Visualizing Drug Sales Data at Knia Pharma Using Business Intelligence

Faulina Husnaini[1*] Keisha Ramadhani[2]
[1]Department of Information Systems, Bina Darma University, Palembang, Indonesia
[2]Department of Informatics, Potensi Utama University, Medan, Indonesia
*Correspondence: faulinahusnaini982@gmail.com

ARTICLE HISTORY
Received: *[15/10/2025]* **Revised:** *[07/12/2025]* **Accepted:** *[04/01/2026* **Published:** *[28/02/2026]*
Vol/No/Pages: *[Vol.1(No.1), 28–35]*

Abstract

Data visualization is a technique for presenting data in a form that is easy to understand. It supports the process of analysis so that more accurate conclusions can be drawn. Business Intelligence (BI) is one solution for a pharmacy to provide access to relevant data in support of decision-making. Increasingly tight business competition requires a pharmacy to make decisions quickly and accurately, so a tool such as Tableau is needed to process and visualize data into valuable information. This study collected data through interviews with the pharmacy owner to obtain the information requirements and applied the Business Intelligence Roadmap as the approach for analysis and the development of the visualization. Source data from spreadsheet files were integrated through an Extract, Transform, and Load (ETL) process and organized into a star schema before being visualized. The result of the study is a BI dashboard able to display drug-sales data in detail, thereby assisting the pharmacy owner in the business decision-making process. The visualization reveals drug-sales patterns that can be used to increase profit in the future.

Keywords: data visualization; decision-making; Tableau; business intelligence; ETL

1. Introduction

Decision-making is an important aspect of managing a company. In the current era of globalization, this process has become increasingly complex because of the growing volume of business data and the need for accurate, timely information. Many companies use only operational reporting applications that cannot provide in-depth analysis, and so they give limited support to management in making strategic decisions.

In the context of healthcare services, and pharmacies in particular, the need for fast and accurate access to information is increasingly pressing. The development of information systems has a significant effect on improving the quality of a business, including the delivery of healthcare services. An information system is an important means for a company to obtain complete, accurate, and easily processed data that supports sound decision-making [1].

Knia Pharma still uses manual methods to manage its data, namely recording in a ledger together with Microsoft Office applications. These methods have several limitations: they are time-consuming, prone to error, and make it difficult to identify sales patterns. With drug transactions occurring continuously, the pharmacy needs a tool to visualize data quickly and accurately.

These problems form the basis of the need to build a system for visualizing drug-sales data. Visualization can help the pharmacy identify sales trends, determine which drugs are in highest demand, understand sales patterns over time, and make business decisions more strategically. Data visualization has been applied in a range of domains for similar purposes, including the visualization of sales and production data for a manufacturing company [2], open food-security data for a province [3], and COVID-19 data using Tableau [4]. On this basis, the present study addresses the visualization of drug-sales data at Knia Pharma, developed through a Business Intelligence approach.

Business Intelligence (BI) provides an approach for transforming operational data into meaningful information that supports managerial analysis and decision-making. Rather than merely recording transactions, a BI system integrates data collection, storage, analysis, and presentation to help organizations understand their operational performance. Negash [5] described BI systems as combining operational data with analytical tools to provide decision-makers with timely and relevant information. Similarly, Chen et al. [6] explained that BI and analytics have evolved into important areas of information systems research because organizations increasingly rely on data to identify patterns, evaluate performance, and respond to changing business conditions. In this context, the development of a drug-sales visualization system at Knia Pharma is intended to move beyond conventional transaction recording toward a more analytical approach to pharmacy management.

A fundamental component of BI implementation is the ability to organize data consistently before presenting them for analysis. Operational records may contain information about transaction dates, drug names, quantities sold, selling prices, and total sales values. When these records are stored separately or processed manually, managers may need to perform repetitive calculations before obtaining a meaningful overview of sales performance. Kimball and Ross [7] explained the importance of dimensional modeling in data warehousing, particularly for organizing business information around measurable events and descriptive dimensions. Their approach provides a useful foundation for structuring drug-sales data according to dimensions such as time, product, and transaction. For Knia Pharma, organizing the available sales records into a consistent analytical structure can facilitate comparisons between drugs, periods, and sales totals, provided that the necessary information is recorded accurately and consistently.

Data integration and preparation are equally important because visualizations are only as reliable as the data on which they are based. Before generating charts or dashboards, transaction records should be checked for duplicate entries, inconsistent drug names, missing values, and differences in date or numerical formats. Olszak and Ziemba [8] discussed an approach to building and implementing BI systems that considers organizational objectives and the processes involved in developing analytical capabilities. Their work emphasizes that BI implementation involves more than selecting visualization software; it also requires an appropriate understanding of information requirements and the organization's data environment. In the case of Knia Pharma, a structured preparation process can help ensure that the displayed sales figures accurately represent the available transaction records and provide a dependable basis for further analysis.

The analytical value of sales visualization lies in its ability to reveal patterns that may be difficult to recognize in tables or handwritten ledgers. Charts can help managers compare the sales performance of different drugs, identify changes in sales over time, and distinguish products that contribute substantially to overall revenue. Côrte-Real et al. [9] investigated the business value of big data analytics and demonstrated its relevance to organizational value creation. Their research supports the broader principle that data analysis can contribute to business performance when analytical capabilities are connected to organizational needs. For Knia Pharma, sales visualization can provide a practical means of examining historical transactions, identifying products with relatively high or low sales, and determining which periods warrant further investigation. Such findings can inform management discussions, although sales volume alone does not establish profitability or the clinical importance of a particular medicine.

The design of the visualization interface also influences how effectively managers can interpret information. A dashboard should communicate important indicators clearly without overwhelming users with excessive charts, decorative elements, or unnecessary detail. Few [10] emphasized that effective dashboard design requires careful selection and presentation of information so that users can monitor important conditions quickly. Yigitbasioglu and Velcu [11] similarly reviewed dashboards in performance management and discussed their implications for design and research. These perspectives suggest that a drug-sales dashboard should prioritize indicators directly relevant to pharmacy operations, such as total sales, transaction volume, leading products by sales, and sales trends across selected periods. Where the underlying data permit, interactive filters can allow managers to examine particular drugs or periods without having to manually reorganize the source records.

The relationship between visualization and decision-making has also received attention in research on human cognition. Padilla et al. [12] reviewed decision-making with visualizations and presented a cognitive framework explaining how visual representations support different types of judgments. Their work indicates that visualizations can help users recognize patterns and make comparisons, while the effectiveness of those representations depends on the task and the way information is presented. Hjelle et al. [13] further investigated how dashboard visualization characteristics influence organizational decision-making. Their experimental study found that information presentation, currency, and completeness can affect decision quality through perceived task complexity and information satisfaction. These findings are relevant to Knia Pharma because sales information should be presented in a form that enables managers to compare results easily, understand the period covered by the data, and interpret the indicators in their proper context.

BI systems can also support the development of a more consistent, data-oriented organizational culture. Wixom and Watson [14] described BI as a combination of technologies, applications, and processes for gathering, storing, accessing, and analyzing data to improve decisions. However, the availability of analytical tools does not automatically ensure that an organization obtains their intended benefits. Ain et al. [15], in their systematic literature review of BI adoption, utilization, and success, identified important research themes concerning the factors that influence the use and outcomes of BI systems. Trieu [16] likewise reviewed research on the value obtained from BI systems and highlighted the need to understand how BI capabilities translate into organizational benefits. For a pharmacy such as Knia Pharma, the practical value of a visualization system therefore depends not only on its technical functionality but also on whether managers use the resulting information to review sales performance and support their operational decisions.

The development of an effective BI solution requires attention to implementation factors, including data quality, system functionality, user requirements, and organizational readiness. Yeoh and Koronios [17] examined critical

success factors for BI systems and highlighted the importance of aligning implementation with business objectives and organizational conditions. Williams et al. [18] also examined BI implementation success factors from technical, organizational, and process perspectives. These studies reinforce the need to develop the proposed visualization system around clearly defined management requirements. At Knia Pharma, this means identifying the sales indicators that managers need, determining the fields available in the existing records, and ensuring that the resulting visualizations are understandable and consistent with the source data. The system should provide relevant information without implying that a visualization alone can replace managerial judgment or a more comprehensive financial analysis.

The potential contribution of sales visualization becomes clearer when it is connected to practical pharmacy operations. For example, examining sales by product may help management identify frequently purchased drugs, while analyzing sales by period may reveal recurring fluctuations or changes in demand. Such patterns may provide useful inputs for reviewing stock availability and planning future purchases. Nevertheless, sales data should be interpreted carefully: high sales do not necessarily indicate high profit, and low sales do not automatically mean that a medicine is unnecessary to stock. Sauter [19] discussed decision support systems as tools that help users identify relevant information and apply it to decision-making. When used appropriately, the proposed BI system can complement existing pharmacy knowledge by presenting transaction-based evidence that supports, rather than dictates, purchasing and inventory decisions.

The reliability of these analyses also depends on the scope and completeness of the available data. If transaction records contain only drug names, dates, quantities, and sales values, the system can support descriptive analysis of sales performance but cannot independently determine profit margins, customer demand outside recorded transactions, or the optimal inventory level. Kimball and Ross [7] provide a foundation for organizing analytical data, while Few [10] emphasizes the importance of presenting information in a way that corresponds to the user's monitoring needs. Accordingly, the proposed system should distinguish clearly between measured indicators and interpretations derived from them. This distinction is particularly important in pharmacy management, where decisions about medicines may involve considerations beyond commercial performance.

Although previous studies have established the value of BI, data warehousing, and dashboard visualization in organizational decision-making, their practical application must be adapted to the context of each business. Large enterprises may have dedicated analytical infrastructure and extensive historical databases, whereas a pharmacy that relies on ledgers and standard office applications may require a more focused solution. The systematic review by Ain et al. [15] illustrates the breadth of research on BI adoption and success, while Olszak and Ziemba [8] emphasize the importance of considering organizational objectives when developing BI systems. The present study addresses this practical context by focusing on Knia Pharma, where sales records are maintained through manual and office-based methods and where identifying sales patterns requires additional effort.

Based on these considerations, this study focuses on visualizing drug-sales data at Knia Pharma using a Business Intelligence approach. The proposed system is intended to organize available sales records and present relevant information through visual representations that facilitate comparisons, trend identification, and monitoring of sales performance. Its contribution lies in applying BI principles to the pharmacy's operational context, with particular attention to the transformation of existing transaction records into accessible and interpretable information. The usefulness of the resulting system should ultimately be assessed through the accuracy of its displayed data, the functionality of its analytical features, and its ability to support the information needs of pharmacy management.

2. Method

The research methodology is arranged to obtain data systematically and to develop the system in line with user needs, following established procedures for research in this field [20].

Data Collection

Data were collected through the following techniques.

Observation. Carried out to understand the system requirements and the process of recording drug sales, including identifying the software needed.

Data processing. The data obtained from observation were analyzed to identify recording errors and the requirements for sales visualization.

Testing and implementation. Test cases were carried out on the system to ensure that each function worked as required, followed by implementation.

Literature study. Involving the examination of books and articles related to data visualization, business intelligence, and the processing of drug-sales data.

Data Analysis Method

The method used follows the Business Intelligence Roadmap of Larissa T. Moss, which comprises seven main stages [21].

Business case assessment. Evaluating the feasibility of applying BI at Knia Pharma.
Enterprise infrastructure evaluation. Determining the infrastructure needed to support the implementation of BI.
Project planning. Preparing the project plan and the estimates required.
Project requirement definition. Determining the requirements that must be met in applying BI.
Data analysis. Analyzing the data to understand the data structure and to correct inconsistencies.
Application prototyping. Building a prototype of the data visualization to understand and refine the scope of the project.
Metadata repository analysis. Analyzing metadata to ensure that the data can be used as relevant information.

3. Results

ETL (Extract, Transform, Load) Process

The ETL process is used to integrate data from various sources so as to produce a single, comprehensive view [22]. The source data are spreadsheet files, which are connected through an Excel Connection Manager. The result of the integration is stored in SQL Server Management Studio.
Drug data table ETL. The process of importing the spreadsheet file and integrating it into the database.

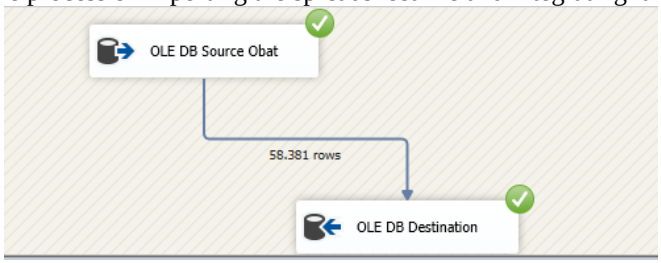


Figure 1. *ETL process for the drug data.*

Supplier (PBF) data table ETL. The process of integrating drug-supplier data from the spreadsheet file into the database.

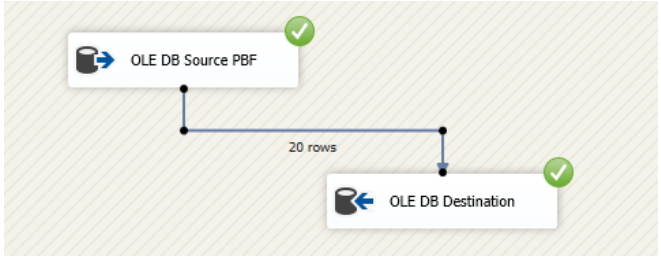


Figure 2. *ETL process for the supplier (PBF) data.*

Time table ETL. Integration of the time data used for period-based analysis.

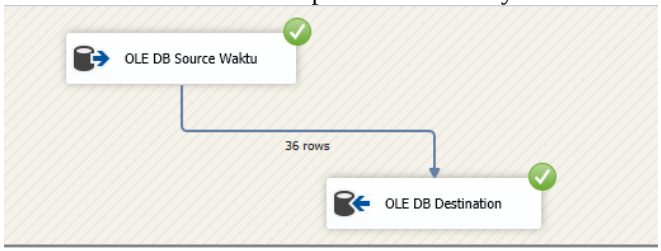


Figure 3. *ETL process for the time data.*

Drug fact table ETL. Integrating the drug-transaction data into the fact table.

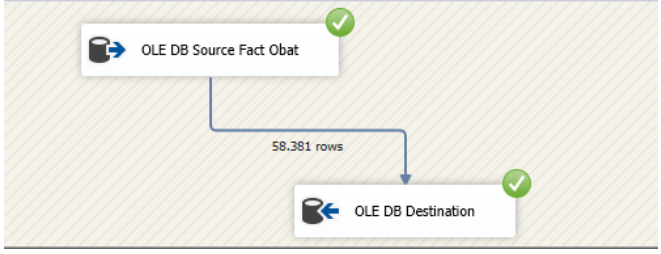


Figure 4. *ETL process for extracting the drug fact data.*

Dimensional Modeling

A star schema is used to map the decision-support model, with a fact table connected to several dimension tables.

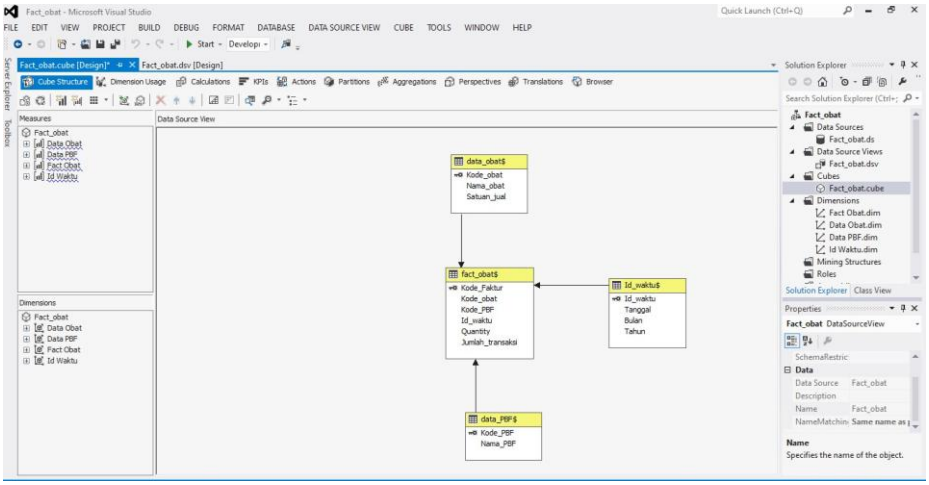


Figure 5. *Fact table and star schema.*

There are three dimension tables: the drug dimension (kode_obat, nama_obat, satuan_jual); the supplier dimension (kode_PBF, nama_PBF); and the time dimension (id_waktu, tanggal, bulan, tahun).

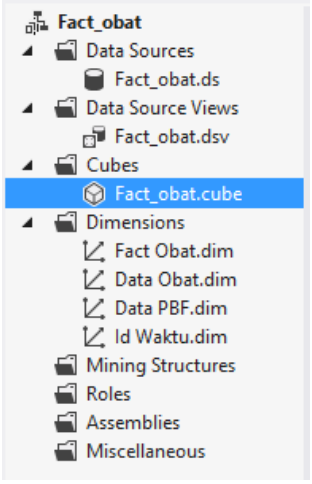


Figure 6. *Dimension table.*

Data Visualization

Sales by drug name. The visualization shows that the drug Teosal had the highest sales in 2018 and declined in 2019 and 2020.

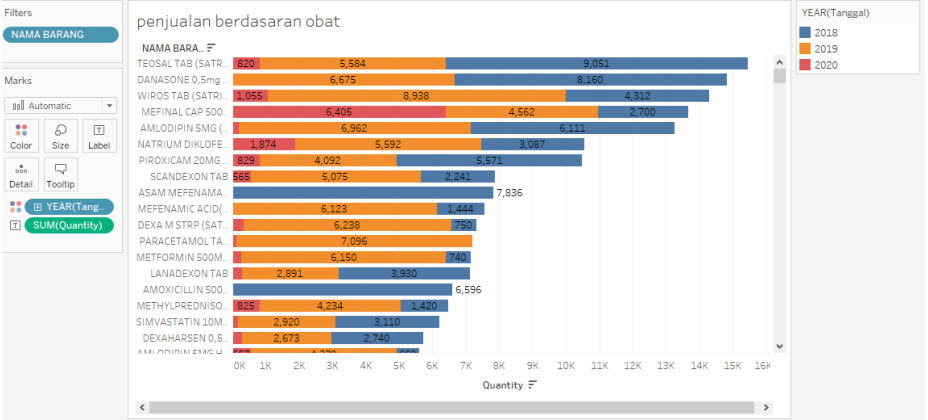


Figure 7. *Sales information by drug name.*

Sales by time. The highest drug sales occurred in December 2018 (Rp154,077,935), December 2019 (Rp180,686,451), and March 2020 (Rp288,259,700).



Figure 8. *Drug-sales information by time.*

Drug-sales dashboard. The BI dashboard displays sales information by drug name, month, and year to support strategic decision-making.

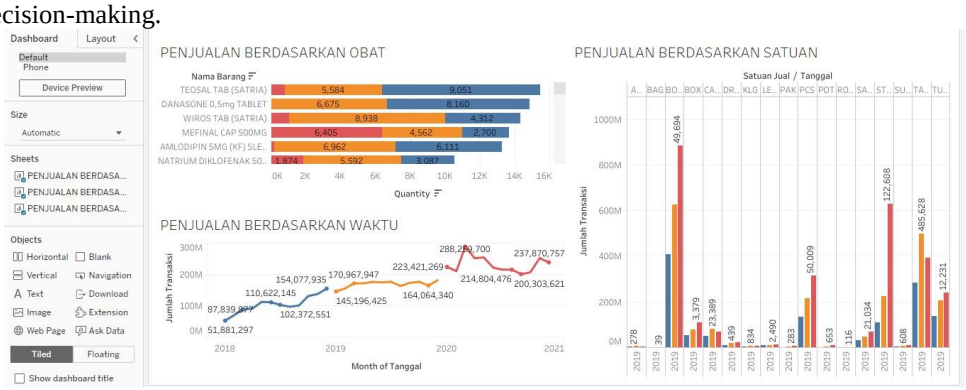


Figure 9. *Drug-sales dashboard of Knia Pharma.*

4. Discussion

Contribution of the Business Intelligence Dashboard

The visualization of drug-sales data built through the Business Intelligence approach provides information that is faster, more precise, and more detailed. The BI dashboard is able to present drug-sales patterns within a given period, help the pharmacy analyze trends, and give a comprehensive picture of sales performance. In this way, the dashboard functions as a decision-support system that presents strategic information to the pharmacy owner.

The ETL process ensures that the data used are clean, consistent, and integrated, while the star-schema model organizes the data so that they can be analyzed by drug, supplier, and time period. The use of a visualization tool to display the data as readily understood charts improves the effectiveness of decision-making, because patterns that were not visible in manual recording become apparent.

Interpretation of the Sales Patterns

The results reveal concrete patterns that can inform business decisions. The identification of a best-selling drug and its decline over subsequent years can guide stock planning and procurement, while the concentration of the highest sales in particular months points to seasonality that the pharmacy can anticipate. These interpretations illustrate how the dashboard moves the pharmacy from recording transactions to analyzing them.

Limitations and Suggestions

This study has several limitations. The visualization was developed for a single pharmacy using its historical sales records, so the patterns observed cannot be generalized to other pharmacies. The evaluation focused on the functionality of the ETL process and the dashboard; a formal assessment of usability and of the effect of the dashboard on the speed and quality of the owner's decisions has not been reported. In addition, the analysis is descriptive and does not include predictive modeling of future demand.

Further development can therefore be directed at a formal evaluation of usability and decision impact, the addition of predictive analytics for demand forecasting, the automation of data updates so that the dashboard reflects current transactions, and the extension of the data model to cover procurement and stock in addition to sales.

5. Conclusion

This study produced a Business Intelligence dashboard that presents drug-sales information at Knia Pharma comprehensively. The BI dashboard simplifies reporting, supports the analysis of sales trends, and enables faster decision-making. The visualization of drug-sales data provides detailed information that was not previously visible through manual recording, and it helps the pharmacy owner set business policy for the future. The clean and integrated data produced by the ETL process, together with the star-schema model and the visualization tool, form a decision-support system that the pharmacy can use to turn its sales records into actionable insight, with a formal evaluation of usability and decision impact recommended as the next step.

Declarations

Acknowledgements. The authors would like to express their sincere gratitude to Knia Pharma and its owner for providing access to the drug-sales data and for supporting the data collection process. The authors also thank their academic supervisors for their guidance, constructive feedback, and valuable suggestions throughout the research and preparation of this manuscript.

Author Contributions. Faulina Husnaini contributed to conceptualization, data collection, data preprocessing, the Extract, Transform, Load (ETL) process, dimensional modeling, dashboard development, data analysis, and manuscript preparation. Keisha Ramadhani contributed to methodological guidance, validation, interpretation of the results, and critical review of the manuscript. Both authors reviewed and approved the final version of the manuscript.

Funding. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of Interest. The authors declare that they have no conflict of interest regarding the publication of this article.

Data Availability. The sales data used in this study were obtained from Knia Pharma. The data supporting the findings of this study are available from the corresponding author upon reasonable request and subject to permission from Knia Pharma and any applicable confidentiality requirements.

6. References

[1] K. M. Hidayat, Mardiani, and S. Warisman, "Perancangan data warehouse transaksi obat-obatan pada RS. ABC Palembang," pp. 1–10, 2013.
[2] D. Aryanti and J. Setiawan, "Visualisasi data penjualan dan produksi PT Nitto Alam Indonesia periode 2014–2018," 2018.
[3] A. Bachtiar, Dharmayanti, and Husnaisa, "Visualisasi data terbuka ketahanan pangan Provinsi Jawa Barat," 2017.
[4] D. Saepuloh, "Visualisasi data COVID-19 Provinsi DKI Jakarta menggunakan Tableau," 2020.
[5] S. Negash, "Business intelligence," *Communications of the Association for Information Systems*, vol. 13, Art. no. 15, 2004. Available: https://doi.org/10.17705/1CAIS.01315
[6] H. Chen, R. H. L. Chiang, and V. C. Storey, "Business intelligence and analytics: From big data to big impact," *MIS Quarterly*, vol. 36, no. 4, pp. 1165–1188, 2012. Available: https://doi.org/10.2307/41703503
[7] R. Kimball and M. Ross, *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling*, 3rd ed. Indianapolis, IN, USA: John Wiley & Sons, 2013. Available: https://www.wiley.com/en-gb/the-data-warehouse-toolkit-the-definitive-guide-to-dimensional-modeling-3rd-edition-p-9781118530801
[8] C. M. Olszak and E. W. Ziemba, "Approach to building and implementing business intelligence systems," *Interdisciplinary Journal of Information, Knowledge, and Management*, vol. 2, pp. 135–148, 2007. Available: https://doi.org/10.28945/105
[9] N. Côrte-Real, T. Oliveira, and P. Ruivo, "Assessing business value of Big Data Analytics in European firms," *Journal of Business Research*, vol. 70, pp. 379–390, 2017. Available: https://doi.org/10.1016/j.jbusres.2016.08.011
[10] S. Few, *Information Dashboard Design: Displaying Data for At-a-Glance Monitoring*, 2nd ed. Burlingame, CA, USA: Analytics Press, 2013. Available: https://www.analyticspress.com/idd.php
[11] O. M. Yigitbasioglu and O. Velcu, "A review of dashboards in performance management: Implications for design and research," *International Journal of Accounting Information Systems*, vol. 13, no. 1, pp. 41–59, 2012. Available: https://doi.org/10.1016/j.accinf.2011.08.002
[12] L. M. Padilla, S. H. Creem-Regehr, M. Hegarty, and J. K. Stefanucci, "Decision making with visualizations: A cognitive framework across disciplines," *Cognitive Research: Principles and Implications*, vol. 3, Art. no. 29, 2018. Available: https://doi.org/10.1186/S41235-018-0120-9
[13] S. Hjelle, P. Mikalef, N. Altwaijry, and V. Parida, "Organizational decision making and analytics: An experimental study on dashboard visualizations," *Information & Management*, vol. 61, no. 6, Art. no. 104011, 2024. Available: https://doi.org/10.1016/j.im.2024.104011

[14] B. Wixom and H. Watson, "The BI-based organization," *International Journal of Business Intelligence Research*, vol. 1, no. 1, pp. 13–28, 2010. Available: https://doi.org/10.4018/jbir.2010071702
[15] N. Ain, G. Vaia, W. DeLone, and M. Waheed, "Two decades of research on business intelligence system adoption, utilization and success: A systematic literature review," *Decision Support Systems*, vol. 125, Art. no. 113113, 2019. Available: https://doi.org/10.1016/j.dss.2019.113113
[16] V.-H. Trieu, "Getting value from business intelligence systems: A review and research agenda," *Decision Support Systems*, vol. 93, pp. 111–124, 2017. Available: https://doi.org/10.1016/j.dss.2016.09.019
[17] W. Yeoh and A. Koronios, "Critical success factors for business intelligence systems," *Journal of Computer Information Systems*, vol. 50, no. 3, pp. 23–32, 2010. Available: https://scholar.google.com/scholar?q=Yeoh+Koronios+Critical+Success+Factors+for+Business+Intelligence+Systems+2010
[18] R. A. Williams, N. J. Sheikh, G. M. Duman, and E. Kongar, "Critical success factors of business intelligence systems implementation," *IEEE Engineering Management Review*, 2022. Available: https://doi.org/10.1109/EMR.2022.3197096
[19] V. L. Sauter, *Decision Support Systems for Business Intelligence*, 2nd ed. Hoboken, NJ, USA: John Wiley & Sons, 2010. Available: https://doi.org/10.1002/9780470634431
[20] S. Arikunto, *Prosedur Penelitian: Suatu Pendekatan Praktik*. Jakarta, Indonesia: Rineka Cipta, 2014.
[21] L. T. Moss and S. Atre, *Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications*. Boston, MA, USA: Addison-Wesley, 2003.
[22] A. I. Y. Fatah, "Implementasi data warehouse dan data mining untuk penentuan rencana strategis penjualan batik," 2014.

© Journal of Sinar Data and Informatics (JSDI) — Sinar Asia Institute. This article is distributed under the Creative Commons Attribution (CC BY 4.0) license.