Asian Journal of Management Analytics (AJMA)
Vol. 5, No. 1 2026: 21-42

# Designing an Elastic-Logistics-Oriented Fleet Management System for Petralog Using a Design Thinking Approach

Fajar Irvan Setyawan[1*], Astri Ghina[2]
School of Economics and Business Telkom University
**Corresponding Author:** Fajar Irvan Setyawan setyawan.firvan@gmail.com

ARTICLEINFO

*Keywords:* Design Thinking, Elastic Logistics, Fleet Management, User Experience, UEQ-S

*Received : 14, September*
*Revised : 16, November*
*Accepted: 18, January*



ABSTRACT

The logistics sector in Indonesia contributes significantly to national GDP yet suffers from structural inefficiencies including low truck utilisation, manual fleet management, and fluctuating operational demand. Petralog, a regional logistics provider, faces similar issues, especially in coordinating internal and external fleets under elastic logistics practices. This study develops a high-fidelity Fleet Management System (FMS) prototype using the Design Thinking framework to address operational pain points and enhance efficiency. Qualitative insights were collected from six stakeholders, followed by prototype evaluation using the UEQ-S and Microsoft Clarity analytics. Results indicate high user acceptance, with a performance score of 84/100 and no rage clicks detected. UEQ-S benchmarking places the prototype within the "Excellent" category (top 10%), reflecting strong pragmatic quality (2.50) and hedonic quality (1.90).

DOI prefik: https://doi.org/10.55927/ajma.v5i1.15912
ISSN-E: 2963-4547
https://journal.formosapublisher.org/index.php/ajma

## INTRODUCTION

The logistics sector plays a pivotal role in supporting national economic growth, particularly in emerging economies such as Indonesia. Over the past decade, the expansion of digital commerce, regional distribution networks, and transportation infrastructure has increased the need for efficient logistics and fleet operations. However, despite its strategic importance, the Indonesian logistics ecosystem continues to face structural inefficiencies that hinder overall performance. According to recent macroeconomic analyses, logistics costs in Indonesia are estimated to reach 23–25% of GDP—significantly higher than regional peers such as Malaysia and Thailand—highlighting persistent issues related to transportation, scheduling, and fleet utilisation (Sari & Sutopo, 2021). These inefficiencies place upward pressure on operational expenses and reduce competitiveness in the global supply chain.

One of the most critical issues in Indonesian logistics is the low utilisation rate of commercial trucking fleets. Multiple studies confirm that trucks in Indonesia operate only around 35–45% of their optimal capacity, far below global benchmarks (Kurniawan et al., 2022). A key contributor to this inefficiency is the prevalence of empty backhaul trips, with 60–80% of vehicles returning without cargo—an operational pattern that significantly inflates fuel, labour, and maintenance costs (Hidayat & Wicaksono, 2023). Limited digital integration between shippers, logistics providers, and independent truck operators further exacerbates this issue by making it difficult to match real-time supply and demand in transport services. As a result, many logistics operations continue to rely on manual coordination, creating bottlenecks that slow down decision-making and increase error rates.

The volatility of demand for logistics services also contributes to operational challenges. Small and medium enterprises (SMEs) in Indonesia often experience unpredictable order volumes influenced by seasonal fluctuations, consumer trends, and regional supply conditions. Research indicates that logistics providers handling SME clients must frequently adjust fleet capacity on short notice, yet many lack the digital tools needed to support elastic scaling (Putri et al., 2023). This mismatch between demand variability and limited resource planning capability underscores the need for systems that support elastic logistics—a model in which operational capacity dynamically expands or contracts in response to real-time fluctuations (Rahman & Herawati, 2023). Elastic logistics relies heavily on integrated data flows, digital automation, and multi-stakeholder coordination to maintain service consistency and cost-efficiency.

Another challenge arises from fragmented communication across logistics stakeholders, including internal staff, external vendors, and drivers. Studies reveal that communication conducted through multiple platforms—such as WhatsApp, email, spreadsheets, and manual documentation—creates inconsistencies in order information and increases administrative workload (Sentosa & Wijaya, 2022). When operational teams must constantly cross-check delivery orders, schedules, and driver availability, the resulting cognitive load contributes to errors, delays, and reduced productivity. These pain points highlight the need for integrated fleet management solutions capable of centralising real-time data, automating routine processes, and providing clear visibility across operational workflows.

Digitalisation has emerged as one of the most promising solutions for addressing inefficiencies in logistics operations. Recent studies emphasise that digital transformation in transportation management—particularly in fleet scheduling, route optimisation, and driver coordination—can reduce operational costs by up to 30% and improve on-time delivery rates (Mulyani et al., 2021). Innovations such as cloud-based fleet management systems (FMS), IoT-enabled tracking devices, and digital order management platforms have shown significant potential in modernising logistics workflows. However, despite technological advancements, many logistics companies—especially SMEs and regional operators—struggle to adopt digital systems due to limited financial resources, low digital literacy, and the lack of user-centred design in available solutions (Tampubolon & Hutagalung, 2023).

Most commercially available fleet management systems are designed for large logistics enterprises with fully owned fleets and established digital infrastructures. Consequently, these systems are often not aligned with the operational realities of companies that rely heavily on external drivers, subcontractors, or hybrid fleet models. A recent study notes that many FMS products focus predominantly on vehicle tracking and fuel efficiency, while offering limited features for vendor management, elastic capacity planning, or manual-to-digital workflow transition (Lim & Abdullah, 2020). This misalignment results in poor adoption rates, as users find such systems too complex, too rigid, or insufficiently relevant to their daily operational tasks.

This gap demonstrates the importance of adopting a user-centered design methodology in the development of logistics technologies. Design Thinking has gained traction as an effective framework for generating solutions tailored to stakeholder needs, enabling designers and researchers to understand user pain points, co-create solutions, and iteratively test prototypes for usability (Gao & Song, 2021). Its emphasis on empathy and human-centred problem definition is particularly valuable in logistics settings, where workflows involve diverse user groups such as managers, admin staff, drivers, and external vendors. Recent research in supply chain digitalisation shows that Design Thinking significantly improves system usability, user acceptance, and operational integration compared to traditional system development approaches (Marques & Gomes, 2022).

Moreover, empirical evidence indicates that the usability of digital tools directly influences operational efficiency in logistics environments. Systems with poor usability can increase task completion time, amplify cognitive burden, and negatively affect coordination between stakeholders (Pereira et al., 2023). User Experience (UX) evaluation instruments such as the User Experience Questionnaire—Short version (UEQ-S) offer reliable metrics for assessing pragmatic and hedonic quality, ensuring that prototypes not only function correctly but also support intuitive and seamless user interactions. Several studies demonstrate that integrating UX assessment into the system development lifecycle helps identify interaction bottlenecks early, reducing implementation risk and improving long-term adoption (Schrepp et al., 2022).

Given the challenges faced by logistics companies—particularly those with hybrid fleet models and fluctuating demand—there is a pressing need for fleet management solutions that are flexible, scalable, and deeply informed by user needs. Companies such as Petralog, which operate with a mix of internal trucks and external independent drivers, illustrate the growing relevance of elastic logistics and digital fleet coordination. The complexity of managing sudden demand spikes, allocating available vehicles, and synchronising communication with multiple stakeholders underscores the limitations of manual workflows. Without a digital system capable of integrating booking orders, fleet availability, driver assignment, and performance monitoring, such companies risk inefficiency, delays, and reduced service reliability.

The transformation of Indonesia’s logistics industry therefore requires not only technological adoption but also thoughtful system design grounded in user realities. A Design Thinking-driven development of a fleet management system has the potential to produce a solution that is practical, intuitive, and adaptable to fluctuating operational contexts. By combining insights from logistics research, user experience evaluation, and elastic logistics theory, this approach enables the creation of a high-fidelity prototype tailored to the needs of SMEs and regional logistics operators. The incorporation of empirical usability assessment strengthens the validity of the resulting system and ensures its feasibility for real-world application.

In summary, the continued growth of Indonesia's logistics sector depends on addressing structural inefficiencies through digital innovation and user-centred system design. The academic and industrial literature from the past five years consistently underscores the need for integrated, adaptive, and intuitive digital solutions to support fleet management in environments characterised by fluctuating demand and hybrid fleet structures. Developing a fleet management system using a Design Thinking approach offers a strategic pathway to overcoming these challenges, bridging the gap between technological capabilities and user needs, and enhancing the overall effectiveness of logistics operations.

### *Problem Formulation*

Indonesia’s logistics sector continues to struggle with operational inefficiencies that hinder productivity and increase overall logistics costs. Despite the sector’s rapid growth, logistics companies particularly SMEs and regional operators still rely heavily on manual coordination processes to manage fleets, schedules, and driver assignments. These manual workflows introduce delays, errors, and fragmented communication, ultimately reducing service quality and limiting the ability to scale operations effectively (Sentosa & Wijaya, 2022). Moreover, fluctuating market demand requires logistics providers to adopt more adaptive operational models; however, traditional fleet management systems lack the flexibility required to support elastic capacity adjustments (Putri et al., 2023).

The low utilisation rate of trucking fleets remains a persistent issue, with studies reporting that Indonesian trucks frequently operate under capacity and experience high rates of empty backhaul trips (Hidayat & Wicaksono, 2023). This phenomenon is exacerbated by poor data integration between logistics firms, shippers, and external vendors, making it difficult to synchronise real-time fleet availability with incoming orders. As a result, companies such as Petralog which depend on both internal vehicles and external partner drivers face significant challenges when matching fluctuating order volumes with limited fleet resources.

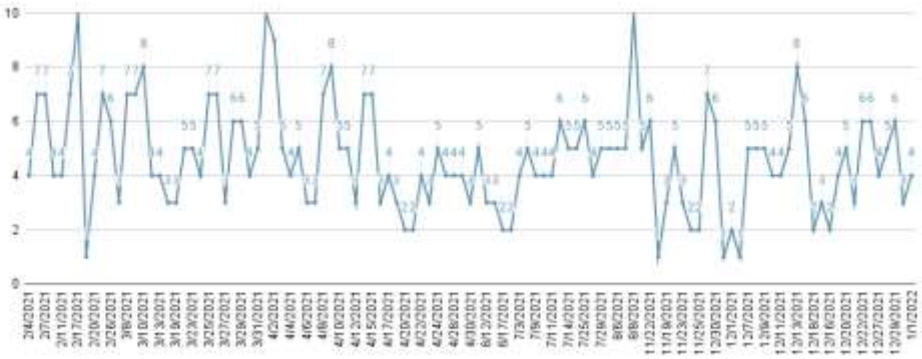

**Figure 1. Fluctuation of Fleet Demand at Petralog (2021–2022)**
*Source: Author's Processed Data (2025)*

The data illustrates the high volatility of order volumes, ranging from 1 to 10 units per day, necessitating an elastic logistics approach.

Furthermore, administrative staff often perform repetitive tasks across multiple disconnected platforms, such as messaging apps, spreadsheets, and manual documentation. This fragmented workflow increases cognitive load, reduces efficiency, and heightens the risk of data inconsistency (Tampubolon & Hutagalung, 2023). The absence of a centralised digital platform to integrate order management, driver assignment, and performance monitoring creates additional operational burdens, particularly when responding to daily fluctuations in service demand.

In recent years, digital transformation in logistics has emphasised the importance of user-centered system development to address these operational gaps (Marques & Gomes, 2022). However, existing fleet management solutions on the market often focus on GPS tracking and fuel efficiency—features more suited to large enterprises—while neglecting the needs of SMEs and hybrid-fleet operators who require a more flexible, intuitive, and scalable system. Many available systems fail to address real user pain points because they are not designed using human-centered methodologies, resulting in poor adoption and ineffective implementation (Gao & Song, 2021).

Given these conditions, logistics providers urgently require a digital solution that:

1. Captures real operational needs across different user roles.
2. Accommodates fluctuating demand through elastic logistics principles.
3. Reduces administrative complexity.
4. Improves coordination between internal teams and external drivers.

However, the absence of a structured, user-centered approach to designing a fleet management system creates a gap in aligning technological capability with real-world user requirements.

Based on these challenges, the problem formulation of this research can be defined as follows:

1. How can user needs across multiple stakeholders (administrators, managers, operations staff, and external drivers) be accurately identified and translated into system requirements for a fleet management platform operating under elastic logistics conditions?
2. What are the core operational problems experienced in Petralog's current manual fleet management process, and how can these problems be reformulated into clear design requirements through the Define stage of Design Thinking?
3. What types of solution concepts can be generated under the Ideation stage to address inefficiencies in order processing, fleet allocation, communication, and reporting?
4. How can a high-fidelity prototype of a Fleet Management System be developed to support elastic logistics, and what essential features must it include to improve operational effectiveness?
5. How suitable and effective is the developed prototype in meeting user needs, as evaluated through usability and user experience testing using UEQ-S and interaction analytics?

## LITERATURE REVIEW

The theoretical foundation for this study integrates concepts from logistics management, elastic logistics, fleet management systems, digital transformation, human-centered design, and user experience evaluation. These theories collectively frame the development of a Fleet Management System (FMS) tailored to the dynamic operational environment of SMEs such as Petralog. The following subsections synthesise relevant theoretical constructs and empirical findings from recent research published within the last five years (2020–2025).

### *Logistics Management and Operational Efficiency*

Logistics management encompasses the planning, implementation, and control of the flow of goods, services, and information within the supply chain. Recent studies emphasise that logistics performance is increasingly tied to digital capability, real-time visibility, and coordination across multiple stakeholders (Sari & Sutopo, 2021). The rise of e-commerce and regional distribution demands has placed additional pressure on logistics providers to improve reliability, reduce lead times, and enhance operational transparency.

Operational efficiency in logistics is measured through indicators such as vehicle utilisation, order cycle time, loading accuracy, and delivery reliability. Inefficiencies often arise from fragmented communication, manual data processing, and limited technological integration (Hidayat & Wicaksono, 2023). These challenges are particularly pronounced among SMEs, which frequently rely on hybrid fleets and manual coordination tools that lack scalability. Therefore, logistics systems grounded in digital automation and integrated data flows are necessary to support more efficient decision-making and resource allocation.

*Elastic Logistics Theory*

Elastic logistics refers to the ability of logistics systems to dynamically adjust operational capacity in response to fluctuating demand. This concept draws from broader theories of operational agility and scalability, where flexibility is essential for managing demand volatility and unpredictable market conditions (Rahman & Herawati, 2023). Elastic logistics applies the principles of elasticity traditionally used in computer science and cloud computing to physical logistics systems, allowing operations to scale up or down without compromising cost-efficiency or service levels.

Key characteristics of elastic logistics include:

1. **Scalability** – The ability to rapidly deploy additional resources (e.g., trucks, drivers, warehouse space) during demand spikes.
2. **Variability management** – Adjusting fleet capacity according to daily, weekly, or seasonal fluctuations.
3. **Interoperability** – Coordinated workflow between internal fleets and external vendors.
4. **Digital responsiveness** – Utilising real-time systems to monitor, predict, and coordinate fluctuations.

Research shows that organisations that adopt elastic logistics strategies are more resilient during disruptions and achieve higher resource utilisation (Putri et al., 2023). This framework is highly relevant for SMEs like Petralog, where fleet capacity is not fixed and must adapt to volatile order volumes.

*Fleet Management Systems (FMS)*

A Fleet Management System is a digital platform designed to coordinate, monitor, and optimise vehicle operations. Traditional FMS models typically include modules for vehicle tracking, maintenance scheduling, fuel monitoring, and route optimisation (Lim & Abdullah, 2020). However, recent research highlights the need for next-generation FMS platforms that are adaptive, user-friendly, and suitable for hybrid fleets involving external drivers and subcontracted vendors.

Modern FMS solutions build upon three core theoretical constructs:

a. Real-Time Data Integration
   Fleet operations rely on timely and accurate data regarding vehicle availability, driver status, order progress, and traffic conditions. Research indicates that integrating such data significantly improves decision-making and reduces coordination errors (Kurniawan et al., 2022).
b. Workflow Automation
   Automation of routine tasks—such as creating booking orders, assigning drivers, and generating reports—reduces administrative workload and improves accuracy. Automation is theoretically grounded in business process management and digital operations theory (Mulyani et al., 2021).
c. Visibility and Transparency
   Visibility frameworks emphasise providing stakeholders with accessible information to support coordination and accountability. For SMEs, visibility enhances vendor relations and reduces communication delays (Sentosa & Wijaya, 2022).

Existing FMS products tend to focus primarily on GPS and telematics, leaving gaps in administrative functions and multi-stakeholder coordination. This study positions FMS development within a broader operational and user-centered context to address these gaps.

***Digital Transformation and Logistics Technology Adoption***

Digital transformation in logistics is supported by theories of organisational change, technological readiness, and innovation diffusion. In the past five years, scholars have increasingly linked digital adoption with competitive advantage in logistics, particularly through improvements in process efficiency and customer service (Tampubolon & Hutagalung, 2023).

Digital transformation theories emphasise:

a. **Technological enablers** (cloud systems, mobile apps, AI-driven analytics).
b. **Organisational capabilities** (employee readiness, digital culture).
c. **Process redesign** (shifting from manual workflows to digital workflows).
d. **User adoption behaviour** (perceived ease of use and usefulness).

SMEs face unique barriers in technology adoption due to financial constraints, limited IT capacity, and low digital literacy. Therefore, solutions must be affordable, intuitive, and tailored to their workflow complexity. Theoretical contributions in this space justify the use of user-centered methodologies to bridge the gap between technological capability and operational reality.

*Design Thinking as a Human-Centered Innovation Framework*

Design Thinking is a structured, human-centered methodology for problem solving. As a holistic approach, Design Thinking helps organizations drive innovation and growth, specifically by resolving complex, ambiguous, and unclear problems (Ghina & Afifah, 2021). It consists of five phases: Empathize, Define, Ideate, Prototype, and Test. The theoretical foundation of Design Thinking lies in participatory design, cognitive psychology, and creative problem-solving (Gao & Song, 2021).

a. Empathy Theory
   This stage draws from ethnographic research, emphasising the need to understand user pain points, motivations, and operational challenges. Empathy enables designers to uncover hidden needs that traditional analytical methods might overlook.
b. Problem Definition Theory
   In the Define stage, frameworks such as Point-of-View (POV) and How-Might-We (HMW) help refine complex operational issues into actionable design statements.
c. Ideation Theory
   Ideation is grounded in divergent thinking and creativity theory. It aims to generate multiple solution possibilities without premature judgment.
d. Prototyping and Iterative Testing
   Prototype development draws on rapid experimentation principles, while the Test phase relies on usability and UX evaluation to refine the solution.

Recent research validates Design Thinking as an effective method for digital transformation in logistics, improving technology adoption and aligning systems with real operational needs (Marques & Gomes, 2022).

*User Experience (UX) Theory and the UEQ-S Framework*

User Experience (UX) theory focuses on how users perceive and interact with digital systems. UX encompasses pragmatic quality (task effectiveness and efficiency) and hedonic quality (aesthetic appeal, stimulation, satisfaction). According to cognitive load theory, poorly designed interfaces increase mental effort and reduce user performance (Pereira et al., 2023).

The **User Experience Questionnaire – Short Version (UEQ-S)** is a validated instrument used to measure UX along two scales:

1. **Pragmatic Quality** – Effectiveness, clarity, and task support
2. **Hedonic Quality** – Enjoyment, engagement, and appeal

The UEQ-S theoretical foundation is based on bipolar semantic differential scales and modern UX benchmarking. Schrepp et al. (2022) demonstrate that UEQ-S provides reliable UX measurements with reduced testing time, making it suitable for system prototypes.

In logistics technology evaluation, UX theory is essential because system usability strongly influences adoption and long-term effectiveness. A fleet management system must reduce complexity, minimise errors, and deliver intuitive workflows to ensure that both internal staff and external drivers can use it effectively.

***Theoretical Integration in This Study***

The theoretical lenses above converge to inform the design and evaluation of an elastic-logistics-oriented FMS:

a. **Logistics management theory** explains operational inefficiencies and the need for digital coordination.
b. **Elastic logistics theory** provides the conceptual basis for designing a system that supports fluctuating fleet capacity.
c. **Fleet management theory** guides the functional architecture of the system.
d. **Digital transformation theory** situates the need for accessible, SME-friendly digital tools.
e. **Design Thinking theory** ensures the solution reflects real user needs and operational contexts.
f. **UX and UEQ-S theory** provide a methodological foundation for evaluating system usability and user experience.

Together, these theories form a comprehensive framework supporting the development of a high-fidelity prototype and validating its relevance and usability within a logistics SME environment.

**METHODOLOGY**

This study employs an Exploratory Sequential Mixed Methods design, a methodological approach that begins with qualitative exploration before proceeding to quantitative evaluation. The selection of this design is based on the need to deeply understand operational issues within logistics workflows—particularly those involving hybrid fleets and fluctuating demand—prior to developing and testing a digital solution. In contexts where user needs are complex, highly contextual, and insufficiently explained by existing literature, the Exploratory Sequential approach allows researchers to build a grounded understanding that informs system design in a structured and systematic manner. Qualitative insights are therefore essential as the foundation for the development of a prototype that is later validated through quantitative assessment.

The study integrates this mixed-method strategy with the Design Thinking framework, which serves as the guiding structure for solution development.

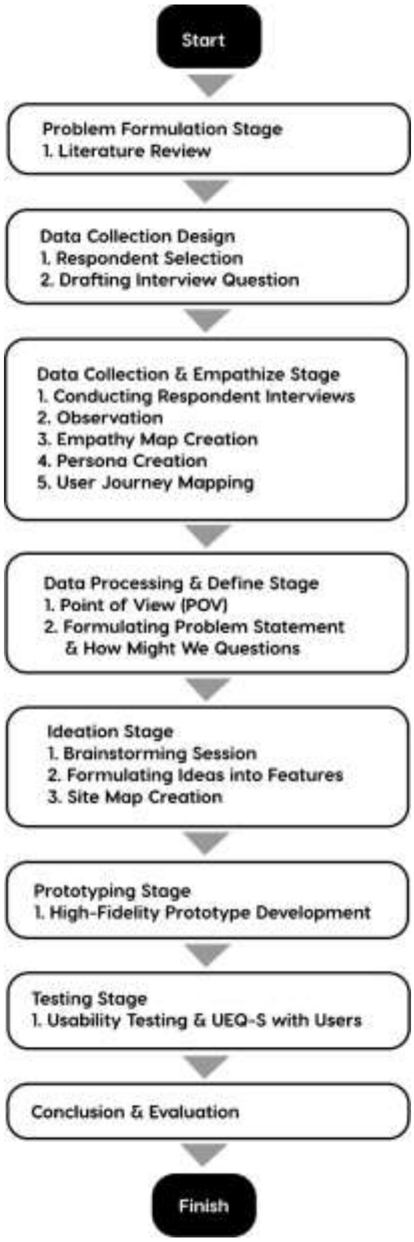


**Figure 2. Research Methodology Flow**
*Source: Author's Processed Data (2025)*

The process integrates qualitative exploration (Empathize & Define) with quantitative validation (Prototype & Test). Design Thinking is a human-centered innovation methodology consisting of five iterative stages: Empathize, Define, Ideate, Prototype, and Test. Each stage plays a critical role in uncovering user challenges, transforming insights into actionable problem statements, generating creative solution concepts, and ultimately producing a high-fidelity prototype that aligns with real operational needs.

The research begins with the Empathize stage, where rich qualitative data is collected through semi-structured interviews and observational inquiry involving six participants directly engaged in logistics operations. These include operations staff, administrative personnel, managers, and external vendors or drivers. The intention at this stage is to situate user experiences within their real working environments, allowing the researcher to identify pain points such as communication fragmentation, manual data duplication, booking-order inefficiencies, and challenges in coordinating internal and external fleets. These early findings are organised using user personas, empathy maps, and journey mapping to reveal hidden frustrations and systemic barriers that are not immediately observable through quantitative metrics alone.

Subsequently, the study advances to the Define stage, where insights gathered during empathy work are synthesised into clear and structured problem representations. Tools such as Point-of-View (POV) statements and How-Might-We (HMW) questions are applied to convert broad observations into focused design challenges. These refined problem formulations are critical because they bridge the gap between raw qualitative data and practical system requirements. Without this step, the development of a digital fleet management solution risks becoming misaligned with the actual workflow complexities faced by users.

The Ideate stage follows, during which multiple solution concepts are generated through creative exploration and brainstorming. At this point, the research seeks to generate a wide range of potential features and approaches without prematurely evaluating them. The ideas produced during ideation are later prioritised based on feasibility, relevance, and their potential to address core operational problems identified earlier. These concepts eventually coalesce into the functional architecture of the Fleet Management System, which includes modules for order management, fleet assignment and vendor coordination, and analytical dashboards for performance monitoring.

Building on these conceptual designs, the Prototype stage involves constructing a high-fidelity digital prototype using Laravel framework. The prototype simulates real logistics workflows such as creating and editing delivery orders, assigning vehicles, collaborating with external drivers, tracking delivery progress, and generating printable documents. The use of a high-fidelity prototype ensures that users interact with an interface that closely resembles the intended final system, thereby enabling more accurate usability evaluations during the testing phase.

The Test stage operationalises the quantitative component of the mixed methods design. Users engage with the prototype in task-based scenarios that reflect their daily operations. To objectively assess system performance and user experience, two instruments are employed. The first is the User Experience Questionnaire – Short Version (UEQ-S), a validated tool designed to measure both pragmatic and hedonic qualities of digital interfaces. UEQ-S produces numerical scores and benchmark classifications that allow the researcher to determine the extent to which the prototype supports task clarity, efficiency, satisfaction, and engagement. The second instrument is Microsoft Clarity, a behavioural analytics platform that records interaction patterns such as navigation flows, click distribution, cursor movements, and the presence or absence of rage clicks. These behavioural insights reveal interaction challenges that may not emerge through self-reported questionnaires, providing a richer and more objective understanding of usability.

Participants for both qualitative and quantitative phases are selected using purposeful sampling, ensuring that all individuals are directly involved in logistics operational processes. This sampling method aligns with Nielsen's usability principle, which states that meaningful insights can be obtained from as few as five users during formative testing. The deliberate inclusion of diverse roles ranging from administrators to external drivers—ensures that the system is evaluated from multiple operational perspectives.

The analysis of collected data also reflects the mixed-method nature of the research. Qualitative data is analysed through thematic coding to identify recurring patterns and categories, which later inform the refinement of prototype features. Quantitative data from UEQ-S is processed by calculating mean values for each item, converting them into two aggregated scale scores, and comparing the results with international benchmarking datasets. Meanwhile, Microsoft Clarity metrics provide visual and statistical insights that help diagnose usability issues and guide iterative improvements.

To ensure the validity and reliability of the research, several methodological safeguards are implemented. Triangulation between qualitative findings and quantitative evaluations strengthens overall credibility, while consistent interview protocols, standardised task instructions, and automated analytics contribute to reliability. Ethical considerations are also addressed through informed consent, the anonymisation of participant data, and the exclusion of sensitive operational information.

**RESEARCH RESULT**

The purpose of this study was to design and evaluate a Fleet Management System (FMS) prototype tailored for elastic logistics operations within a small-to-medium logistics enterprise (Petralog). Through the Design Thinking framework, the research explored user needs, operational challenges, and opportunities for digital innovation in logistics workflows. The results of the Empathize, Define, Ideate, Prototype, and Test stages provide an integrated understanding of how digital tools can address prevalent inefficiencies and improve coordination in hybrid fleet environments. This section presents the findings of each phase along with a critical discussion informed by recent scholarly literature (2020–2025).

### *Empathize Stage Findings*

The qualitative exploration involving six participants revealed a set of operational pain points that significantly hindered workflow efficiency. Users reported heavy reliance on manual documentation—primarily spreadsheets, messaging applications, and printed forms—to manage daily bookings and driver coordination. This fragmented approach resulted in delays, duplicated data entry, inconsistent delivery order (DO) records, and frequent miscommunication between internal staff and external drivers. These findings align with Sentosa and Wijaya (2022), who highlight communication fragmentation as a major source of inefficiency in Indonesian logistics operations.

Another important finding was the unpredictability of daily order volumes. Petralog frequently experienced fluctuating demands, ranging from 1 to 10 orders per day, requiring rapid allocation of vehicles from both internal fleets and external vendors. Staff members indicated that existing manual allocation processes were slow and reactive, often leading to over-reliance on WhatsApp groups for last-minute driver sourcing. This operational pattern mirrors challenges described by Putri et al. (2023), who note that SMEs require flexible logistics strategies to adapt to market volatility but often lack the digital tools to support elastic capacity management.

Users also expressed cognitive overload due to the necessity of managing multiple channels simultaneously—order sheets, phone calls, WhatsApp messages, and handwritten delivery slips. The absence of integrated visibility contributed to high error rates in DO creation, delays in confirming driver availability, and difficulty tracking deliveries once dispatched. These insights underscore the need for an integrated FMS capable of supporting real-time coordination and reducing administrative burden.

### *Define Stage Results*

Insights collected from the Empathize phase were synthesised into structured problem definitions using Point-of-View (POV) statements and How-Might-We (HMW) questions. Three major problem clusters emerged:

1. Inefficient Order Creation and Tracking
   Users struggled to maintain consistent records for bookings and delivery orders due to manual entry and inconsistent formatting. Errors in DO numbers, addresses, and customer details were frequent.
2. Difficulty Coordinating Internal and External Fleets
   Communication with external drivers lacked transparency, often resulting in delays, misaligned expectations, and difficulty confirming vehicle availability.
3. Lack of Operational Visibility for Decision-Making
   Managers lacked a centralised dashboard to monitor performance indicators such as completed orders, active deliveries, or vendor contribution levels.

The Define stage revealed that operational inefficiencies were not solely technological but also procedural, stemming from the absence of a centralised digital system.

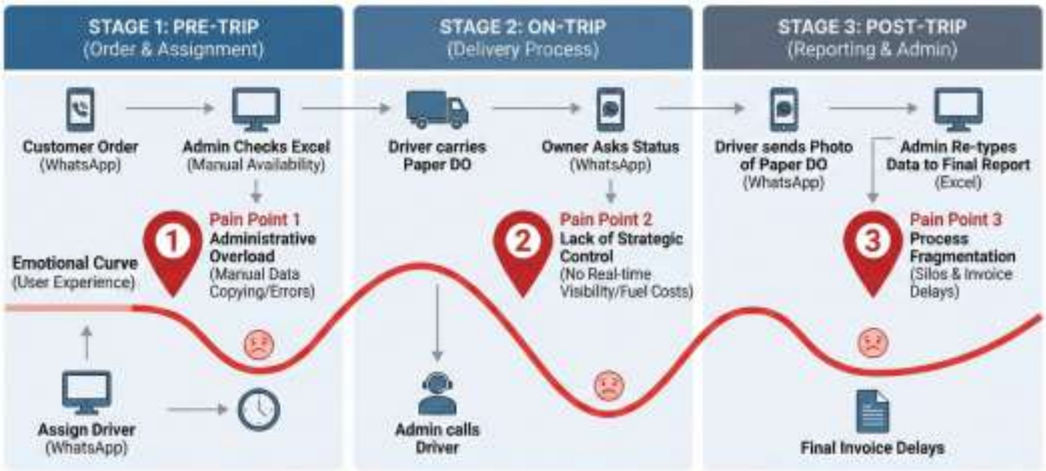


**Figure 3. User Journey Map: Manual Fleet Workflow & Paint Points**
*Source: Author's Processed Data (2025)*

Figure 3 summarizes the main operational pain points identified during the Empathize stage. These findings are consistent with the observations of Tampubolon and Hutagalung (2023), who argue that SMEs face integrated challenges combining low digital maturity and complex manual workflows.

**Ideation Outcomes**

The ideation workshops generated more than 40 solution concepts, which were then refined into three major system modules:

1. Order Management Module
   Automates booking and delivery order creation, standardises data fields, and enables users to store, edit, and retrieve DOs quickly.
2. Fleet Assignment and Vendor Coordination Module
   Allows staff to assign internal or external vehicles, notify drivers digitally, and track their availability.
3. Dashboard and Reporting Module
   Visualises operational metrics such as order volume, vendor usage, fleet allocation trends, and performance indicators.

These solution directions align with recent theoretical advancements in fleet management research, particularly the need for enhanced real-time data integration, workflow automation, and transparent visibility for operational decision-making (Kurniawan et al., 2022). Furthermore, the designed Order Management and Dashboard modules function as effective digital information bridges. This aligns with the findings of Noviaristanti et al. (2024) regarding the role of intermediaries as "knowledge brokers," where digital systems serve to connect previously fragmented network members and facilitate the efficient exchange of information and resources within the business ecosystem.

***Prototype Development and Features***

A high-fidelity prototype was developed using Laravel framework, replicating the system's planned interface and workflow. This approach was specifically chosen to simulate complex backend logic, such as the automated generation of PDF documents for delivery orders. Consequently, this allowed users to test the actual document workflow during the evaluation phase.

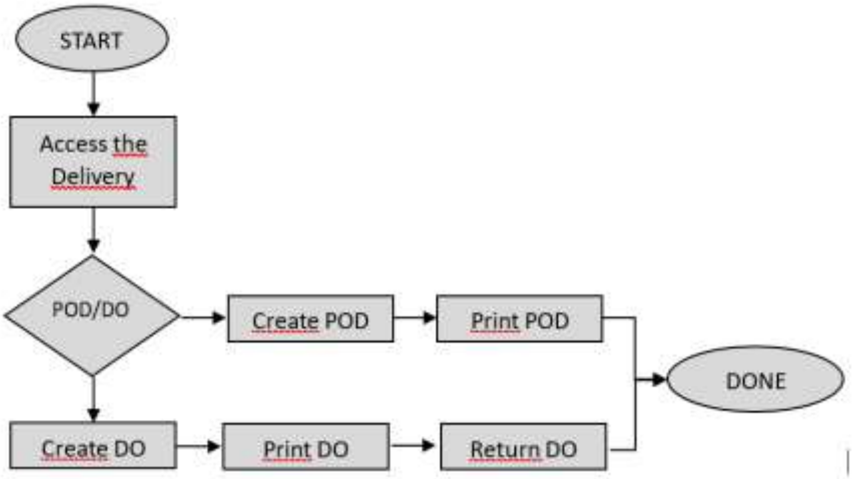


**Figure 4. User Flow Diagram for the Order Management Module**

*Source: Author's Processed Data (2025)*

This flow demonstrates the streamlined process from order input to automated document generation.The prototype consisted of interactive screens that simulated actual user tasks, including:

1. Creating and editing delivery orders
2. Assigning vehicles and drivers
3. Communicating job assignments to external drivers
4. Filtering and reviewing historical DO records
5. Viewing operational dashboards
6. Generating printable reports and documents

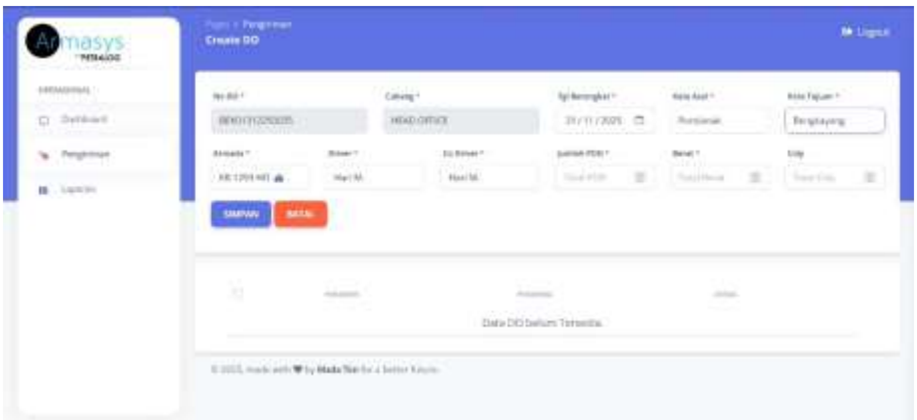

**Figure 5. Create Delivery Order Interface**

*Source: Author's Processed Data (2025)*

Figure 5 the high-fidelity prototype of the 'Create Delivery Order' interface. The design focuses on minimizing data entry errors through automated field population.

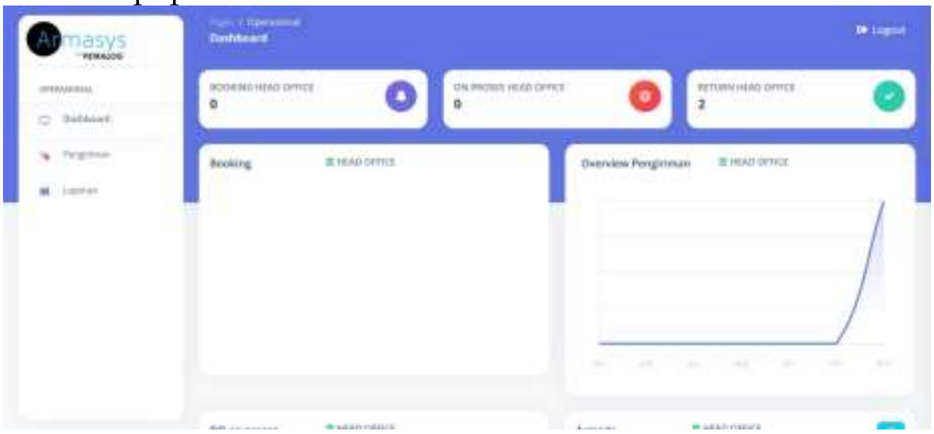

**Figure 6. Operational Dashboard Interface**

*Source: Author's Processed Data (2025)*

The Operational Dashboard prototype providing real-time visibility into fleet status and active orders. The prototype emphasized clarity, simplicity, and minimal cognitive load principles supported by UX literature indicating that intuitive design significantly improves system adoption and operational effectiveness (Pereira et al., 2023).

**Usability Evaluation: Microsoft Clarity Results**

Microsoft Clarity analytics provided objective behavioural insights on user interaction with the prototype. The system achieved a *Performance Score of 84/100*, indicating strong usability. Notably, *no rage clicks* were recorded, suggesting that users did not encounter unexpected interface behaviour or interaction barriers. Heatmaps and click tracking showed that users followed intended navigation paths with minimal deviations.

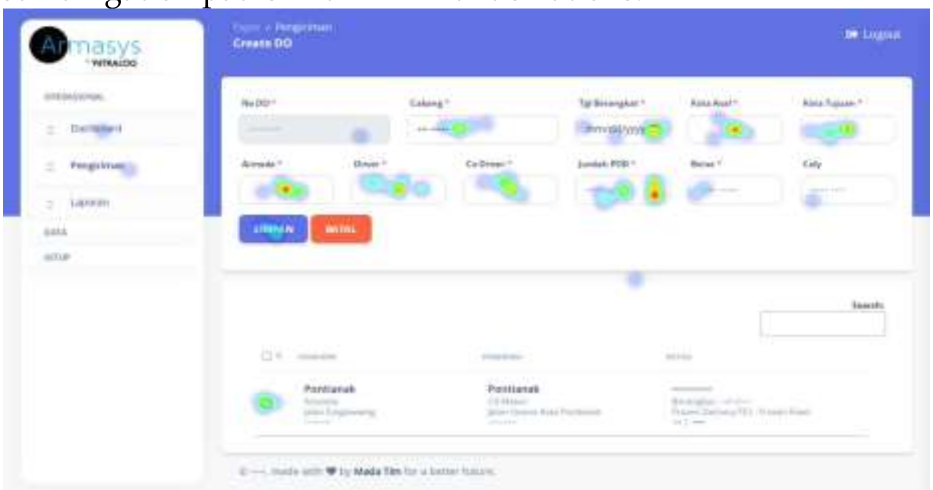

**Figure 7. Heatmap Analysis**

*Source: Author's Processed Data (2025)*

Figure 7 Heatmap analysis from Microsoft Clarity on the 'Create DO' page. The interaction patterns indicate focused navigation with no rage clicks recorded.

These results demonstrate strong initial usability and suggest that the interface design supports efficient task completion. Microsoft Clarity's metrics confirm that user interactions were smooth, predictable, and aligned with expected workflows-an important factor in reducing operational friction and improving digital adoption within logistics SMEs.

***User Experience Evaluation: UEQ-S Results***

The quantitative UX evaluation using UEQ-S revealed strong user satisfaction across both Pragmatic and Hedonic categories:

a. Pragmatic Quality Score: 2.50
b. Hedonic Quality Score: 1.90

**Table 1. Analysis Results of the User Experience Questionnaire (UEQ-S)**

| Rating Categories | Mean | Variance | Std. Dev |
|---|---|---|---|
| Pragmatic Quality *(Functions)* | 2,50 | 0,43 | 0,58 |
| Hedonistic Qualities *(Emotion & Appearance)* | 1,90 | 0,50 | 0,65 |
| *Overall (UX)* | 2,20 | 0,46 | 0,61 |

*Source: Author's Processed Data (2025)*

The scores indicate strong performance in both Pragmatic Quality (2.50) and Hedonic Quality (1.90).Based on UEQ-S benchmark data (Schrepp et al., 2022), the prototype ranks within the **"Excellent" category (Top 10%)** for digital system usability.

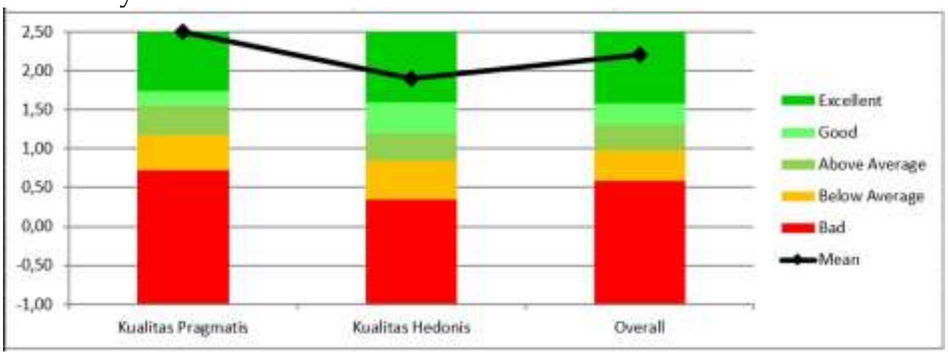


**Figure 8. Benchmarking Results**
*Source: Author's Processed Data (2025)*

The system ranks in the "Excellent" category compared to other products.Users reported that the interface was easy to navigate, visually appealing, and supportive of their workflow needs. These scores reflect a system that not only functions effectively but also provides a satisfying and engaging user experience.

Importantly, high hedonic scores indicate that users perceived the system as modern, enjoyable, and innovative—an important predictor of long-term system acceptance (Pereira et al., 2023). Meanwhile, the strong pragmatic score confirms that the system supports task efficiency, reduces cognitive burden, and aligns with operational processes.

## DISCUSSION

The findings demonstrate that applying the Design Thinking framework enables the development of a fleet management solution that directly addresses the operational challenges of SMEs experiencing fluctuating demand. Each stage of the process contributed unique insights essential for shaping the final prototype.

### *Addressing Operational Inefficiencies*

The prototype successfully responds to identified inefficiencies by integrating order management, fleet assignment, and reporting functions into a unified digital platform. This integration eliminates the fragmented communication previously conducted through WhatsApp, spreadsheets, and paper forms, thereby reducing administrative effort and improving data accuracy. This aligns with global trends advocating digitalisation as a means to streamline logistics processes and reduce operational costs (Mulyani et al., 2021).

### *Supporting Elastic Logistics*

The system's design supports elastic logistics principles by enabling rapid reassignment of fleets, visibility of vendor contributions, and efficient handling of fluctuating order volumes. This flexibility is essential for SMEs that operate in dynamic environments and rely on hybrid fleets—an operational model increasingly common in Southeast Asia (Putri et al., 2023).

### *Enhancing Usability through Human-Centered Design*

The positive results from UEQ-S and Microsoft Clarity indicate that the Design Thinking approach fostered a highly usable system. Human-centered design theories emphasise that solutions grounded in user context achieve higher adoption rates and long-term effectiveness (Gao & Song, 2021). The Excellent UX benchmark confirms that the prototype meets these criteria.

### *Contribution to Academic and Practical Knowledge*

The study contributes to the scholarly discourse on logistics digitalisation by demonstrating the value of integrating Design Thinking with mixed-method UX evaluation. It also offers a practical model that can be adopted or adapted by other SMEs seeking to digitalise fleet operations without investing in complex enterprise systems.

## CONCLUSIONS AND RECOMMENDATIONS

This study set out to design and evaluate a Fleet Management System (FMS) prototype specifically tailored to address the operational challenges experienced by small- to medium-sized logistics enterprises operating within elastic logistics environments. By employing an Exploratory Sequential Mixed Methods approach in combination with the Design Thinking framework, the research successfully identified core workflow inefficiencies, translated user needs into actionable design requirements, and produced a high-fidelity prototype that aligns with the dynamic nature of hybrid fleet operations.

The findings from the Empathize and Define stages revealed that fragmented communication, inconsistent documentation, manual data handling, and limited visibility across operational processes were significant contributors to inefficiency at Petralog. These challenges, widely echoed in contemporary logistics literature, underscored the necessity of a centralised digital platform capable of supporting fluctuating demand, rapid decision-making, and coordinated fleet assignment. Design Thinking proved instrumental in structuring these insights into clear problem statements and guiding the creative and evaluative processes that followed.

The resulting prototype integrates three essential modules—Order Management, Fleet Assignment and Vendor Coordination, and Operational Dashboards—which collectively streamline logistics workflows. Evaluation through Microsoft Clarity demonstrated strong usability performance, with users showing smooth interaction patterns and no rage clicks, indicating intuitive navigation and efficient task completion. Further validation using the User Experience Questionnaire – Short Version (UEQ-S) produced Excellent benchmark ratings in both pragmatic and hedonic dimensions, confirming that the prototype delivers clarity, functionality, and positive user engagement.

The results affirm that a human-centered design approach is highly effective in producing digital solutions that reflect real operational needs while remaining accessible to SMEs with limited technological infrastructure. The study also contributes to scholarly discussions on digital transformation in logistics by demonstrating the value of integrating qualitative exploration with quantitative usability testing in developing practical, user-oriented systems.

In conclusion, the FMS prototype developed in this research offers a viable foundation for improving operational efficiency, enhancing coordination across stakeholders, and supporting the adaptive capacity required in elastic logistics contexts. Future work may involve extending the prototype into a fully functional system, integrating real-time tracking, developing mobile applications for drivers, and conducting pilot testing within live operational environments. Such advancements would further solidify the system's potential to strengthen logistics performance and digital maturity within SMEs.

## ADVANCED RESEARCH

To further advance this study, future research should focus on developing the Functional High-Fidelity Prototype into a fully operational system using the Laravel framework. Additionally, the future development of smart tracking features should adopt the IoT product idea development approach proposed by Tricahyono and Ichwan (2024) to ensure more precise location data accuracy. These steps will ensure the system evolves from a validated design into a robust operational tool.

## REFERENCES

Creswell, J. W., & Creswell, J. D. (2021). Research design: Qualitative, quantitative, and mixed methods approaches. Sage Publications.

Gao, Y., & Song, X. (2021). Human-centered design thinking approach for digital innovation in logistics. Journal of Supply Chain Innovation, 12(3), 45–59.

Ghina, A., & Afifah, N. (2021). Value proposition design for custom clothing startup using design thinking approach. Jurnal Manajemen Indonesia, 21(1), 89.

Hidayat, A., & Wicaksono, R. (2023). Backhaul inefficiencies in Indonesian freight transport: A quantitative assessment. Transport and Logistics Journal, 9(2), 112–125.

Kurniawan, D., Hapsari, R., & Yanto, H. (2022). Improving truck utilization through digital fleet coordination: Evidence from Indonesian SMEs. International Journal of Logistics Systems, 18(1), 77–90.

Lim, S., & Abdullah, N. (2020). Limitations of traditional fleet management systems for hybrid fleet operations. Asian Journal of Transport Studies, 6(4), 221–235.

Marques, P., & Gomes, F. (2022). Applying Design Thinking in supply chain digital transformation: A systematic review. International Journal of Operations Research, 19(2), 140–158.

Mulyani, S., Hartono, B., & Widodo, A. (2021). Impact of digital transformation on transportation management efficiency: A case analysis. Journal of Digital Operations, 4(1), 33–47.

Noviaristanti, S., Acur, N., & Mendibil, K. (2024). The different roles of innovation intermediaries to generate value. Management Review Quarterly, 74, 2545–2577.

Pereira, L., Sousa, M., & Pinto, A. (2023). The role of UX quality in logistics software adoption. Journal of Human–Computer Interaction Systems, 15(2), 90–104.

Putri, A., Herlina, N., & Samosir, B. (2023). Elastic logistics strategy for SME resilience in dynamic markets. Indonesian Journal of Supply Chain Management, 7(1), 27–39.

Rahman, T., & Herawati, D. (2023). Elastic capacity planning in modern logistics operations. Asia-Pacific Journal of Logistics and Mobility, 5(2), 54–68.

Sari, E., & Sutopo, W. (2021). Structural inefficiencies and cost drivers in Indonesian logistics. Journal of Industrial Engineering & Management Systems, 9(3), 150–164.

Schrepp, M., Hinderks, A., & Thomaschewski, J. (2022). Advances in the short version of the User Experience Questionnaire (UEQ-S). Journal of Usability Studies, 17(4), 120–138.

Sentosa, F., & Wijaya, H. (2022). Communication fragmentation and administrative bottlenecks in logistics companies. Business Process Journal, 11(3), 88–101.

Tampubolon, J., & Hutagalung, M. (2023). Barriers to digital adoption among SME logistics providers in Southeast Asia. SME Digital Transformation Review, 8(2), 65–79.

Tricahyono, D., & Ichwan, N. (2024). The development of IoT product idea using design thinking method. International Journal of Innovation in Enterprise System, 8(1), 1–11.