International Journal Software Engineering and Computer Science (IJSECS)
5 (2), 2025, 510-518
Published Online August 2025 in IJSECS (http://www.journal.lembagakita.org/index.php/ijsecs)
P-ISSN: 2776-4869, E-ISSN: 2776-3242. DOI: https://doi.org/10.35870/ijsecs.v5i2.4273.

RESEARCH ARTICLE Open Access

Business Intelligence and Decision Support to Enhance Decision-Making Quality in Higher Education

Syamsiah *
Universitas Indraprasta PGRI, South Jakarta City, Special Capital Region of Jakarta, Indonesia.
Corresponding Email: ncham.unindra08@gmail.com.

Agus Darmawan
Universitas Indraprasta PGRI, South Jakarta City, Special Capital Region of Jakarta, Indonesia.

Halimatusa'diah
Universitas Indraprasta PGRI, South Jakarta City, Special Capital Region of Jakarta, Indonesia.

Reko Syarif Hidayatullah
Universitas Indraprasta PGRI, South Jakarta City, Special Capital Region of Jakarta, Indonesia.

Nasrulloh Isnain
Universitas Indraprasta PGRI, South Jakarta City, Special Capital Region of Jakarta, Indonesia.

Received: May 14, 2025; Accepted: June 20, 2025; Published: August 1, 2025.

Abstract: The availability of accurate and reliable data is essential for organizational sustainability. Business intelligence (BI) enhances an organization's ability to analyze challenges, support decision-making, and improve performance. The term "Business Intelligence System" refers to applications and technologies that facilitate BI activities, including data collection, storage, access, and analysis, thus providing insights into performance and aiding informed decisions. These activities include decision support systems, querying, reporting, OLAP, statistical analysis, forecasting, and data mining. BI applications encompass reporting tools, analytics platforms, dashboards, alerts, and portals, and involve technologies such as data integration, quality management, warehousing, and content analysis. Accordingly, a Business Intelligence system can function as a decision support system (DSS). This study uses SPSS version 17 for data analysis to evaluate the impact of BI and decision support on decision-making quality in colleges in Jakarta and Bekasi. ANOVA (F-test) results show an F-value of 117.041, exceeding the F-table value of 3.29, with a significance of 0.000 < α = 0.05. Since the calculated F-value surpasses the critical value and the significance level is below 0.05, the null hypothesis is rejected. Thus, BI and decision support significantly and simultaneously influence decision-making quality (Y). These findings highlight the essential role of BI and decision support in improving decision-making within higher education institutions.

Keywords: Business Intelligence; Decision Support System; Decision Making.

1. Introduction

As business competition becomes increasingly fierce, the speed and accuracy of decision-making are crucial. The development of information technology has experienced rapid progress; one of these advances is in decision-making for business activities, which has contributed significantly to fundamental changes in an organization's structure, operations, and management [1]. The business world has also been greatly aided by the development of increasingly sophisticated information systems, especially in business intelligence. Various analyses are also developed with information technology to support information systems that can increase managerial effectiveness and improve business and organizational performance [2]. Business Intelligence is not a single product, nor a technology or methodology. Business Intelligence combines technology, practical methods, and products to organize key data needed to increase profits and improve the performance of business activities. Specific actions can drive business performance, and decisions are based on business analysis and focused information around key business processes [3]. Business Intelligence is a form of implementation that can answer organizations' needs to improve their ability to analyze the problems they face and to increase the company's competitive advantage through the utilization of various data, information, and knowledge owned by the company as raw materials in the decision-making process. BI has been widely used by organizations to manage data and information and support decision-making. BI can be interpreted as knowledge obtained from the results of data analysis from an organization's activities [4].

The definition of [5] is what, as expressed by DJ Powers 0, "describes a concept and method on how to improve the quality of business decision-making based on data-driven systems. BI is often equated with briefing books, report and query tools, and executive information systems. BI is a data-based decision-making support system." Business Intelligence is a way to collect, store, organize, reshape, summarize data, and provide information, both in the form of data on the company's internal business activities as well as data on the company's external business activities, including the business activities of competitors that are easily accessible and analyzed for various management activities [7]. BI is an application and technique to collect, store, analyze, and provide access to data, which will ultimately help companies make better business and strategic decisions. The main applications include search and reporting activities, processing analysis (OLAP), DSS, data mining, planning, and statistical analysis [3][8].

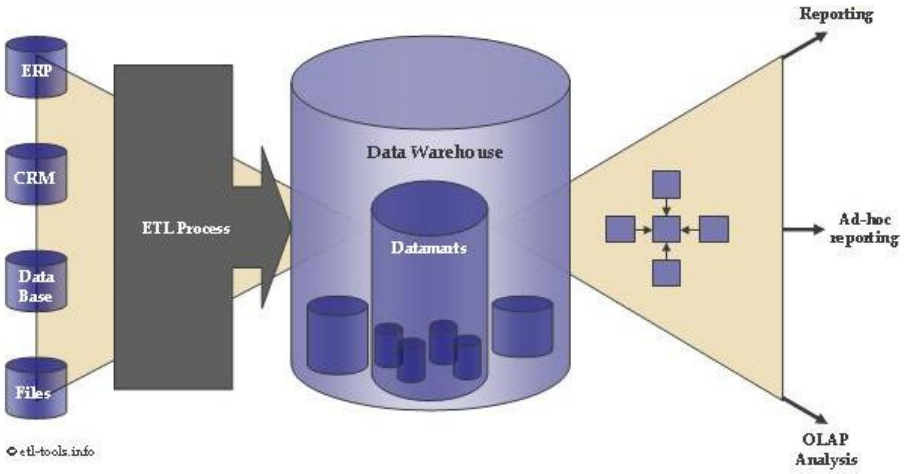

Figure 1. Turban Business Intelligence Process

Business Intelligence solution is a term generally used for the type of application or technology used to help BI activities, such as collecting data, providing access, and analyzing data and information about company performance to help users make accurate decisions by carrying out various activities including decision support systems, queries, reporting, online analytical processing (OLAP), statistical analysis, forecasting, and data mining for data analysis [9]. Therefore, business intelligence can help in the decision-making process of management in an organization by using several BI tools.

The concept of a Decision Support System (DSS) was first expressed in the early 1970s by Michael S. Scott Morton with the term Management Decision System [10]. This computer-based system is intended to help decision-makers by utilizing specific data and models to solve various unstructured problems. The term DSS refers to a system that utilizes computer support in decision-making. To provide a deeper understanding of several DSS definitions developed by experts, including Man and Watson, who provide the following definitions: DSS is an interactive system that helps decision-makers solve semi-structured or unstructured problems [11]. Decision-making is choosing between two or more alternative actions to achieve certain goals [1]. Decision-making is selecting alternative actions to achieve specific goals or targets. Decision-making is

carried out with a systematic approach to the problem by collecting data and information and supplementing it with factors that need to be considered in decision-making [12]. Decision-making is a mental process (cognitive process) resulting in the choice of action between several alternative scenarios. Every manufacturing process decision results in a final choice. The output can be an action or an opinion of choice [13]. Decision-making in management plays a vital role because the decisions made by a leader or manager are the final result that the leader in the organization must implement. Decision-making is required at all levels of administrators in the organization. Decision-making is the selection of alternatives with the least risk to be carried out to achieve organizational goals. Three forces influence the process: individual dynamics, group dynamics, and environmental dynamics [14].

Therefore, knowing the types of decisions in advance would make them more manageable. This will help us estimate what information is needed, where it comes from, and how to obtain it so that the decisions made are the best for the smooth running of the organization's activities. Some research on the influence of Business Intelligence and Decision Support on the quality of decision-making in higher education includes [12]. Improving the Greatness of MTV Europe, especially the report on the contribution of several OLAP functionalities to the MTV Europe strategic plan and considering it as one of the drivers of sustainable competitive advantage. The results of the analysis show that business intelligence and decision support significantly affect the quality of decision-making in five-star hotels in the capital city [14]. Overall Transport Effectiveness (OTE) is a framework solution that measures operational performance and can be used to measure the effectiveness of transportation activities shared by logistics service providers [15]. Information providers use this system; this information is of high value, the system can widely neutralize the decision-making process, and using business intelligence can improve achievement targets [16].

This study's results suggest using BIDSA in an ERP perspective that can be provided through innovation factors. This study found that this adoption/usage perspective helps evaluate organizational characteristics that make them willing to accept innovation and change—success in implementing information systems in Thai government higher education institutions [13]. Integrating knowledge management with BI solutions can help add value (knowledge) from much information that can add input to strategic decisions [17]. The results of the study show that there is an allegation that the decision and competitive effort are greatly influenced by how bank technology can see the progress and threats of competitors in meeting the demands of customer needs [18]. Technological advancements and digitalization have changed the landscape of higher education worldwide. Universities and colleges must adapt quickly to provide more effective and efficient services to their students. The use of information technology and decision-support systems in higher education can be the key to improving the quality of the decision-making process [5][19][20][21].

One of the research gaps in this area is the lack of understanding of integrating business intelligence and decision support systems to improve decision-making in higher education settings. Several previous studies have shown the potential of this technology in the field of education [22][23][24], but only a few have explicitly focused on the context of decision-making in higher education. Previous research has explored various benefits of technology-based learning systems, such as increasing student independence, encouraging collaboration between students, teachers, and parents (Hutami, 2021), and assisting the decision-making process in education (Hutami, 2021). On the other hand, research on the use of decision support systems in the context of education has also been conducted, although it is still limited [25]. To fill this gap, this study aims to investigate the urgency, research gaps, and novelty of using business intelligence and decision support systems to improve the quality of decision-making in higher education environments.

2. Related Work

The integration of Business Intelligence (BI) and Decision Support Systems (DSS) has attracted significant attention across various domains, including business, healthcare, and higher education. Zarour and Benmerzoug (2019) highlight how decision-making support can optimize business process outsourcing in multi-cloud environments, emphasizing the importance of tailored DSS solutions for complex organizational needs [1]. Similarly, Santi and Putra (2018) conducted a systematic review that illustrates the growing role of BI in higher education, where BI technologies are increasingly leveraged to enhance both administrative and academic decision-making [2]. Ali and Khan (2019) discuss organizational capability readiness as a critical factor for successful BI implementation, underscoring that technological adoption alone is insufficient without a supportive organizational culture [3]. In the healthcare sector, Sousa and colleagues (2019) demonstrate the value of big data analytics in people management, showing that data-driven decision-making can significantly improve operational outcomes [7]. Esteves *et al.* (2021) further reinforce this perspective by presenting a pervasive BI platform designed to streamline decisions related to healthcare service waitlists [11].

The challenge of ensuring the continued use of BI systems is explored by Hayajneh and Harb (2023), who identify user engagement and perceived value as key determinants for sustained adoption within

organizations [5]. Meanwhile, Güngör-Demirci and co-authors (2019) introduce a risk-based tool to guide groundwater well rehabilitation decisions, showcasing the practical application of DSS in resource management [4]. Technological advancements such as artificial intelligence are also reshaping decision support. Beheshti *et al*. (2023) describe ProcessGPT, a generative AI framework that transforms business process management and enhances the adaptability of decision-making systems [9]. Pereira and colleagues (2022) explore how AI-driven customer models support decision-making in online retail supply chains, proving that intelligent systems can respond dynamically to market changes [14]. Zhdanov *et al*. (2022) address the ethical dimensions by proposing privacy-aware AI models, which are increasingly vital as businesses rely on automated decision-making [16].

In education, Wiwik and colleagues (2023) argue that DSS has become a game changer, particularly in supporting complex decisions in academic environments [12]. Hmoud *et al*. (2023) examine the factors influencing BI adoption in higher education, noting that institutional readiness and leadership commitment are essential for successful integration [22]. Yie, Susanto, and Setiana (2021) discuss the synergy between DSS and BI in enabling digital connectivity for government, a strategy that holds potential for educational institutions aiming to modernize their operations [27]. Despite these advancements, there remains a research gap regarding the optimal integration of BI and DSS in higher education, especially in the context of developing countries. As Maluleka and Chummun (2023) point out, competitive intelligence and strategic implementation are critical but often underexplored dimensions in current literature [25]. These studies suggest that while BI and DSS offer transformative potential, further research is needed to address contextual challenges and to tailor solutions for the unique needs of higher education institutions.

3. Research Method

The population in this study consists of universities in the East Jakarta area, specifically one university in East Jakarta and four universities in Bekasi. The researcher used random sampling to select 40 managers from the top and middle management levels at these universities. The research employs a descriptive analysis method, which investigates current issues based on factual data from the population. The purpose of descriptive research is to test hypotheses or answer questions related to the current status of the subjects being studied, and to use quantitative methods to examine the influence among the variables. The choice of this method is based on the researcher's aim to capture the influence of business intelligence and decision support on the quality of decision-making in universities in Jakarta and Bekasi, as well as their direct and indirect effects on the following research variables:

1) Business intelligence functions as an independent variable, denoted as X1.
2) Decision support functions as an independent variable, denoted as X2.
3) Decision-making quality functions as the dependent variable, denoted as Y.

The instrument was developed using the Rensis Likert model (1932), with options: Strongly Agree (SA), Agree (A), Quite Agree (QA), Disagree (D), and Strongly Disagree (SD). Each option is assigned a weight ranging from 5 for strongly agree to 1 for strongly disagree. According to Nur Indriantoro (2002), the data properties are categorized as interval scales [29]. To determine the relationship between business intelligence, decision support, and the quality of decision-making in higher education, the author analyzes the collected data using quantitative analysis methods. This involves statistical formulas such as correlation and regression analysis, as these methods are considered fully appropriate for data analysis in this research.

4. Result and Discussion

4.1 Results

This study analyzes two independent variables: Business Intelligence (X1) and Decision Support (X2), along with the dependent variable, decision-making quality (Y). The data were processed using SPSS version 17, yielding the following results:

Table 1. Simple Correlation Coefficients

Correlations

		Business Intelligence	Decision Support	Pengambilan Keputusan
Business Intelligence	Pearson Correlation	1	.776**	.861**
	Sig. (2-tailed)		.000	.000
	N	36	36	36
Decision Support	Pearson Correlation	.776**	1	.900**
	Sig. (2-tailed)	.000		.000
	N	36	36	36
Pengambilan Keputusan	Pearson Correlation	.861**	.900**	1
	Sig. (2-tailed)	.000	.000	
	N	36	36	36

**. Correlation is significant at the 0.01 level (2-tailed).

1) Relationship between Business Intelligence (X1) and Decision-Making Quality (Y)
As shown in Table 1, the correlation coefficient (r) between Business Intelligence and decision-making quality is 0.861. This indicates a strong and significant positive relationship. In other words, as the level of business intelligence increases, so does the quality of decision-making. Since the coefficient falls within the 0.81–1.00 interval, this relationship is categorized as very strong—meaning that greater use of business intelligence is closely linked to higher decision-making quality.

2) Relationship between Decision Support (X2) and Decision-Making Quality (Y):
Table 1 also shows that the correlation coefficient (r) between decision support and decision-making quality is 0.900. This also represents a very strong and significant positive relationship. Thus, increased decision support leads to greater decision-making quality.

Table 2. Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.936[a]	.876	.869	.85495

a. Predictors: (Constant), Decision Support, Business Intelligence

b. Dependent Variable: Pengambilan Keputusan

According to Table 2, the multiple correlation coefficient between Business Intelligence (X1), Decision Support (X2), and decision-making quality (Y) is 0.936. This demonstrates a robust positive relationship, indicating that improvements in both business intelligence and decision support are associated with higher decision-making quality. The strength of this relationship, being above 0.5, confirms that changes in X1 and X2 directly impact Y.

Table 3. ANOVA Test Results

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	171.101	2	85.551	117.041	.000[a]
	Residual	24.121	33	.731		
	Total	195.222	35			

a. Predictors: (Constant), Decision Support, Business Intelligence

b. Dependent Variable: Pengambilan Keputusan

Table 3 presents the results of the ANOVA (F-test). The F-value for Business Intelligence (X1) and Decision Support (X2) is 117.041, which is greater than the F-table value of 3.29, with a significance level of 0.000 < α = 0.05. The F-table was calculated using df1 = K-1 and df2 = n-K (where K is the number of variables; df1 = 3-1 = 2, df2 = 36-3 = 33). Since the calculated F-value exceeds the F-table value and the significance level is below 0.05, the null hypothesis is rejected. This indicates that Business Intelligence (X1) and Decision Support (X2) together have a significant effect on decision-making quality (Y).

4.2 Discussion

This study set out to explore how Business Intelligence (BI) and Decision Support Systems (DSS) can elevate the quality of decision-making in higher education institutions. The results clearly show that both BI and DSS play an essential role in shaping not only strategic decisions but also everyday operational choices. Their implementation has been shown to boost efficiency, increase accuracy, and improve the institution's ability to respond to change. A key insight from this research is the importance of high-quality data and information in the decision-making process. By leveraging BI, universities are able to systematically collect, integrate, and analyze vast amounts of data, which leads to more accurate and relevant insights for evidence-based decision-making [10][26]. This finding is echoed by Wixom and Watson (2010), who noted that BI can uncover deep insights from big data, thus enhancing decision quality and providing a competitive edge [27]. Moreover, both BI and DSS help reduce the time needed for data analysis and decision-making. For instance, when it comes to tasks like scheduling faculty or managing budgets, DSS enables institutions to simulate different scenarios and quickly pinpoint the best solutions. This observation is consistent with Negash (2004), who found that DSS can significantly speed up decision-making, particularly in complex and fast-changing environments [10][15][16].

Traditionally, many decisions in higher education have relied heavily on individual intuition or past experience, which can sometimes introduce bias. This study highlights how the adoption of BI and DSS encourages a shift toward data-driven decision-making. This shift is especially vital in higher education, where important policies—such as student admissions, faculty evaluations, and curriculum design—require thorough and objective data analysis. As pointed out by [28], a data-driven approach allows organizations to make decisions that are more objective and measurable. However, the path to fully implementing BI and DSS is not without challenges. The research reveals several obstacles, including the need for advanced technological infrastructure, resistance to organizational change, and a lack of staff expertise in BI tools. Overcoming these hurdles will require investing in staff training and upgrading digital infrastructure. This aligns with the findings of [25], who stressed the importance of organizational readiness and managerial support for successful BI adoption.

Beyond improving day-to-day operations, BI and DSS also have significant long-term, strategic value. For example, analyzing student data can help institutions anticipate future trends and needs, allowing them to develop more adaptive and forward-thinking strategies. This supports the perspective of [23], who suggested that BI can be a powerful tool for driving change and fostering innovation in education. Given these insights, the study recommends that higher education institutions develop a comprehensive BI implementation strategy that involves all relevant stakeholders and promotes data literacy across the organization. Furthermore, integrating BI with emerging technologies—such as machine learning and artificial intelligence—could unlock even greater potential to enhance decision-making efficiency and effectiveness [9][22]. This research adds important evidence to the growing literature on BI and DSS, particularly within the context of higher education. The findings reinforce the value of BI as a means to support higher-quality decision-making and underscore the necessity of a data-centric approach in meeting the challenges posed by globalization and digital transformation. Ultimately, embracing BI and DSS is a strategic move that not only improves decision quality but also bolsters the competitiveness of higher education institutions. To fully realize these benefits, ongoing collaboration among educational leaders, technology developers, and policymakers will be crucial to ensure that BI and DSS are effectively leveraged across the sector.

5. Conclusion and Recommendations

The study's findings highlight the role of business intelligence and decision support systems in fostering high-quality decision-making in higher education institutions. Effective use of business intelligence enables universities to process and interpret data regularly, supporting more informed and accountable decisions at various levels of the organization. Robust decision support systems provide critical analytical tools that assist university leaders and stakeholders in evaluating alternatives and anticipating potential outcomes. Integrating these systems into institutional processes not only accelerates decision-making but also enhances its precision and relevance. Notably, the interaction between business intelligence and decision support systems creates a synergistic effect, amplifying the positive impact on decision quality in higher education, where complexity and rapid change demand adaptive and evidence-based approaches.

Based on these findings, universities are recommended to prioritize the development and integration of business intelligence and decision support infrastructure. Such efforts will not only strengthen institutional governance and strategic planning but also contribute to a culture of continuous improvement and innovation. Ultimately, investing in these technologies positions higher education institutions to respond more effectively to current and future challenges, ensuring that decision-making processes remain rigorous and responsive in an increasingly dynamic environment.

References

[1] Zarour, K., & Benmerzoug, D. (2019). A decision-making support for business process outsourcing to a multi-cloud environment. *International Journal of Decision Support System Technology, 11*(1), 66–92. https://doi.org/10.4018/IJDSST.2019010104

[2] Santi, R. P., & Putra, H. (2018, October). A systematic literature review of business intelligence technology, contribution and application for higher education. In *2018 International Conference on Information Technology Systems and Innovation (ICITSI)* (pp. 404–409). IEEE. https://doi.org/10.1109/ICITSI.2018.8696019

[3] Ali, M. S., & Khan, S. (2019). Organizational capability readiness towards business intelligence implementation. *International Journal of Business Intelligence Research, 10*(1), 42–58. https://doi.org/10.4018/IJBIR.2019010103

[4] Güngör-Demirci, G., Lee, J., Keck, J., Harrison, S. J., & Bates, G. (2019). Development of a risk-based tool for groundwater well rehabilitation and replacement decisions. *Journal of Water Supply: Research and Technology-Aqua, 68*(6), 411–419. https://doi.org/10.2166/aqua.2019.021

[5] Hayajneh, S., & Harb, Y. (2023). Understanding the continuous use of business intelligence: The case of Jordan. *Journal of Decision Systems*, 1–32. https://doi.org/10.1080/12460125.2023.2253587

[6] Huang, J.-C., Huang, H.-C., & Chu, S.-H. (2019). Research on image quality in decision management system and information system framework. *Journal of Visual Communication and Image Representation, 63*, 102588. https://doi.org/10.1016/j.jvcir.2019.102588

[7] Sousa, M. J., Pesqueira, A. M., Lemos, C., Sousa, M., & Rocha, Á. (2019). Decision-making based on big data analytics for people management in healthcare organizations. *Journal of Medical Systems, 43*(9), 290. https://doi.org/10.1007/s10916-019-1419-x

[8] Miah, S. J. (2021). Tailorable technologies for improving business intelligence systems. In *Research Anthology on Decision Support Systems and Decision Management in Healthcare, Business, and Engineering* (pp. 814–829). IGI Global. https://doi.org/10.4018/978-1-7998-9023-2.ch039

[9] Beheshti, A., *et al*. (2023, July). ProcessGPT: Transforming business process management with generative artificial intelligence. In *2023 IEEE International Conference on Web Services (ICWS)* (pp. 731–739). IEEE. https://doi.org/10.1109/ICWS60048.2023.00099

[10] Kirilov, L., Guliashki, V., & Staykov, B. (2021). Web-based decision support system for solving multiple-objective decision-making problems. In *Research Anthology on Decision Support Systems and Decision Management in Healthcare, Business, and Engineering* (pp. 594–620). IGI Global. https://doi.org/10.4018/978-1-7998-9023-2.ch029

[11] Esteves, M., Miranda, F., & Abelha, A. (2021). Pervasive business intelligence platform to support the decision-making process in waiting lists. In *Research Anthology on Decision Support Systems and Decision Management in Healthcare, Business, and Engineering* (pp. 848–863). IGI Global. https://doi.org/10.4018/978-1-7998-9023-2.ch041

[12] Wiwik, L., Dwiningrum, S. I. A., & Sujarwo, S. (2023). Decision support systems: A game changer in the field of education. *AL-ISHLAH: Jurnal Pendidikan, 15*(4). https://doi.org/10.35445/alishlah.v15i4.4245

[13] Osuszek, L., & Ledzianowski, J. (2020). Decision support and risk management in a business context. *Journal of Decision Systems, 29*(sup1), 413–424. https://doi.org/10.1080/12460125.2020.1780781

[14] Pereira, A. M., *et al*. (2022). Customer models for artificial intelligence-based decision support in fashion online retail supply chains. *Decision Support Systems, 158*, 113795. https://doi.org/10.1016/j.dss.2022.113795

[15] Zarghami, S. A., & Zwikael, O. (2022). Measuring project resilience – Learning from the past to enhance decision making in the face of disruption. *Decision Support Systems, 160*, 113831. https://doi.org/10.1016/j.dss.2022.113831

[16] Zhdanov, D., Bhattacharjee, S., & Bragin, M. A. (2022). Incorporating FAT and privacy aware AI modeling approaches into business decision-making frameworks. *Decision Support Systems, 155*, 113715. https://doi.org/10.1016/j.dss.2021.113715

[17] Hsu, M.-F., & Lin, S.-J. (2021). A BSC-based network DEA model equipped with computational linguistics for performance assessment and improvement. *International Journal of Machine Learning and Cybernetics, 12*(9), 2479–2497. https://doi.org/10.1007/s13042-021-01331-7

[18] Sujith, A. V. L. N., Qureshi, N. I., Dornadula, V. H. R., Rath, A., Prakash, K. B., & Singh, S. K. (2022). A comparative analysis of business machine learning in making effective financial decisions using structural equation model (SEM). *Journal of Food Quality, 2022*, 1–7. https://doi.org/10.1155/2022/6382839

[19] Iftekhar, M. S., & Pannell, D. J. (2022). Developing an integrated investment decision-support framework for water-sensitive urban design projects. *Journal of Hydrology, 607*, 127532. https://doi.org/10.1016/j.jhydrol.2022.127532

[20] Lennerholt, C., van Laere, J., & Söderström, E. (2023). Success factors for managing the SSBI challenges of the AQUIRE framework. *Journal of Decision Systems, 32*(2), 491–512. https://doi.org/10.1080/12460125.2022.2057006

[21] Suboyin, A., Eldred, M., Thatcher, J., Rehman, A., Gee, I., & Anjum, H. (2023, January). Environomics framework for sustainable business practices: Industrial case studies on true impact reduction and process optimization through AI. In *Day 1 Tue, 17 January 2023*. SPE. https://doi.org/10.2118/214459-MS

[22] Hmoud, H., Al-Adwan, A. S., Horani, O., Yaseen, H., & Al Zoubi, J. Z. (2023). Factors influencing business intelligence adoption by higher education institutions. *Journal of Open Innovation: Technology, Market, and Complexity, 9*(3), 100111. https://doi.org/10.1016/j.joitmc.2023.100111

[23] Al-Surmi, A., Bashiri, M., & Koliousis, I. (2022). AI-based decision making: Combining strategies to improve operational performance. *International Journal of Production Research, 60*(14), 4464–4486. https://doi.org/10.1080/00207543.2021.1966540

[24] Parsamehr, M., Perera, U. S., Dodanwala, T. C., Perera, P., & Ruparathna, R. (2023). A review of construction management challenges and BIM-based solutions: Perspectives from the schedule, cost, quality, and safety management. *Asian Journal of Civil Engineering, 24*(1), 353–389. https://doi.org/10.1007/s42107-022-00501-4

[25] Maluleka, M. L., & Chummun, B. Z. (2023). Competitive intelligence and strategy implementation: Critical examination of present literature review. *SA Journal of Information Management, 25*(1). https://doi.org/10.4102/sajim.v25i1.1610

[26] Tewari, A., Gabarro, J., Sole, J., Lapouble, B., & Montull, L. (2020). Artificial intelligence based decision making for venture capital platform. In *Proceedings* (pp. 136–149). https://doi.org/10.1007/978-3-030-46224-6_11

[27] Yie, L. F., Susanto, H., & Setiana, D. (2021). Collaborating decision support and business intelligence to enable government digital connectivity. In *Research Anthology on Decision Support Systems and Decision Management in Healthcare, Business, and Engineering* (pp. 830–847). IGI Global. https://doi.org/10.4018/978-1-7998-9023-2.ch040

[28] Samihardjo, R., & Nugraha, U. (2020). Design of the Business Intelligence Dashboard for Sales Decision Making. *International Journal of Psychosocial Rehabilitation, 24*(2), 3498–3513. https://doi.org/10.37200/IJPR/V24I2/PR200670

[29] Indriantoro, N., & Supomo, B. (2002). *Metode penelitian bisnis*. Yogyakarta: BPFE.