Analysis of Tableau Dashboard Visualization for Efficiency and Accuracy in Industrial Decision Making

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Abstract

As data complexity increases, Tableau-based data visualization dashboards play an important role in simplifying information and improving understanding for decision makers. This study uses a mixed methods approach by combining quantitative data from 154 questionnaire respondents and qualitative data through in-depth interviews with five informants from various industrial sectors. Statistical analysis using SmartPLS shows that ease of data comprehension has a significant effect on efficiency (coefficient = 0.703) and decision-making accuracy (coefficient = 0.566), while Tableau dashboard visualization has a positive but more moderate effect (coefficient = 0.207). Qualitative results reinforce these findings, where the application of interactive dashboards has been proven to accelerate the analysis process, reduce interpretation errors, and improve communication between departments within the organization. In addition, real-time data access helps decision makers obtain information more quickly and reliably. However, there are still challenges in implementing data visualization, particularly limitations in digital literacy and technological infrastructure. Therefore, effective data visualization integration needs to be accompanied by technical training and user competency improvement in order to optimize its benefits in the modern industrial era. The results of this study provide practical implications for industry in improving operational performance and the quality of data-based decision making.

Keywords: *Tableau Dashboard, Data Visualization, Efficiency, Accuracy, Decision-Making, Industry*

Abstrak

Seiring dengan meningkatnya kompleksitas data, dashboard visualisasi data berbasis Tableau memainkan peran penting dalam menyederhanakan informasi dan meningkatkan pemahaman bagi pengambil keputusan. Studi ini menggunakan pendekatan campuran dengan menggabungkan data kuantitatif dari 154 responden kuesioner dan data kualitatif melalui wawancara mendalam dengan lima informan dari berbagai sektor industri. Analisis statistik menggunakan SmartPLS menunjukkan bahwa kemudahan pemahaman data memiliki pengaruh signifikan terhadap efisiensi (koefisien = 0.703) dan akurasi pengambilan keputusan (koefisien = 0.566), sementara visualisasi dashboard Tableau memiliki pengaruh positif namun lebih moderat (koefisien = 0.207). Hasil kualitatif memperkuat temuan ini, di mana penerapan dashboard interaktif terbukti mempercepat proses analisis, mengurangi kesalahan interpretasi, dan meningkatkan komunikasi antar departemen dalam organisasi. Selain itu, akses data real-time membantu pengambil keputusan memperoleh informasi dengan lebih cepat dan andal. Namun, masih ada tantangan dalam implementasi visualisasi data, terutama keterbatasan literasi digital dan infrastruktur teknologi. Oleh karena itu, integrasi visualisasi data yang efektif perlu didukung oleh pelatihan teknis dan peningkatan kompetensi pengguna agar manfaatnya dapat dioptimalkan di era industri modern. Hasil penelitian ini memberikan implikasi praktis bagi industri dalam meningkatkan kinerja operasional dan kualitas pengambilan keputusan berbasis data.

Kata Kunci: Dashboard Tableau, Visualisasi Data, Efisiensi, Akurasi, Pengambilan Keputusan, Industri

INTRODUCTION

In recent years, data visualization has become a major factor in the decision-making process, especially in the aspect of big data. As the amount of data increases, visualization methods are designed to help users analyze information effectively (Bibire Seyi- Lande et al., 2024). Kucukural et al., (2019) states that although interactive data visualization offers promising opportunities to facilitate understanding of complex data, its analysis in practice is still not optimal. On the one hand, technology allows users to explore and analyze data dynamically, but on the other hand, the utilization of this capability in the field has not been maximized. This gap reflects the challenges in adopting and integrating interactive visualization solutions into everyday use.

Problems in analyzing visualization technology are often related to the limitations of user knowledge and experience (Tratz, 2021). This can slow down the adoption of modern visualization tools and reduce their effectiveness, especially when many professionals still rely on conventional tools such as Microsoft Excel (Lavanya et al., 2023). Other obstacles include a lack of technology, lack of support from superiors, limited resources, and a lack of effective data visualization implementation (Postma & Goedhart, 2019). The appropriate use of visualization, such as in the application of lean production in the automotive sector, has been proven to improve the efficiency and accuracy of decision-making (Canonico et al., 2022). Therefore, providing adequate training and technical services is an important step in overcoming these problems.

Perkhofer et al., (2019) state that interactions between users and data visualizations have a significant impact on perceptions of the efficiency and accuracy of using these visualization tools, while the importance of best practice analysis in data visualization supports data-based security systems, in which structured reports can provide deeper and more practical understanding (Khasnabish et al., 2020). Various obstacles exist in the implementation of interactive visualization, including aspects of human resources and technology (Deshwal, 2025).

Gottfried et al., (2021) state that there is great potential in utilizing open government data for business analysis purposes to improve the quality of decision making. However, limited understanding of how to optimize data remains a major obstacle to its adoption. It is

important to improve literacy and develop more user-friendly visualizations to overcome problems and facilitate data access for decision makers in various industrial sectors (Sharma, 2023). A more detailed and education-focused approach is needed to maximize data visualization analysis in the decision-making process, where efforts are made to overcome obstacles and develop an understanding of visualization tool innovations that play a role in maximizing the benefits of existing data (Lande et al., 2024).

In an industrial context, research from the *Kementrian Industri Indonesia* (2021) shows that the use of interactive dashboard-based data visualization in the manufacturing sector increases operational efficiency by up to 20% and reduces errors in the production process. This study emphasizes the importance of technical training and the application of visualization tools such as Tableau in analyzing production data in real-time. In addition, another study from the Ministry of Communication and Information Technology (Kominfo, 2022) reveals that the integration of data visualization with big data analytics technology in the public transportation sector increases the accuracy of decision-making related to operational schedules and resource allocation by up to 30%. This example shows how the development of more intuitive visualization tools can have a real impact on improving efficiency in various industrial sectors.

Sharma (2023) states that industries that strategically adopt data visualization are able to overcome challenges in complex data management. For example, the logistics sector that uses data-based dashboards has succeeded in accelerating the decision-making process related to goods distribution with a reduction in time of up to 15% and significant savings in operational costs. Therefore, it is important to continue to evaluate and develop more adaptive visualization approaches according to industry needs so that the benefits of data can be maximized optimally.

Literature Review and Hypothesis Development :

1. Data Visualization

   Data visualization is a way of conveying information and data in a graphical form that is easy to understand, analyze, and make decisions (Wicaksono, 2024). Nuraini et al.,(2025) state that effective visualization can simplify complex data so that it is easier to understand and access quickly. In the industrial world, displaying data visualization is

very important because it can help measure performance and make more accurate decisions. Effective visualization can also help detect problems and find patterns that may not be detected using conventional analysis methods (Yalim et al., 2023). That way, it will be more effective in dealing with changes, which ultimately reduces risks and makes operations more efficient.

2. Tableu Dashboard Visualization

Tableau is a widely used data visualization platform that enables users to create interactive dashboards through features such as filtering, drill-down, and real-time data updates. Baktiar et al., (2024) state that data visualization implemented through Tableau dashboards enhances understanding and supports comparative analysis in decision-making. Previous studies indicate that Tableau dashboards facilitate exploratory data analysis by allowing users to interact directly with visual elements and uncover hidden insights (Zahra & Utomo, 2023). Interactivity is a key advantage of Tableau, as it increases user engagement and supports deeper analysis compared to static visualizations.

The effectiveness of Tableau dashboards, however, is influenced by user competency and dashboard design quality. Poorly designed dashboards or insufficient user training may limit the benefits of visualization tools, even when advanced technology is available (Putra & Shofianisa, 2024). Furthermore, dashboards implemented using Tableau have been shown to improve order management visibility and support operational decision-making (Marvaro & Samosir, 2021).Therefore, understanding how Tableau visualization contributes to data comprehension is essential in evaluating its overall impact on decision making.

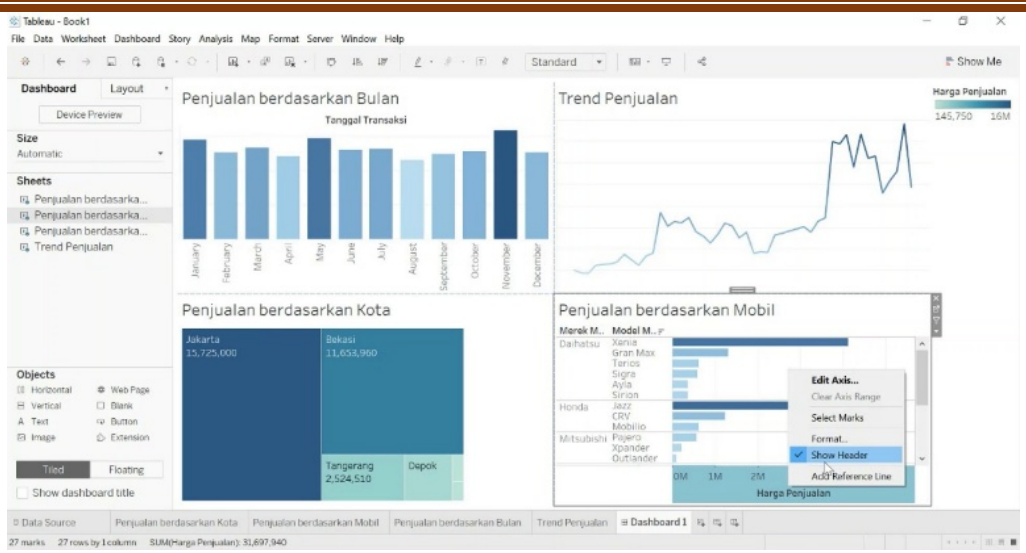

Figure 1. Tableau Data Visualization

3. Ease of Data Comprehension

   Ease of data comprehension refers to the extent to which users can quickly and accurately understand information presented through visual representations. Eberhard, (2023) states that information visualization can improve both the quality and speed of decision-making, although its effects on other variables, such as decision confidence, tend to be more mixed. Similarly, (Suvita et al., 2025) indicate that data visualization has proven to be an effective educational tool for enhancing public understanding of complex information. Furthermore, Interactive dashboards that apply appropriate visual elements such as color, scale, and layout have been shown to enhance user understanding and reduce misinterpretation (Putra & Shofianisa, 2024). Consequently, ease of data comprehension is a critical factor that mediates the relationship between visualization tools and decision-making outcomes.

4. Data-Driven Decision Making

   Data-driven decision making is an approach that uses data and analysis to determine strategic steps for an organization. Decisions based on data analysis have the potential to significantly improve operational efficiency and effectiveness (Kumar, 2019). This is very important in an active and competitive industrial environment. Educational management studies also demonstrate that DDDM significantly improves organizational effectiveness (Alfrica Mustafa et al., 2025). Emma, (2024) states that companies that

analyze data in decision-making prioritize better performance. By applying data to the maximum extent possible, it is possible to minimize uncertainty and risk in the decisions made.

5. Hypothesis Development

Figure 2. Research Model

Based on the theoretical framework, this study proposes the following hypotheses:

H^1: Tableau dashboard visualization has a significant effect on ease of data comprehension.

H^2: Ease of data comprehension has a significant effect on decision-making efficiency.

H^3: Ease of data comprehension has a significant effect on decision-making accuracy.

RESEARCH METHOD

1. Research Design

This study employed a mixed methods research design by integrating quantitative and qualitative approaches. The quantitative approach was used to examine the relationships between data visualization, ease of data comprehension, and decision-making outcomes using structural equation modeling (SEM-PLS). The qualitative approach was conducted to gain deeper insights into users experiences and to support theinterpretation of quantitative findings. The research procedure consisted of problem identification, instrument development, data collection, data analysis, and conclusion drawing. The overall research flow is presented in Figure 3.

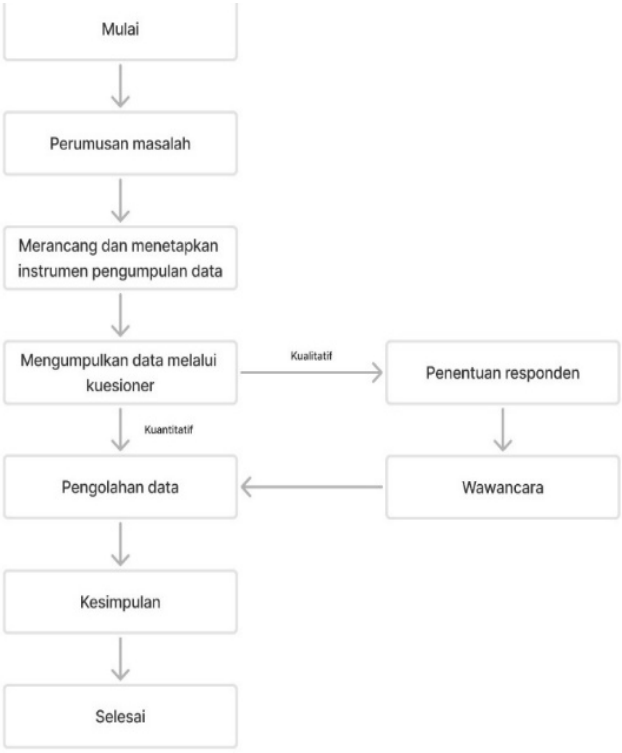

Figure 3. Research Flow

2. Research Object and Respondents

The object of this study was the use of Tableau-based interactive dashboards in supporting decision making within industrial environments. The quantitative data were collected from 154 respondents who work in various industrial sectors, including manufacturing, logistics, finance, and technology. Respondents were selected using a simple random sampling technique with the criteria of having experience in using data visualization tools for work-related decision making.

3. Data Collection Methods

This study uses mixed methods, namely quantitative and qualitative methods.

a. Quantitative Data Collection

Quantitative data were collected through an online questionnaire distributed using Google Forms. The questionnaire employed a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The measurement indicators covered data visualization, ease of data comprehension, decision-making efficiency, and decision-making accuracy.

b. Qualitative Data Collection

Qualitative data were obtained through semi-structured interviews with five informants who were directly involved in data-driven decision-making processes. The interviews aimed to explore users' perceptions, challenges, and experiences in using Tableau dashboards to support their work activities.

4. Data Analysis Method

Quantitative data analysis was conducted using SmartPLS software with the Partial Least Squares–Structural Equation Modeling (PLS-SEM) approach. This method was selected due to its suitability for predictive analysis and complex research models involving mediation effects. The data analysis process consisted of two main stages: measurement model evaluation and structural model evaluation.

The measurement model was assessed to ensure the reliability and validity of the research instruments. Reliability was evaluated using Cronbach's alpha and composite reliability, with values exceeding 0.70 indicating acceptable reliability. Convergent validity was examined through outer loading values and Average Variance Extracted (AVE), where outer loadings above 0.70 and AVE values above 0.50 indicated adequate convergent validity.

The structural model evaluation was conducted to examine the relationships among variables and test the proposed hypotheses. This evaluation involved analyzing path coefficient values to determine the strength and direction of relationships, as well as R-square (R^2) values to assess the explanatory power of the model. Hypothesis testing was performed by evaluating the magnitude and significance of the path coefficients.

Qualitative data analysis was carried out using thematic analysis. Interview data were transcribed, coded, and categorized into key themes that represent users' experiences, perceived benefits, and challenges in using Tableau-based dashboards. The qualitative findings were used to support and enrich the interpretation of the quantitative results.

RESULTS AND DISCUSSION

1. Respondent Demographics

The descriptive statistics from 154 valid questionnaires present the demographic

characteristics of the respondents, providing an overview of the sample profile used in this study.

Table 1. Demographics and Respondents

Variable	Criteria	Frequency	Percentage (%)
Gender	Male	62	39.7%
	Female	94	60.3%
Age	<20	1	0.6%
	20-25	52	33.3%
	26-30	63	40.4%
	>30	40	25.6%
Idustry	Manufacturing	37	23.7%
	Logistics	37	23.7%
	Finance	46	29.5%
	Technology	34	21.8%
	F&B	2	1.3%
	Mining	1	0.6%

The majority of respondents were women, accounting for 60.3%, while men accounted for 39.7%. Based on age group, the largest number of respondents were in the 26–30 age range, accounting for 40.4%, followed by those aged 20–25, accounting for 33.3%. Respondents aged over 30 accounted for 25.6%, while those under 20 accounted for only 0.6%, making them the smallest group.

The majority of respondents came from the financial sector (29.5%), followed by manufacturing and logistics sectors, each accounting for 23.7%. The technology sector contributed 21.8% of respondents, while the food and beverage sector accounted for 1.3%, and the mining sector represented 0.6% of the sample.

2. Descriptive Statistics

Table 2. Descriptive Statistics

Variabel	Indikator	Mean	Median	Scale min	Scale max	Standard deviation
Visualisasi Data	VD1 Visualisasi data memudahkan pemahaman informasi yang kompleks	4.65	5	3	5	0.497
	VD2 Visualisasi data interaktif meningkatkan pemahaman saya	4.57	5	3	5	0.534
Efisiensi Pengambilan Data	EPD 1Percepatan proses analisis data	4.42	5	2	5	0.666
	EPD 2 Pengurangan beban kerja	4.54	5	1	5	0.699
	EPD 3 Efisiensi waktu manajemen data	4.57	5	3	5	0.587
	EPD 4 Peningkatan produktivitas	4.59	5	1	5	0.665
Akurasi Pengambilan Data	APD 1 Keputusan lebih akurat	4.55	5	2	5	0.606
	APD 2 Interpretasi lebih benar	4.53	5	2	5	0.608
	APD 3 Kesalahan pengambilan data berkurang	4.48	5	2	5	0.685
	APD 4 Percaya diri dalam membaca data	4.51	5	3	5	0.592
Kemudahan Pemahaman Data	KPD 1 Visualisasi data (dashboard interaktif) lebih mudah dipahami dibandingkan Excel	4.46	5	1	5	0.639
	KPD 2 Visualisasi data mempermudah dalam menemukan pola atau tren dibandingkan Excel	4.54	5	1	5	0.699
	KPD 3Visualisasi data lebih efisien dalam menyajikan data kompleks dibandingkan Excel	4.38	4	1	5	0.675

Table 2 presents the descriptive statistics for all research variables, including mean values, medians, minimum and maximum scales, and standard deviations. The mean values of all indicators ranged from 4.38 to 4.65 on a five-point Likert scale, indicating a high level of agreement among respondents. The standard deviation values ranged from 0.49 to 0.70, reflecting relatively low variability in respondents' answers.

For the Data Visualization variable, the highest mean value was observed for indicator VD1 (mean = 4.65; SD = 0.497). For the Data Collection Efficiency

variable, indicator EPD4 showed the highest mean value (mean = 4.59; SD = 0.665), while EPD1 had the lowest mean value. In the Data Collection Accuracy variable, APD1 recorded the highest mean value (mean = 4.55; SD = 0.606), whereas APD3 showed the lowest mean value. For the Data Comprehensibility variable, indicator KPD2 obtained the highest mean value (mean = 4.54; SD = 0.699).

3. Measurement Model Evaluation

Table 3. Validity and Reliability Test

Variabel	Cronbach`s alpha	Composite reliability (rho_c)	Average Variance Extracted (AVE)
Akurasi Pengambilan Data	0.667	0.797	0.498
Efisiensi Pengambilan Data	0.744	0.837	0.565
Kemudahan Pemahaman Data	0.711	0.838	0.634
Visualisasi Data	0.366	0.759	0.612

Based on Table 3, the reliability and convergent validity of the measurement model were evaluated using Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). The Composite Reliability values for all constructs exceed the recommended threshold of 0.7, indicating satisfactory internal consistency.

The Cronbach's Alpha values for Data Collection Efficiency and Data Comprehensibility are above 0.7, while Data Collection Accuracy records a value of 0.667, which is considered acceptable. The Data Visualization construct shows a lower Cronbach's Alpha value; however, its Composite Reliability value exceeds the recommended threshold, indicating adequate reliability.

Regarding convergent validity, the AVE values for Data Collection Efficiency, Data Comprehensibility, and Data Visualization exceed the minimum threshold of 0.5. The AVE value for Data Collection Accuracy is 0.498, which is marginally below the recommended level but remains acceptable given its satisfactory Composite

Reliability value.

Table 4. Convergent Validity Test

Variabel	Indikator	Outer Loading	AVE	Result
Visualisasi Data	VD 1	0.767	0.612	Valid
	VD 2	0.797		
Efisiensi Pengambilan Data	EPD 1	0.684	0.565	Valid
	EPD 2	0.835		
	EPD 3	0.652		
	EPD 4	0.818		
Akurasi Pengambilan Data	APD 1	0.638	0.498	Tidak Valid
	APD 2	0.789		
	APD 3	0.712		
	APD 4	0.674		
Kemudahan Pemahaman Data	KPD 1	0.720	0.634	Valid
	KPD 2	0.852		
	KPD 3	0.812		

Table 4 presents the outer loading values of each indicator. Most indicators show outer loading values above 0.7, while all indicators meet the minimum acceptable threshold of 0.6. These results indicate that the indicators adequately represent their respective constructs.

4. Structural Model Evaluation

Table 5. R-Square (R^2) Test Results for Research Variables

	R-square	R-square adjusted
Akurasi Pengambilan Data	0.320	0.313
Efisiensi Pengambilan Data	0.494	0.489
Kemudahan Pemahaman Data	0.043	0.033

Table 5 presents the coefficient of determination (R^2) values for the endogenous variables. The R^2 value for Data Collection Accuracy is 0.320, while Data Collection Efficiency records an R^2 value of 0.494. The R^2 value for Data Comprehensibility is 0.043.

Table 6. Path Coefficients

	Path coefficients
Kemudahan pemahaman Data -> Akurasi pengambilan Data	0.566
Kemudahan pemahaman Data -> Efisiensi pengambilan Data	0.703
Visualisasi Data -> Kemudahan pemahaman Data	0.207

The path coefficient results are presented in Table 6. The path coefficient from Data Comprehensibility to Data Collection Accuracy is 0.566, while the path coefficient from Data Comprehensibility to Data Collection Efficiency is 0.703. The path coefficient from Data Visualization to Data Comprehensibility is 0.207.

5. Qualitative Results

The qualitative results were then reinforced through interviews with five informants directly involved in decision-making in the industrial sector. All informants stated that data visualization facilitates the understanding of complex information and speeds up the work process. An operations manager said, "Before the dashboard, we had to read long reports and it took a long time to understand the results. Now, with the graphics and colors, it's immediately clear,“ (Respondent 1). A similar statement was made by a data analyst who explained that, ”Visualization makes complex data easy to explain to management. Just show them the graph, and they immediately understand," (Respondent 3).

Data visualization also improves efficiency by enabling real-time access to information. A logistics supervisor revealed, "In the past, reports were only collected in the afternoon and were often late. Now, just open the dashboard, and all the data appears automatically,“ (Respondent 2). An IT staff member added, ”The dashboard is directly connected to the database, so all indicators appear on one screen, eliminating the need to open multiple files," (Respondent 4). This supports statistical findings that ease of data comprehension increases work efficiency. In addition to efficiency, decision accuracy has also improved. One dashboard user said, “Before this system was in place,

misinterpretations often occurred because the numbers were entered manually. Now the graphs can immediately show if there is any unusual data" (Respondent 5). However, several informants emphasized the importance of proportional design to avoid misreading. "If the graphs are not proportional or the colors are similar, it can cause misreading. So the visual display must be carefully considered," (Respondent 3).

Nevertheless, there are obstacles to the implementation of data visualization, particularly limitations in digital literacy and technical constraints. A logistics supervisor acknowledged, "Some staff are still more comfortable with manual reports," (Respondent 2). IT staff also highlighted network issues, "When the connection is slow, the dashboard is difficult to access," (Respondent 4). Informants hoped that the company would provide regular training and develop a more user-friendly dashboard. "If it can be accessed via mobile phones, management can monitor it at any time," (Respondent 5).

From the thematic analysis of all interviews, four main themes emerged that describe respondents' perceptions of the application of data visualization in industry, namely: (1) data visualization facilitates the understanding of complex information; (2) ease of understanding improves the efficiency and accuracy of decisions; (3) the main obstacles stem from limitations in digital literacy and infrastructure; and (4) the need to develop adaptive and accessible dashboards.

Discussion

1. **Tableau dashboard visualization has a significant effect on ease of data comprehension (H1)**

   The results indicate that ease of data comprehension has a strong positive effect on data collection efficiency, as reflected by the highest path coefficient value ($\beta = 0.703$). This finding suggests that when data is presented in a form that is easy to understand, users can process information more quickly, reduce analysis time, and improve overall productivity.

   This result is consistent with previous studies by (Perkhofer et al., 2019) and Sharma (2023), which emphasize that clear and intuitive data presentation significantly enhances analytical efficiency in organizational contexts. Qualitative findings further support this

result, where informants reported that interactive dashboards enabled faster access to key information and reduced reliance on manual reporting processes.

From a practical perspective, these finding highlights that improving data comprehensibility should be a priority for organizations seeking to enhance operational efficiency. Rather than focusing solely on increasing data volume, organizations should emphasize clarity, structure, and usability in dashboard design.

2. **Ease of data comprehension has a significant effect on decision-making efficiency (H2)**

   The analysis also shows that ease of data comprehension positively affects data collection accuracy ($\beta = 0.566$). This indicates that better understanding of data reduces misinterpretation and supports more accurate decision-making.

   This finding aligns with (Canonico et al., 2022), who found that well-structured visual representations help decision-makers detect anomalies and patterns more effectively, thereby improving accuracy. Interview results support this conclusion, as respondents stated that visual dashboards helped them identify unusual data trends more quickly compared to traditional tabular reports.

   These results imply that accuracy in decision-making is not only influenced by data quality, but also by how information is presented. Clear visualization helps users interpret data correctly and increases confidence in decision outcomes.

3. **Ease of data comprehension has a significant effect on decision-making accuracy (H3)**

   The relationship between data visualization and ease of data comprehension shows a positive but relatively weaker effect ($\beta = 0.207$). Although visualization contributes to improving understanding, its impact is not as strong as the direct influence of data comprehension on efficiency and accuracy.

   This finding suggests that visualization alone is insufficient if not supported by appropriate design principles and user competencies. Similar observations were reported by (Postma & Goedhart, 2019), who emphasized that poorly designed visualizations may fail to enhance understanding despite the use of advanced tools. Interview participants

also noted that unclear color usage or disproportionate graphs could lead to misinterpretation.

Therefore, the effectiveness of data visualization depends not only on the technology used, such as dashboards or visualization software, but also on visual literacy and thoughtful design implementation.

CONCLUSIONS AND RECOMMENDATIONS

This study examined the role of Tableau dashboard visualization in supporting industrial decision-making through ease of data comprehension. Using a mixed methods approach, the results demonstrate that ease of data comprehension is a key factor influencing both decision-making efficiency and accuracy.

The findings indicate that ease of data comprehension has a strong positive effect on decision-making efficiency and a significant positive effect on decision-making accuracy. This confirms that when data is presented in a clear and understandable manner, decision-makers are able to process information more quickly, reduce errors, and make more confident decisions. In addition, Tableau dashboard visualization was found to have a positive effect on ease of data comprehension, although its impact is relatively moderate compared to the direct effects of comprehension on efficiency and accuracy.

Qualitative findings reinforce the quantitative results, showing that interactive dashboards help users understand complex information, improve communication across departments, and support real-time monitoring. However, the effectiveness of dashboard visualization depends not only on the technology itself, but also on users' visual literacy and the quality of dashboard design.

Overall, this study concludes that Tableau dashboard visualization serves as an enabling tool that enhances decision-making performance primarily through improving ease of data comprehension in industrial environment.

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