CHAPTER 2
LITERATURE REVIEW AND BASIC THEORY

2.1 Literature Review

Problems in the logistics and transportation process are a major challenge for distribution companies, especially PT Wajira Jagratara Transindo. Delays in billing, inefficient vehicle allocation, and inaccurate delivery time estimates can lead to increased operational costs and decreased customer satisfaction with the services offered. To address these problems, a literature review from previous studies are conducted to have a better understanding of the problems. The studied literature covers the topic of document management, allocation, delivery scheduling, time estimation in relation to delivery performance in distribution company. Fleet management system, and digital integration also become critical factors in order to built a reliable information system. This literature review will be the basis for building a theoretical framework that will be used in the design process of this project.

2.1.1 Delay in Invoice Creation due to Delivery and Billing Management

Manual and paper-based document management can cause delays in invoice creation, thereby impacting the efficiency of the billing process. Paper-based invoicing system slows down the billing process because it requires additional time for grouping, validation, and document storage, which risks in data loss or corruption (Yang et al., 2024). This has an impact on the company's billing cycle and cash flow, because capital turnover depends on the speed of document processing, not solely on the completion of goods delivery. Delays in the billing cycle can cause obstacles to cash flow, where payments from customers are delayed even though deliveries have been completed on time. Rumondang et al. (2021) states that delays in receiving Delivery Order (DO) documents at logistics companies cause delays in invoice creation, which impacts the smoothness of cash flow and increases the administrative workload. To overcome this problem, an integrated digital system can be implemented to improve the accuracy and speed of the billing process. This system allows drivers or field staff to upload proof of delivery digitally, so that the administration department can immediately verify and create invoices without waiting for the physical documents.

2.1.2 Inefficient Vehicle and Driver Allocation

Inefficiency in vehicle and driver allocation is one of the factors that affect operational effectiveness in logistics systems. Fleet management system (FMS) plays an important role as an integrated system used to manage transportation fleets, including route

planning, scheduling, vehicle monitoring, and real-time position tracking. Azevedo (2022) explains that the implementation of FMS aims to optimize the utilization of transportation resources through the digital integration of vehicle and driver data, which helps in the decision-making process to be faster and more accurate. The availability of real-time data is an important aspect of fleet management because it allows companies to track vehicle locations and delivery status. Tracking systems based on the Internet of Things (IoT) and GPS not only increase visibility in the supply chain but also reduce the risk of delays due to miscommunication or scheduling errors (Al-Turjman & Malekloo, 2019). From an optimization perspective, mathematical approaches such as the Vehicle Routing Problem (VRP) are often used to determine the most efficient vehicle routes by considering mileage, delivery time, and vehicle capacity. The VRP model can help companies reduce total operating costs by determining optimal routes and balancing driver workloads (Kumar, 2020). Inefficient vehicle allocation can directly impact delivery delays, increased fuel consumption, and wasted operating costs.

2.1.3 Inaccurate Delivery Scheduling and Time Estimation

Delivery performance in logistic system become one of core factor affecting customer satisfaction. The ability to estimate task precisely, allocate resources efficiently, and predict delivery timelines reliably can determine whether a project meets its objective or encounters costly delays and overruns (Akinboboye et al., 2022). How the company deliver goods between a compromised expected time will become the delivery reliability. Consistency of logistic delivery has emerged as one of key elements influencing customer satisfaction, as a result of the increasing complexity of customer service system and the increased significance that user place on logistic timeliness (Tian et al., 2025). Customer rely on predicted delivery times, with expectation that product will delivered on-time, inaccurate delivery time estimations could become a major problem lead to customer dissatisfaction, and even negatively impact to the overall customer experience (Kumar & Mishra, 2024)

The study conducted by Tian et al. (2025) implies that delayed delivery and longer delivery time will significantly reduce the frequency of future customer purchases. Timely delivery had a positive and statistically significant effect on customer satisfaction, which would lead to customer loyalty. The significance of distribution and logistics operations is currently steadily growing. To guarantee that the items reach clients on time, businesses must thus examine their distribution procedures, by guaranteeing customer pleasure, companies may reach more potential customer and will become more profitable (Dündar & Öztürk, 2020). Timeliness, safety, and courier service attitude all

have a significant beneficial impact on customer satisfaction, loyalty, and repurchase intentions in the express delivery industry (Sun & Kim, 2023).

In the study conducted by (Modelling & Yerra, 2025) implies that one of the major mechanisms used to improve customer satisfaction are through increasing delivery speed and accuracy. Traffic bottlenecks, inefficient warehouses, and sporadic supply chain failures are all problems with outdated logistics systems. However, by employing predictive models, businesses can foresee any bottlenecks beforehand and address issues before they affect deliveries. Another key advantage of predictive analytics is that it supports optimizing last-mile delivery, which is the most complicated and costly part of logistics. Another duty where analytics significantly enhances logistics operations and customer satisfaction is predictive maintenance. Because vehicle malfunctions can cause major delays and operational inconvenience, fleet management is an important aspect of logistics. IoT sensors and artificial intelligence algorithms are used in predictive maintenance to track vehicle performance, identify possible mechanical problems, and plan repair before problems occur.

2.1.4 Lack of System Integration and Need for Digital Transformation

The old integration system becomes a significant obstacle while transforming to digital organizational. Without effective integration, data will fragment, and business processes will be spread out, that can lead to reducing the organization's competitiveness in an increasingly digital market. According to Shonubi (2025), many organizations face the difficulty to integrate the old system with new technology, that inhibit their digital transformation efforts. This is in line with the Rakgoale et al. (2024) that identified the obstacles in digitalization involving the constraints in maintaining the software and the difficulties to develop old system. Furthermore, Atieh et al. (2025) stated that without effective integration, digital technology as automation and data integration would not be able to give a significant effect to the supply chain performance. The digital transformation is required to use the full potential of these technologies. Industry 4.0 is initiated through digitalization and transformation, with the Internet of Things (IoT) serving as one of the supporting technologies that can integrate all stakeholders in intra-organizational logistics operations. Companies acknowledge both the benefits and challenges of IoT on the performance of the logistics network, which plays a role in overall organizational performance. One of the challenges that may influence a company's decision to adopt IoT is the management of large volumes of data (Gong, 2025). A company in Africa faced challenges such as a lack of professionalism and low capacity to integrate technology into business processes. This affected their ability to deliver fast, efficient, and accurate services. Companies that implement logistics

information systems benefit from digital system development that encompasses all essential features, allowing for stronger collaboration potential to build business partnerships due to their advantages in operational efficiency.

Table 2.1 Summary Table of Literature Review

No	Reference	Object	Problem	Solution	Method and Tools	Result
1	Yang et al. (2024)	Analysis of problems with traditional paper invoices and introduction of electronic invoices as a solution in commercial transactions	Paper invoices are susceptible to damage, loss, and fraud, require high costs and labor to manage, and lack real-time sharing and tracking capabilities, leading to inefficiency	Adoption of electronic invoices based on digital signatures and electronic data exchange, ensuring reduced costs, improved security, real-time tracking, and integration with enterprise financial systems	Qualitative literature review and technology analysis comparing paper versus electronic invoicing systems and exploring the digital transformation and innovations such as blockchain	Electronic invoicing significantly improves transaction security, efficiency, and convenience, reduces operational burdens, and is expected to become the mainstream invoicing form promoting digital transformation in business
2	Rumondang et al., (2021)	Fleet availability and controlling variables affecting delivery accuracy at PT. Cardig Logistics Indonesia	Issues with delivery such as inadequate fleet availability, poor driver supervision, incomplete shipment documents, and incorrect routes lead to delivery inefficiency	Improve fleet availability by rejuvenating the fleet and enhance control through better performance measurement, setting KPIs, and more stringent supervision	Survey method with questionnaires distributed to 30 operational employees. Data analyzed using descriptive statistics and multiple linear regression to test the influence of variables	Fleet availability and controlling significantly and positively affect delivery smoothness, jointly explaining 88% of delivery process effectiveness. Recommendations include fleet renewal and improved controlling standards

Table 2.1 Summary Table of Literature Review (Continuation)

No	Reference	Object	Problem	Solution	Method and Tools	Result
3	Tian et al., (2025)	Consumers' purchase frequency behavior on a Chinese cross-border luxury e-commerce platform.	Lack of integrated data linking logistic metrics and customer behavior over time. Discover the connection between logistic performance and purchase delivery	The study proposes empirically linking logistics data and consumer purchase behavior using real transaction data	Quantitative method: Instrumental Variable Regression (IVR)	Delayed delivery lead to decreases purchase frequency, logistic reliability and efficiency are key to maintaining customer loyalty and repeat purchases
4	Akinboboye et al. (2022)	Application of predictive analytics in project planning, particularly in large-scale and remote projects	Traditional project planning tools are static, subjective, and prone to bias. Organizations lack consistent, high-quality data to support accurate predictive models.	Integrating predictive analysis and machine learning to do task duration forecast, resource needs, and delivery timelines. Predictive models (linear regression, decision tree, ARIMA). Integration with project management tools for real-time updates and scenario simulation.	Mixed-method conceptual synthesis with data-driven modelling cycle. Tools: Machine learning, time series forecasting, data preprocessing, validation metrics, visualization.	Predictive analytic improved task estimation accuracy, resource utilization efficiency, delivery accuracy, cost saving.

Table 2.1 Summary Table of Literature Review (Continuation)

No	Reference	Object	Problem	Solution	Method and Tools	Result
5	Kumar & Mishra, (2024)	Food delivery operations, particularly the prediction of delivery times to improve customer satisfaction.	Inaccurate estimation of food delivery times leads to customer dissatisfaction and operational inefficiencies in delivery management systems.	The study propose a machine learning-based predictive model for accurately estimating food delivery times, to minimizing error in delivery time estimation	Data preprocessing, Exploratory Data Analysis (EDA), Machine learning algorithms (Linear Regression, Decision Tree, Lasso Regression), GridSearchCV used for hyperparameter optimization, Model evaluation using R^2 score	Among all models tested, the XGBoost Regressor achieved the best performance with an $R^2 = 0.83$, indicating strong predictive accuracy. The study concludes that accurate delivery time prediction significantly enhances customer satisfaction and overall operational efficiency in food delivery systems.
6	Dündar & Öztürk (2020)	Observes consumers using physical and online shopping channels (channel integration) in Konya, Turkey	Retailers face challenges in ensuring on-time delivery while integrating online and physical sales channels, which affects customer satisfaction and loyalty	Develop a conceptual model linking channel integration, on-time delivery, customer satisfaction, and customer loyalty. The proposed solution emphasizes the importance of efficient logistics and synchronized channels to ensure timely deliveries	Quantitative research, data analysis with SPSS 23.0 and AMOS 22.0, statistical technique to test hypotheses (validity and reliability tests, correlation analysis, multiple regression analysis)	Channel integration positively affects on-time delivery, which significantly impacts customer satisfaction, influencing customer loyalty. The findings confirm that efficient and timely delivery through channel integration increases satisfaction and loyalty among customers.

Table 2.1 Summary Table of Literature Review (Continuation)

No	Reference	Object	Problem	Solution	Method and Tools	Result
7	Yerra, (2024)	Observes logistics and delivery systems, focusing on how predictive analytics enhances customer satisfaction	Traditional logistics systems suffer from inefficiencies such as delivery delays, poor route planning, and lack of real-time updates, leading to customer dissatisfaction	Implementation of predictive analytics powered by AI and machine learning to forecast delivery delays, optimize routes, and improve real-time communication with customers. The system integrates IoT sensors, GPS data, and ERP systems to enhance prediction accuracy and transparency	Route optimization, real-time tracking, predictive maintenance, and demand forecasting	Predictive analytics improved delivery reliability, reduced delivery delays by up to 25–40%, and enhanced customer satisfaction through real-time notifications and personalized delivery options. The study concludes that predictive analytics provides a strategic advantage by optimizing logistics operations and boosting customer trust
8	Mary et al., (2023)	Development of a web-based information system for freight forwarding in logistics management in the East African region.	The freight forwarding industry in East Africa still largely relies on manual systems. This results in inefficient, expensive, and slow services.	Developing a web-based information system for freight forwarding.	Mixed Methods, Extreme Programming (XP)	The developed system was implemented and evaluated and it is believed that it has fulfilled its objective and it has the potential to be used as an independent application for managing logistics.

Table 2.1 Summary Table of Literature Review (Continuation)

No	Reference	Object	Problem	Solution	Method and Tools	Result
9	Gong, (2025)	The use and development of Logistics Information Systems (LIS) to improve operational efficiency, distribution, tracking, and customer satisfaction in the global logistics industry.	Limitations of traditional systems in supporting product tracking and data storage.	Implement LIS, CONPAS LIS, Senseaware, data security, change management	This study uses case studies on CONPAS in Japan and Senseaware at FedEx and analyzes the technical challenges and recommendations for LIS.	LIS implementation has been proven to reduce waiting times, increase transparency, and encourage customer satisfaction in logistics operations.
10	Shonubi, (2025)	Innovation challenges faced by enterprises transitioning from legacy systems to digital futures across Asian and African.	Critical research gap persists in comparative studies exploring the intricate relationships between emerging technologies and diverse innovation types across different emerging economies	It conducts a comparative analysis of two prominent developing economies	Structural equation modelling with quantitative data from managers across two continents.	Confirms that organizational innovation catalyzes overall innovation within enterprises, particularly in regions such as Asia and Africa, where distinctive eco systems foster innovation that harnesses global orientation to address local needs.

Table 2.1 Summary Table of Literature Review (Continuation)

No	Reference	Object	Problem	Solution	Method and Tools	Result
11	Atieh et al., (2025)	Digital transformation as a moderating variable influences the relationship between digital technologies, automation, and data integration of upstream and downstream providers on supply chain performance.	Digital technologies, automation, and data integration, yet how digital transformation affects supply chain performance has not been sufficiently explored	Digital technologies and automation's performance impact in terms of the entire digital transformation landscape	SmartPLS (Partial Least Squares Structural Equation Modeling / PLS-SEM)	Automation improves operational efficiencies and decreases lead times is similar to the literature.
12	Rakgoale et al. (2024)	Barriers of successful implementation of digitalization	Many digitalization programmers fail in the implementation phase due to unforeseen obstacles.	The use of ISM to analyze the barriers to the successful implementation of digitalization provides organizations with a thorough understanding of the obstacles they need to overcome and effective strategies to address them	Interpretive Structural Modelling (ISM)	It comprehensively identifies 11 barriers specific to South Africa, and through ISM, elucidates the intricate interplay among these obstacles, establishing a hierarchical structure that pinpoints critical elements for overcoming top-level barriers.

2.2 Basic Theory

At the design stage for the selected solution, several theories are used, which will be described in this section. The theory used is from the Business Process and Information Systems, and Industrial Organization Design and Management courses. In compiling the basis for this theory, books on the course in question are used. The Business Process and Information Systems course is a theoretical reference for business process improvement, as well as the digitalization process with EDMS. Meanwhile, the Industrial Organization Design and Management course is used as a reference for the theory of standard operating procedure and key performance indicators.

2.2.1 Business Process Improvement

Business processes are a collection of interconnected activities that produce a product or service for customers. Business Process Improvement (BPI) is a systematic approach used to analyse, redesign, implement, and continuously improve business processes so that they become more effective, efficient, and aligned with organizational objectives (Page, 2015). In performing its function, BPI focuses on utilizing information technology to achieve simpler business processes with improved process performance. Business Process Improvement begins with the identification of all activities that are inefficient, bottlenecked, repetitive, or do not add value within a business process. A deep understanding of how the process currently operates (as-is process) is required so that the organization can evaluate whether the current process still aligns with business objectives and customer needs. Information systems play an important role at this stage to enable the organization to obtain data, ensure data transparency, and subsequently make improvement decisions based on that data.

According to Page (2015), Business Process Improvement begins with understanding the existing business process (as-is process) to identify bottlenecks, duplicated activities, waiting time, unnecessary movement, and other non-value-added activities. The quality of an organization is highly dependent on the quality of the processes it executes, so process improvement must be performed evenly and fully oriented toward the customer. The improvement now has the main goal of enhancing the final work output, work methods, activity flow, and the relationships between organizational processes.

In practice, the Business Process Improvement approach consists of four main stages: process identification, process analysis, process redesign, and process implementation. In the process identification stage, critical processes that require improvement are determined. During process identification, organizations determine the critical business processes that require improvement. Process analysis aims to identify the root causes

of operational problems by examining workflow, information flow, stakeholder responsibilities, and process performance. Process redesign focuses on simplifying workflows, eliminating non-value-added activities, improving coordination among stakeholders, and integrating information technology into business processes. Finally, process implementation applies the redesigned process while continuously monitoring performance to ensure sustainable improvement (Page, 2015). The following are some general approaches described in business process redesign:

a. Business Process Reengineering (BPR)

Business Process Reengineering (BPR) is a business process redesign approach that emphasizes fundamental rethinking and radical redesign of business processes to achieve significant improvements in organizational performance, including cost, quality, service, and process speed. Unlike incremental improvement approaches, BPR reconstructs business processes from the ground up by challenging existing assumptions and redesigning workflows to create greater organizational value. According to Dumas et al. (2018), business process redesign supported by information technology enables organizations to simplify complex workflows, eliminate non-value-added activities, integrate business functions, automate manual tasks, and improve organizational responsiveness. Typical redesign strategies include process simplification, workflow integration, task automation, activity elimination, and restructuring organizational responsibilities to support more efficient operations.

b. Waste Elimination

Waste elimination is an approach focused on reducing waste and increasing the efficiency of process flow by ensuring that every activity is performed on time and in the right quantity. The concept of waste elimination originates from the Toyota Production System (TPS), where Taiichi Ohno introduced seven categories of waste, known as *muda*. These include waiting, overproduction, transportation, overprocessing, unnecessary motion, excess inventory, and defects (Ohno, 1988). By eliminating these wastes, business processes can run faster, more efficiently, and more responsively to customer needs. According to (Ohno, 1988) and (Wonmack & Jones, 1996), the waste elimination approach also emphasizes the importance of continuous flow, where information and activities flow seamlessly between processes. Furthermore, this approach encourages the use of systems capable of providing real-time information so that decisions can be made quickly and accurately. Therefore, implementation is often combined with information technology to support data transparency and integration.

Business Process Improvement is closely related to information systems, where this approach is carried out by converting activities that are currently performed manually into

digitalized processes so that data can be managed accurately and the time for information exchange can be accelerated. The use of integrated web and database systems is one manifestation of Business Process Improvement because it provides real-time visibility, speeds up decision-making, and improves operational coordination. Thus, Business Process Improvement can become a continuous improvement cycle.

2.2.2 System Development Life Cycle (SDLC)

The System Development Life Cycle (SDLC) is a systematic approach used in the information systems development process through structured stages, from planning to system maintenance. The SDLC aims to ensure that the developed system meets user needs, is of good quality, and can be implemented effectively and efficiently. With clear stages, the system development process can be carried out in a directed manner. According to Satzinger, Jackson, and Burd (2016), the SDLC consists of several main stages: planning, analysis, design, implementation, testing, deployment, and maintenance. Each stage has a different function but is interrelated in producing a system that meets the organization's needs. Figure 2.1 below shows the SDLC stage.

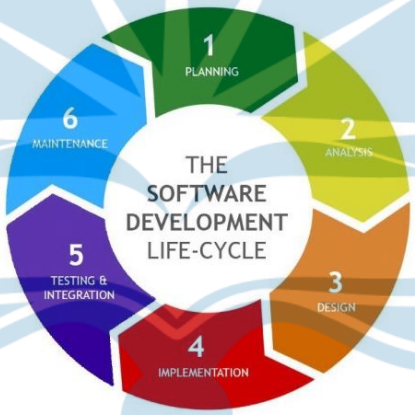


Figure 2.1 System Development Life Cycle (SDLC) Stage
(https://ids.ac.id/pengertian-sdlc/)

a. Planning

This stage identifies the problems encountered, the objectives of the system development, the project scope, resource requirements, the work schedule, and an initial feasibility study. The planning stage is crucial to ensure the project has a clear direction and can be completed according to the established targets.

b. Analysis

This stage focuses on understanding the current business processes, identifying user needs, and analyzing problems in the existing system. Common activities include

observation, interviews, documenting work processes, and compiling functional and non-functional system requirements. The results of this stage form the basis for designing the new system.

c. Design

This stage involves designing a system solution based on the results of the needs analysis. The design includes system architecture, database design, user interface design, system process flow, menu structure, and other technical specifications. The purpose of the design stage is to produce a blueprint for the system to be built.

d. Implementation

This stage is the process of building the system according to the established plan. Activities in this stage include program development, database creation, system configuration, and integration between modules. The result of this stage is a prototype or operational system.

e. Testing

After the system is completed, testing is conducted to ensure all functions operate as required and are free from major errors. Testing can take the form of functional testing, scenario testing, or user acceptance testing. This stage aims to identify system deficiencies before full deployment.

f. Deployment

At this stage, the system is deployed to users in a real operational environment. Implementation activities include system installation, data migration, user training, and initial system user assistance. This stage is crucial for a smooth transition from the old system to the new one.

g. Maintenance

After the system is deployed, maintenance is performed to fix bugs, adapt the system to changing organizational needs, and improve system performance. Maintenance is an ongoing process to ensure the system remains relevant and supports the company's operations in the long term.

2.2.3 Operational Process using Integrated System

a. Management System

A management system is a framework that integrates processes, people, data, and technology to support the decision-making and coordination process in an organization. A management system provides a structure and processes that can be controlled, and monitored by an organization. Data in the management system will be updated accurately so that each stakeholder can access the same data to avoid missing data,

and support an understanding in processing data, so that improvisation can be carried out in the operational process using timely and accurate data. According to Laudon & Laudon (2021), the management system is part of the information system hierarchy, which allows planning, controlling, and analysing organizational activities for the evaluation of operational system efficiency and strategic alignment.

One of the methods in the management system is the Database Management System (DBMS). Database Management System (DBMS) is software that allows organizations to centralize data, so that all data can be stored in one platform and not scattered, also making it easier to manage data efficiently (Laudon & Laudon, 2021). A database management system provides an interface between the program application and the physical data file, allowing multiple users to access the same data similarly so that it is integrated in the same storage platform (Rainer, et al., 2020). DBMS is a system for storing and managing structured data, which functions to record, process, and retrieve transaction data and operational data. DBMS focuses on managing structured data such as records, data tables, and integrating them so that they are accessible to every stakeholder. The purpose of DBMS implementation is to consolidate data to facilitate managerial analysis for business process improvement.

In addition, the Electronic Document Management System (EDMS) method is also one of the commonly used approaches. Document management systems are used to store and compile semi-structured or unstructured information, such as reports, image media, emails, and make them available to users through search, versioning, and workflow features (Laudon & Laudon, 2021). Document Management System (DMS) is used to store, retain, and detect changes to electronic documents and paper-based information. This system supports version control and access management (Rainer, et al., 2020). EDMS is a system used to store and manage unstructured documents such as pdfs, image media, and delivery orders. EDMS will store, index, and control through digital diction, used for digital archives, document management, and workflow approval. The main goal of EDMS implementation is to prioritize document efficiency, compliance, and trail audits.

b. Supporting Tools to do Digitalization

In the digital design sketch process, visual design and prototyping are first carried out to illustrate the appearance of the website as well as the User Interface (UI) and user experience (UX). According to Bilousova et al. (2021), User Interface (UI) is a visual aspect that governs the layout, colors, typography, and interaction elements of a digital system, while user experience (UX) focuses on how users interact with the system so that it can be applied easily, efficiently, and user-friendly. UI/UX design aims to create an

intuitive and consistent interface, thereby increasing usability and user satisfaction. While Prototyping allows early testing of usability and interaction before full-scale system implementation, reducing errors, time, and cost (Laudon & Laudon, 2021). In this process, there are many platforms that can be used as tools to carry out the design and prototyping process, including Figma and Adobe XD. Figma and Adobe XD enable visualizations that resemble the final product, providing early testing of usability problems, visual communication between designers and developers, and rapid iteration in feedback loop designs. Current industry trends show a shift from low-fidelity paper prototyping to tool-based high-fidelity digital prototyping that supports collaboration efficiency and realistic visualization (Chen & Yoon, 2024).

Figma is a commonly used cloud-based application for visual design and prototyping that enables real-time collaboration between users. This feature allows multiple parties to access, review, and evaluate the design together. According to Borysova et al. (2024), Figma is considered the most optimal tool for learning and developing UI/UX interactive design. Figma supports collaborative editing, interactive prototyping, and cloud-based version control that enable fast and efficient iteration. Figma is used to create interactive sketches, in the form of wireframes and prototypes, that visualize the structure and functionality of the website before the coding process begins, so that developers can better understand the navigation flow and final design (Shobha, 2024). In the field of teaching and training, Figma is effectively used in the UI/UX design education framework, because it provides simulation of real projects based on digital prototyping so that it provides a real approach with professional industry practices.

Adobe XD is a desktop-based software supported on Windows and MacOS for visual design, wireframing, and interactive prototyping. According to Machado and Campos (2021), Adobe XD allows designers to prototype interfaces that can be directly converted to front-end code, thus becoming a direct link between the design and technical implementation stages. Adobe XD supports auto-animate for creating realistic transitions, voice prototyping and gesture interactions, and full integration of Adobe Creative Cloud to support complex professional workflows. The use of Adobe XD in interface prototyping helps save on development costs and time because it is able to simulate user interaction before the actual implementation is carried out (Milivojević & Zeljković, 2020).

2.2.4 Standardized Work

Standardized work is a systematic approach used to document the best way to do work so that it can be repeated consistently. Standardized work is considered a fundamental lean concept that establishes the most efficient sequence of steps to perform a task with

minimal waste and maximum consistency (Ohno, 1988). By implementing standardized work, variations in performance can be reduced so as to produce performance that tends to be consistent in each iteration, then the guidelines provided have also been systematically compiled to ensure the quality and safety of work. This standardized work is used as a basis for continuous improvement, so that each performance can be evaluated based on existing standards, to then analyzed whether improvements are needed from existing standards so that performance can be further improved.

In practice, standardized work is embedded within organizational operations through two main forms of documented information: standard operating procedures (SOPs) and Work Instructions (WIs). Together, these documents form a hierarchical documentation strategy that standardizes operations at both the process and the individual-task level, directly supporting improvements in operational efficiency and reductions in errors and rework (ISO 10013:2021).

a. Standard Operating Procedures (SOP)

SOPs serve as a formal document regarding the guidance on how an organization runs its operational processes with the aim of creating consistency, efficiency, and quality of a system. SOP are prepared to direct workers in completing tasks in a predetermined order to ensure quality in accordance with the standards that have been set (Pandiangan et al., 2024). The Theory of Administrative Management proposed by Henri Fayol expands the use of SOPs not only limited to the factory environment, but also in the administrative process of the organization. Fayol emphasized how important it is to have a clear instruction and well-defined management philosophy. This includes the principles of order, discipline, and uniformity to ensure that each stakeholder works efficiently and in harmony to achieve the same goals (Jones & George, 2016). In the preparation of SOPs, it is necessary to ensure ease and efficiency in its use, as well as specificity to achieve goals in an organization. SOP writing must be done in a clear, consistent, specific format, and includes step-by-step stages, so that it is easy for readers to understand. The purpose of preparing SOPs is to provide clear instructions on how to complete a task, so that the information contained in it should not be ambiguous, confusing, or complicated, but should be arranged in short and concise sentences to ensure understanding. Workflows are also important to use so that they can illustrate the stages of the process that need to be followed (Beyene et al., 2022).

b. Work Instruction (WI)

In addition, another method that can be used is Work Instruction (WI). In contrast to SOPs, Work Instruction is designed to provide guidance or procedures for specific activities within a certain scope, such as for certain individuals (Pandiangan et al., 2024).

Work Instructions are detailed, step-by-step guides that explain how to perform specific tasks or activities within a broader process. While SOPs focus on the 'what' and 'why' of a process, ensuring consistency and compliance, Work Instructions address the 'how', detailing the precise actions necessary for successful completion of a task. The use of images, flowcharts, and diagrams is important to provide visual mapping. Highlight each critical point used to ensure safety, quality of results, and time in each task performed. Carry out implementation and testing with the operator to ensure the clarity and feasibility of the work instruction that has been prepared, the results of this test can be used as evaluation material whether the WI is feasible enough to be implemented or if improvement is needed. Once ready to be implemented, make sure the WI is installed at each work station so that it is accessible. Conduct training for workers to ensure they can understand and follow the instructions listed in the WI. It is also necessary to conduct periodic audits to ensure worker compliance with the existing Work Instructions.

2.2.5 Performance Measurement

Performance measurement is a critical component of management system, providing organization a mechanism to evaluate whether their intended goals are achieved through operational activities performed, and identifying areas requiring improvement. Among the various tools available for performance measurement, Key Performance Indicators (KPIs) are among the most widely used across industries. According to the Engineering Management Body of Knowledge, “Key performance indicators are quantifiable measurements, agreed to beforehand, that reflect the critical success factors of an organization” (ASEM, 2020). Strategic goals are converted into measurable elements by KPIs, ensuring that performance can be tracked, evaluated, and improved over time. KPIs provide objective measures across various domains, ensuring an organization meets specific standards that have already been set. In practice, KPI used as tools to control, provide assessments, and feedback for continuous improvement. One of the fuctions of KPI implementation is act as performance tracking, with KPI, progress can be monitored through its efficiency and profitability, and whether it is moving toward the targets or not.

The development and implementation of KPI system requires a structured framework to ensure that the KPIs indicators are actionable, reasonable and alignes with organizational objectives. Two prominent franeworks commonyly used in KPI development are SMART KPI framework (Ishak et al., 2019) and the Balanced Scorecard (Kaplan & Norton, 1992).

Balanced scorecard (BSC) is a strategic performance management framework introduced by Robert S. Kaplan and David P. Norton (1992) as a response to limitation on traditional performance measurement that focuses on financial metric, therefore failed to provide a comprehensive view of overall organization performance. To address this limitation, BSC structure performance measurement into four intercorrelated perspective: Financial, Customer, Internal Process, and Learning and growth (Koplan & Norton, 1992). These four perspectives are linked through a Strategy Map that visualize cause effect relationship between objectives, illustrating how improvements in one perspective can affect outcomes in another.

Key performance indicators play a vital role in operationalizing the BSC framework, enabling organizations to translate strategic objective into quantifiable metrics across each of the four perspectives. The development of BSC usually follows a structured flow, starting with strategic analysis, establishing strategic objectives in each perspectives, developing Strategy Map, and strategic initiatives for each objectives (Kaplan & Norton, 1996). A study designing a logistic performance measurement system using BSC approach found that evaluating performance across all four perspectives showing cause effect relationships between dimensions that single-perspective measurement would otherwise fail to detect. Specifically, the study found that a decline in employee training was associated with an increase in delivery errors, demonstrating how the BSC provides a systemic view of performance that enables more informed management decision-making (IRAJTMA, 2024).

2.2.6 Fleet Management System

Fleet Management System plays an important role in information integration, particularly in the field of optimal fleet management and monitoring. The concept of information systems implemented in the Fleet management system is developed through data integration and digital technology to support visibility of fleet delivery progress, estimated arrival time of a fleet, and other operational activities. The effectiveness of a Fleet management system is not only measured by how advanced the technology or how complete the features are, but also by how system users (drivers) can interact smoothly with the application interface. If the designed interface makes it difficult for users, the data entered into the system may become inaccurate. The following are methods that can be used as references in the development of a Fleet management system.

a. User-Centered Design

The design of the driver application interface involves an approach that places humans as the main users. According to Lowdermilk (2013), the User-Centered Design (UCD) method is a philosophy of the design process that places users as the top priority

throughout the entire system development cycle in order to create a user-friendly digital product. In addition, UCD ensures that design development can adapt to the real needs, limitations, and behaviors of users while working, rather than requiring users to adapt to the complexity of the system. The stages in the User-Centered Design method according to Lowdermilk (2013) consist of several phases, namely:

i. Analysis

The initial stage, namely the analysis stage, demonstrates how the design process deeply understands who the system users are, what tasks are performed by the users, and in what kind of environment the designed application will be used. If implemented in a Fleet Management System, the analysis stage will be conducted to gain a deeper understanding of user characteristics and operational conditions that may affect application usage.

ii. Requirements

At this stage, the designer determines the specific requirements that must be fulfilled by the application to support user activities. The main focus here is determining features and their details that provide added value without disrupting the overall usability of the application. These features are expected to facilitate operational status management for both drivers and admin.

c. Design

The design process begins at the design stage where the output is a visual and digital solution in the form of an application. At this stage, designers can begin by building wireframes, and the final output is a functional prototype. The purpose of wireframe design is to build an intuitive application workflow so that drivers can operate the interface optimally and minimize errors even under busy or unfavorable operational conditions.

d. Evaluation

Evaluation is a critical stage where the designed prototype will be tested directly by users in order to obtain feedback aligned with system usability. At this stage, the evaluation process is iterative, where each design result will be repeatedly tested and continuously improved until the application truly meets and aligns with user needs.

e. Implementation

Implementation is the final stage where the design will be validated through a series of testing and improvements, marking the completion of product development. User involvement from the early stages of design provides benefits in minimizing system

failure during operational activities. Therefore, the implementation stage will improve the overall operational efficiency of the fleet.

2.3 Standard and Ethic Code

The implementation of information systems in an organization requires the role of ethical principles in managing how information is processed and used beyond existing technical standards. Standards and codes of ethics play a role as guidelines to position information systems so that they are operated in accordance with organizational objectives and run with maintained responsibility and security. In the context of information systems, standards aim to provide consistency, reliability, and system integration, while codes of ethics focus on ap propriate behavior in the context of technology and information usage (Rainer et al., 2020).

From an information systems perspective, the existence of standards becomes one of the important keys in carrying out system development, data processing, and system usage in accordance with established rules and best practices. Rainer et al. (2020) explain that the implementation of standards in information systems plays a role in supporting organizations in maintaining data accuracy, system reliability, and operational efficiency. Standards also support system integration, especially when information systems are used across functions or connected through digital platforms.

In addition to standards, codes of ethics are another important element in maintaining human behavior related to the use of information systems. Codes of ethics are needed in an information system because of their role as guidelines for individuals in determining actions that are appropriate and accountable while using information systems. Ethical issues in information systems are generally related to the extensive use of data, including personal data, operational data, and organizational data. Without structured ethical guidelines, the use of information has the potential to cause problems such as data misuse, security breaches, and decreased trust in the system.

The ethical principles emphasized in information systems are the responsibility of users and organizations in safeguarding information assets. Codes of ethics emphasize accountability, where each system user is responsible for the actions taken when interacting with information systems (Rainer et al., 2020) In practice, the implementation of standards and codes of ethics can be realized through information system usage policies, including data protection and the regulation of user access rights. These policies function as written guidelines that explain the boundaries and behaviors permitted in the use of information systems.

2.3.1 ISO 9241-210 Human-Centred Design

ISO 9241-210 Human-Centred Design is an approach used to design interactive systems by prioritizing users, with the aim of improving usability, effectiveness, efficiency, and user satisfaction in using the system. This approach emphasizes user needs, user characteristics, and the context of system use, so that the system designed not only functions technically but is also easy to use and aligned with users' operational needs.

In ISO 9241-210:2019, human-centred design is incorporated into user-oriented system development by integrating ergonomics and usability principles. This aims to improve the quality of interaction between humans and systems. This approach is intended to enhance system effectiveness and efficiency, improve user well-being, and reduce potential risks to user health and safety.

There are several main principles in human-centred design that serve as the foundation for system design. The first principle is that design must be based on an understanding of user needs, tasks, and the usage environment. This indicates that the system must be designed by considering who the users are, what goals are to be achieved, and the conditions of the operational environment. The second principle is that users should be involved throughout the design and development process, ensuring that the resulting system aligns with user needs. The third principle is that design should be driven by user-based evaluation, where user feedback is used to refine the system. The fourth principle is that the design process is iterative, meaning it is carried out repeatedly to achieve optimal design results. The fifth principle is that design must address the overall user experience, not only in terms of functionality but also comfort and ease of use. The final principle is that the design team should consist of multidisciplinary expertise to produce comprehensive solutions.

Another than principles, ISO 9241-210 also emphasizes the main activities in human-centred design, namely understanding the context of use, identifying user needs, producing design solutions, and evaluating the design. This ensures that the system being designed truly meets user needs and therefore must be conducted iteratively. In the context of application-based system design, this approach is very important to ensure that the application not only has complete features but is also easy to use, efficient, and capable of optimally supporting users' operational activities.

2.3.2 Standardization Basis and Hierarchy of Documented Information

In terms of developing the design for operational standards and work procedures, this study uses several systematic management frameworks. The framework adopted for the development of documented information serves to ensure the quality, systematic

structure, and consistency of documents. The standard used is the globally recognized international ISO standard, so that the management framework developed encourages company operations to be documented, consistent, and meet international standards.

ISO 9001:2015 is an international Quality Management System (QMS) standard that specifies the requirements of each organization on how to provide products and service consistently, in order to meet customer satisfaction and regulatory requirements. Rather than prescribing document formats, ISO 9001:2015 establishes the operational and documentation requirements that organization should achieve to ensure process consistency, traceability, continual improvement, and customer satisfaction. Clause 7:5 regarding documented information regulates the creation, updating, and control of documents to ensure the availability and ease of access to documents. This clause serves as the basis for designing the SOP and WI structure as well as a cloud-based archiving system to ensure the availability and security of operational data. Clause 8.5.1 also regulates the control of service provision implemented through the preparation of technical operational procedures to ensure the services provided are controlled. In addition, traceability is also regulated in Clause 8.5.2 to ensure that each order has a distinct identity (order ID) that is standardized in the digital system, to facilitate status tracking and structured document storage. ISO 9001:2015 define what documented operational controls should exist, while the actual design and organization of those documents are guided by ISO 10013 ans EPA QA/G-6.

ISO 10013:2021 provides technical guidelines for the development, maintenance, and control of documented information. This standard defines a hierarchical document structure, that organization need to classify documents according to their level of detail and operational purpose. Standard operating procedures (SOP) are positioned as procedure-level documents that regulate end-to-end operational worlkflows within certain scope, involving multiple functional roles, responsibilities, decision points, and process interactions. Meanwhile, Work Instructions (WI) are positioned as task-level documents that provide a more detailed technical guidance for individual activities performed by single actor. Each WI functions as a supporting document derived from its corresponding SOP, ensuring that every operational step is executed consistently and in accordance with the overall business process. ISO 10013:2021 also recommends that documented information should be standardized in terms of document identification, version control, reference, focument structure, and traceability to ensure consistency throughout the organization. This standardized hierarchy also establishes clear relationships between SOPs and their supporting Wis, enabling operational activities to

be documented systematically while minimizing ambiguity and overlapping responsibilities.

The Guidance for Preparing standard operating procedure (EPA QA/G-6) is a standard that provides a practical recommendation for designing clear, consistent, and effective SOP. EPA QA/G-6 focuses on the organization, readability, and usability of procedural documents to ensure that operational activities can be performed consistently by different personnel. This document emphasizes the use of concise, active, and unambiguous language to avoid misinterpretation by users. EPA recommends SOP to include document identification, purpose, scope, responsibilities, reference, terminology, and the technical procedures. This study adopted the writing structure according to EPA QA/G-6, all SOP developed in this study will adopt standardized header as document identity, preliminary information, swim lane procedure, input, output, actor, time standard, and remarks.

The American National Standards Institute (ANSI) and Business Process Model and Notation (BPMN) provide guidance on the use of standardized graphical symbols to model business processes. The use of symbols according to these standard references ensures that the procedural flow visualized in the SOP is universally understood. This standard is used as a reference in compiling swim lane flowcharts which function as visualizations of technical procedures in SOP documents.

Overall, the four standards were adopted as complementary references rather than overlapping guidelines. ISO 9001:2015 establishes the quality management requirements that operational processes should achieve. ISO 10013:2021 provides guidance for documented information structure and control within the QMS. While EPA QA/G-6 specifies the recommended structure and writing approach for developing practical and user-friendly SOP. ANSI/BPMN take roles to standardizing the visual representation or workflows through universal flowchart symbols. The integration of these standards ensures that the documented information developed in this stucy is not only compliant with quality management principles, but also systematic, consistent, practical, and easy to implement in actual daily operations.

2.3.3 SMART Criteria as KPI Formulation Standard

SMART KPI Framework provides a structured methodology for designing and validating individual performance indicators by evaluating each KPI against five criteria: Specific, Measurable, Attainable, Relevant, and Time-bound (Ishak et al., 2019). The goal of this framework is to ensure each indicator is precisely defined, can be measured quantitatively, realistic towards available resources, relevant to operational objectives,

and subject to a clearly defined evaluation period. SMART KPI framework, if well designed, could increase motivation, engagement, and accountability while fostering communication and collaboration within the organization (Ishak et al., 2019).

Setiawan and Purba (2020) explained that KPI based performance measurement has been widely implemented in various types of organizations and can support continuous performance monitoring. This indicates that the KPI are not only used as reporting tools, but also as managerial instruments to control, evaluate, and improve organizational processes. The effectiveness of KPI depends on how the indicators are formulated. Van de Ven et al. (2023) stated that research on KPI is often “dispersed and lack of clarity”, which shows the importance of having a systematic basis for defining and selecting indicators.

In this study, SMART criteria are used as a standard reference for KPI formulation. Consist of five criteria: Specific, Measurable, Attainable, Relevant, and Time-bound, SMART ensure the indicators used in KPI are relevant and could actually measure the output from evaluated system. Specific ensure KPI must clearly define the object or process being measured. Measurable means that the KPI must have a quantifable formula, data source, and calculation method. Attainable ensure that the target is realistic based on the available resources and system capability. Relevant means that the KPI must directly support the project objective. Meanwhile Time-Bound manage that KPI must have a defined monitoring frequency or evaluation period.

The relevance of SMART criteria in KPI formulation is supported by Bigwanto et al. (2024), who developed SMART based KPI to measure the effectiveness of lean implementation. Their study emphasizes that clear and measurable KPI are necessary to evaluate process improvement effectiveness. SMART criteria can be applied as a formulation standard to ensure that the KPI developed in this project are not only theoretically relevant, but also practically measurable. The framework used to classify KPI perspectives is the Balanced Scorecard, while SMART is used to assess the quality and feasibility of each KPI. This distinction is important because the Balanced Scorecard determines the performance dimensions, whereas SMART ensures that each selected indicator can be operationalized into a clear formula, target, data source, monitoring frequency, and responsible actor.