Ad-Hoc Business Intelligence for Agile Decision-Making: A Case Study Using Adventure Works 2022

Zuli Maulidati[1], Satrio Bagas Pangestu[2], Salma Nur Aini[3]
[1,2,3]Sistem Informasi, Fakultas Teknik Elektro dan Teknologi Informasi, Institut Teknologi Adhi Tama Surabaya
Email: [1]zulimaulidati@itats.ac.id, [2]satriobagas.id@gmail.com, [3]salmanraini79@gmail.com

Abstrak
Pengambilan keputusan yang adaptif dalam bisnis saat ini sangat penting bagi organisasi untuk tetap kompetitif. Kecerdasan Bisnis telah mengatasi situasi tersebut untuk memberikan solusi dalam kondisi krusial apa pun. Tidak seperti dasbor statis, dasbor ad hoc dianggap sebagai solusi yang layak dalam menyesuaikan bisnis untuk membuat keputusan berdasarkan data dengan fleksibilitas yang tinggi. Studi ini bertujuan untuk mengimplementasikan dan mengevaluasi dasbor ad-hoc menggunakan dataset Adventure Works 2022 menggunakan alat visualisasi data yang beranam Tableau. Hasil studi menunjukkan bahwa kedua dasbor menerapkan pemfilteran interaktif, kemampuan drill-down, dan visualisasi waktu nyata untuk meningkatkan ketangkasan pengambilan keputusan berdasarkan data. Desain dasbor A memberikan tampilan multidimensi terstruktur yang cocok untuk analisis mendalam; sementara itu, sedangkan, dasbor B memprioritaskan kesederhanaan dan aksesibilitas, menyajikan wawasan utama secara intuitif untuk pengambilan keputusan yang cepat. Studi ini menyoroti hasil bahwa tantangan terbesar dalam membangun dasbor adalah kelebihan informasi dan kegunaan yang nyaman untuk user. Penting untuk dicatat bahwa implementasi BI ad-hoc harus menyeimbangkan antara kemampuan analitis dan kemudahan penggunaan untuk memastikan bahwa dasbor memberikan nilai yang berarti dan mudah digunakan oleh pengguna akhir.
Kata Kunci: *Ad-hoc BI, Agile Decision Making, BI Dashboard*

Abstract
Agile decision-making in today's business is highly crucial for an organization to stay competitive. Business intelligence has overcome the situation to provide solutions in any crucial condition. Unlike the static dashboard, the ad hoc dashboard is considered to be a viable solution in tailoring business to make a data-driven decision with high flexibility. This study aims to examine and implement ad-hoc dashboards using the Adventure Works 2022 dataset using a data visualization tool called Tableau. The result of the study shows that both dashboards implement interactive filtering, drill-down capabilities, and real-time visualization to enhance data-driven decision-making agility. The design of dashboard A provides a structured, multi-dimensional view suitable for in-depth analysis; meanwhile, dashboard B prioritizes simplicity and accessibility, presenting key insights intuitively for quick decision-making. Furthermore, the study highlights the result that the biggest challenges of building a dashboard are information overload and usability. It is important to note that the implementation of ad-hoc BI should balance between analytical capabilities and user-friendliness to ensure that dashboards provide meaningful insights and are easy to use by end users.
Keywords: *Ad-hoc BI, Agile Decision Making, BI Dashboard*

1. Introduction

In today's rapidly evolving business environment, agile, real-time decision-making is essential for organizations to maintain competitiveness and meet stakeholder expectations (Chu & Yong, 2021). Business intelligence and analysis have emerged as a significant role in establishing decision-making in business with the development of technology and the availability of data. BI has been leveraged by businesses utilizing the data and analyzing it accurately to support decision-making, which could vary based on business operations and the level of business culture leveraging the data (Turban et al., 2011).

The growing need for agile and real-time decision-making cannot be hindered by some factors. This is caused by the need for flexibility of business to adapt to changing market conditions, customer needs, and technological advancements (Krawatzeck et al., 2015). Customers increasingly demand immediate, personalized experiences, necessitating real-time adjustments to operations and product offerings. The rapid emergence of new technologies compels companies to adapt and innovate quickly to stay competitive (Bhagyashree, 2024). The abundance of real-time data enables data-driven decision-making, providing insights that guide immediate actions (Bhagyashree, 2024). Collectively, these factors underscore the critical importance of agile, real-time decision-making in contemporary business practices. BI agility refers to the ability of BI systems to adjust effectively to environmental changes (Krawatzeck & Dinter, 2015).

BI visualization is one of the core BI solutions supporting decision-making in business. The type of dashboard relating to the user and organization's needs is considered a variety (Khatuwal & Puri, 2022). Compared to the static dashboard, the ad hoc dashboard could be more agile in analyzing and presenting data supporting decision-making in business. Static and performance dashboards are predefined and fixed, displaying key metrics and KPIs in a structured format based on the organization level required in decision-making (Ghazisaeidi et al., 2015; Hester et al., 2017). These dashboards are updated at scheduled intervals, making them ideal for routine reporting, executive summaries, and standardized performance tracking (Ghazisaeidi et al., 2015; Sarikaya et al., 2019). In contrast, ad-hoc BI dashboards are highly flexible and customizable, allowing users to modify queries, apply filters, and generate real-time visualizations based on current needs (Berthold et al., 2012). They offer greater interactivity, enabling users to drill down into data and explore trends dynamically (Wang et al., 2018). The flexibility in any situation and case enables businesses to get the data insight specifically for the condition and problem that they want to solve. In short, static dashboards are best for long-term tracking and monitoring business performance, while ad-hoc dashboards provide more real-time flexibility for data-driven decision-making. The study conducted by Davcheva and Benlian (2018) showed that the use of real-time visualization can enhance decision-making performance in time-critical situations. The finding revealed that ad-hoc visualization can rapidly make a decision in a paced business environment. Another study by Pendyala (2024) emphasized the critical need for flexible tools and queries in making rapid, precise decision-making.

This study explores the process of designing and implementing an ad-hoc dashboard tailored to specific business scenarios. It evaluates the key steps involved in building such dashboards to ensure they effectively respond to dynamic business needs. As part of the research, the Adventure Works 2022 dataset is utilized, providing a freely accessible and structured dataset for analysis. By leveraging this dataset, the study aims to extract valuable insights, demonstrating how ad-hoc dashboards can enhance business intelligence and decision-making. Furthermore, the study is the result of class studies in leveraging data and BI tools in developing agile decision-making. It involves two ad-hoc dashboards with different scenarios for ad-hoc reporting and analysis.

2. Methodologies

The dataset of this study is *"AdventureWorks 2022"*, a sample database provided by Microsoft (MashaMSFT, 2024). The data contain realistic business data for a fictional company called Adventure Works, which sells bicycles and related products, including tables for sales, customers, products, resellers, region, and salasperperson.

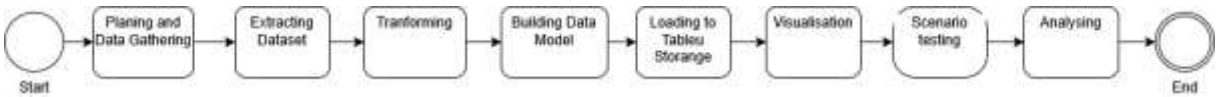

Figure 1. Research Methodology

In this study, the implementation process begins with data gathering and planning then extracting the dataset, transforming it into new models, and loading it into Tableau's storage for further analysis. The transformation in this study is conducted in steps to clean, aggregate, and structure the data to fit analytical models. Once prepared, the data is loaded into Tableau and managed for

visualization and exploration to obtain insightful data. The visualization of the study aims to build an interactive dashboard with capabilities that include drag-and-drop analytics and real-time filtering.

Two ad-hoc dashboards were developed using the BI tools called Tableau. The utilized tableau is the public version, which enables direct publishing in BI communities. It is easy for collaboration among team members to bring an insightful view during query analysis. The dashboard design follows key principles for interactive and user-friendly dash, ensuring it remains flexible, dynamic, and capable of drill-through analysis and real-time exploration.

The business scenarios of this study are developed to evaluate the ad hoc dashboard. It is an instrument to get to know the agility and flexibility of the dashboard in accommodating any case. The business scenarios for this study are formulated in the following:

1. **Scenario 1**: Sales Performance and Revenue Trend Analysis
   The sales department wants to monitor sales performance across different regions, product categories, and periods to identify trends and optimize strategies.
2. **Scenario 2**: Customer Purchase Behavior and Profitability Analysis
   The marketing team wants to analyze customer purchasing patterns to identify high-value customers and improve targeted marketing strategies.

3. Implementation and Result

3.1. Dataset Preparation

The dataset consists of eight main tables: **Sales, Reseller, Product, Region, Date, Salesperson, Targets,** and **SalespersonRegion**. Those are stored in one typical data mart that focuses on sales and are modelled in dimensional modelling called the star scheme. The fact table is "Sales" with 57.851 row records of the data, which stores most of the related data and relates to the other table. The star scheme is presented in the following figure, which is tied with **one-to-many (1:M)** relations.

Process transformation in this model happens to create distinct record values in the dimension of date. Since it cannot be connected with the fact table if there is redundant data. The "Date" record is extracted, and the duplicate values are then split into different attributes such as "Day", "Month", and "Year".

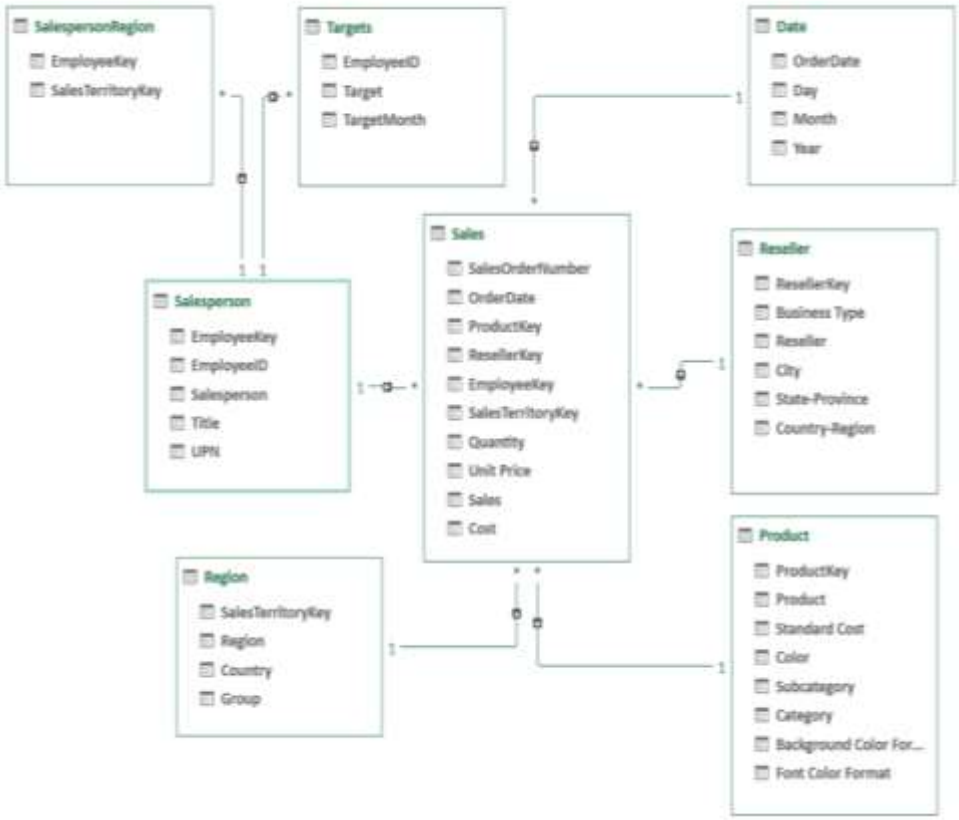

Figure 2. Star Scheme of AdventureWorks 2022

The given illustration above represents a star schema for the AdventureWorks 2022 dataset. In this model, the relation among tables clearly depicts to be well known how well-known each attribute can be analyzed during dashboard implementation. The Sales is the fact table containing essential information relating to the other data. The **dimension tables** surrounding the Sales table include **Product, Reseller, Date, Region, Salesperson, Targets,** and **SalespersonRegion**. The relationships within the table fact follow a **one-to-many (1:M)**, where each dimension table record can be referenced multiple times in the **Sales** as a fact dimension.

The transformation process in this dataset was conducted to fill in the dimensional modelling. Some data was transformed into a modelling format. The dimension of date is one of the results of normalization, which separates date, month, and year to ease the data analysis from different dimensions. Several aggregation functions had been applied to find the values and present them in the dashboard. Some aggregation functions are listed below:

Tabel 1. Aggregation Calculation List

No	Aggregation Function	Description
1	SUM ([Sales (Sales)])	To find the total sales over the period
2	SUM ([Sales (Sales)])/COUNT ([Sales Order Number])	To calculate the Average Sales per Customer
3	(SUM ([Sales (Sales)])/ SUM ([Target])) *100	To find the percentage of Sales Target Achievement
4	SUM ([Cost]) - SUM ([Sales])	To calculate the total margin

3.2. Dashboard Implementation

The information presented in the dashboard plays a crucial role in processing and creating the graphical illustration to present the knowledge in data-driven decision-making. A dashboard can be defined as a visual representation of the most significant information displayed on one screen ready to be analyzed and monitored, in which the visualization is considered presented to the non-expert users (Abduldaem & Gravell, 2019; Martins et al., 2022). Tokola et al. (2016) define the dashboard as a management communication tool for exchanging data to monitor the company's performance. The purpose of the dashboard depends on the kind of dashboard to be presented to the management level (Rahman et al., 2017). The general principles of the dashboard relate to how effectively the dashboard can give insightful data to the users. Ad-hoc Business Intelligence (BI) dashboards need flexibility and customization, empowering users to tailor their data analysis experience according to specific requirements (Berthold et al., 2012).

Figure 3. Dashboard A

Figure 4. Dashboard B

In this study, the dashboards were built, enabling users to modify queries dynamically and apply various filters to refine data views. The implementation of drill-down and filtering in the dashboard could provide flexibility for users to analyze. This adaptability ensures that users can quickly adjust their analyses based on evolving business needs and uncover hidden patterns in the data. The two dashboards were developed to accommodate the needs of ad-hoc reporting, which provides the flexibility and availability to analyze data based on the user's needs.

Both dashboards presented above were built to accommodate the ad hoc dashboard, which provides the flexibility for users to adjust to find the information. Based on the same dataset, the development dashboard and the result visualization could be far different based on the purpose and goals of BI development makers. The dashboard A presents the huge information with simple and similar visualization, while the dashboard B makes different visualizations, which make it more appealing and easier. Those are also present as a result of the aggregate calculations and also link the data among the kinds of visualization, hence, those are fully integrated.

3.3. Result and Analysis

Given the scenarios to evaluate how ad-hoc BI dashboards can make a decision. Between **Figure 3**, dashboard A, and **Figure 4**, dashboard B, it can be seen that the data represents performance in **Sales.** Scenario A: Sales Performance and Revenue Trend Analysis shows that both dashboards could present the information about the sales in some categories. Dashboard A provides the information of sales related to the three different dimensions, such as sales per customer, sales based on the target sales, and sales productivity. Total sales in dashboard A are illustrated in detail, which contain the data for each month and are filtered by the year. The line chart gives an appropriate visualization to show how the revenue rate increases month by month. Likewise, dashboard B also shows the total sales data in a line chart in which is detailed to be tracked per day using filters by month and year. Moreover, it also gives a glance total profit and cost in total, which can be much easier to obtain the data at a first glance. Relating to the other dimensions, such as customer, territory, category, and target sales, those dashboards have preferences based on the ad hoc needs to make agile decision-making. Dashboard A visualizes the sales analyzed with several dimensions; for example, average sales can be analyzed based on targeted seller and also customers. With filtering, the data could be flexible to analyze.

The second scenario is about Customer Purchase Behavior and Profitability Analysis. The dashboard A utilizes data specifically to present the relationship between sales and customers, hence, it can directly affect how customers affect the sales and profit. The bar chart visualizes average sales per customer and represents frequency and the tendency to repurchase the product based on the geographical locations. The dashboard B does not directly answer the second scenario, but the visualization can give insightful information through the category of the data. Sales per category and sales per territory can help to analyze customer behavior and find the root of the phenomenon happening during ad hoc reporting.

According to the two data visualizations, the ad hoc features of BI dashboards play a crucial role in generating insightful data that supports decision-making. The filter feature, in particular, enables management to refine and analyze data efficiently, thereby enhancing the decision-making process. Visualization B shows simplicity, which enables users to quickly obtain key information effortlessly. The design of the dashboard B is intuitive and user-friendly, which could enhance its accessibility. The user-friendly visualizations could help users derive the insightful data more easily and with less stress. In contrast, dashboard A failed to accommodate the usability principles and tended to present data more rigidly and complexly. The visualization needs greater analytical skills and focus to interpret effectively. It may be beneficial for in-depth analysis, but it can also be more time-consuming and challenging for users with limited experience.

Overall, based on the analysis, both dashboards successfully provide flexibility and adaptability for dynamic visualizations. The dashboards that resulted in this study are different to the static dashboard, which is designed specifically for tracking an organization's performance at time intervals. The static offer may give some advantages, such as consistency and reliability, unfortunately, it may lack the agility needed to respond to rapidly changing scenarios or surpass situations and conditions.

4. Discussion

As highlighted in the literature review on dashboard implementation, BI development plays a crucial role in supporting data-driven decision-making for businesses. The findings of this study indicate that ad-hoc dashboards provide a high level of flexibility and agility under certain conditions, allowing users to dynamically modify queries, apply filters, and generate insights in real time. However, the scenario tests also revealed certain limitations where specific analytical needs could not be fully met by the dashboards. While the flexibility of ad-hoc dashboards enhances agility in analysis, their effectiveness is constrained by the type of analytics they support.

In this study, BI reporting is categorized under descriptive analytics, which primarily presents historical data extracted from the data mart. According to Orlovskyi and Kopp (2020) Business intelligence reporting and analytics can be categorized into two broad categories: descriptive and predictive analytics. Descriptive analytics, as used in this study, focuses on presenting and summarizing past data to find the related patterns, whereas predictive analytics involves forecasting future trends. Agile decision-making, however, requires a degree of predictive capability to anticipate market shifts and business risks proactively (Dhatchayani et al., 2025). The reliance on descriptive analysis in this study means that the dashboards enable real-time insights from the past and current data without looking at predictions that are crucial for more strategic and proactive decision-making. Therefore, in order to enhance analytical agility, allowing real-time data exploration by integrating predictive analytics will be crucial to further strengthen their role in agile business intelligence.

Implementing ad-hoc BI dashboards presents several challenges, including information overload and usability barriers (O'Hear, 2023). According to this study, it is highlighted that information overload occurs when dashboards present excessive data without clear prioritization. This presentation makes it difficult to extract relevant insights effectively because the user needs a deep and meticulous analysis. Dashboard A demonstrates whole data with less precise prioritization, as it only attempts to accommodate a large amount of information on a single screen. This visualization could not be a big problem for IT users, but it is a big problem for non-expert users. For non-technical users, such as executives and managers, this design can be overwhelming and frustrating. It might not be easy to get insightful data because the dashboard is quite complex and rigid. It may require users to spend additional time deciphering trends and patterns, and can reduce the dashboard's overall usability. In the

contradictory result of visualization, dashboard B is presented, accommodating usability principles in mind. The design ensures that the interface is more intuitive and simpler. Organizing key data points clearly and using well-spaced visualizations is key in developing an interactive dashboard, which can help the non-expert users get insight at a first glance. Furthermore, another issue found in this study is that the dashboards only present descriptive analytics without including predictive one. The key to designing an effective ad-hoc BI dashboard is to strike a balance between powerful analytics capabilities and user-friendly design (Stodder, 2015). While these dashboards have not yet been implemented with these principles and criteria, the analysis of the study using aggregation and further queries of analytical data can help in addressing the following trend in the future.

In short, ad hoc dashboards should provide flexibility as well as maintain an intuitive interface to ensure the users can easily access relevant insights without being overwhelmed by excessive data. The strongest finding in this study is that balancing analytics capabilities between descriptive and predictive is crucial in agile decision-making, while the dashboard is also designed with a simple and intuitive design that ensures that users can easily access insights without being frustrated.

5. Conclusion

These results add to the rapidly growing evidence that ad-hoc Business Intelligence (BI) dashboards are important in supporting agile, data-driven decision-making in organizations. Two different dashboards in this study demonstrate the dynamic, flexibility, interactivity, and usability of visualization responding to the given scenarios. Dashboard A is designed to provide a structured and detailed analytical approach, while Dashboard B prioritizes simplicity and usability. Dashboard A benefits in some depth analytics caused by rigid data informed, while visualization B is excellent in providing interactive and user-friendly dashboards. According to the study, it is also crucial to note that information overload, usability barriers, and the need for training are some challenges in ensuring effective dashboard usage.

The scope of this study was limited in terms of presenting the data, resulting in only the development of two descriptive dashboards. The lack of descriptive analytics limits the presentation to current and historical data only, while the ability to provide predictive decision-making is crucial for anticipating market trends and business risks. This would be a fruitful area for further work if the dashboard were implemented with predictive analytics for maximizing the benefits of ad-hoc BI dashboards in empowering agile and flexible decision-making according to the business environment. The scenario testing is also based on the researcher's heuristic perspective based on the usability principles. For further research and dashboard implementation, usability testing might need to be conducted directly by the end users, hence it tends to obtain the real feedback. In addition, the use of data in this study was also limited to only using datasets coming from the public domain. The following research could utilize the real data coming from business organizations; hence, it can help formulate the solution and also contribute more to business intelligence research and studies.

Reference:

Abduldaem, A., & Gravell, A. (2019). *PRINCIPLES FOR THE DESIGN AND DEVELOPMENT OF DASHBOARDS: LITERATURE REVIEW*.

Berthold, H., Rösch, P., Zöller, S., Wortmann, F., Carenini, A., & Campbell, S. (2012). Towards Ad-Hoc and Collaborative Business Intelligence. In *Business Intelligence Applications and the Web: Models, Systems and Technologies* (pp. 266–284). IGI Global Scientific Publishing. https://doi.org/10.4018/978-1-61350-038-5.ch012

Bhagyashree. (2024, August 22). *How to Derive Data-Driven Insights for Agile Decisions?* PromptCloud. https://www.promptcloud.com/blog/data-driven-insights-for-agile-decision-making/

Capital, F. (2024). *Agility in Decision making: The Key to Effective Business Strategy*. FasterCapital. https://fastercapital.com/content/Agility-in-Decision-making--The-Key-to-Effective-Business-Strategy.html

Chu, M. K., & Yong, K. O. (2021). Big Data Analytics for Business Intelligence in Accounting and Audit. *Open Journal of Social Sciences*, *09*(09), 42–52. https://doi.org/10.4236/jss.2021.99004

Dhatchayani, K., Vezhaventhan, D., Sornamugi, P., T, Varsha., S, Priyadharshini., & T, Leha. (2025). Agile Decision-Making Framework using Hybrid Statistical and Predictive Models for Efficient Business Operations. *2025 6th International Conference on Mobile Computing and Sustainable Informatics (ICMCSI)*, 822–829. https://doi.org/10.1109/ICMCSI64620.2025.10883071

Ghazisaeidi, M., Safdari, R., Torabi, M., Mirzaee, M., Farzi, J., & Goodini, A. (2015). Development of Performance Dashboards in Healthcare Sector: Key Practical Issues. *Acta Informatica Medica*, *23*(5), 317. https://doi.org/10.5455/aim.2015.23.317-321

Hester, P., Ezell, B., Collins, A., Horst, J., & Lawsure, K. (2017). A Method for Key Performance Indicator Assessment in Manufacturing Organizations. *International Journal of Operations Research*, *14*(4), 157–167.

Khatuwal, V. S., & Puri, D. (2022). Business Intelligence Tools for Dashboard Development. *2022 3rd International Conference on Intelligent Engineering and Management (ICIEM)*, 128–131. https://doi.org/10.1109/ICIEM54221.2022.9853086

Krawatzeck, R., & Dinter, B. (2015). Agile Business Intelligence: Collection and Classification of Agile Business Intelligence Actions by Means of a Catalog and a Selection Guide. *Information Systems Management*, *32*(3), 177–191. https://doi.org/10.1080/10580530.2015.1044336

Krawatzeck, R., Dinter, B., & Pham Thi, D. A. (2015). How to Make Business Intelligence Agile: The Agile BI Actions Catalog. *2015 48th Hawaii International Conference on System Sciences*, 4762–4771. https://doi.org/10.1109/HICSS.2015.566

Martins, N., Martins, S., & Brandão, D. (2022). Design Principles in the Development of Dashboards for Business Management. In D. Raposo, J. Neves, & J. Silva (Eds.), *Perspectives on Design II* (Vol. 16, pp. 353–365). Springer International Publishing. https://doi.org/10.1007/978-3-030-79879-6_26

MashaMSFT. (2024, September 4). *AdventureWorks sample databases—SQL Server*. https://learn.microsoft.com/en-us/sql/samples/adventureworks-install-configure?view=sql-server-ver16

Nookala, G. (2022). Improving Business Intelligence through Agile Data Modeling: A Case Study. *Journal of Computational Innovation*, *2*(1), Article 1. https://researchworkx.com/index.php/jci/article/view/14

O'Hear, E. (2023). *THE IMPLICATIONS OF INFORMATION LOAD ON USABILITY AND PERFORMANCE IN DASHBOARDS*.

Orlovskyi, D., & Kopp, A. (2020). *A Business Intelligence Dashboard Design Approach to Improve Data Analytics and Decision Making*.

Rahman, A. A., Adamu, Y. B., & Harun, P. (2017). Review on dashboard application from managerial perspective. *2017 International Conference on Research and Innovation in Information Systems (ICRIIS)*, 1–5. https://doi.org/10.1109/ICRIIS.2017.8002461

Sarikaya, A., Correll, M., Bartram, L., Tory, M., & Fisher, D. (2019). What Do We Talk About When We Talk About Dashboards? *IEEE Transactions on Visualization and Computer Graphics*, *25*(1), 682–692. https://doi.org/10.1109/TVCG.2018.2864903

Stodder, D. (2015). *Visual Analytics for Making Smarter Decisions Faster: Applying Self-Service Business Intelligence Technologies to Data-Driven Objectives*.

Tokola, H., Gröger, C., Järvenpää, E., & Niemi, E. (2016). Designing Manufacturing Dashboards on the Basis of a Key Performance Indicator Survey. *Procedia CIRP*, *57*, 619–624. https://doi.org/10.1016/j.procir.2016.11.107

Turban, E., Sharda, R., & Delen, D. (2011). *Decision support and business intelligence systems* (9th ed). Prentice Hall.

Wang, F. L., Rischmoller, L., Reed, D., & Khanzode4, A. (2018). *Ad Hoc Data Analytics and Business Intelligence Service Framework for Construction Projects*. 1058–1068. https://doi.org/10.24928/2018/0535