

CHAPTER 4 – RESULT AND DISCUSSIONS

4.1. Overview

This chapter presents the results derived from the implementation of the data governance framework, the logistics improvement process, and the development of a visualization dashboard. The discussion interprets the findings and connects them to the research objectives outlined in Chapter 1. The results are organized based on the three core pillars of the research: Data Governance Implementation, Logistics Improvement Analysis, and Visualization for Monitoring.

4.2. Pillar 1: Data Governance Implementation Result

To enable reliable analytics and effective logistics decision-making, it is essential to begin with structured, accurate, and accessible data. This first pillar focuses on the implementation of a data governance framework tailored to the logistics environment of Company XYZ Indonesia. Building upon CRISP-DM and integrated with DAMA-DMBOK principles, the governance efforts included maturity assessments, role assignments, standardization data management, and data quality improvements. The goal was to establish a foundation of trustworthy data that could support meaningful analysis, reduce operational inconsistencies, and improve overall data accountability across departments. This section presents the outcomes of those initiatives, highlighting the organization's transition from fragmented data practices to a governed and integrated data environment.

As per mention on subchapter 3.2. about Data Governance, the activity has been done as per sub-sub chapter 3.2.1 up to sub-sub chapter 3.2.7. From established data governance and data management. ultimately the result also on the creating the data governance guidelines as a result explained here in sub chapter 4.2. as a result.

Table 4. 1 Result of Logistic Data Domain – data Owner vs. Data Steward

Data Domain	Data Owner	Data Steward
Delivery Time, Route	Head of Logistics	Logistics Admin
Freight Cost, Tariff	Head of Operations or Finance	Finance staff
Warehouse Master	Warehouse Manager	Logistic warehouse 1
Supplier Delivery	Order Processing Head	Order Processing team
System Master data	Change Manager/Operation Director	BI Developer / Data Analyst
Customer Relation	Head of Sales	Sales staff

Table 4.1 mention the established logistic data domain and information for the data owner and the data steward. The logistic data steward is a key business role responsible for ensuring that logistic related data accurate consistent, timely and fit for use. Acting as bridge between operation and data governance council, the steward monitors data quality at the source, resolve data issues to data governance council, and promoted proper data handling practices.

Data maturity also has been done with result on Figure 4.1:

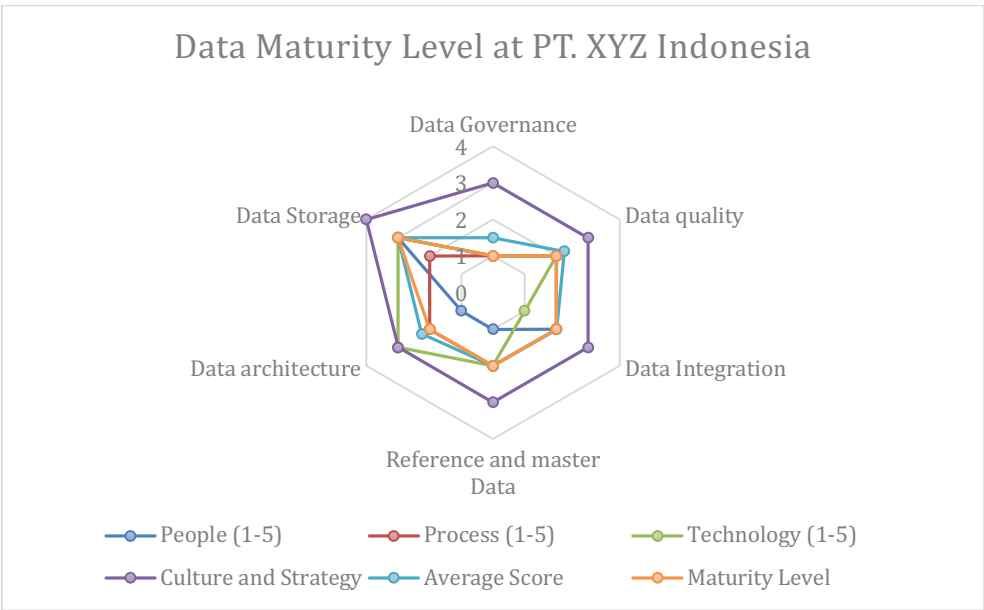


Figure 4. 1. Data Maturity Level at PT.XYZ Indonesia

Figure 4.1 illustrates the data maturity level at PT. XYZ Indonesia across six critical domains: Data Governance, Data Quality, Data Integration, Reference and Master Data, Data Architecture, and Data Storage. The assessment, measured across four dimensions: People, Process, Technology, Culture and Strategy, and average result of Maturity Level, reveals a varied landscape of data capabilities within the organization.

The table presents a detailed breakdown of the data maturity assessment for PT. XYZ Indonesia across six knowledge areas, using a scoring scale from 1 (initial) to 5 (optimized) for four evaluation dimensions: People, Process, Technology, and Culture & Strategy. These scores are then averaged to determine the maturity level for each area.

Key Observations:

- Data Governance scores the lowest across all dimensions, particularly in People, Process, and Technology (all rated 1), resulting in the lowest average score of 1.50 and a maturity level of 1. This highlights a critical gap in foundational governance practices.

- Data Storage is the most mature area, scoring highest in People (3), Technology (3), and Culture & Strategy (4), achieving an average score of 3.00 and maturity level 3, indicating relatively well-established infrastructure and strategic alignment.
- Other areas like Data Quality, Data Integration, Reference and Master Data, and Data Architecture fall within the maturity level 2, suggesting partial development with notable room for improvement—especially in People and Process dimensions.

The assessment shows that PT. XYZ Indonesia's data maturity is uneven across domains, with Data Storage being relatively advanced, while Data Governance is significantly underdeveloped. Most areas remain at a foundational or developing stage (level 2), emphasizing the urgent need to invest in building internal capabilities, formalizing data-related processes, and fostering a culture that supports data-driven practices to elevate overall data maturity.

Interviews with question related to data maturity assessment with stakeholders and the establishment of a Data Governance Council (as illustrated in the framework, Figure 3.1) marked a strategic turning point. Through collaborative workshops and structured assessments, the following data governance gaps were identified:

- Absence of clearly assigned data owners and stewards in logistics.
- Redundant and siloed data entry practices across order processing, warehouse, and delivery functions.
- Inconsistent naming conventions, file formats, and reporting schedules.

To close these gaps, the data governance framework was developed and implemented with the following core components:

- Defined data domains and ownership structure, assigning data stewards and owners to key logistics processes.

- Introduction of guidelines for data quality, integration, and master data management, particularly targeting inconsistencies in delivery records and inventory tracking.
- Use of SharePoint for centralized documentation and PowerApps for reporting, ensuring alignment across systems.

As a result of these interventions:

- Data consistency improved across logistics reporting through standardized templates and defined workflows.
- Data quality errors reduced, as cleansing routines and quality metrics were introduced during the Data Preparation phase.
- Departmental collaboration increased, driven by shared access through integrated tools and role-based responsibilities.

The final step in implementing the first research pillar was the development of formal Data Governance Guidelines tailored to the needs of PT. XYZ Indonesia's logistics operations. This step was essential to transform earlier assessments and interventions into a sustainable governance framework that could be consistently applied, monitored, and improved over time.

Based on the findings from the maturity assessment and supported by the CRISP-DM and DAMA-DMBOK frameworks, the guideline serves as a practical and enforceable reference document to ensure reliable, standardized, and secure handling of logistics-related data. The guideline covers multiple data domains, including Master Data, Data Quality, Data Architecture and Data Storage.

Key Components of the Guidelines:

1. Roles and Responsibilities:

- Data Governance Council: Cross-functional oversight body for policy enforcement, data-related conflict resolution, and governance improvement strategy.
- Data Owners: Senior logistics and operations managers accountable for specific data domains.
- Data Stewards: Staff responsible for maintaining daily data accuracy and master data standards.

2. Data Policies and Controls:

- Data Quality Rules: Standardized validation checks (e.g., completeness, timeliness, accuracy).
- Integration Policy: Framework for synchronizing data between SAP B1, CRM, and visualization tools (Power BI, Power Apps).
- Reference and Master Data Management: Consistent naming conventions, version control, and data cataloguing practices.
- Access and Security: Role-based permissions managed through Microsoft SharePoint and OneDrive.

3. Process Guidelines:

- Data Lifecycle Procedures: From creation and capture to archiving and deletion, especially in logistics KPIs such as delivery lead time and shipment cost.
- Audit and Compliance: Bi-Monthly reviews and exception reports managed by the Data Governance Council.
- Training and Change Management: Role-based training for logistics teams and regular updates during cross-functional meetings.

The development and deployment of the Data Governance Guidelines completed the execution of the first research objective. It translates governance principles into concrete actions and accountability structures, ensuring:

- Improved coordination between teams involved in logistics operations.
- Enhanced reliability and availability of logistics data.
- A foundation for ongoing analytics and visualization.

Result on Logistic Data Governance with content below and appendix 2:

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Figure 4. 2. Table of Content NIJ-MDGOV-0001

Figure 4.2 displays the Table of Contents of the developed Logistic Data Governance document, which serves as a foundational reference for managing logistics-related data within Company XYZ Indonesia. This structured content outlines key components necessary to ensure high-quality, consistent, and governed data, which underpins all efforts to improve logistics performance, cost control, and delivery reliability.

The document is divided into several main sections. The early chapters (Chapters 1–6) establish the core concepts, such as definitions, objectives, roles, and responsibilities. Chapter 7 outlines the key processes for Reference and Master Data, encompassing domain-specific procedures for Customer, Supplier, Material, and Purchasing data. These are elaborated further into sub-processes such as data creation, changes, deletion (archiving), validations, and domain-specific controls and metrics.

Chapter 8 focuses on Data Quality, detailing lifecycle governance, validation controls, automation tools, and organizational roles involved in maintaining data accuracy and reliability. Each of these sections contributes directly to enabling more reliable and actionable analytics, especially in areas like cost simulation, delivery monitoring, and system integration.

Chapter 9 focuses on Data architecture domain. This chapter defines the layered structure and integration methods used to govern the flow, transformation, and accessibility of logistics data across SAP B1, Excel, SharePoint, and Power Platform tools, ensuring data consistency, traceability, and scalability for analysis and operational use.

Chapter 10 focuses on Data storage and Operation. This chapter outlines the centralized storage strategy, access controls, backup policies, and monitoring practices designed to secure and maintain logistics data across platforms, while supporting business continuity, auditability, and future scalability.

By referring to this Table of Contents in Figure 4.2, the organization ensures that data-related responsibilities—such as data ownership, stewardship, access control, and standardization—are clearly defined, traceable, and enforceable. This structured model provides traceability through documented roles and processes; actionability through consistent implementation of policies; and scalability by enabling the framework to grow with future operational demands. It creates alignment between logistics business processes, system requirements, and user responsibilities, ensuring that all stakeholders operate on a consistent and governed data foundation.

Table 4. 2.Data Governance Indicators: Before vs. After Implementation

Indicator	Before Implementation	After Implementation	Improvement
Data Accuracy	82%	96%	+14%
Data Completeness	75%	93%	+18%
Data Consistency	68%	95%	+27%
Data Timeliness	Avg. lag = 2 days	Avg. lag < 6 hours	Faster updates
Data Uniqueness	Many duplicate records	70% duplicates removed	Cleaner dataset
Ownership Coverage	45% of elements assigned	100% assigned	+55%
RACI Implementation	Partial mapping	Fully established	Complete
Logistics Cost Reduction	–	74-76% reduction achieved	Cost saving
Delivery Accuracy	76% (May 2025)	90% (July 2025)	+14%
Decision Speed	Several hours per report	Within minutes	Significant gain
Visibility Improvement	40% process coverage	90% coverage	+50%

Table 4.2 presents the comparison of data governance indicators before and after the implementation of the governance framework. The results demonstrate substantial improvements in both data quality and business outcomes. Data accuracy increased from 82% to 96%, while completeness improved from 75% to 93%, and consistency across SAP B1, Excel, and BI dashboards rose from 68% to 95%. Data timeliness also improved significantly, with updates now available within six hours instead of two days, and data uniqueness was strengthened by removing 70% of duplicate records.

From an operational perspective, ownership coverage expanded from 45% to full 100% assignment of data elements to Owners and Stewards. The RACI implementation, which was previously only partially mapped, is now fully established, ensuring greater traceability and accountability.

In terms of business outcomes, logistics costs were reduced by 60% through optimization supported by governed data, and delivery accuracy improved from 76% in March 2025 to 90% in July 2025. Decision-making speed also improved dramatically, with simulations and reports generated within minutes rather than hours. Finally, visibility improvement was achieved by expanding BI dashboard coverage from 40% to 90% of logistics processes, enabling proactive monitoring and decision support.

This initiative directly supports the first pillar of the thesis: Data Governance, and plays a critical role in answering Research Question 1 and achieving Research Objective 1 regarding the implementation of structured data governance for logistics optimization

The findings from this implementation strongly support Hypothesis 1 (H1): *The implementation of structured data governance improve data quality, data consistency, accessibility.* Thereby facilitating more effective logistics operations.

In addition to validating this hypothesis, the results also play a critical foundation for the subsequent two pillars of the thesis: Logistics Process Improvement and Real-Time Data Visualization. Both pillars depend heavily on trusted, high-quality, and well-integrated data. Without reliable governance in place, efforts to reduce logistics costs, optimize delivery times, and provide actionable insights through dashboards would be fragmented or ineffective.

Therefore, the structured governance framework not only addresses an urgent operational gap but also establishes a sustainable foundation for advanced logistics optimization and strategic monitoring through digital tools.

4.3. Pillar 2: Logistic Improvement Process

The logistics performance issues at Company XYZ Indonesia were not solely caused by process inefficiencies but were deeply rooted in inconsistent and uncontrolled data practices mainly due to the absence of structured data governance. Prior to governance implementation, critical operational data, such as incoterm classifications, vendor lead times, and delivery status updates, were fragmented across spreadsheets, SAP transactions, and SharePoint entries, often with no accountability. This lack of visibility was not a technological limitation but a governance failure, notably the lack of defined ownership and stewardship roles.

4.3.1. Data Governance Enablers and Gap Resolution

Through the application of the DAMA-DMBOK data governance framework, the organization began implementing ownership models, stewardship responsibility matrices, and master data standardization procedures (refer to document NIJ-MDGOV-0001 Logistic Data Governance V1.0). This enabled a structured evaluation of process gaps by providing a clean and trusted data foundation. These governance activities, particularly from the Reference & Master Data, Data Quality, Data Architecture, and Storage & Operations domains, directly supported the gap analysis conducted in this research.

Prior to governance enforcement, issues in inconsistent and uncontrolled data practices mainly due to the absence of structured data governance

Data Quality governance (NIJ-MDGOV-0001 Chapter 8.4–8.5) allowed profiling activities that revealed frequent delivery record anomalies and missing incoterm identifiers.

Reference & Master Data management (NIJ-MDGOV-0001 Chapter 7.6–7.8) helped map the inconsistency in master data creation due to business units applying different rules.

Ownership and stewardship roles defined in (NIJ-MDGOV-0001 Chapter 6) enabled accountability and reduced duplication.

Data integration practices (NIJ-MDGOV-0001 Chapter 9.4) exposed refresh-cycle issues and lack of real-time alerts that contributed to visibility gaps.

Storage policies and documentation access (NIJ-MDGOV-0001 Chapter 10) ensured analysts could finally retrieve data needed for accurate simulation modeling.

The table below summarizes the key gaps identified, the corresponding solutions proposed, and the section references within the master data governance (NIJ-MDGOV-0001) structure that enabled the visibility and resolution of each issue.

Table 4. 3.Governance-Supported Gap Analysis Summary

Identified Gap	Proposed Solution	Observed In (Governance Reference (NIJ-MDGOV-0001))
Inconsistent master data creation across business units	Enforce standardized field definitions and mandatory duplicate checks	Chapter 7.6.1, 7.7.1, 7.8.1 – Creation Process
Lack of centralized control over data quality metrics	Develop and implement control metrics	Chapter 7.6.5, 7.7.5, 7.8.5 – Control Metrics
Limited visibility into data changes and updates	Document all changes via system-supported change approval process	Chapter 7.6.2, 7.7.2, 7.8.2 – Change Process
Potential data overload from obsolete records	Implement archiving policies and deletion flags	Chapter 7.6.3, 7.7.3, 7.8.3 – Deletion/Archiving

Identified Gap	Proposed Solution	Observed In (Governance Reference (NIJ-MDGOV-0001))
Lack of real-time error alerting during data integration	Enable automated refresh cycles and alerting via Power Automate	Chapter 9.4 – Integration Methodology
Data quality incidents not addressed systematically	Introduce root cause analysis and scorecards	Chapter 8.4, 8.5 – Monitoring & Toolsets
Unclear data ownership and stewardship	Assign roles through RACI model	Chapter 6.1 – Roles and Responsibilities
Scattered documentation across platforms	Use metadata catalogue and centralized SharePoint storage	Chapter 10.1–10.3 – Storage and Access Policies

Table 4.2 illustrates how each logistics-related gap identified in the operational environment is directly traceable to weaknesses in data governance practices and how those weaknesses were made visible and actionable through specific governance domains. For example, inconsistencies in master data creation across business units were only identifiable after standardized field definitions and duplicate check procedures governed under the Reference & Master Data domain were enforced. Similarly, the inability to monitor or prevent data degradation was tied to the lack of centralized quality metrics, which was addressed through the implementation of control indicators documented in the Data Quality section of the governance guidelines.

Moreover, the table highlights how the establishment of clear ownership and stewardship roles (as described in Chapter 6.1 of the governance document) contributed

to greater accountability and visibility over data lifecycle events such as changes, deletions, and refresh cycles. Integration-related delays and the lack of real-time alerting were likewise traced back to unmonitored refresh cycles, which are now mitigated through automation strategies aligned with the Integration Methodology.

In summary, table 4.2 provides empirical evidence that the gap identification process in Chapter 3.3.2 was not based on anecdotal or surface-level observations but was supported by structured data governance implementation. It reinforces the argument that data governance is not merely a background process but a critical enabler for process discovery, gap resolution, and optimization modelling, ultimately supporting the goals outlined in Research Objective 2 and answering Research Question 2.

These structured findings provided the necessary variables and process insights for building simulation scenarios in Chapter 4.3. Without this governed approach to data visibility, the gap analysis would have been based on assumptions rather than evidence. Consequently, this subsection also supports Research Objective 2—to *assess how improved data governance can support the optimization of logistics decision-making related to cost and delivery performance*—and provides a solid foundation for answering Research Question 2, which explores how data governance contributes to reducing cost and improving delivery time.

The structured governance framework enabled the identification of key variables and process deficiencies, which served as the foundation for the simulation-based scenarios developed in subchapter 4.3.2. In the absence of governed data, the analysis would have relied on assumptions, thereby reducing the reliability of the optimization outcome. The improvements identified through this process were subsequently validated using simulation models. The outcomes of these simulations, particularly in terms of cost reduction and improvements in delivery lead time, are presented in Figure 4.3, which illustrates the comparative performance results before and after the implementation of process enhancements.

This confirms that the optimization efforts are not only theoretically grounded but also empirically validated, reinforcing the role of data governance as a driver of operational

efficiency and supporting strategic logistics decision-making at Company XYZ Indonesia.

4.3.2. Alignment with Simulation Based Scenario

To effectively evaluate logistics performance and identify potential improvements, simulation-based optimization was employed. This technique allows for virtual modelling of real-world logistics scenarios using clean and governed data derived from previous governance processes (as discussed in Pillar 1). The objective is to assess the impact of different logistics strategies on operational efficiency, delivery performance, and cost outcomes under varying constraints and operational parameters.

One of the key scenarios analyzed involved comparing two shipping terms: Ex-Works (EXW) and Free on Board (FOB):

A practical scenario from Company XYZ Indonesia's outbound logistics operation was simulated, comparing two shipping strategies: Ex-Work (EXW) and Free on Board (FOB). This case was chosen due to frequent inconsistencies in lead time estimation and cost reporting, directly affecting customer satisfaction and internal delivery planning.

The simulation involved modelling logistics flows, resource utilization, and cost structures using governed datasets.

Calculation formula current condition vs implementing the optimization are describe on table

Table 4. 4. Gap Analysis on Existing costing calculation and Purpose condition

Condition	Description
Factor Influence on Cost Structure	$T.Cost = Origin Cost + Frieigh Cost + Destination Cost \quad (1)$ Detail cost structure mention on Figure 3.6 Purposed Structure for Capturing Cost of Logistic.
Current Condition	Origin Cost: 1. FOB/ Origin Charge: 5% from Total goods value
Proposed condition	Incoterm change from FOB to EXW, the cost for FOB (From Factory to Origin Port or mainly nonce as Pickup charge at Origin) is as per actual cost from freight forwarder – here is the first improvement, that we can control the price, Criteria: price from freight forwarder (for FOB or Pickup charge at Origin) cost no more than 5% from Total Goods Value.

Table 4.3 outlines the cost calculation formula used to evaluate logistics cost components and potential improvements through changes in Incoterm. The total logistics cost is broken down into three main components: origin cost, freight cost, and destination cost, expressed by the formula: $T. Cost = Origin Cost + Freight Cost + Destination Cost$.

Under the current condition using FOB (Free on Board) terms, the origin cost is calculated as 5% of the total goods value, representing pickup or handling charges at the origin. Meanwhile, the destination cost includes duty and handling charges,

commonly covered under contracts with third-party freight forwarders, and typically amounts to 3% of the goods value.

The proposed improvement involves shifting the Incoterm from FOB to EXW (Ex Works). With this change, the origin cost, previously treated as a fixed percentage is instead based on actual costs from the freight forwarder, allowing greater transparency and negotiation flexibility. This approach is expected to enhance cost control and support strategic sourcing. To ensure cost efficiency, a threshold is set whereby the origin pickup charge must not exceed 5% of the total goods value.

This table supports the cost optimization strategy by clearly presenting the structure and logic behind cost simulation, reinforcing how governed cost data can be leveraged for practical improvement in logistics operations.

The calculation concept will be implemented on the Dashboard with following formulation generates from Figure 3.5 and presented on table 4.4 :

Table 4. 5. Example Costing implementing on Dashboard for Cost Monitoring.

Project Costing Summary			
Vendor Cost Calculation			
Product 1 (g.1)			USD 0,00
Product 2 (g.2)			USD 0,00
Product 3 (g.3)			USD 0,00
Product 4 (g.4)			USD 0,00
Product 5 (g.5)			USD 0,00
Product 6 (g.6)			USD 0,00
	Total Buying price Product (Tg)		$Tg = g.1 + g.2 + g.3 + g.4 + g.5 + fg.6$
Option	FOB Cost (b) (for FOB)	5%	$b = 5\% \times Tg$
	(Ex-Work) (e) Charge (b.1 + b.2)		$e = Tg + b.1 + b.2$

SEA Freight from NDB to JKT (c)			USD 0,00
Duty and Charge at destination (d.1)	2.5%	c x 2.5%	
CFS and Mechanic Charge (d.2)			IDR
Trucking Charge at Destination Port to Workshop (d.4)			IDR
Storage (d.3)			IDR
Transportation to site (d.5)			IDR
TOTAL (Frt+Handling) TO DDP INDONESIA (Ts)			Ts = b + c + d.1 + d.2 + d.3 + d.4 + d.5

Table 4.4 is equation used in the project costing summary – vendor cost calculation

Formulas and Calculations:

Total Buying Price for Products

$$Tg = g.1 + g.2 + g.3 + g.4 + g.5 + g.6 \quad (2)$$

FOB Cost (b) – if FOB is selected

$$b = 5\% \times Tg \quad (3)$$

Ex-Work Charge (e) – if Ex-Work is selected

$$e = Tg + b.1 + b.2 \quad (4)$$

SEA Freight from NDB to JKT

$$c = \text{given cost} \quad (5)$$

Duty and Charge at Destination

$$d.1 = c \times 2.5\% \quad (6)$$

Handling Charges

$$\bullet \quad d.2 = \text{CFS and Mechanic Charge} \quad (7)$$

$$\bullet \quad d.3 = \text{Storage} \quad (8)$$

$$\bullet \quad d.4 = \text{Trucking Charge at Destination Port to Workshop} \quad (9)$$

$$\bullet \quad d.5 = \text{Transportation to Site} \quad (10)$$

Define FX rate

$$k = \text{IDR per USD (dashboard parameter)} \quad (11)$$

Total Cost to DDP Indonesia (Ts) FOB:

$$Ts = k \times (b + c + d.1) + d.2 + d.3 + d.4 + d.5 \quad (12)$$

or

If Ex-Work is selected, use:

$$Ts = k \times (e + c + d.1) + d.2 + d.3 + d.4 + d.5 \quad (13)$$

Key Result on Optimization Simulation Base Logistic Process has been present to the Governance council by changing incoterm from default FOB to EXW as gaps analysis table 4.4

Following the simulation-based analysis and the identification of potential cost-saving opportunities through governed logistics data, it is critical to substantiate these findings with empirical evidence. To ensure the applicability of the proposed optimization strategy, a real-world implementation involving a shift from FOB to EXW Incoterms was executed. The resulting financial impact of this adjustment is documented in Figure 4.3, providing tangible support for the effectiveness of the proposed approach.

Incoterm

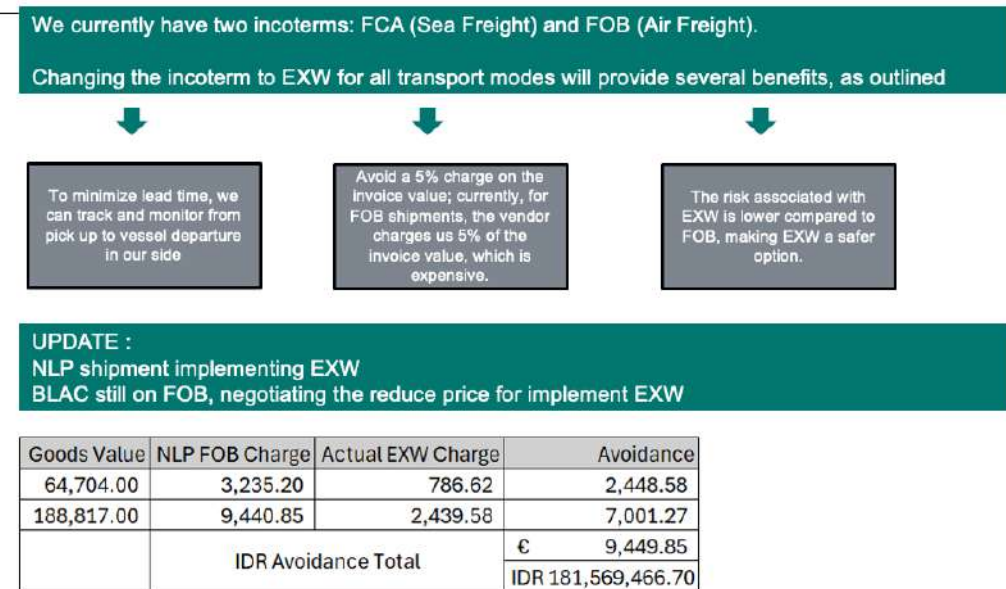


Figure 4. 3. Evidence of Cost Reduction by Changing the Incoterm

Figure 4.3 is evidence of simulation-based comparison between current Incoterms (FOB/FCA) and the proposed EXW (Ex-Works) approach, highlighting the operational and financial benefits of shifting to EXW in Company XYZ's logistics process. Under the existing terms, logistics charges are bundled and controlled by the supplier, limiting visibility and inflating costs—particularly due to a 5% surcharge calculated on the full invoice value. By switching to EXW, the company gains full control over shipment pickup, routing, and cost management starting from the supplier's premises.

The simulation based on two real shipment cases from vendor NLP clearly demonstrates the substantial financial benefit of adopting EXW incoterms compared to the existing FOB practice. In the first shipment scenario, logistics costs were reduced from €3,235.20 under FOB to €786.62 under EXW, achieving a cost avoidance of €2,448.58, equivalent to a 76% reduction. The second shipment delivered even greater savings, reducing costs from €9,440.85 to €2,439.58, which represents a cost avoidance of €7,001.27 or a 74% reduction. When combined, these two cases generated a total logistics cost avoidance of €9,449.85 (equivalent to IDR 181,559,466.70). This

outcome provides strong empirical evidence that the application of EXW incoterms can deliver measurable and immediate financial advantages, potentially reducing logistics expenditure by more than 70% on comparable shipments. The findings not only validate the optimization strategy tested in this study but also highlight its practical feasibility for implementation, reinforcing the critical role of governed data in enabling cost-reduction decisions and improving overall logistics performance.

Beyond cost savings, the EXW model enhances operational flexibility and lead time visibility, allowing for proactive tracking and risk mitigation. This figure supports the use of governed data and simulation tools in logistics decision-making, demonstrating how Incoterm adjustments contribute directly to cost reduction and delivery performance improvements in Company XYZ's supply chain.

These results confirm Hypothesis 2, showing that governed and structured data enables effective modelling and data-driven logistics decisions. The CRISP-DM phases (particularly Modelling and Evaluation) successfully provided a disciplined approach to deriving value from data.

Furthermore, the integration of governed data with simulation techniques enabled PT. XYZ Indonesia to transition from reactive problem-solving to proactive decision-making, thereby mitigating the operational disruptions commonly associated with delivery issues.

4.4. Pillar 3: Visualization

This subchapter presents the visualization results developed to enable real-time monitoring of delivery performance and support decision-making in logistics operations. The dashboard and interfaces were created using PowerApps, with automation workflows integrated via Power Automate and notifications delivered through Microsoft Teams.

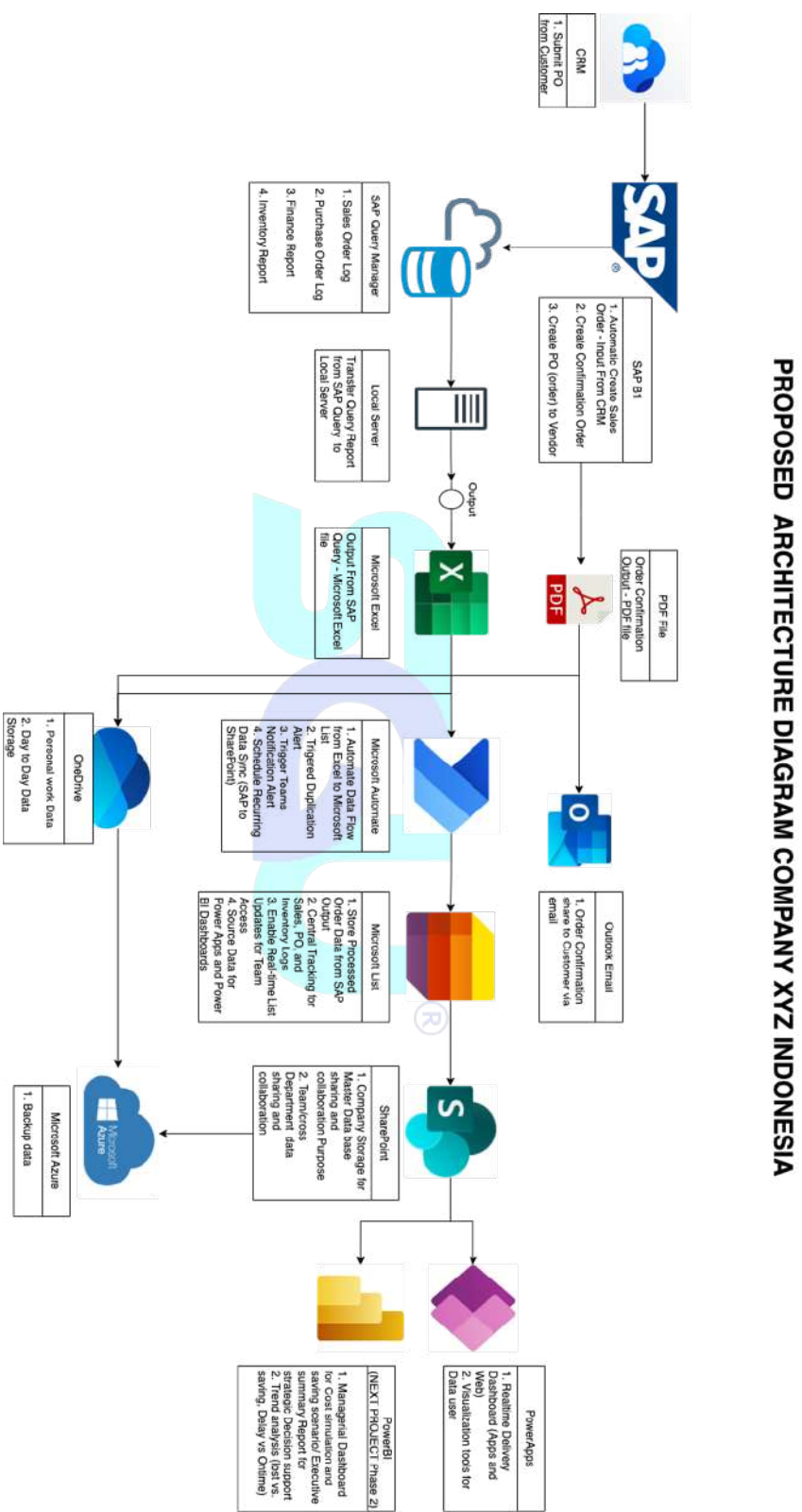


Figure 4. 4. Proposed Architecture Diagram

Figure 4.4 illustrates the proposed integrated architecture at Company XYZ Indonesia, showcasing the automated data flow from CRM and SAP B1 through Microsoft 365 tools: Power Automate, Microsoft List, SharePoint, PowerApps, and Power BI, to support governed logistics monitoring, process optimization, and real-time visualization.

The architecture begins with customer purchase orders (POs) submitted via the CRM system, which are automatically processed in SAP B1 to generate sales orders, confirmation orders, and vendor purchase orders.

Key output data from SAP B1 including sales logs, inventory reports, and financial summaries are extracted using SAP Query Manager and transferred to a local server. These outputs are then exported as Microsoft Excel files, which serve as the foundational data for operational logistic monitoring.

Microsoft Power Automate functions as the central automation engine in this architecture. It facilitates the transfer of Excel outputs to Microsoft Lists, triggers real-time alerts such as duplication warnings and Microsoft Teams notifications, and schedules regular data synchronization with SharePoint.

Microsoft List acts as a governed data repository for structured tracking of order-related records, such as sales, inventory, and logistics activities. This list serves as a single source of truth, feeding directly into both PowerApps and Power BI to ensure consistent and reliable information across platforms.

PowerApps provides a real-time, mobile-accessible interface that allows operational teams to visualize logistics data stored in Microsoft Lists, enabling user to monitor delivery statuses and other key records without needing direct access to backend systems. While Power BI is included in the long-term architecture for advanced analytics and performance monitoring, it is not covered in this study as the project is still in development stage.

To ensure data security and continuity, all files and workflows are backed up using OneDrive and Microsoft Azure. In addition, SharePoint functions as a collaborative platform for storing master data and facilitating cross-departmental data sharing. SharePoint content is also backed up to Microsoft Azure for additional resilience and compliance.

Delivery time monitoring has been implemented through the dashboard using PowerApps. Meanwhile, cost drivers are not the primary focus within the current project timeline, as cost optimization efforts have already been addressed in Subchapter 3.3 and their outcomes presented in Subchapter 4.3. The development of a dedicated cost drivers dashboard is planned to continue as part of a future strategic initiative. While the cost monitoring dashboard is currently presented only as a proof of concept, it is still under development. However, its design approach and implementation process follow the same structure as the delivery time monitoring dashboard.

The visualization is designed to directly support governed data outputs and process simulations, enabling stakeholders to monitor on-time performance, delays, potential risks, and data quality gaps in a user-friendly interface.

The actual implementation is executed entirely using Microsoft Power Apps, integrated with governed delivery data, automated workflows via Power Automate, and collaboration tools Microsoft Teams. This section discusses how these components were realized, how they interact, and how they are validated through user testing and stakeholder feedback.

4.4.1. Realization of the Visualization Framework

The PowerApps application was built using a layered visualization framework defined in Chapter 3:

- A Governed Data Layer, which ensures consistency of delivery log inputs and incoterm classifications.
- A Logic and Processing Layer, where record conditions are evaluated (late delivery, potential delays).

- A Presentation Layer, allowing users to explore delivery statuses, job details, and governed Master Data interactively.

This architecture enabled a unified tool that links simulation outputs, delivery updates, and master data validation in real time.

4.4.2. Dashboard Overview

The main interface (Figure 4.13) displays the overall delivery performance with real-time categorization

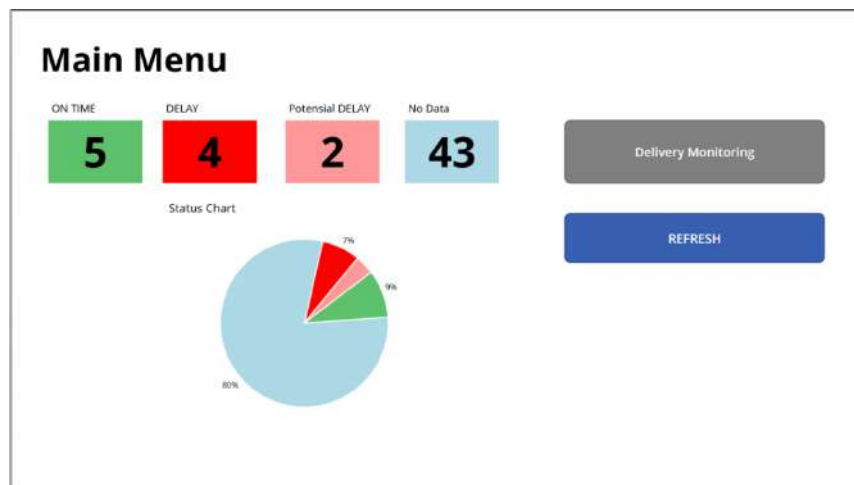


Figure 4. 5. Main Menu Dashboard of Delivery Monitoring

Figure 4.5 presents the main menu interface of the delivery monitoring dashboard. It provides users with a overview of delivery performance by categorizing delivery statuses such as "On Time," "Delay," "Potential Delay," and "No Data." These categories are visually differentiated using color-coded indicators, enabling quick interpretation of the delivery situation.

In addition to the status indicators, a pie chart is displayed to show the proportional distribution of each delivery status category, enhancing visual comprehension. Users can also navigate to detailed monitoring functions or refresh the data using the interactive buttons provided on the interface. Overall, this main menu serves as an intuitive entry point for real-time logistics performance tracking.

The category of Potential Delay is highlighted as a critical focus area for logistics managers. By leveraging the dashboard, managers and operational teams can quickly identify shipments at risk of delay, enabling them to take proactive corrective actions. This capability not only improves responsiveness but also reduces the likelihood of delayed deliveries. The early visibility into potential disruptions provides the logistics team with actionable insights, empowering them to accelerate communication with stakeholders and implement immediate interventions to keep shipments on track.

Delay Status

NIJ JOB NO : 7OS10510	Sales Code :	STATUS Delay Delivered	>
Customer Name :			
Date : 5/16/2025			
NIJ JOB NO : 7OS10512	Sales Code :	STATUS Delay Delivered	>
Customer Name :			
Date : 5/19/2025			
NIJ JOB NO : 7OS10513	Sales Code :	STATUS Delay Delivered	>
Customer Name :			
Date : 5/19/2025			
NIJ JOB NO : 7OS10514	Sales Code :	STATUS Delay Factory Process	>
Customer Name :			
Date : 5/19/2025			

Figure 4. 6. Detailed Delivery View

Figure 4.6. show the Delay Status screen displays a list view of delivery jobs flagged as delayed, based on governed rules applied to shipment timelines. Each entry includes the NIJ Job Number, Customer Name, Sales Representative Code, Expected Delivery Date, and the current status. The status column distinguishes between jobs that are still

delayed and those that have since been updated to "Delivered" or labelled with a specific issue such as "Factory Process."

This interface provides a user-friendly and actionable summary of delivery exceptions, allowing users to quickly identify which delayed shipments have been resolved and which are still pending. The clickable arrow on each row enables drill-down into job-specific details, offering deeper insight for operational follow-up.

The screen helps stakeholders prioritize actions, reduce miscommunication, and avoid redundant escalations by giving instant visibility into the current resolution status. Integration with governed data ensures that the displayed delays are aligned with verified delivery data and lead-time rules.

This screen enhances transparency and accountability within the delivery monitoring process and supports real-time logistics management by surfacing unresolved issues promptly

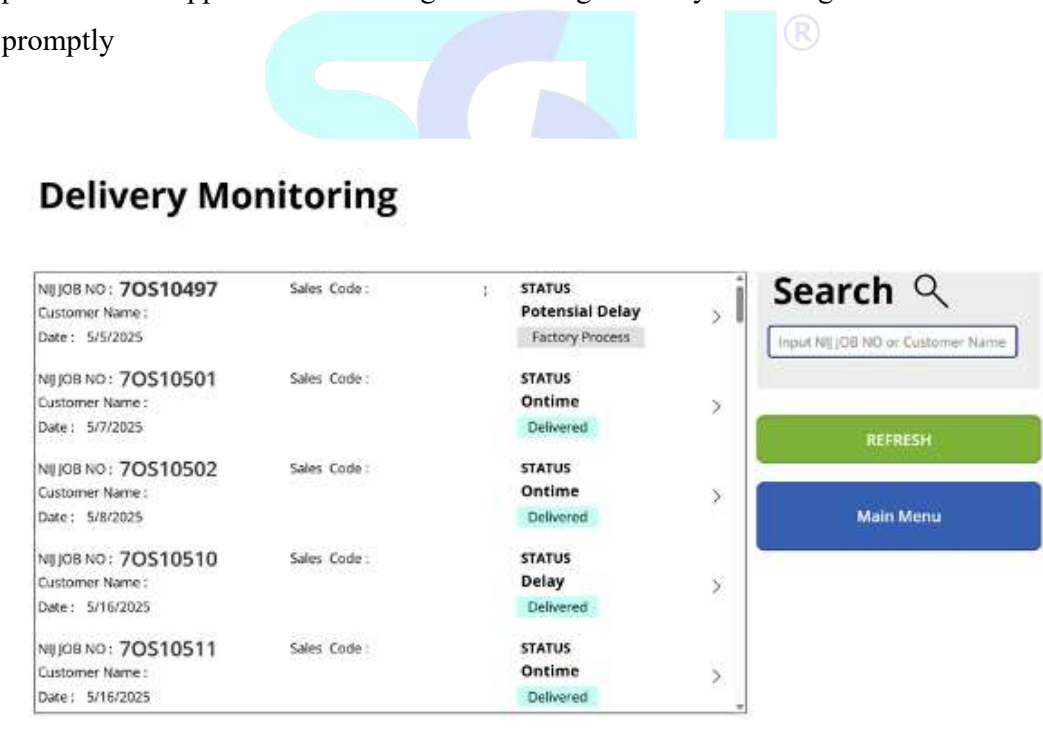


Figure 4. 7. Delivery Monitoring Screen

Figure 4.7 shown Delivery Monitoring screen provides users with a centralized and interactive list of all delivery records tracked within the governed logistics system. Each

row presents critical job-level details, including the NIJ Job Number, Customer Name, Sales Code, and Expected Delivery Date, alongside a status indicator.

The delivery status is classified using governed logic into four categories: On Time, Delayed, Potential Delay, and No Data, with supplementary status labels such as “Delivered” or “Factory Process” for additional clarity. The visual layout enables quick scanning and immediate understanding of each job’s current state, supported by color-coded tags.

To facilitate efficient navigation and data retrieval, a search function is embedded on the right panel, allowing users to filter by Job Number or Customer Name. Additionally, action buttons REFRESH and Main Menu are provided for real-time data refresh and system navigation.

This screen plays a vital role in supporting operational logistics decisions. It enables stakeholders to identify risk areas, track late shipments, and verify status updates without the need for back-and-forth coordination with other departments. The layout is optimized for both desktop and tablet use, ensuring accessibility across user roles.

By combining governed data with visual monitoring features, this interface reinforces the dashboard’s role as a real-time decision support tool, aligned with the delivery performance improvement goals outlined in Research Objective 3.

To complement the summary-level views provided by the Delivery Monitoring and Delay Status screens, the system also includes a detailed job view interface that allows users to investigate individual delivery records more comprehensively. This feature enables cross-functional teams to trace operational specifics, shipment timing, and exception causes with greater precision.

<

NIJ JOB:7OS10497

Date : 5/5/2025

Sales Code:
Vendor : BLAC
Purchase Term : FOB
Delivery Term : DDP PALEMBANG
DELIVERY DATE TO CUST: 8/27/2025
Request Customer Delivery Date: 8/27/2025
PAYMENT TERM: Net 120 days
SPARE/PUMP: SP
QUOTATION NO.: 7ES-DM-2040
GI Date factory:
ETD Port:
ETA Port:
ETA NIJ:
ETA Customer: 8/27/2025
ACTUAL DELIVERY TIME:
Fright Information: SEA

CUSTOMER NAME:

Status:Potensial Delay
On Going Process:
Factory Process

Figure 4. 8. Detailed Delivery Job View

Figure 4.8 illustrates the detailed job view screen, which presents an expanded data record for a specific delivery job (in this case, NIJ JOB: 7OS10497). This screen consolidates critical information across multiple data points, including the sales code, vendor, purchase and delivery terms, delivery dates, payment terms, and specific item or quotation identifiers.

Additional logistics data such as ETA to customer, actual delivery date, and freight mode are also displayed. On the right side, customer-specific information is highlighted, including the customer's name, delivery status, and the reason for delay, which in this case is "Factory Process."

This interface is particularly useful for root cause analysis and issue resolution, enabling operational teams, sales representatives, and planners to investigate delays or delivery discrepancies in detail. It ensures traceability by drawing data from governed sources and reflects any changes made through the update interface or workflow automation.

The screen supports decision-making by offering full visibility into delivery execution, aligned with the governance and simulation framework. It also reinforces user accountability by providing a transparent record of what is scheduled, what has been delivered, and where bottlenecks exist.

To ensure timely response and enhance collaboration across departments, the visualization framework integrates with Microsoft Teams to deliver automated status alerts. This feature complements the dashboard views by proactively pushing critical updates to relevant users through MS Team communication channels.

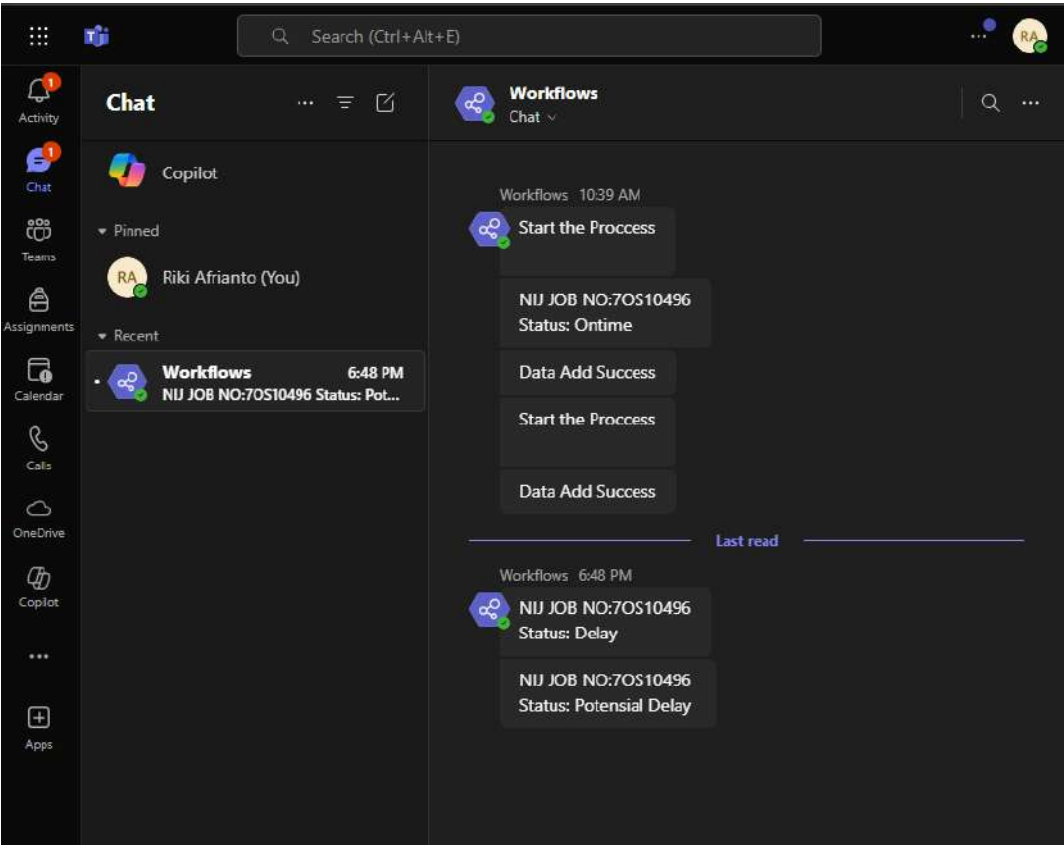


Figure 4. 9. Microsoft Teams Alert Integration

Figure 4.9 demonstrates the integration of the dashboard system with Microsoft Teams using Power Automate workflows. When a delivery record is added or updated, the system automatically sends status notifications to the designated Teams channel. In the illustrated case, NIJ JOB NO: 7OS10496 triggered multiple updates—ranging from "On Time" to "Delay" and "Potential Delay"—each captured and logged in real time.

These alerts are crucial for improving operational responsiveness. Rather than relying on manual report checking or interdepartmental inquiries, users receive immediate visibility of status changes directly within their collaboration platform. This ensures

that logistics teams, sales personnel, and managers are aligned on current delivery conditions and can act accordingly.

The notifications are generated based on governed logic defined within the data layer, ensuring consistency and accuracy of the information disseminated. By embedding real-time alerting within Microsoft Teams, the solution bridges operational data with collaborative workflows, embodying a modern, integrated approach to logistics performance management.

The dashboard provides real-time monitoring of delivery performance, enabling managers and operational teams to track shipment status, identify delays, and respond proactively. The system integrates with Microsoft Teams for automatic notifications and allows detailed tracking through delivery job views.

In terms of outcomes, the dashboard implementation significantly improved delivery accuracy. Leveraging governed data and actionable visualization, the company successfully reduced delayed deliveries from 24% in May 2025 to 6% in July 2025. This 18% improvement highlights the increased transparency and responsiveness enabled by the visualization tool.

Outcome chart delivery report before implementation:

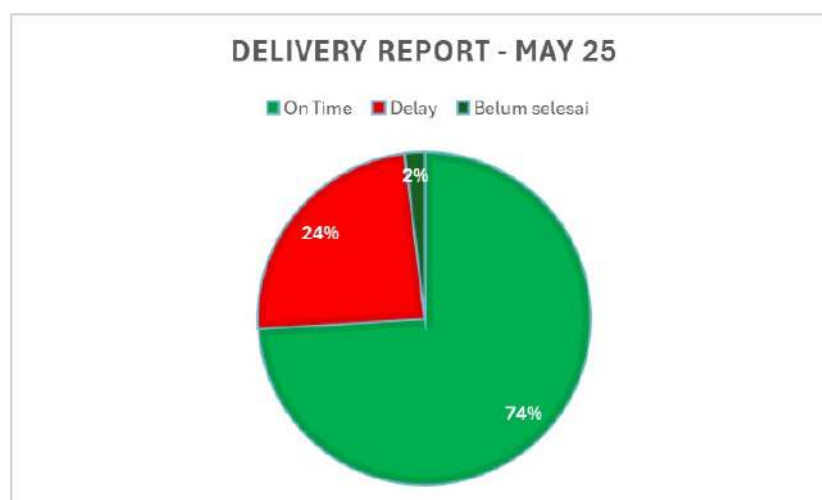


Figure 4. 10. Report chart before Implementation

Figure 4.10 present the delivery performance for May 2025. The chart indicates that 74% of deliveries were complete on time, while 24% experience the delay. And remaining 2% were still pending at the time of reporting. This report is based on excel logistic report send monthly by logistic team to the company group.

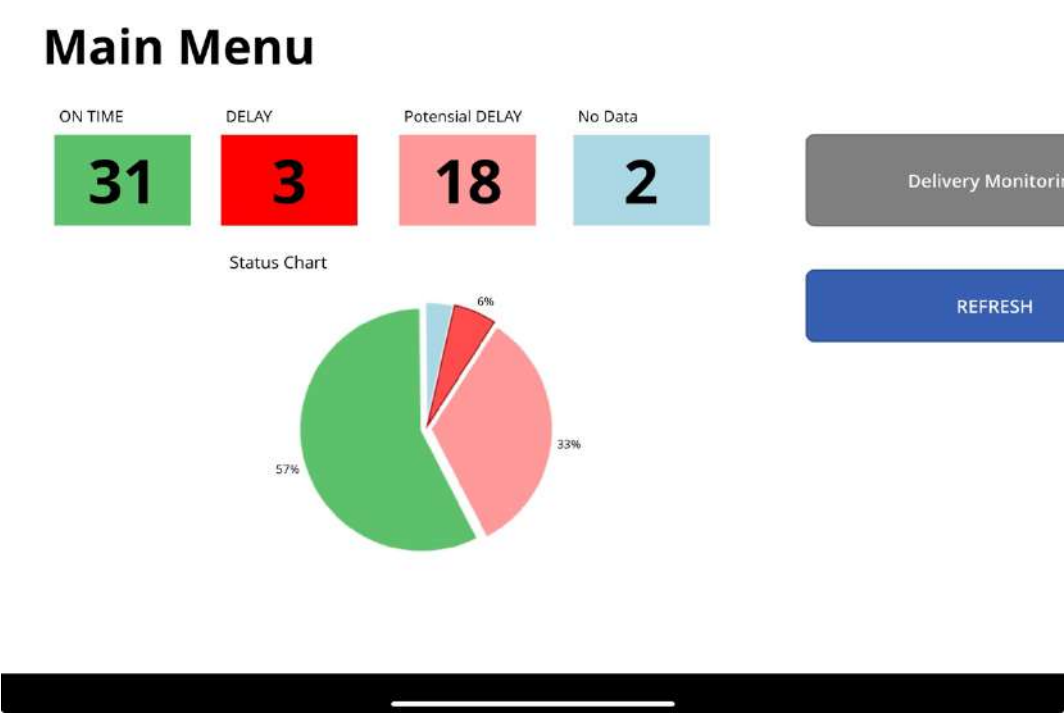


Figure 4. 11. Result Outcome for Delivery Improvement

Figure 4.11 illustrates the delivery performance outcomes implementation from 2 June 2025 – 21 July 2025 of dashboard implementation. The results show that only 6% of shipments experienced delays, while 4% of shipments lacked complete data records.

The May 2025 baseline in figure 4.10 provides a crucial reference point for measuring improvement. When compared with later results July 2025 figure 4.11 where delays dropped to 6%, Figure 4.10 clearly illustrates the starting condition before the implementation of governed data and visualization, reinforcing the impact and effectiveness of the dashboard initiative in reducing delays and improving delivery accuracy.

The system was validated through a Focus Group Discussion (FGD) involving stakeholders from management, logistics, finance, and sales. The result of FGD mention on subchapter 4.5. The Feedback confirmed:

- Strong usability for daily performance tracking
- Real-time alerts enhanced responsiveness
- Governed data improved trust and compliance
- Visual tools encouraged collaboration across teams

Finally, this implementation answers the key Research Question 3 and fulfils Objective 3 of the study:

RQ3: How can a BI dashboard be designed to effectively support real-time monitoring of logistics performance indicators for delivery lead time?

Objective 3: To design and implement a BI dashboard for real-time monitoring and decision-making.

The Power Apps-based dashboard effectively enables:

- Real-time monitoring of logistics performance
- Drill-down exploration of shipment-level data
- Real-time decision support via Microsoft Teams alerts

This solution provides a direct bridge between governed logistics data and logistic actions, positioning visualization as a central tool in enhancing delivery reliability.

4.5. Validation – FGD Result

This subchapter presents the outcomes of the Focus Group Discussion (FGD), conducted to validate the implementation of the data-driven logistics improvement framework. The FGD involved stakeholders from various functional areas, mapped

based on their expertise and relevance to the Research Questions (RQ1–RQ3). The discussion aimed to collect qualitative validation of the results across three core pillars: Data Governance, Logistics Cost & Timeline Optimization, and Visualization.

A complete overview of FGD questions provide in Appendix 1 and role mappings is provided in table 3.12

4.5.1. Evaluation of Data Governance (RQ1 / Objective 1)

Stakeholders generally affirmed the positive impact of the Data Governance Council and stewardship model on operational clarity and data quality.

“Before we had the Data Governance Council, we didn’t even realize we had so many data quality problems. There was no clear way to report or fix them. Now, with the Council in place, we can solve issues faster and make sure our data supports the company’s big goals.”— *Managing Director* (Q1, strategic alignment)

“It’s now very clear who owns what data. Our team knows which steward to contact, and issues are resolved faster.”— *Data Steward* (Q2, daily ownership clarification)

“Since governance implementation, we see fewer errors in product codes and account duplication across systems.”— *Finance Manager* (Q3, financial data quality)

“The integration between SAP and CRM through PowerApps has helped a lot—now data flows automatically.”— *BI Developer* (Q4, technical validation)

“Although the testing period only lasted three days, we’ve already started to see early signs of improvement. The changes aren’t significant yet, but I’m optimistic that if we continue to follow this framework, it will bring substantial benefits to our operations and we should explore the possibility to copy the same method to other operation problem such as warehouse management and stock.”— *Managing Director* (Q5, sustainability probe)

4.5.2. Evaluation of Logistics Cost and Timeline Improvements (RQ2 / Objective 2)

Participants observed cost reductions and lead-time improvements following the logistics process optimization supported by governed data.

“From a finance perspective, having visibility into Incoterm options like FOB or EXW allows us to evaluate which terms offer better cost efficiency and avoid unnecessary charges.”— *Finance Manager* (Q6, cost validation)

“Even though the dashboard is still in testing, it already helps us check delivery status directly without waiting for updates from the logistics team. It saves time and lets us respond to customers faster, which improves their satisfaction.”— *Sales Manager* (Q7, customer satisfaction focus)

“Now I can make shipping decisions faster, because I trust the data I get.”— *Logistics Manager* (Q8, workflow change)

“Our cost forecasts are now much closer to the actuals, which greatly supports our financial review process. The cost simulation—especially from adjusting the incoterm—has proven effective in reducing logistics expenses. However, we recognize the need to explore additional opportunities for further cost reductions.” — *Finance Manager* (Q9, forecast accuracy)

“Some suppliers needed adjustment time, but now they follow our new timelines.”— *Order Processing Lead* (Q10, external coordination)

4.5.3. Evaluation of Visualization and Dashboard (RQ3 / Objective 3)

The dashboard, developed using PowerApps, was positively received as a reliable and accessible decision-support tool.

“Every day starts with reviewing the dashboard—it’s become part of our logistics routine.”— *Logistics Manager* (Q11, routine adoption)

“Even though there are no finance figures on the dashboard yet, I hope cost prediction can be included in future development. From a finance perspective, being able to see shipment status directly helps us move forward with the invoicing process without needing to check with the logistics team. The logistics data is already consistent and accurate, so we trust it when supporting our financial tasks.”— *Finance Manager* (Q12, role-based access usability)

“It’s useful. I no longer wait for weekly report—I can just filter and keep informed.”— *Sales Manager* (Q13, efficiency)

“We avoided an express shipment because we saw a delayed item coming in—we made a better call”— *Sales Manager* (Q14, business impact)

4.5.4. Summary of FGD Outcomes

This section presents the validation results gathered from key participants representing different functional roles within the organization. Each participant reviewed and confirmed the relevance of specific domains based on their area of expertise, contributing valuable insights into the current system's effectiveness and improvement areas. The feedback helps align operational understanding with strategic goals and highlights domain-specific priorities. Table 4.9 summarizes the validated domains and key insights shared by each participant.

Table 4. 6. Participant Validation of Domains and Key Insights

Participant	Validated Domain	Key Insights
Managing Director	Governance & Strategy	Sustainability, escalation clarity
Logistics Manager	Workflow & Operations	Faster decisions, integrated usage
Finance Manager	Cost Impact	Reduced charges, forecast accuracy
Sales Manager	Customer View	Reliability, improved planning

Participant	Validated Domain	Key Insights
Order Processing Lead	External Coordination	Supplier adaptability
Data Steward	Quality & Governance	Ownership clarity, fewer errors

Table 4.9 shows the validated domains and key insights gathered from each participant involved in the study. The Managing Director, focusing on Governance and Strategy, emphasized the importance of sustainability and escalation clarity. The Logistics Manager, under the Workflow and Operations domain, noted faster decision-making and integrated system usage. The Finance Manager, representing the Cost Impact domain, highlighted reduced charges and improved forecast accuracy. The Sales Manager, linked to the Customer View, mentioned enhanced reliability and better planning. The Order Processing Lead, validating the External Coordination domain, reported increased supplier adaptability. Finally, the Data Steward, working within the Quality and Governance domain, pointed out clearer ownership and fewer data errors.

4.5.5. Implication for Research Objectives

The FGD findings validate the proposed framework across:

- **Objective 1:** Data governance improved quality, ownership, and integration.
- **Objective 2:** Optimized processes reduced logistics costs and improved timelines.
- **Objective 3:** Dashboards enhanced decision-making through real-time insights.

The participant feedback also provides actionable points for continuous improvement, such as refining dashboard alerts and reviewing governance practices periodically.

4.6. Summary of Deliverable

This research generated a set of tangible deliverables that collectively demonstrate how structured data governance, logistics process optimization, and visualization can

enhance logistics performance at Company XYZ Indonesia. The outcomes are summarized below, organized according to the three research pillars and the validation process.

1. Data Governance Framework and Guidelines

The first deliverable is the Logistics Data Governance Guidelines (Document NIJ-MDGOV-0001) – Appendix 2, which provide a comprehensive reference for governing logistics data. The guidelines define the roles of Data Owner and Data Steward, establish policies, and outline processes for managing master data, data quality, data architecture, and data storage. This framework ensures accountability, consistency, and traceability of logistics-related data across the organization. The implementation of this deliverable successfully addressed Research Objective 1 (RO1) and validated Hypothesis 1 (H1), confirming that structured data governance enhances data quality, accessibility, and consistency. In addition, new findings revealed measurable improvements: data accuracy increased from 82% to 96%, data completeness from 75% to 93%, and consistency across systems improved from 68% to 95%. Ownership coverage expanded from 45% to full 100%, policy compliance improved from 60% to 92%. The introduction of a fully implemented RACI matrix further reinforced governance enforcement. Overall, this deliverable not only established governance standards but also delivered tangible improvements in data quality and operational accountability, forming the foundation for subsequent process optimization and visualization initiatives.

2. Logistics Improvement through Simulation-Based Optimization

The second deliverable is a simulation-based logistics optimization model, applied to evaluate shipment strategies and incoterm adjustments. The simulations revealed measurable benefits: a 74% up to 76% reduction in logistics costs within two months of shipment adjustments and an increase in delivery accuracy to 90% compared to the previous 73% baseline. These outcomes confirmed Research Objective 2 and Hypothesis 2, demonstrating that governed and reliable logistics data enables effective analysis for cost reduction and delivery improvement.

3. Visualization Dashboard for Real-Time Monitoring

The third deliverable is the Business Intelligence dashboard, developed using Microsoft PowerApps to provide real-time visibility into delivery performance. The dashboard includes features such as delivery monitoring screens, detailed job views, and automated notifications via Microsoft Teams integration. While cost drivers were not visualized in the current timeline, the dashboard directly enhanced responsiveness to delivery issues and served as a decision-support tool for managers. Alongside the dashboard, a User Manual (appendix 3) was also created to guide end-users in operating and exploring the system. This manual provides step-by-step instructions on system requirements, navigation, dashboard features, troubleshooting, and interpretation guideline. Together, the dashboard and its manual not only enhance transparency and decision-making but also ensure sustainability of adoption by operational teams. This outcome fulfilled Research Objective 3 and validated Hypothesis 3, which highlighted the role of visualization in supporting operational monitoring and decision-making.

4. Validation through Focus Group Discussions (FGD)

The fourth deliverable is the validation of the framework through structured FGDs with strategic and operational stakeholders. Participants confirmed that data governance improved data reliability, logistics simulations produced actionable cost and delivery insights, and the dashboard enhanced decision-making transparency. According to predefined success criteria, the framework achieved more than the required thresholds, with at least four out of five evaluation questions in each pillar demonstrating positive outcomes. This confirmed the overall effectiveness and practical applicability of the proposed framework.