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Research article

One Data Indonesia Policy Adoption for Telkom University Data Warehouse Framework

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ABSTRACT

The Indonesian government has implemented a data warehouse named One Data (Satu Data) Indonesia (ODI) to support its operations since 2019. However, the implementation of this concept in universities has been limited, with only a few universities adopting it. Telkom University is one of the few universities in Indonesia that has already taken steps to implement ODI at the university level. The adoption of ODI at Telkom University is known as the One Data Telkom University (ODTU) project. This project aims to create a platform for universities to share data and collaborate more effectively. This paper thoroughly examines the implementation of the ODI policy and data warehouse framework at Telkom University, focusing on the ODTU data warehouse design and architecture. This paper discusses the implementation of ODTU into several applications, including the One Data Portal, One Data Dashboard, and One Data Market. Moreover, it identifies the challenges encountered during the implementation process, such as data integration, data privacy and security, standardized data models, and the promotion of a shared vision among stakeholders with varying levels of data literacy. Our analysis results demonstrate the effectiveness of the ODTU framework in improving data management practices at Telkom University. The customer satisfaction index (CSI) shows that across key reliability, assurance, and responsiveness measures, Telkom University experienced average score improvements of 3-6% after implementing ODTU. This study contributes to the existing literature on ODI policy adoption in the context of higher education institutions, providing insights for institutions seeking to improve their data management practices.

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1. Introduction

Data warehouses are essential to many industries, enabling organizations to store and analyze large amounts of data [1]. This data can be utilized to make better-informed decisions and improve operations, ultimately leading to increased efficiency and profitability [2], [3]. Various implementations of data warehouses exist in different sectors, each offering unique advantages and challenges [4]. Data warehouses store large amounts of data, enabling organizations to quickly access and analyze the information [5], [6]. This data can be employed to identify trends, understand customer behavior, and optimize processes [7]. Additionally, data warehouses are also used to track performance metrics, helping organizations identify areas of improvement and make data-driven decisions [8].

Data warehouses are powerful tools that enable businesses to store and analyze large amounts of data. In the banking [9], health [10], [11], marine sector [12], and Internet of Things (IoT) industries [13],

data warehouses can be used to improve efficiency and accuracy as well as gain insights into customer behavior and market trends.

Indonesia is a country rapidly embracing the use of data warehouses to support the national government. The Indonesian government has implemented a data warehouse named One Data (Satu Data) Indonesia to support its operations since 2019 [14], [15]. One Data Indonesia (ODI) provides the government with a centralized data repository, allowing them to access and analyze all data in one place to help the government better serve the citizens [16].

The launch of One Data Indonesia in 2019 was a significant milestone for the country. Since its launch, the system has been implemented on a smaller scale in various provinces and cities, such as East Nusa Tenggara [17] and Pontianak [18]. The use of data in various sectors, such as small and medium enterprises (SMEs) [19], open spatial data [20], taxation [21], and more, is also becoming increasingly prevalent. However, the implementation of this concept in universities has been limited, with only a few universities adopting it.

The implementation of one data Indonesia in universities would have numerous benefits. It would enable universities to access and analyze data from their systems and databases better. It would also enable universities to collaborate more effectively with other universities and government departments. Despite the potential benefits, implementing this concept in universities still needs improvement due to a lack of understanding of the concept and its potential benefits. It is also hindered by a lack of funding and resources to develop the necessary infrastructure.

Telkom University, located in Indonesia, is among several higher education institutions that have adopted the ODI framework at the university level [22]. This adoption aligns with the institution's ongoing transition towards a fully digital campus. This transition, occurring within Telkom University or Tel-U, heavily relies on the successful execution of a robust data management strategy. A recent agreement has highlighted the development and improvement of the One Data Telkom University (ODTU) concept as a critical component of this strategy [22].

The ODTU concept seeks to establish a consistent virtual data repository using Microsoft's advanced technology. This enables more effective data-based decision-making and facilitates easier data visualization. However, these technological developments serve a larger, more encompassing purpose. The main goal of the ODTU initiative is to establish a single, robust data source that can enhance the quality of services and decision-making processes. The successful implementation of the ODI concept at ODTU will yield significant advancements in its data management system, indicating the effectiveness of this comprehensive approach.

This paper thoroughly examines the implementation of the ODI policy and data warehouse framework at Telkom University. It begins by presenting an overview of the ODI policy and its impact on the institution. The paper then analyzes the ODI data warehouse framework, providing detailed information about its architecture, components, and advantages. Additionally, the paper discusses the challenges encountered during the ODTU implementation process and recommends strategies to overcome them. Overall, this study highlights the significance of ODI adoption and its influence on Telkom University.

This paper is organized into six sections to enhance our comprehension of the One Data Indonesia (ODI) Policy Adoption for One Data Telkom University (ODTU) Framework. Section 1 introduces the problem statement and background information, while Section 2 explores the ODI structure and policy. Section 3 details the main idea of its adoption at Telkom University. Section 4 focuses on the implementation of ODTU in terms of its data warehouse design. Section 5 discusses the ODTU framework named MyTelU Core. Finally, Section 6 summarizes the works presented and concludes the problem stated in the first section.

2. Materials and Methods

2.1. The Structure and Policy of One Data Indonesia

The Indonesian government recently issued Presidential Regulation (Perpres) No. 39 of the Year 2019, which outlines the purpose and intent of One Data Indonesia (ODI) [14]. ODI represents a government-driven effort to implement a comprehensive and unified data governance framework across the nation. Its primary objective is to regulate the data governance enforcement for data produced by both central and regional agencies, which, in turn, supports the development of planning, execution, evaluation, and

controlling. This will ultimately allow for more efficient and effective policy-making and decision-making. Additionally, ODI aims to enhance transparency and accountability in managing public data.

Furthermore, the specific objectives of the ODI include: (1) Providing references for Implementation and Guidelines for Organizing Data Governance, (2) Ensuring availability of accurate, up-to-date, integrated, accountable, easily accessible, and shared data between agencies, (3) Encouraging Data Openness and Transparency, (4) Supporting the National Statistical System.

The breakdown of Presidential Regulation (Perpres) No. 39 of the Year 2019 about ODI [14] is shown in Figure 1. The ODI principles form a set of guidelines designed to ensure the quality and accessibility of data. The principles of ODI include data standardization, metadata, interoperability, and reference codes. Data standardization involves presenting data in a consistent format to facilitate readability and interpretation across different systems. Metadata describes additional details, such as the author, date created, and purpose, ensuring that data is adequately attributed and can be used to track changes in the data over time. Interoperability focuses on enabling different systems to communicate and share data seamlessly. Reference codes serve as unique identifiers linking data from diverse sources.

ODI represents a concerted effort to define and implement a governance framework aimed at ensuring the trustworthiness and safety of all Indonesian data. This comprehensive framework includes several key elements, including a board of directors, ODI forums, data stewards, data custodians, support data custodians, and data producers. The board of directors plays a pivotal role in decision-making, policy setting policies, and overseeing the overall operations of ODI. Comprising representatives from the government, private sector, and civil society representatives, this group is also responsible for developing and approving the ODI framework and road map, which delineate the goals and objectives of ODI. ODI forums serve as a platform for stakeholders to engage in discussion and coordinate data governance initiatives. The forums are open to all interested parties and cover data sharing, security, privacy, storage, and more. Moreover, the forums play a crucial role in guiding data stewards and custodians in fulfilling their responsibilities.

Data Indonesia Enforcement consists of four key components: planning, collection, inspection, and sharing. The planning phase is focused on developing policies and procedures to ensure data collection, storage, and usage align with the laws and regulations of the country. The collection process involves gathering data from various sources, including public records, surveys, and interviews. Subsequently, data is then analyzed and used to inform decision-making. Inspection involves reviewing data to ensure accuracy and compliance with relevant laws and regulations. Finally, the sharing component involves disseminating data to other government agencies, private entities, and the public.

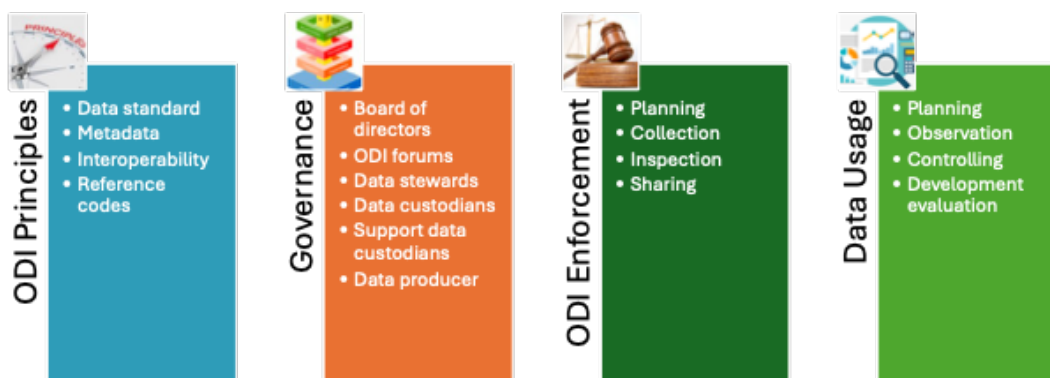


Fig. 1. The breakdown of Perpres No. 39, 2019, about ODI

Data Indonesia employs various methods to assist organizations in planning, observing, controlling, and evaluating the development of Indonesia's electronic-based government system (e-government). Planning involves the process of setting goals and objectives for the organization. It also provides insights into the resources and capabilities required to achieve ODI goals. Observation entails the process of monitoring the progress of the organization, helping organizations identify areas for improvement and recognizing areas of proficient performance. Controlling ensures that the organization is meeting its goals. The utilization of Data Indonesia helps monitor the organization's progress and identify potential issues within the organization.

2.1.1. The Organization of ODI Enforcement

Data Indonesia enforcement has a well-defined organizational structure designed to ensure effectiveness and efficiency in its operations. As illustrated in Figure 2, the organizational structure consists of six main bodies. First, the **ODI Board of Directors (BOD)** comprises seven members, each overseeing the institute’s activities, policies, and objectives. The Ministry of National Development Planning leads the BOD and acts as the custodian for Big Data. Furthermore, the Ministry of Communication and Informatics manages the data center. At the same time, the Ministry of State Apparatus Utilization and Bureaucratic Reform serves as the architect of the e-governments. Other central data custodians appointed by the BOD include the Ministry of Finance, The Ministry of Home Affairs, The Central Bureau of Statistics, and the Geospatial Information Agency. The BOD plays a crucial role in ensuring that ODI meets its goals and objectives on time and adheres to established standards.

The second role is fulfilled by the **ODI Forums**, which are organized at three levels: the central, province, and district/city. Each level has a coordinator, data custodians, data stewards, and data producers to ensure the success of Open Data Initiative. The central level forum, led by The Ministry of National Development Planning appoints the central data custodians and stewards. These members are tasked with facilitating the sharing of open data among government agencies and promoting the use of open data among citizens. At the provincial level, the forum is headed by the Head of Province National Development Planning. This level of the forum consists of province-level data custodians and data stewards, province-level support data custodians and data stewards, and data producers. Similarly, the Head of District/City National Development Planning heads the district/city-level forum. This forum level consists of district/city-level data custodians and data stewards, district/city-level support data custodians and data stewards, and data producers.

The third role is that of the **data custodian**, responsible for establishing data standards applicable across central and regional agencies. They determine the standard metadata structure and format. Furthermore, the data custodian is responsible for providing recommendations in the data collection planning process, re-checking the priority data, and developing HR implementation.



Fig. 2. The Organization of ODI Enforcement

The role of data custodian is of paramount importance within any organization. The establishment of data standards plays a crucial role in ensuring consistency and accuracy across a larger organization, facilitating streamlined and reliable data collection. The standardized metadata structure and format also contribute to easier data tracking and sharing, which helps increase efficiency in data records and management. Additionally, the data custodian is also responsible for providing recommendations in the data collection planning process, ensuring that the generated data is both useful and relevant.

The final roles within the Open Data Institute are the data stewards and producers, who are tasked with the following responsibilities: (1) Collecting, Checking, and Managing data according to ODI principles, (2) Disseminating data, metadata, reference codes, and master data on the ODI portal, (3) Assisting the data builder in fostering data producers, (4) Providing feedback on data standards, metadata, and data interoperability, (5) Generating data in accordance with ODI principles, (6) Delivering data and metadata to data custodians.

2.2. ODI for One Data Telkom University

Implementing One Data Indonesia (ODI) in universities would benefit both institutions and the country as a whole. ODI, initiated by the Indonesian government, aims to enhance the the accessibility and value of data from various government departments, universities, and other organizations. This implies that universities could access better data from their systems, databases, and other sources. ODI would also facilitate greater collaboration between different universities and government departments.

Telkom University is among the few universities in Indonesia already taking steps to implement ODI at the university level. The adoption of ODI at Telkom University is known as the One Data Telkom University (ODTU) project. This project is designed to establish an integrated data management system to benefit the university and the country, creating a platform for universities to share data and collaborate more effectively. Furthermore, it will also enable the university to use data to drive innovation and research.

The ODTU project was initiated in 2018 to provide a data integration platform across Telkom University applications. Since its inception, ODTU has consistently developed a comprehensive one data platform.

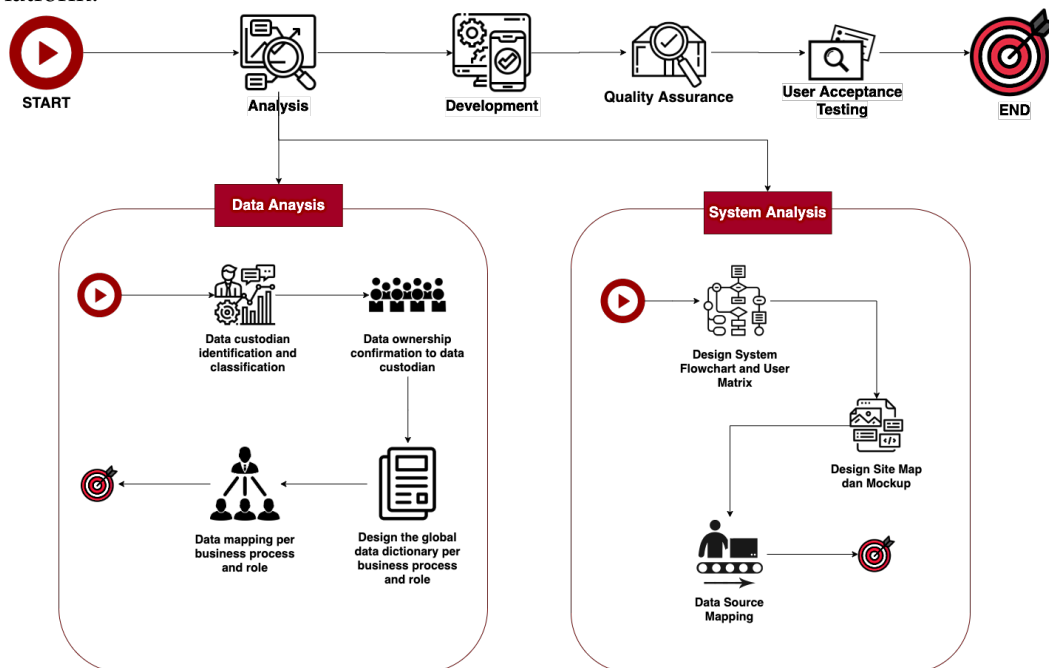


Fig. 3. One Data Telkom University development life cycle

2.2.1. The ODTU Development Life Cycle

The ODTU Development Life Cycle (Figure 3) comprises four distinct stages, the first being the Analysis stage. During this stage, the ODTU team is responsible for developing the project plan, setting the project goals, and conducting a comprehensive analysis of the problem. This process is divided into two sub-processes - Data Analysis and System Analysis.

In the Data Analysis process, the system analyst's role is to identify and classify all data custodians across all directorates at Telkom University. Additionally, they should conduct interviews with all data custodians to acquire knowledge about their data ownership. This process eventually leads to the design of a global data dictionary and mapping for each business process and role. The System Analysis process involves designing a system flowchart, user matrix, mock-up, and data source mapping.

The successive phases of the project must be completed for its successful completion. The second stage is the development phase, where the product is designed and crafted. The third stage is quality assurance, where the product is tested, and any bugs are identified and resolved. Finally, the fourth stage involves user acceptance testing, during which users test the product to determine if it meets their requirements.

2.2.2. ODTU Portal

The One Data Portal (ODP) serves as an essential front-end interface for stakeholders of the ODTU. This interface facilitates effective communication and secure collaboration between data consumers and custodians. The ODP provides a comprehensive platform for data consumers and custodians to access, analyze, and share data. It offers comprehensive features, including data visualization, sharing, and security. Additionally, the ODP provides a secure environment for data custodians to store, manage, and access data.

For ODTU stakeholders, the ODP proves to be an invaluable tool, allowing them to quickly and securely access and share data. It plays an essential role in ODTU's data transparency initiatives, ensuring a secure and efficient means for stakeholders to collaborate. Through the ODP, data consumers and custodians can easily access and share data, promoting both security and accessibility for all stakeholders. Figure 4 visually represents the ODP flow chart.

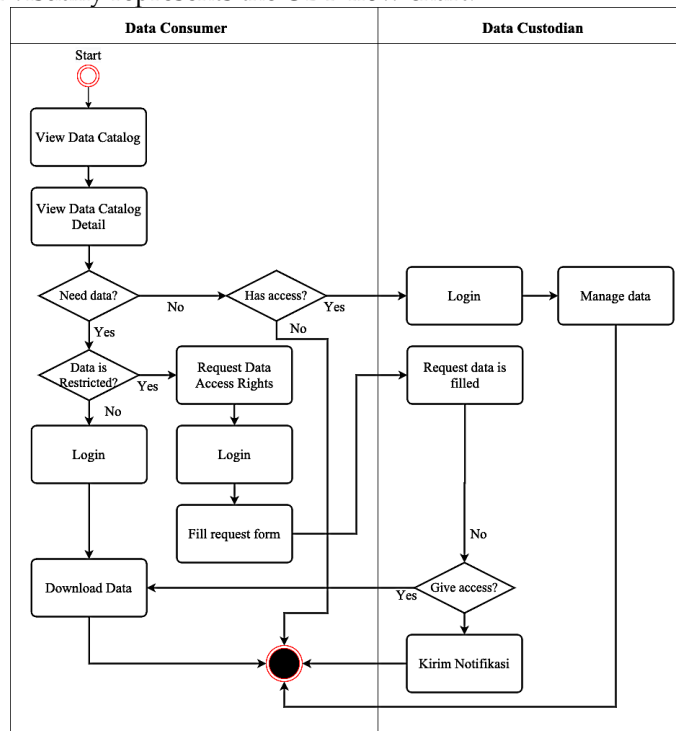


Fig. 4. The flow chart of One Data Portal for ODTU

2.3. ODTU Data Warehouse Design

This section exclusively focuses on the 'One Data Telkom University (ODTU) Data Warehouse Design.' Figure 5 provides an overview of the data warehouse architecture, serving as the backbone of ODTU. The left block represents the data source, which consists of all information systems at Telkom University. Among these, iGracias, a legacy framework established in 2007, contains information systems related to academics, human resources, finance, student affairs, research, and more. The second framework is SITU, a newly developed framework in 2019, which contains information systems for employee check-in, dorm refunds, hybrid courses, service desk, and others. The third one is external systems, including external finance information systems.

Data from iGracias, SITU, and external systems undergo extraction, transformation, and loading (ETL) using Pentaho [23] into the data warehouse, depicted in the middle block. The data warehouse consists of three main databases: staging, transactional, and warehouse. Staging serves as the transition database in which the ETL process is located. Transactional is a fast-moving database that contains prone-to-change tables. The warehouse consists of master databases and data marts.

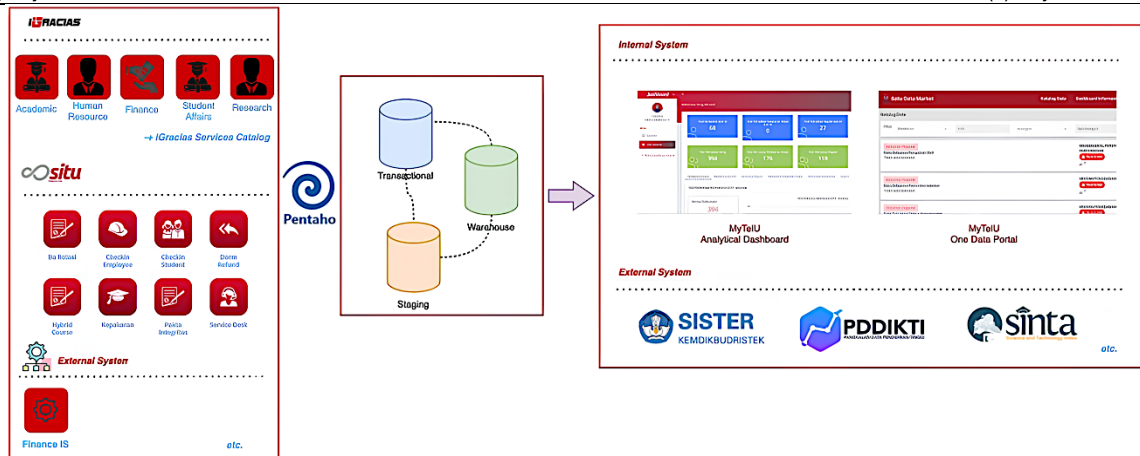


Fig. 5. ODTU Data Warehouse Design

2.3.1. ODTU Database Design

This subsection discusses the database design of the ODTU database, accompanied by Figure 6, which provides a visual representation of the design. The database design is structured into three primary table clusters: the master cluster, the inherited cluster, and the analytical table.

The **master cluster** comprises lookup tables containing rarely changed information, such as user information, roles, scopes, and categories. These tables are used to store information that is referenced by other tables in the database.

The **inherited cluster** includes child and relationship tables, mapping tables, and sub-tables. These tables are used to establish relationships between data across different tables. For example, a mapping table may link users with specific roles or permissions.

Finally, the **analytical table** consists of logs and query logs. These tables track database changes and offer information for analysis and reporting purposes.

Overall, the paragraph provides an overview of the various types of tables in the ODTU database design and their respective purposes. The accompanying figure provides a visual aid, helping readers in better understanding the layout of the database.

2.3.2. ODTU Data Warehouse Architecture

This subsection discusses the database architecture of the ODTU system, and it is accompanied by Figure 7, providing a visual representation of the architecture. The system is divided into three main subsystems: the ODTU Data warehouse, One Data Portal, and MyTelU Dashboard.

In the figure, a green-colored house icon represents the ODTU Data warehouse. It functions as a centralized data repository for analysis and reporting purposes. The data warehouse is designed to support the storage and processing of large volumes of data from various sources. ODTU uses Pentaho as its data integration and business intelligence platform [23]. Pentaho, an open-source business intelligence (BI) platform, provides various tools for data integration, reporting, analysis, and visualization. The platform includes a range of products and services that can be used to create customized BI solutions for organizations of all sizes.

Pentaho offers a range of features and capabilities, including data integration, which allows users to extract, transform, and load data from a variety of sources. Its reporting feature enables users to create and distribute reports based on data from different sources. The analysis feature provides users with the ability to analyze and explore data to uncover insights and trends. Additionally, visualization enables users to create interactive dashboards and visualizations to help them better understand their data.

The **One Data Portal** is a web-based application that grants authorized users access to data and analytical tools. This portal facilitates users in searching for and accessing data from the ODTU Data warehouse, as well as in performing data analysis and generating reports.

The **MyTelU Dashboard** serves as an additional web-based application, providing personalized views of data to authorized users. This application allows users to create custom dashboards displaying information relevant to their roles and responsibilities.

Overall, Figure 7 provides an overview of the three main subsystems within the ODTU system and their respective purposes. The accompanying figure functions as a visual aid, helping readers in better understanding the system's architecture.

2.3.3. The ODTU Data Warehouse

This subsection discusses the architecture of the ODTU data warehouse. It is accompanied by Figure 8, which visually represents the architecture. The figure shows that the various data sources, including SITU, iGracias, and MyTelU core, feed the ODTU data warehouse. Furthermore, it highlights the implementation of a single data aggregation warehouse, referred to as Satu Data, for Telkom University Framework data. Serving as the primary source for the One Data Portal and One Data Market, Satu Data supplies comprehensive and up-to-date information for further analysis and utilization.

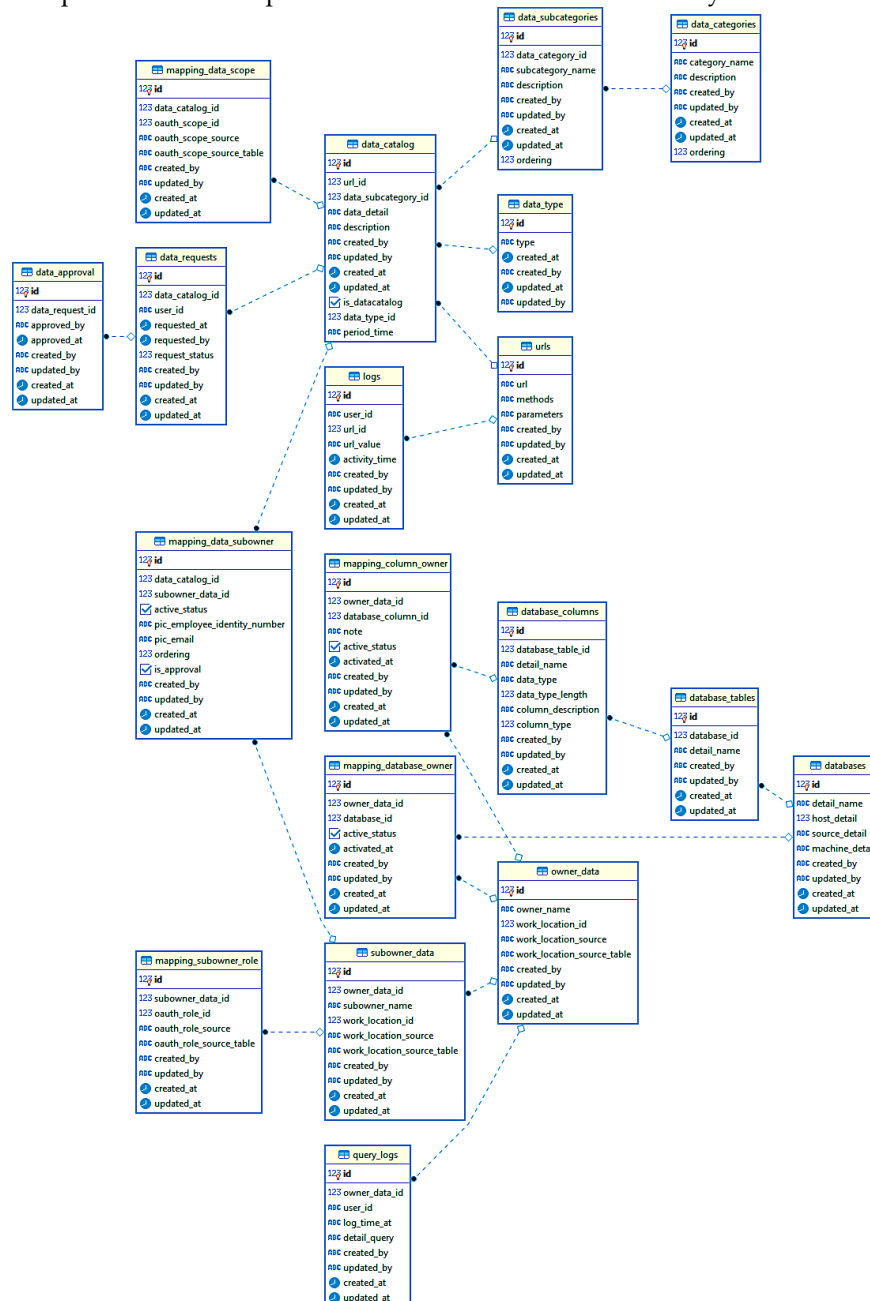


Fig. 6. One Data Telkom University database design

Telkom University Framework as a Source for ODTU. SITU functions as a framework for the non-academic system at Telkom University, providing data related to non-academic activities such as student affairs, finance, and human resources. iGracias, on the other hand, serves as a framework for the academic system at Telkom University, providing data related to academic activities such as curriculum, course schedules, and student performance. MyTelU core is a framework for the strategic system at Telkom University, offering data related to the university's long-term goals and objectives.

This data can include information about enrollment trends, research activities, and partnerships with other organizations.

Data Warehouse as a Source for Staging and Data Marts. To support in-depth analysis and streamline data processing, the Satu Data data warehouse serves as a source for staging and data warehouse layers. These layers are designed to feed and facilitate the creation of several directorate-aware data marts. By segregating data into smaller, more manageable subsets, the data marts enable efficient analyses and cater to the specific requirements of individual directorates.

Data Marts as Sources for Directorate and University Dashboards. The directorate-aware data marts generated from the staging and data warehouse layers are essential for constructing various dashboards. Each related directorate utilizes its data mart to develop and maintain a tailored dashboard, providing valuable insights into directorate-specific data and trends. Additionally, the university dashboard, which offers a holistic view of the institution and its performance, is also built upon these data marts. By leveraging the information within each directorate-aware data mart, the university dashboard delivers a comprehensive overview of the institution's operations and achievements. This approach facilitates effective decision-making and strategic planning.

2.3.4. The One Data Portal

The One Data Portals (ODPs) are dedicated websites for each directorate, facilitating its data management. Each directorate can manage, request, and share its data as a Telkom University data steward. The ODP architecture consists of three layers, as shown in Figure 7: (1) Front-end interface, (2) Persistence layer, (3) Aggregation layer

The front-end interface layer serves as the web interface for each directorate to access and manage its data. **The persistence layer** acts both as a direct back-end for the front-end interface and a "back-end for the back-end" for the aggregation layer. It functions as the storage for data for each directorate. **The aggregation layer** wraps each directorate's data mart, functioning as a back-end service. It aggregates data from the persistence layer to provide a unified view of Telkom University's data. The aggregation layer obtains data from the persistence layer, which serves as the back-end for this back-end service.

In summary, the ODP architecture comprises a front-end interface layer, a persistence layer responsible for storing each directorate's data, and an aggregation layer that integrates data across directorates. This architectural design enables each directorate to manage its data while enabling an integrated university-wide view. Both the persistence and aggregation layers play pivotal roles by providing back-end services for the front-end interface and aggregation layer within Telkom University's data management framework.

2.3.5. The MyTelU Dashboard

The university dashboard provides a holistic overview of Telkom University and its performance by integrating data from the ODP data marts. Each ODP data mart contains data from a specific directorate, enabling detailed insights into the operations of that directorate. The university dashboard can deliver a comprehensive, institution-wide view of Telkom University's activities, outputs, and outcomes by accessing and aggregating ODP data marts.

This integrated view facilitates data-driven decision-making and strategic planning at the university level. Leaders have the ability to analyze trends across directorates, assess the impact of initiatives, identify collaboration opportunities, and optimize resource allocation. The university dashboard effectively transforms data silos from each directorate into a cohesive and transparent view of institutional performance.

Administrators and decision-makers can attain a "single source of truth" about the university's key performance indicators, student outcomes, research activities, community engagement, and more by accessing the aggregated data in the university dashboard. This centralized platform allows them to monitor progress toward strategic goals, identify areas for improvement, and explore new growth opportunities. The university dashboard, built upon the ODP data marts, allows Telkom University to harness the full potential of its data for analytics, evaluation, and continual advancement of its mission.

In essence, the university dashboard provides a comprehensive overview of Telkom University's operations by integrating data from each directorate-level ODP data mart. This holistic perspective of

institutional data facilitates data-driven decision-making, strategic planning, and progress monitoring at the university level. The university dashboard transforms siloed data into an integrated perspective that facilitates optimization, innovation, and overall institutional effectiveness at Telkom University.

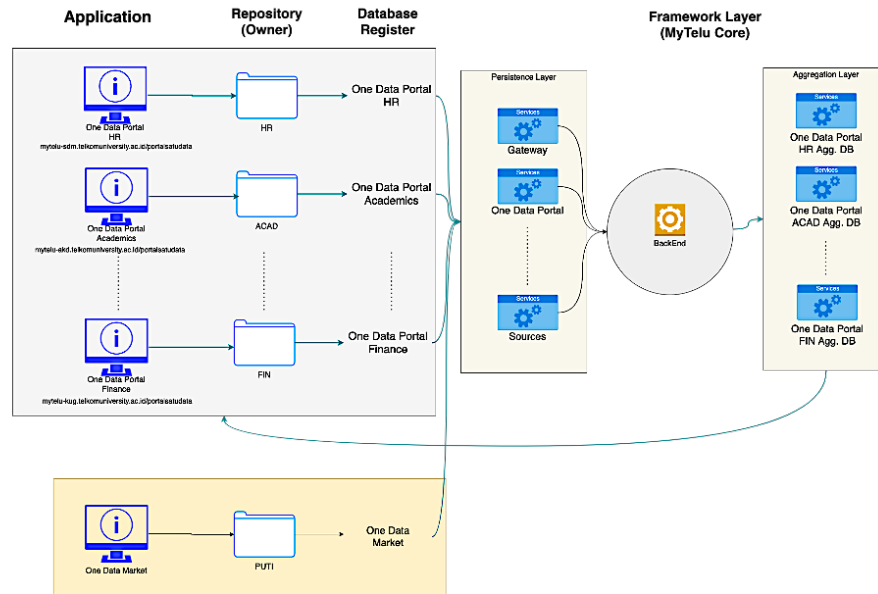


Fig. 7. ODTU Data Warehouse Architecture

3. Results and Discussion

This section presents the implementation results for the One Data Indonesia Policy Adoption within the Telkom University Data Warehouse Framework, also known as One Data Telkom University (ODTU). The ODTU framework has played a crucial role in facilitating data sharing and collaboration among various departments at the university. The framework's analytical capabilities have enabled the university to generate valuable insights and make well-informed decisions based on data-driven evidence.

However, the implementation of the ODTU framework posed challenges. This section also discusses the challenges faced during the implementation process, such as the integration of data from diverse sources into a unified platform and ensuring data privacy and security. Despite these challenges, the implementation of the ODTU framework has significantly improved data management practices at Telkom University. The results of this implementation demonstrate the effectiveness of the One Data Indonesia policy in improving data management practices within higher education institutions.

3.1. ODTU Implementation Result

This subsection discusses the outcomes of the implementation of One Data at Telkom University.

3.1.1. One Data Portal for Data Management

The One Data Telkom University (ODTU) framework has successfully facilitated the integration of the university's data sources into a unified platform, providing a centralized hub for data management. As part of the ODTU framework, Telkom University has developed the One Data Portal, which serves as the primary interface for users to access and manage data. Figure 8 displays a screenshot of the One Data Portal, highlighting its Data Management feature. This feature equips users with comprehensive tools for data management, including functionalities such as data upload, search, and visualization capabilities. The portal also enables users to collaborate and share data with other departments, providing a seamless data-sharing experience.

Overall, the One Data Portal stands as a crucial component within the ODTU framework, offering users a centralized platform to effectively manage their data. The portal's user-friendly interface, coupled with its comprehensive toolset, has enabled users to easily access and manage their data, improving data management practices at Telkom University.

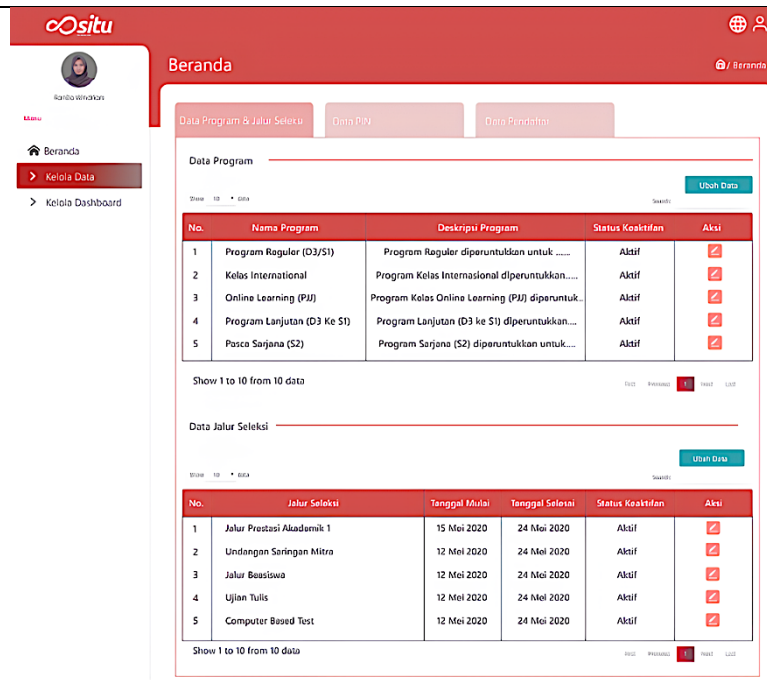


Fig. 8. One Data Portal for Directorate-Data Management

3.1.2. Mini-Query Feature in One Data Portal

As an integral aspect of the One Data Telkom University (ODTU) framework, Telkom University has developed the One Data Portal, serving as the primary interface for users to access and manage data. A standout feature within the One Data Portal is the Mini-Query feature, which is specifically designed to enable data stewards to self-query their data to meet their specific needs.

Figure 9 displays a screenshot of the Mini-Query feature in the One Data Portal. This feature allows data stewards to execute queries through a simple and user-friendly interface. Users can select the data sources they wish to query and specify the criteria for their queries. The Mini-Query feature then generates the results, which are exportable in various formats such as CSV and Excel.

The Mini-Query feature has been a valuable addition to the One Data Portal, providing data stewards greater autonomy and flexibility in managing their data. By facilitating self-query capabilities for data stewards, the Mini-Query feature has alleviated the workload on IT departments, and consequently, improved the efficiency of data management practices at Telkom University. Overall, the Mini-Query feature has been an essential component of the ODTU framework, facilitating data stewardship and contributing to the improvement of data management practices at Telkom University.

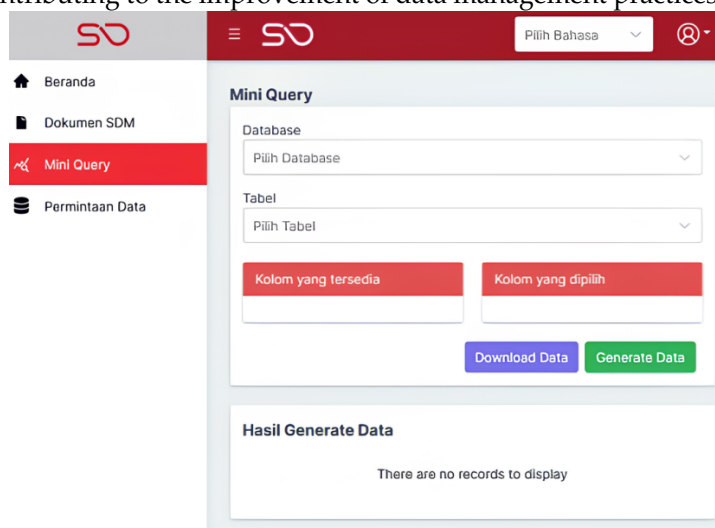


Fig. 9. One Data Portal for Directorate - Mini Query

3.1.3. One Data Market in Telkom University

As part of the One Data Telkom University (ODTU) framework, Telkom University has introduced the One Data Market, serving as the primary portal for stakeholders to request and share data from Data Stewards.

Figure 10 displays a screenshot of the One Data Market at Telkom University. This platform equips stakeholders with comprehensive tools, including a user-friendly interface and search capabilities, facilitating the seamless request and sharing of data. Moreover, the portal also enables Data Stewards to manage data requests and approvals, ensuring that data is shared exclusively with authorized users.

The One Data Market emerges as a critical component of the ODTU framework, providing stakeholders with a centralized hub for requesting and sharing data. By enabling stakeholders to request and share data seamlessly, the One Data Market has improved data sharing and collaboration among various departments at Telkom University. Notably, the portal has allowed Data Stewards to manage data requests more efficiently, reducing the workload on IT departments and improving the overall efficiency of data management practices at Telkom University.

Overall, the One Data Market has been a valuable addition to the ODTU framework, granting stakeholders increased autonomy and flexibility in managing their data. The portal's user-friendly interface and comprehensive toolsets have made it easier for stakeholders to request and share data, improving data management practices at Telkom University.

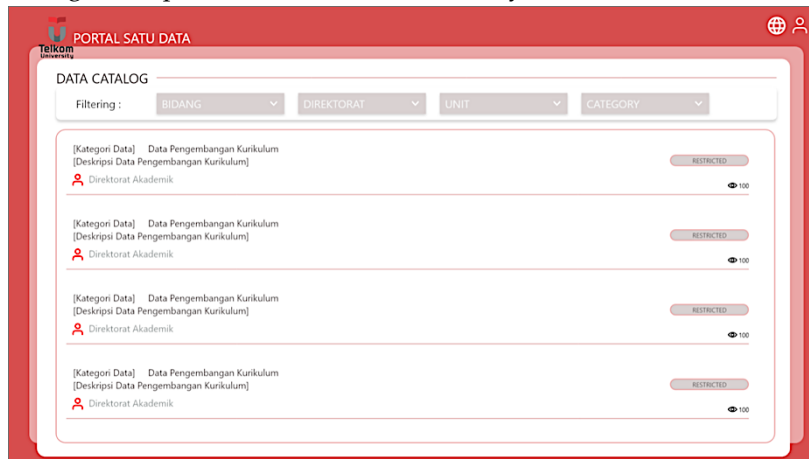


Fig. 10. One Data Market for Data Sharing

3.1.4. Directorate Dashboard in Telkom University

As an integral part of the One Data Telkom University (ODTU) framework, Telkom University has developed the Directorate Dashboard, which provides a comprehensive overview of the data statistics for its directorate. Figure 11 displays a snapshot of the Directorate Dashboard at Telkom University. This dashboard provides a range of data statistics, including the number of students, faculty members, research publications, and research grants. Users can conveniently explore data statistics for various periods, such as weekly, monthly, and yearly.

Overall, the Directorate Dashboard stands as a valuable addition to the ODTU framework, providing Telkom University with greater visibility into its data statistics. The dashboard's user-friendly interface and comprehensive toolsets contribute to a more streamlined process for the directorate to monitor its performance, improving data management practices at Telkom University.

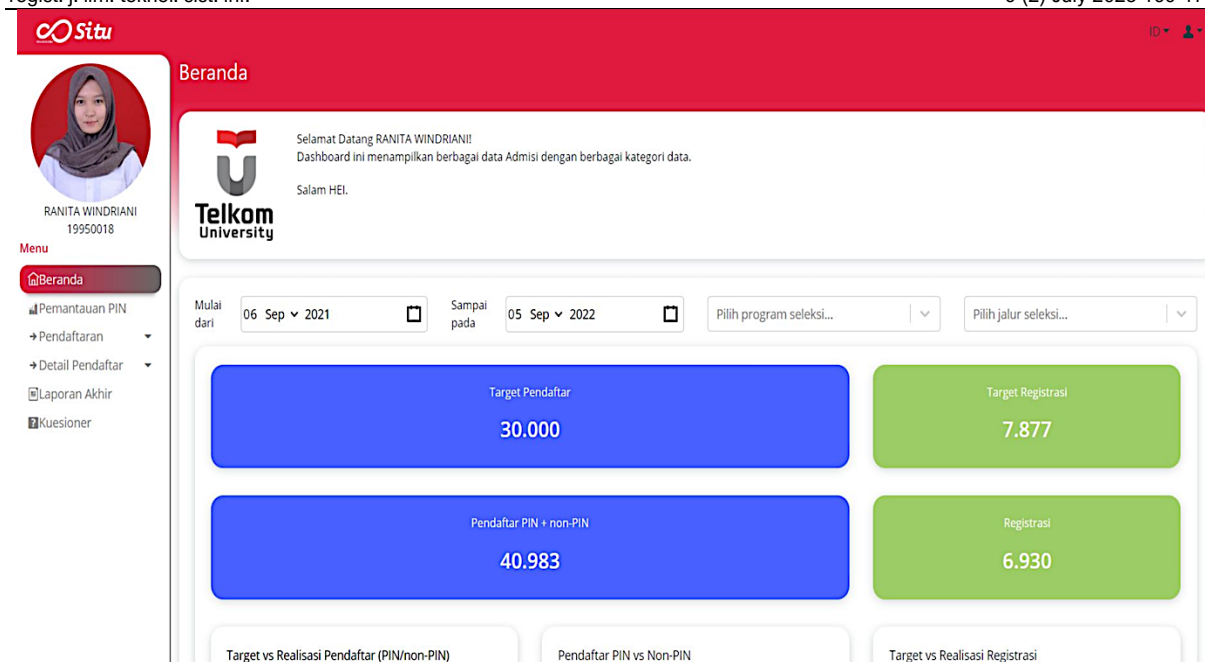


Fig. 11. One Data Dashboard for Directorate

3.2. Key Stakeholders Satisfaction

Telkom University has consistently conducted annual customer satisfaction index (CSI) surveys. Survey participants are key stakeholders in Telkom University, such as directorate employees, faculty members, and students. There are 22 faculties and directorat which are divided into six rectorate group. The number of employees in Telkom University is 1810 employees in total. Table 1 shows the survey participant statistics of CSI.

Table 1. Survey Participant Statistics of CSI

Faculty / Directorate	Number of Employees	Rectorate Group	Total
Directorate of Academic	48	Vice Rector for	92
Directorate of Postgraduate and Advanced Learning	44	Academic	
Directorate of Human Resources	38	Vice Rector for	95
Directorate of Assets and Sustainability	26	Resources	
Directorate of Finance	31		
Directorate of Career Development, Alumni, and Endowment	21	Vice Rector for	81
Directorate of Student Affairs	23	Admission,	
Directorate of Marketing and Admission	37	Student Affairs	
		and Alumny	
Directorate of PUI-PT AICOMS	2	Vice Rector for	100
Directorate of Strategic Partnerships and International office	22	Research,	
Directorate of Bandung Techno Park	52	Innovation dan	
Directorate of Research and Community Service	24	Partnership	
Faculty of Electrical Engineering	224	Faculty	1252
Faculty of Applied Sciences	169		
Faculty of Communication and Business	158		
Faculty of Creative Industries	191		
Faculty of Economics and Business	152		
Faculty of Industrial Engineering	171		
Faculty of Informatics	187		
Directorate of Telkom University Jakarta Campus	7	Rectorate	190
Directorate of Secretariat and Strategic Planning	64		
Directorate of Information Technology Center	119		
TOTAL			1810

The primary objective of this survey is to gauge awareness, recognition, and feedback regarding all information systems at Telkom University. Commencing in 2019, additional questions pertaining to the ODTU initiative were incorporated, extending through 2022. Table 1 shows the CSI average result before (2018-2019) and after (2020-2022) the implementation of ODTU. Notably, the assessment specifically focuses on the areas of Reliability, Assurance, and Responsiveness, which align with and support the evaluation of ODTU.

Table 2. Customer Satisfaction Index Result

No	Code	Area	Statement	Before Odtu Average (2018-2019)	After Odtu Average (2020-2022)	Gap
1	S1.1	Reliability	Accuracy of the unit in providing services	91.00%	95.44%	4.44%
2	S1.2	Reliability	Consistency of the unit in delivering services	90.78%	95.41%	4.63%
3	S2.1	Assurance	Knowledge of the unit in performing its duties/services	92.21%	95.47%	3.26%
4	S2.2	Assurance	Technical skills possessed by the unit in providing services	92.51%	95.63%	3.12%
5	S3.1	Responsiveness	Speed of the unit in responding to the desires of its service users	88.56%	95.06%	6.50%
6	S3.2	Responsiveness	The ability of the unit to cooperate with its service users	90.88%	95.87%	4.99%
7	S4.1	Empathy	The concern of the unit for its service users	89.92%	95.53%	5.61%
8	S4.2	Empathy	Willingness of the unit to provide suggestions/alternative solutions for its service users	90.97%	96.08%	5.11%
9	S5.1	Tangible	Politeness of behavior from each personnel of the unit	93.80%	96.55%	2.75%
10	S5.2	Tangible	Neatness of appearance expected from each personnel of the unit	96.83%	97.04%	0.21%

Table 2 above shows performance scores across ten service quality areas before and after the ODTU implementation from 2018 to 2022. Columns 4 and 5 present average scores before and after ODTU. Reliability (rows 1 and 2) measures the ability to perform services accurately and consistently. Both scores improved by over 4% after ODTU, showing that ODTU helped improve the university's reliability.

Assurance (rows 3 and 4) measures staff knowledge and skills. Both scores improved by over 3% after the implementation of ODTU, indicating that ODTU contributed to the university's improved assurance. Responsiveness (rows 5 and 6) assesses the ability to quickly respond to and assist students. Both scores improved by over 4% after ODTU, demonstrating that ODTU helped improve the university's responsiveness to students.

In summary, the table shows that across crucial measures of reliability, assurance, and responsiveness, Telkom University witnessed average score improvements of 3-6% after implementing ODTU. This supports the assertion that ODTU improved the university's reliability, assurance, and responsiveness.

3.3. The Challenge of ODTU Implementation

The implementation of the One Data Telkom University (ODTU) framework represents a significant step in enhancing data management practices at the university. However, the implementation process posed considerable challenges.

One primary obstacle during the implementation process involved the integration of **data from various sources** into a single platform. This process required significant department coordination to ensure data consistency and accuracy. Additionally, **ensuring data privacy and security** emerged as another critical concern, requiring the implementation of robust security measures to protect sensitive data. Another challenge encountered during the implementation process was a **standardized data model** across different data sources, which made integrating data from different sources difficult and

required significant effort to develop a standardized data model. Furthermore, the implementation process of the ODTU framework required **significant investment in terms of time and resources**, involving multiple stages, such as data profiling, data cleansing, data mapping, and data integration.

Another significant challenge faced during the implementation of the One Data Telkom University (ODTU) framework was **the need for a shared vision among stakeholders** and their **varying levels of data literacy**. Stakeholders at Telkom University came from different departments, each with varying levels of understanding and experience in data management practices. Therefore, it is important to foster a shared vision regarding the importance of data management practices and the benefits of the ODTU framework. Additionally, stakeholders with lower levels of data literacy found it challenging to understand the technical aspects of the framework, making it difficult for them to fully utilize its capabilities.

In response to this challenge, Telkom University made a strategic investment in a comprehensive training program designed to improve stakeholders' data literacy and promote a shared vision of the benefits of the ODTU framework. The training program included workshops, seminars, and one-on-one coaching to ensure that stakeholders had the necessary skills and knowledge to utilize the ODTU framework effectively.

Despite these challenges, the implementation of the ODTU framework has significantly improved data management practices at Telkom University. The challenges encountered during the implementation process have provided valuable insights into the complexities of data management practices within higher education institutions. Overall, the implementation of the ODTU framework has not only been a valuable learning experience but has also provided Telkom University with the necessary tools and knowledge to streamline its data management practices effectively.

4. Conclusion

In this paper, we have thoroughly examined the implementation of the One Data Indonesia policy and data warehouse framework at Telkom University. The focus of our analysis centered on the One Data Telkom University (ODTU) data warehouse design and architecture, as well as the implementation of ODTU into several applications, including the One Data Portal, One Data Dashboard, and One Data Market.

Our analysis underscores how the ODTU framework has significantly improved data management practices at Telkom University. By integrating data sources into a single platform, the ODTU framework has facilitated data sharing and collaboration across various departments in the university. The analytical capabilities embedded in the framework have also allowed the university to derive valuable insights and make informed decisions based on data-driven evidence.

The customer satisfaction index (CSI) shows that across key reliability, assurance, and responsiveness measures, Telkom University witnessed average score improvements of 3-6% following the implementation of ODTU. This supports the claim that ODTU has enhanced the university's reliability, assurance, and responsiveness.

While the ODTU framework has helped improve data management practices at the university, several ongoing challenges that warrant attention have been identified. One such challenge involves the adoption of a data governance structure with clearly defined roles, responsibilities, and policies. This structure is essential to oversee data usage and ensure responsible data practices, especially as the university expands the scope of integrated data and collaborates with external entities. Another challenge is the necessity to provide more training and resources to improve data literacy among staff and students.

As data plays an increasingly important role in strategic decisions, fostering baseline data skills among all university community members becomes paramount for effective functioning in a data-driven environment. Finally, ongoing changes in technology and data availability will require flexibility and evolvability in the ODTU architecture. The university must establish processes for routine reviews and updates to the ODTU framework, ensuring its relevance to emerging needs and its ability to capture new opportunities. Overall, a combination of data governance, data literacy programs, and an adaptive framework will be essential for sustaining the benefits of ODTU over the long term.

Author Contributions

A. A. Gozali: Conceptualization, formal analysis, investigation, methodology, project administration, resources, software, supervision, validation, visualization, writing – original draft, and writing - review & editing. A. Romadhony: Conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, validation, writing - original draft, and writing – review & editing. Subaveerapandiyan A: Supervision, validation, and writing - review & editing.

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