heavily on the availability of exact and up-to-date information. In today's fast-paced business environment, the use of cloud computing and business intelligence tools has become increasingly important in enhancing decision-making processes.

Cloud computing is a technology that allows users to access and store data, applications, and resources over the internet rather than on local servers or personal computers. The cloud provides organizations with a scalable and cost-effective way to manage and process data, enabling them to make more informed decisions in real-time. Business intelligence (BI) refers to the technologies, applications, and practices for the collection, integration, analysis, and presentation of business information to improve decision-making.

Literature reviews have shown that using cloud computing and business intelligence tools can significantly enhance decision-making processes in various ways. One study by Tariq et al. (2018) [1] found that organizations using cloud-based BI systems have improved data accuracy, timeliness, and accessibility, leading to better decision-making outcomes. Another study by Zhang et al. (2017) [2] found that cloud-based BI systems enable organizations to analyze large volumes of data from multiple sources, providing valuable insights that can be used to make strategic decisions.

Furthermore, research by Kim et al. (2019) [3] highlighted the role of cloud-based BI in improving decision-making through data visualization and predictive analytics. By analyzing data in real-time and visualizing key performance indicators, organizations can identify patterns and trends that can help them make more informed decisions. Additionally,

research by Kiron et al. (2016) [4] emphasized the importance of cloud-based BI in enabling organizations to access and analyze data from anywhere, at any time, leading to more agile and responsive decision-making processes.

In conclusion, the literature review reveals that using cloud computing and business intelligence tools can have a significant impact on enhancing decision-making processes in organizations. By leveraging the cloud for data storage and access, and utilizing BI tools for data analysis and visualization, organizations can make more informed and timely decisions that drive business success. As technology continues to advance, it is crucial for organizations to harness the power of cloud computing and business intelligence to stay competitive in today's fast-paced business environment.

The rest of the paper is structured as follows: in the ensuing section 2, we discuss the literature review. Section 3 introduces a discussion and future research before concluding the paper in Section 4.

1. Literature Review

In recent years, the use of cloud technology and business intelligence (BI) tools has become increasingly important in enhancing decision-making processes within organizations. The ability to access and analyze vast amounts of data in real-time has enabled businesses to make more informed decisions, leading to improved operational efficiencies and better strategic planning. This literature review will explore the current research and best practices on how cloud and BI can be used to enhance decision-making in various industries.

One of the key benefits of using cloud technology and BI is the ability to access data from anywhere, at any time. By storing data in a cloud-based system, organizations can easily

share information across departments and locations, enabling better collaboration and decision-making. According to Shang and Seddon (2017) [5], cloud-based BI allows organizations to collect, analyze, and visualize data in a more efficient manner, leading to better decision-making processes.

Orlovskyi and Kopp (2020) presented a Dashboard of a method for BI to improve corporate data analytics and decision making [6]. The suggested methodology includes two stages: dataset preparation and analysis. Although dataset preparation focuses mostly on transforming star schemas into flat structures, the dataset analysis step recommends which visualizations may be presented on a dashboard. For suggesting, threshold values for dataset sizes were used. A method for designing dashboards, which serves as the foundation for the suggested dashboard design approach, is described. A sample dataset is examined, five data subsets are created, and dashboard-compatible suggestions for visualization charts for these datasets are made. In addition, they discussed their findings and ended their research.

Kurnia and Suharjito (2018) presented a BI dashboard approach to monitor the success of each Subject or channel of news broadcast to social media platforms such as Facebook and Twitter [7]. Contextual performance in social media is the proportion of social media-posted items that get likes, shares, comments, etc. To determine the Subject of a social media news item, text classification algorithms such as Naive Bayes, SVM, and Decision Tree were employed. For later deployment in the data warehouse, the most accurate SVM method was determined by comparing the results of competing algorithms. Meanwhile, the data source for the business intelligence dashboard may be obtained from previously created data warehouses.

Magdalena et al. at 2019 [8] suggested A dashboard based on a BI tool that offers corporate leaders and business managers with analytical data information to enhance the efficiency of processes and infrastructure. PT XYZ designed and implemented BI Dashboard to assist its operations in the Maintenance, Repair, and Overhaul (MRO) market. Unfortunately, use of the BI dashboard inside the firm remains very low and has even been abandoned. Thus, a plan to increase the use of the BI dashboard was required. This research outlined such a technique, which includes user testing and heuristic assessment. The findings of the research were suggestions for enhancing the BI dashboard.

Khalid et al. (2020) presented a model based on a dashboard that was designed to give business information and assist the company in making decisions according to the suggested research model [9]. The dashboard consists of four primary elements: summary, delivery, driver profile, and driver behavior. In fleet management, this initiative concentrates on the work of the driver. Unbalanced driver participation in fleet management decreased the organization's productivity, particularly in the transportation sector. Each driver's productivity and contribution to the company should be reviewed and analyzed depending on their performance. This project's objective is to discover the elements impacting driver performance in logistic transportation and to create a business intelligence dashboard for enterprises to visualize driver performance for decision-making purposes. For the research study, the transportation sector using a business intelligence architecture and dashboard creation tools has been chosen. As the result of this research, a conceptual model illustrating the elements that affect driver performance was suggested. The

dashboard was assessed by responders with fleet management responsibilities.

Scholtz et al. (2018) presented a Business Intelligence (BI) framework for strategic environmental information management (the Sustainable BI Framework) that may be used at Higher Education Institutions (HEIs) [10]. The study utilized the design science investigation technique to a case study of a South African higher education institution. Difficulties with information management for sustainability are addressed, and a theoretical framework is provided. Moreover, a realistic BI software application was created as a proof of concept to solve these issues and aid in the administration of strategic sustainability information in a HEI. The suggested BI tool for sustainability was examined by top management using heuristic and usability assessments. The findings suggested that the usability of the BI tool was scored favorably and that the framework may aid HEIs in overcoming the obstacles they experience in handling sustainability information efficiently.

Saragih et al. (2021) designed an information system through using BI methodology to analyze Bali tourist data and data administration by substituting paper usage with digital interfaces so that knowledge doesn't just disappear but is utilized as a decision-making source [11]. During system development, various techniques were employed, such as the Codeigniter framework with the MVC web architecture (Model, View, and Controller), OLAP (on-line Analytical Processing) to display data visualization, and double exponential smoothing to show the outcomes of data forecasting for the following period. Using the Mean Absolute Percentage Error methodology, the error value of this forecasting approach can be determined. Black box testing, usability testing, and user acceptability testing were used to

establish the quality and functioning of the system in terms of input, output, and evaluation by system users in order to identify the amount of system usage. This research shown that BI technology is not only beneficial for businesses, but also for tourism, government, and services. The designed method may aid in tourist tracking and improve decision making.

Marzouk and Hanafy (2022) presented research on strengthening the consistency of the elements of the system in a healthcare organization at the early phases of design in order to improve maintenance schedule [12]. The paper proposed a framework that collects inputs from all business parties to aid in the development of a Maintainability Information Database (MID) that stores the maintenance information of system components, the data responsibilities matrix, and the manageability goals used in the design phase to evaluate the design alternatives. Regarding the maintainability elements of systems design in healthcare facility buildings, eight indicators were established. Using the C# programming language, the framework connects Building Information Modeling (BIM) and Business Intelligence (BI) system to aid in analyzing maintainability. The program retrieved all data necessary for maintainability assessment from the BIM models, executed the computation model for the assessment, and exported all maintainability data and evaluations to an interactively BI Dashboard through a web interface. The Dashboard for Business Intelligence is designed to monitor maintainability plans for all systems components of a healthcare facility's structure. For a real design project for a healthcare facility, the system's features were tested in order to assess two alternative design possibilities and demonstrate its potential.

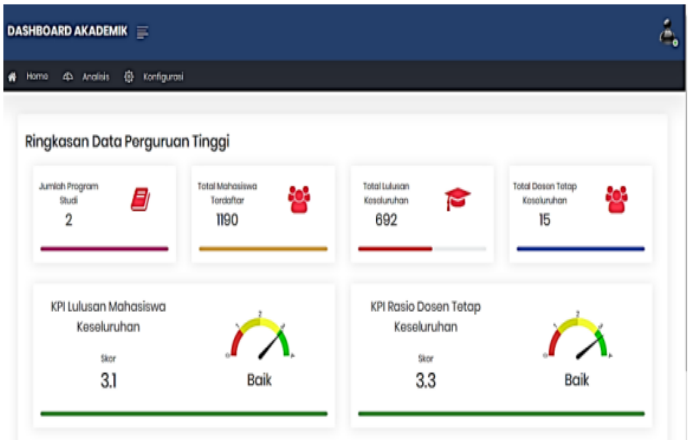
Data from commercial transactions needs through an ETL (Extract-Transform-Load) process that clears, transforms,

and reshapes the data into a data warehouse or a data warehouse in order to provide business intelligence. Data warehouses and data marts are databases developed specifically to facilitate data analysis and knowledge discovery. The assessments of data are directed by the organization's Key Performance Indicators (KPIs), which differ from company to business.

To resolve the issue of providing the necessary reporting on sales transactions at the XYZ Store, the BI software can be implemented with an Interactive Dashboard Display. In XYZ Stores, Akbar et al. (2020) proposed an interactive BI Dashboard Visualization application [13]. Data Management is among the most important methods used by XYZ Store to get information about product sales. XYZ Store utilizes the Smile Invent application to handle data on product sales transactions as part of its operational operations. In creating the BI application, the BI Roadmap served as a foundation for conducting research, beginning with the identification of to-be-selected challenges. The infrastructure and planning projects were then evaluated during the planning phase. The analysis phase then focuses on doing a thorough examination of business issues and opportunities resulting from BI adoption. The design phase involves implementing the data warehouse design procedure and ETL via Pentaho Data Integration (PDI). Subsequently, the implementation phase, which included the choosing and execution of BI software tools for Data Visualization, was executed.

There are several problems with academic data that is saved but transforming it into a report at the time of review is difficult and time-consuming. Monitoring, evaluation, and measuring systems that can evaluate the effectiveness of universities are required. Destiandi and Hermawan (2018)

proposed a BI model for an academic dashboard [14], and the Business Intelligence Lifecycle is a process for producing successful BI decision support tools, such as the Academic



Dashboard. There are six phases in the BI life cycle: Rationale, Planning, Business Analysis, Design, Construction, and Deployment. Each phase is elaborated in line with the BI's environmental requirements (L. T. Moss). Administration of tertiary institutions in Indonesia requires timely and accurate academic reports that enable strategic decision-making and enhance the quality of education. As shown in (Figure 1), Academic assessments can be observed on a dashboard that facilitates decision-making. By integrating KPI parts, the Business Intelligence Lifecycle may be leveraged to deliver information for high resolution.

Figure 1: Academic dashboard by a proposed BI model [14].

As a measurable statistic, current corridor screening approaches use observed crash frequency. Due to traffic and uniform circumstances throughout corridors, screening at the corridor level is crucial in order to fulfill drivers' expectations and confusion.

In 2020, Veeramisti et al. suggested a business intelligence platform based on a systematic strategy for corridor-level network inspection [15]. The solution method was built inside a BI platform to solve the practical obstacles to the greatest degree feasible.

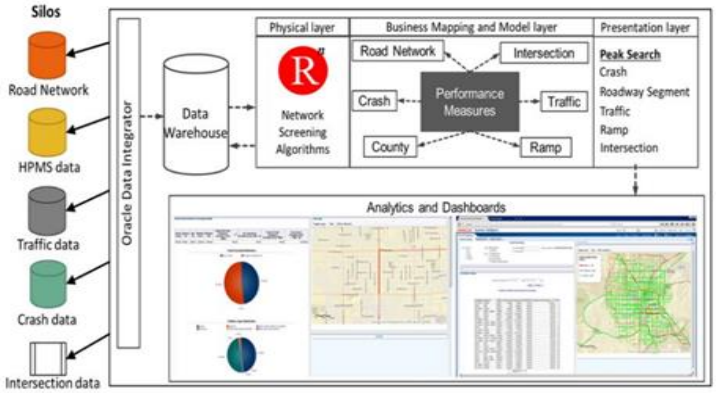


Figure 2: A business intelligence approach for traffic safety analysis [15].

As shown in (Figure 2) BI offers techniques and procedures for integrating and processing data, generating sophisticated analytics, and visualizing outcomes via the use of intuitive and interactive web-based dashboards and maps. Tests and results demonstrated the benefit of using the suggested framework for corridor-level network monitoring for traffic safety on a BI platform.

The government provides hospitals with demands and needs to optimize their resources and improve their services. Hospital Management needs accurate information in order to organize and manage hospitals in accordance with government standards. The hospital's information is still restricted, does not correspond to actual events, and needs significant resources to

collect since it is gathered manually. The use of information technology such as BI is a solution since BI is a system designed to process and analyze data into valuable information and give assistance for strategic decision making in hospitals. The initial phase in this study is issue identification, followed by data gathering, data analysis, the creation of Business Intelligence, implementation, and assessment. To optimize evidence-based practice, data from the Hospital Information System (SIMRS) is utilized.

Rapid shifts in the financial atmosphere and circumstances have thrust Business Intelligence (BI) into the spotlight for even small and mid-sized businesses (SMEs). To gain a competitive edge, organizations must consider novel methods to enhance their operations. Usage of Data Warehouse and Business Intelligence represents one of the many used solutions.

Jayakrishnan et al. (2018) suggested a dashboard for the Management Diagnostics Framework that utilizes the characteristics of Big Data Analytics (BDA) and Business Intelligence (BI) to observe the complex picture of organizational strategic performance [16]. Their study aimed to examine BDA and BI as dynamic research that has helped businesses to infiltrate and produce more knowledge formation and decision-making. The objective of their study is to increase the comprehension of new information generated from arranging large data scenarios and BI framework development in the real world. To address the confusing situations of BDA, they developed a framework that incorporates the current BDA and BI phases, as well as their analytic characteristics, into the construction of an organizational strategic performance management framework. The result of their efforts is the construction of a typical strategic performance administration

software based on the strategic diagnostic dashboard of the business organization.

Mailasan et al. (2018) proposed a dashboard of organizational performance diagnostics framework that describes the special characteristics of Knowledge Management (KM) and Business Intelligence (BI) enabling decision-makers to see the wider issue [17]. Knowledge Management (KM) and Business Intelligence (BI) are two significant models and methodologies that enable firms to derive superior intelligence knowledge generation and decision making. By designing and using KM and BI together as a vital performance of organizational operations for adapting to and coping with problematic scenarios such as data deluge. This study focuses on displaying the analytical capability of a company for strategic performance choices. This conceptual framework thus links the present phases of KM and BI in the execution of a plan for showing an organizational performance indicator. The objective of this study is to give a full understanding of new information from constructing KM and BI phases as well as their mashing features while developing the organizational performance framework. This effort result in the development of a standard strategic performance application dashboard for corporate diagnostics.

Wadii et al. (2018) provided a BI solution to help decision-making in higher education and academic affairs at Taibah University [18]. BI is a collection of technologies and tactics that enable the analysis of data and the provision of information to aid in decision-making. When BI principles are incorporated into the academic process, tremendous advances are possible. Using BI, they used a collection of analytical tools that facilitate decision-making for various users. The suggested BI system comprises primarily of three tasks:

gathering data from various sources using the three operations (ETL), providing a multidimensional solution, and presenting findings through a collection of visualizations and reports. With SQL Server Data Tools, experiments were conducted. SQL Server Integration Services, SQL Server Analytic Services, and SQL Server Reporting Services were described as the three phases. Several statistical and predictive indications required for academic work were provided by the suggested method.

Girsang et al. (2018) made a suggestion for a Reporting System that should be used by the Indonesian Construction Company Recognition association [18]. Being one of the Indonesian organizations of construction service sector, the association guarantees that each construction service company is recommended and recorded in accordance with Indonesian legislation and the constitution. As the job of this organization is to provide detailed reports to the government, domestic or international investors, and all institutions that require information regarding market needs, resource developments, and advancements in construction technologies, the challenge is to create queries for every data from MySQL tables in order to generate reports quickly, efficiently, and automatically. The suggested option is to use a Data Warehouse with organized storage and the ability to analyze data using OLAP, which can rapidly process and display data. The Data Warehouse was constructed using the Kimball Technique so that this association may create customized reports for each instance.

Noonpakdee et al. (2018) suggested a methodology for assessing and generating dashboard templates for small and medium-sized businesses (SMEs) in order to efficiently analyze and display data [19]. Because the sales are a fundamental and vital service, so that its design would be

simple for SME users to comprehend, the study focused on sale templates. According to the research, the framework consists of four primary elements: business operation, attribute list, visualization, and dashboard capabilities. Forty SMBs utilized the templates for six to nine months. In addition to evaluating the assessment of the templates and potential modifications, advantages and obstacles were also investigated.

Suganda et al. (2019) suggested a BI system that can assess student learning progress [20]. Assessment and monitoring are the primary purpose of school operations. Each school's curriculum is unique and cannot be simplified while employing the same textbooks. Also, school employees, such as the headmaster, teacher, and staff, aren't limited to a single school site and may have several responsibilities at each school location. At this level of complexity, a single query cannot provide a score report quickly enough. This study used nine processes to develop a data warehouse as a business intelligence tool. Using Online Analytical Processing (OLAP), the data are analyzed and shown using the dashboard. Using a data warehouse, each school may answer a scoring-related business question and display the results on a dashboard before making a choice.

Wu and Chen (2020) presented several recommended business processes, a realized scenario case, and several administration dashboards and reports for a researched SME (manufacturing) utilizing the Odoo 9th community edition ERP system with a business intelligence tool [21]. For small to medium-sized businesses, using a commercial ERP system commonly involves expensive consultancy fees, software costs, and risk (SMEs). However, open-source ERP solutions may be seen as a viable choice for SMEs with limited financial and human resources. Implementation outcomes demonstrated

that the business scenario supplied by the Odoo ERP system is applicable to the manufacturing under study. Many factors, including the localization of application modules and the training of expert consultants with hands-on experience with the Odoo ERP system, must be addressed in order to maximize the system's advantages. The Odoo ERP system, which is less costly, flexible, under complete control, and efficient, may be regarded as an alternative teaching system to ERP courses and undergraduate students' themes at universities for the purpose of enhancing students' practical ERP skills.

Fraihat et al. (2021) developed a BI solution framework including a market and technology assessment, issue domain objectives, solution architecture modeling, design, and testing, and the usability of descriptive and predictive features [22]. The findings of the framework give an efficient BI solution with user-friendly market information for investors with little or no market expertise. The solution includes predictive analytics based on existing machine learning modeling methodologies, which are compared to determine the optimal methodology and model combination for anticipating market behavior in order to empower novice users.

Real estate is one of the most important and difficult areas on the market, which represents the economy, and it requires continuous progress. Nowadays, business intelligence plays a vital role in boosting the decision-making and risk management processes in several industries. Abutahoun et al. (2019) provided a framework for an efficient BI solution to analyze the real estate market and estimate property prices [23]. Several stages of the development of the BI solution were exhibited and assessed on real estate data.

There are also some challenges that organizations can face when implementing a BI solution. Some of the key challenges include data (quality integrity, and security), technology complexity and cost issue.

Cloud-based BI solutions can provide several benefits over traditional on-premises solutions, include accessibility, low cost, ease of use, and security.

HALIM and Siana (2019) proposed cloud-based tool Power BI dashboard that serve a restaurant's marketing plan in Surabaya [24]. The restaurant is a café that serves to middle-class consumers. The primary issue with this restaurant is the absence of a defined marketing plan. Since they are not based on a plan, the promotions that have been implemented so far are not targeted and have no effect on sales. It is anticipated that the application of business intelligence with Power Business Intelligent (Power BI) enable restaurants to identify customer consumption habits. Capturing consumer consumption habits and using them to develop the optimal marketing plan. It was discovered that certain restaurant menus had a unique connection that may be exploited as a sales pitch. As a result of implementing the proposed Power BI dashboard, restaurant managers can have a simpler time to evaluate sales patterns based on the incidence of occurrences and activities.

B. Jena (2019) proposed a system that is built on cloud-based business intelligence tools and gives deep understanding of the tableau tool [25]. It used tableau for data visualization in forecasting and data analysis. This paper's primary objective is to demonstrate how simple forecasting and analysis can be performed using this tool via Tableau by utilizing a superstore's dataset to anticipate future sales and profit for the next four quarters of the next year. In the gathered dataset, sales and

profit figures for various product categories are provided, and utilizing the forecasting technique in the tableau platform, these two metrics are computed and depicted for the next year. The article concludes with a comparison of all business intelligence and analytics frameworks based on several characteristics such as complexity and speed.

Atsani et al. (2019) proposed a dashboard based on Business Intelligence that informs management of the Hospital decision-making to manage hospital beds, doctors' compliance with the service or clinical route, and hospital mortality [26]. These restrictions are dependent on the outcomes of data gathering, which is restricted to the types of data in the database. The BI Dashboard informs management whether the Hospital SPM falls below or surpasses the Ministry of Health criteria. The SPM number that is below or above the requirement shows that the quality of hospital services is subpar, thus management must take steps to enhance it. The steps of producing Business Intelligence (data sources, data warehouses, Power BI) include extracting, transforming, and loading (ETL) data from data sources, accessing data from the data warehouse using the Power BI application, and creating dashboard visualization. The Power BI program was used to construct Business Intelligence dashboards because of its user-friendliness and comprehensive feature set. Before being put to full use, BI systems were assessed for used to verify their quality and viability. The final findings of the Hospital administration's assessment of the BI system were evaluated with eleven users and revealed a suitable category when compared to the SUS score table.

Widjaja and Mauritsius (2019) proposed the cloud-based monitoring system using Power BI at the Indomobil company's strategic management level [27]. The sales and net loss of

Indomobil, one of the leading automobile firms in Indonesia, have been declining. The industry should identify ways to enhance the efficacy and productivity of its operations. BI is the process of analyzing and presenting a huge quantity of data as a collection of reports; this involves synthesizing the implied main ideas of the full data and converting these concepts into a conclusion that can be used to enhance company performance. The construction of the dashboard system is predicated on the Vercellis framework, which consists of four major phases: analyzing, designing, planning, implementing, and controlling. The user's participation in the analysis and design process as well as the validation of the results will also enhance the quality of the needed dashboard. The purpose of this research is to examine the capabilities of Power BI to enhance the decision-making process in the automotive business sector.

Bhargava et al. (2018) suggested a strategy for the interactive display of datasets from educational institutions utilising Microsoft Power BI Tool with several features [28]. This model concentrates on the processing of Microsoft Power BI, the variety of data sources accessible in the Tool, and the many visual findings or contexts associated with them. Data visualization in BI and analytics is increasingly valuable in every domain. There are a variety of approaches for visualizing information, including those that are responsive or dynamic, and datasets also be shown in a variety of visual insights.

Al-Aqrabi et al. (2015) presented an OPNET paradigm for a cloud-based small-scale BI and OLAP platform [29]. The network has been constructed such that the load can be spread uniformly among all Relational Database Management System (RDBMS) servers. In addition, the application needs have been designed so that all RDBMS servers receive and execute an equal amount of OLAP query load. The model's RDBMS array

consists of eight servers servicing four OLAP application servers. The load distribution has been controlled equitably by application demand flow modeling, which is an outstanding OPNET capability that performs better. The servers selected for this model have similar hardware specifications and are of the same brand and model. The load has been characterized as constant after an initial exponential rise. This model's simulation of the load lasted just 50 million events and failed to prepare for load changes. This model only supports 3000 concurrent OLAP user connections. A genuine BI system based on cloud computing would have tens of thousands of concurrent end users pushing BI load to the servers. The BI on the cloud model is discussed together with the simulation outcomes. These outcomes are an excellent indicator of how a massively parallel RDBMS system might well be deployed to construct a BI and OLAP framework and how the framework should execute in a cloud environment.

Moreover, BI tools can help organizations extract valuable insights from their data, allowing them to make more informed decisions. By using advanced analytics and visualization tools, businesses can identify trends, patterns, and correlations within their data, leading to more accurate forecasting and strategic planning. As noted by Pulkkinen, Huhtala, and Jormanainen (2015) [30], BI tools can help organizations gain a competitive advantage by providing insights into customer behavior, market trends, and industry best practices.

Overall, the combination of cloud technology and BI tools offers organizations a powerful solution for enhancing decision-making processes. By providing access to real-time data, scalability, flexibility, cost savings, and valuable insights, businesses can make more informed decisions that drive

success and growth. As organizations continue to embrace digital transformation, cloud-based BI solutions will play an increasingly important role in driving innovation and competitive advantage.

2. Discussion & Future Research Avenues

The literature review conducted in this paper reveals significant insights into the realm of decision-making enhancement through the integration of cloud computing and business intelligence (BI) within businesses. By synthesizing findings from a range of scholarly articles, this discussion section aims to highlight key themes, implications, and avenues for future research.

Firstly, the review underscores the growing importance of cloud computing in facilitating efficient decision-making processes within businesses. Cloud-based solutions offer scalability, flexibility, and accessibility, enabling organizations to harness vast amounts of data and computational power to make informed decisions. Studies highlighted the role of cloud platforms in providing on-demand access to BI tools, thereby empowering decision-makers with real-time insights and analytics.

Furthermore, the synthesis of literature emphasizes the transformative impact of business intelligence on decision-making practices. BI technologies enable organizations to gather, analyze, and visualize data from disparate sources, fostering a data-driven culture that enhances decision quality and agility. Through advanced analytics techniques such as predictive modeling and data mining, businesses can uncover valuable patterns and trends, enabling proactive decision-making and strategic planning.

Moreover, the review identifies several challenges and considerations associated with the integration of cloud and BI for decision-making purposes. Security and privacy concerns emerge as critical factors, as businesses grapple with safeguarding sensitive data stored and processed in the cloud. Additionally, interoperability issues between disparate BI tools and cloud platforms may hinder seamless integration, necessitating careful planning and implementation strategies.

The literature also highlights the importance of organizational readiness and change management in driving successful adoption of cloud-based BI solutions. Effective training programs and cultural shifts are essential to ensure that stakeholders embrace data-driven decision-making practices and leverage the full potential of cloud-enabled BI tools.

In terms of future research directions, this review underscores the need for empirical studies examining the efficacy and impact of cloud-based BI solutions on decision-making outcomes across various industry sectors. Longitudinal studies could provide insights into the evolving nature of decision processes in response to technological advancements and organizational dynamics. Additionally, investigations into emerging trends such as edge computing and artificial intelligence could shed light on novel approaches to enhancing decision-making capabilities in the digital era.

Given the evolving nature of cloud and business intelligence technologies, there are several future research avenues that researchers can explore to further enhance decision-making in businesses. One potential research avenue is to investigate the impact of AI and machine learning algorithms on decision-making in businesses. By incorporating AI-powered analytics into cloud-based business intelligence

tools, businesses can gain deeper insights into their data and make more accurate predictions.

Another future research avenue is to explore the adoption of hybrid cloud architectures for decision-making in businesses. Hybrid cloud architectures combine public and private cloud resources to create a more flexible and cost-effective infrastructure. By studying the implications of hybrid cloud architectures on decision-making, researchers can help businesses optimize their cloud resources and improve their decision-making processes.

Furthermore, researchers can also investigate the role of data governance and compliance in decision-making using cloud and business intelligence technologies. With the increasing focus on data privacy and regulatory compliance, businesses need to ensure that their decision-making processes are in line with legal and ethical standards. Researchers can explore ways to integrate data governance and compliance mechanisms into cloud-based business intelligence tools to ensure that businesses make informed decisions while adhering to regulatory requirements.

In conclusion, the integration of cloud computing and business intelligence technologies has the potential to transform decision-making processes in businesses. By leveraging the scalability, flexibility, and analytical capabilities of cloud and business intelligence tools, businesses can make more informed decisions and gain a competitive edge in the market. However, there are still several challenges that need to be addressed to fully realize the benefits of these technologies. Future research avenues can help researchers explore new approaches and techniques to enhance decision-making using cloud and business intelligence in businesses. By addressing

these research gaps, researchers can help businesses maximize the potential of cloud and business intelligence technologies for decision-making.

4. Conclusion

In today's fast-paced world, businesses are constantly looking for ways to enhance their decision-making processes in order to stay competitive and agile in the market. One of the strategies that have gained popularity in recent years is the use of cloud and business intelligence tools to facilitate data-driven decision making. The literature review paper examined in this essay focuses on the benefits of using cloud and business intelligence for businesses to improve their decision-making processes.

In conclusion this literature review paper has explored the role of cloud computing and business intelligence in enhancing decision-making processes for businesses. The integration of cloud resources and advanced analytics tools offers significant benefits for organizations seeking to improve their decision-making capabilities and strategic outcomes.

Through the analysis of existing research studies and case examples, it is evident that leveraging cloud and business intelligence solutions can empower businesses to make data-driven decisions in a dynamic and competitive environment. Cloud computing provides the infrastructure and scalability needed to store and process large volumes of data, while business intelligence tools enable organizations to extract insights and generate actionable intelligence from their data assets.

By centralizing data management in the cloud and utilizing business intelligence platforms for analytics and

visualization, businesses can gain a competitive edge by making informed decisions based on real-time information and predictive analytics. The synergy between cloud computing and business intelligence not only enhances decision-making efficiency but also enables organizations to respond proactively to market trends and opportunities.

Despite the benefits of integrating cloud and business intelligence for decision-making, challenges such as data security, privacy concerns, and organizational resistance to change must be addressed to maximize the value of these technologies. Future research should focus on addressing these challenges and exploring innovative strategies for optimizing the use of cloud and business intelligence in decision-making processes.

To sum up, the convergence of cloud computing and business intelligence presents a transformative opportunity for businesses to enhance their decision-making capabilities and drive strategic growth. By embracing these technologies and leveraging data-driven insights, organizations can navigate complexity, mitigate risks, and capitalize on emerging opportunities in the digital age.

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