CONTINUOUS IMPROVEMENT OF INTERNAL BUSINESS PROCESSES IN A FREIGHT-FORWARDING AND CONTRACT-LOGISTICS ORGANISATION

A Lean Six Sigma (DMAIC) Case Study of Transportation and Depot Process Re-Engineering and Governance Build-Out

A Business Case Study

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by

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Abstract

This thesis documents an end-to-end continuous-improvement (CI) project undertaken within the CEO Office of a freight-forwarding and contract-logistics group in Indonesia (hereafter, "the Company") during a period of organisational transformation. The Company operated without a formal Project Management Office (PMO), without standard operating procedures (SOPs), and without a performance-measurement system; core transportation and depot business processes were slow, inconsistent, and heavily dependent on individual knowledge. The purpose of the study was to systematically diagnose and improve these internal processes, and to institutionalise the improvements so that they would be sustained.

The project adopted the Lean Six Sigma Define–Measure–Analyse–Improve–Control (DMAIC) framework as its methodological backbone, integrated with Lean process analysis, business-process management, and structured change management. A mixed-methods case-study design combined document analysis, semi-structured interviews, direct observation, time-and-motion studies, and system-data extraction. Business-analysis techniques - stakeholder interviews, surveys, facilitated workshops, user stories, use cases, a requirements traceability matrix, and a product roadmap - were used to elicit and structure requirements. Diagnostic and analytical techniques included Voice-of-the-Customer analysis, SIPOC and Critical-to-Quality (CTQ) mapping, swimlane and value-stream mapping, descriptive statistics and process-capability analysis, Pareto analysis, cause-and-effect (Ishikawa) analysis, the 5-Whys, and value-added/non-value-added (VA/NVA) analysis. Solutions were generated using ECRS (Eliminate–Combine–Rearrange–Simplify) and benchmarking, prioritised with a weighted decision matrix and an impact–effort analysis, agreed among stakeholders through a structured decision-making process (expert judgment and participation, the Nominal Group Technique, Wideband Delphi, voting and fist-to-five consensus checks, multi-criteria decision analysis, and an Owner-Approver-Reviewers-Participants model), de-risked with Failure Mode and Effects Analysis (FMEA), and embedded through an SOP architecture, a RASCI accountability model, a cascaded KPI dashboard, and a formal governance cadence. Stakeholder engagement was planned with a Stakeholder Engagement Plan (SEP) and SEP matrix, motivation was tailored using McClelland's needs and Theory X/Y/Z, influence was managed with an influence diagram, and change adoption was carried through with the Prosci ADKAR model.

The redesigned process reduced the mean end-to-end cycle time of the target process by approximately 22 per cent (from 40.2 to 31.3 hours), reduced the rework rate from 14 to 5 per cent, increased on-time service-level attainment from 71 to 93 per cent, raised first-pass yield from 78 to 94 per cent, and lifted the estimated process sigma level from approximately 2.3 to 3.2. Twenty-plus SOPs were authored from a zero base, the Company's first legally registered Company Regulation (Peraturan Perusahaan) was secured, and a monthly governance and audit cadence was established to sustain the gains. The thesis contributes a replicable, resource-lean CI blueprint for small transforming organisations that lack a dedicated PMO or process-engineering function.

Keywords: continuous improvement; Lean Six Sigma; DMAIC; business process re-engineering; cycle-time reduction; governance; SOP; contract logistics.

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I am grateful to the executive leadership of the Company for the mandate and the trust to build its governance and process foundations from the ground up, and to the department heads, coordinators, drivers, and depot crews who generously shared their time and their frontline knowledge during interviews, observations, and workshops. I also thank the mentors and reviewers whose feedback strengthened the methodological rigour of this work. Any remaining errors are my own.

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List of Abbreviations

BPM — Business Process Management

BPR — Business Process Re-engineering

CI — Continuous Improvement

CTQ — Critical to Quality

DMAIC — Define–Measure–Analyse–Improve–Control

ECRS — Eliminate–Combine–Rearrange–Simplify

FMEA — Failure Mode and Effects Analysis

FPY — First-Pass Yield

KPI — Key Performance Indicator

LSS — Lean Six Sigma

NVA — Non-Value-Added

PMO — Project Management Office

PP — Peraturan Perusahaan (Company Regulation)

RASCI — Responsible-Accountable-Support-Consulted-Informed

RPN — Risk Priority Number

SIPOC — Suppliers-Inputs-Process-Outputs-Customers

SLA — Service-Level Agreement

SOP — Standard Operating Procedure

VA — Value-Added

VOC — Voice of the Customer

VSM — Value-Stream Mapping

BCR — Benefit-Cost Ratio

EVA — Economic Value Added

IRR — Internal Rate of Return

NPV — Net Present Value

PMIS — Project Management Information System

ROI — Return on Investment

ROIC — Return on Invested Capital

ROM — Rough Order of Magnitude

TVM — Time Value of Money

WACC — Weighted Average Cost of Capital

WBS — Work Breakdown Structure

BA — Business Analyst / Business Analysis

MVP — Minimum Viable Product

PO — Product Owner

RTM — Requirements Traceability Matrix

Chapter 1 Introduction

1.1 Background

Continuous improvement (CI) is the disciplined, never-ending pursuit of better organisational performance through the incremental and breakthrough enhancement of processes, products, and services (Imai, 1986; Bhuiyan & Baghel, 2005). In logistics and supply-chain organisations, where margins are thin and service promises are exacting, the quality and speed of internal business processes determine competitiveness as directly as the physical movement of goods. Slow approvals, unclear ownership, manual re-keying of data, and inconsistent execution translate quickly into longer lead times, higher cost-to-serve, and eroded customer trust.

The organisation studied in this thesis is a freight-forwarding and contract-logistics group operating in Indonesia (referred to throughout as “the Company” to preserve commercial confidentiality). At the time of the project the Company was undergoing a period of rapid transformation ahead of a corporate integration. It had grown operationally faster than it had matured administratively: it possessed neither a Project Management Office (PMO) nor documented standard operating procedures (SOPs), and it lacked any systematic measurement of process performance. Core transportation and depot handling processes had accreted organically, were executed differently by different people, and depended heavily on the tacit knowledge of a few experienced individuals. The author served in the CEO Office and was mandated to build the Company’s governance foundations and to improve its core operating processes.

This thesis presents that work as a structured, evidence-based continuous-improvement study. It follows the full arc of a professional process-improvement engagement — from the definition of the problem, through the collection and analysis of data, to the design, selection, implementation, and control of solutions — and it makes explicit the reasoning behind every methodological choice.

1.2 Organisational Context

The Company provides international freight forwarding together with domestic contract-logistics services, including warehousing, storage, and transportation across several operating sites. The unit of analysis for this study is the internal, end-to-end business process by which an inbound job is received, documented, cleared, planned, executed through the depot, and dispatched — hereafter the “target process.” This process was selected because it was cross-functional (touching commercial, operations, documentation, and finance), high-volume, and repeatedly cited by both staff and customers as a source of delay and rework.

Three contextual constraints shaped the entire project and are important to state at the outset. First, there was no PMO and no pre-existing process documentation, so the improvement effort had to build its own governance scaffolding as it went. Second, the project was led by a single practitioner without a dedicated team of process engineers, analysts, or a separate finance function, so techniques had to be resource-lean and executable by one person supported by departmental participants. Third, the Company owned little of its own physical infrastructure and relied on outsourced capacity, so improvements had to work across organisational boundaries and be enforceable through governance rather than direct control.

1.3 Problem Statement

Despite growing volumes, the Company’s target process was slow, variable, and error-prone. Preliminary observation indicated that the end-to-end cycle time frequently exceeded internal expectations, that a material share of jobs required rework because of missing or incorrect information, and that on-time completion against internal service-level expectations was inconsistent. Because no baseline metrics existed, the magnitude of the problem could only be asserted anecdotally. The absence of SOPs meant that even where good practice existed it was neither standard nor transferable, and the absence of KPIs meant that performance could be neither seen nor managed. In short, the Company could not answer three basic questions: how well is the process performing, why is it performing that way, and what would make it demonstrably better?

1.4 Research Questions

To convert this problem into an actionable inquiry, the study posed four research questions (RQs):

1. RQ1 — What is the current (baseline) performance of the target process, expressed in objective, quantified terms?
2. RQ2 — What are the root causes of the observed delays, rework, and variation?

3. RQ3 — Which improvement interventions will most effectively address those root causes given the Company's resource and governance constraints, and how should the choice be justified?
4. RQ4 — To what extent do the implemented interventions improve process performance, and how can the gains be sustained?

1.5 Aim and Objectives

The aim of the project was to design and institutionalise a measurable improvement in the Company's core internal business process. This aim was decomposed into the objectives shown in Table 1, each mapped to the research question it serves and to the primary methods used to achieve it.

Table 1. Research questions mapped to objectives and methods.

RQ	Objective	Primary methods
RQ1	Establish an objective performance baseline for the target process.	SIPOC, process mapping, time-and-motion study, system-data extraction, descriptive statistics, capability analysis
RQ2	Identify and validate the root causes of poor performance.	Pareto analysis, Ishikawa diagram, 5-Whys, VA/NVA analysis, hypothesis testing
RQ3	Design, prioritise, and de-risk improvement solutions.	ECRS, benchmarking, weighted decision matrix, impact–effort analysis, FMEA
RQ4	Implement, measure, and sustain the improvements.	Pilot, ADKAR change management, SOP/RASCI/KPI build, control plan, control charts, audit

1.6 Scope and Limitations

The study is bounded to the internal target process and to the Company's own controllable activities; it does not attempt to re-engineer the processes of external vendors beyond the interfaces the Company can specify and enforce contractually. The improvement horizon covers one full DMAIC cycle with an early sustainment period. Quantitative results are drawn from the Company's operational records and from primary time studies; where confidentiality prevents disclosure of absolute commercial figures, results are expressed as indexed changes or as representative values. As a single-organisation case study the findings are analytically rather than statistically generalisable, though the method is explicitly designed to be transferable.

1.7 Significance and Contribution

Much of the Lean Six Sigma literature assumes a resourced environment: a trained belt population, a functioning PMO, and reliable historical data. Small and rapidly transforming organisations rarely enjoy these preconditions. This thesis contributes a demonstrated, resource-lean CI blueprint that a single practitioner can execute in such an environment — one that builds the measurement and governance infrastructure as part of the improvement itself. It also offers a worked example, complete with the actual analytical artefacts, that can serve as a template for practitioners and students.

1.8 Structure of the Thesis

Chapter 2 reviews the relevant theory and positions the study. Chapter 3 sets out the research methodology and, importantly, the reasoning behind the selection of DMAIC and of each analytical tool. Chapters 4 to 8 present the five DMAIC phases in turn — Define, Measure, Analyse, Improve, and Control. Chapter 9 reports and discusses the results, and Chapter 10 concludes with answers to the research questions, recommendations, and directions for future work. Appendices provide the project charter, the SOP register, and sample data.

Chapter 2 Literature Review and Theoretical Framework

2.1 Continuous Improvement and Kaizen

Continuous improvement originates in the Japanese philosophy of kaizen — change (kai) for the good (zen) — popularised by Imai (1986) and embedded in the Toyota Production System. Its central premise is that sustainable competitive advantage arises not from occasional heroic projects but from a culture in which every process is treated as improvable and every employee as an improver. Bessant, Caffyn, and Gallagher (2001) frame CI as an organisational capability that matures through stages, from ad-hoc problem-solving to a fully embedded, strategy-linked routine. The Plan–Do–Check–Act (PDCA) cycle of Shewhart and Deming provides CI's elemental learning loop, and DMAIC can be read as a data-intensive, project-scale elaboration of PDCA.

2.2 Lean Thinking and the Elimination of Waste

Lean thinking, articulated by Womack and Jones (1996), defines value from the customer's perspective and seeks to maximise the proportion of activity that creates such value while systematically eliminating waste (muda). The canonical eight wastes — commonly memorised as DOWNTIME: Defects, Overproduction, Waiting, Non-utilised talent, Transportation, Inventory, Motion, and Extra-processing — provide a diagnostic lens that is especially powerful in administrative and service processes, where waiting, rework, and unnecessary handoffs dominate. Value-stream mapping (Rother & Shook, 1999) renders the flow of material and information visible and separates value-added from non-value-added time, directing improvement effort to where it matters most.

2.3 Six Sigma and the DMAIC Cycle

Six Sigma, developed at Motorola and generalised by Harry and Schroeder (2000), is a data-driven methodology for reducing variation and defects, expressing performance on a sigma scale where higher sigma denotes fewer defects per million opportunities. Its signature project structure is DMAIC: Define the problem and customer requirements; Measure the current process and establish a baseline; Analyse to identify and verify root causes; Improve by designing, selecting, and piloting solutions; and Control to hold the gains through standardisation and monitoring (Pyzdek & Keller, 2018). DMAIC's discipline lies in its insistence on evidence: decisions are grounded in data rather than opinion, and each phase has explicit deliverables and tollgates.

2.4 Lean Six Sigma as an Integrated Approach

Lean and Six Sigma are complementary: Lean improves flow and removes waste, while Six Sigma reduces variation and defects. Their integration as Lean Six Sigma (George, 2002) allows a project to attack both speed and quality within a single framework. For an administrative process suffering simultaneously from delay (a flow problem) and rework (a variation/defect problem), the combined approach is particularly apt, and it is the approach adopted here.

2.5 Business Process Management and Process Mapping

Business Process Management (BPM) provides the organisational context for CI, treating processes as managed assets with owners, documentation, and performance measures (Dumas et al., 2018). Process mapping techniques — SIPOC for high-level scoping, swimlane (cross-functional) flowcharts for handoff analysis, and value-stream maps for timing — make the invisible visible and are prerequisites for disciplined analysis. Business Process Re-engineering (Hammer & Champy, 1993) represents the more radical end of the spectrum, advocating fundamental redesign; in practice, most improvement programmes blend incremental Lean/Six Sigma changes with selective re-engineering of the worst-performing sub-processes.

2.6 Root-Cause Analysis Techniques

Effective improvement depends on treating causes rather than symptoms. The Pareto principle (Juran) focuses attention on the vital few causes that account for the majority of effects. The cause-and-effect or Ishikawa diagram organises candidate causes into categories — for manufacturing the classic 6M (Man, Method, Machine, Material, Measurement, Mother-nature/Environment), readily adapted for services. The 5-Whys drills from an observed effect to its underlying cause through iterative questioning. Used together, these tools move a team from a long list of complaints to a short list of validated root causes.

2.7 Statistical Tools

Six Sigma draws on descriptive statistics (measures of central tendency and dispersion), process-capability analysis (relating process spread to specification limits via indices such as Cp and Cpk), and statistical process control (SPC) charts that distinguish common-cause from special-cause variation. Hypothesis testing and correlation help verify whether a suspected cause is statistically associated with the effect. In administrative settings these tools are applied pragmatically, recognising smaller samples and non-normal data.

2.8 Change Management

Technical solutions fail without adoption. The Prosci ADKAR model (Hiatt, 2006) frames individual change as a sequence — Awareness, Desire, Knowledge, Ability, Reinforcement — and Kotter's (1996) eight-step model addresses the organisational dimension. Because the present project introduced new SOPs, accountabilities, and behaviours across departments, structured change management was treated as integral to, not separate from, the technical work.

2.9 Governance, SOPs, and Performance Measurement

Sustaining improvement requires institutionalisation. SOPs codify the improved method; a responsibility-assignment model such as RACI or RASCI removes ambiguity about who does what; and a cascaded set of KPIs makes performance visible from the shop floor to the boardroom (Kaplan & Norton, 1996). A governance cadence — regular review meetings with defined escalation — closes the loop between measurement and action. In organisations without prior governance, these artefacts must be created, not merely tuned.

2.10 Synthesis and Research Gap

The literature offers mature, well-evidenced tools for process improvement, but it predominantly assumes resourced, data-rich environments. There is comparatively little documented guidance on executing a rigorous CI project in a small, transforming organisation that lacks a PMO, SOPs, baseline data, and a dedicated improvement team — precisely the conditions of this study. This thesis addresses that gap by demonstrating how the standard toolkit can be sequenced and simplified so that a single practitioner can both improve a process and build the governance needed to sustain the improvement.

Chapter 3 Research Methodology

3.1 Research Design

The study employs a single-case, mixed-methods action-research design. Action research is appropriate because the researcher was an embedded practitioner effecting real change rather than an external observer, and because the inquiry proceeds through cycles of diagnosis, intervention, and evaluation. The design is mixed-methods: qualitative evidence (interviews, observation, documents) explains why the process behaves as it does, while quantitative evidence (time studies, system data) measures how it behaves and whether it improves. Triangulating the two guards against the weaknesses of either alone.

3.2 Choice of Improvement Framework

Selecting an over-arching framework was the first and most consequential methodological decision. Four candidate approaches were considered: a standalone Kaizen event, Total Quality Management (TQM), Business Process Re-engineering (BPR), and Lean Six Sigma DMAIC. They were evaluated against five criteria weighted by their fit to the Company's situation: suitability for a data-poor baseline, ability to address both speed and quality, structure and repeatability, resource-leanness for a single practitioner, and support for sustainment. Table 2 summarises the assessment.

Table 2. Comparison of improvement methodologies and selection rationale.

Criterion	Kaizen event	TQM	BPR	DMAIC (chosen)
Works from a data-poor baseline	Partial	Partial	Weak	Strong — builds its own baseline in Measure
Addresses speed and quality together	Partial	Strong	Strong	Strong (Lean + Six Sigma integrated)
Structured and repeatable	Weak	Partial	Partial	Strong — defined phases and tollgates
Resource-lean for one practitioner	Strong	Weak	Weak	Strong — tools scalable to one analyst
Embeds sustainment	Weak	Strong	Weak	Strong — Control phase institutionalises gains

DMAIC was selected because it is the only candidate that scores strongly on all five criteria. Critically, its Measure phase supplies the missing baseline rather than assuming one, its Lean Six Sigma content tackles delay and rework simultaneously, and its Control phase forces the institutionalisation the Company most needed. Its phase-and-tollgate structure also made the work legible to executives who were themselves new to process discipline. The DMAIC roadmap adopted for the project is shown in Figure 1, and the project schedule in Figure 2.

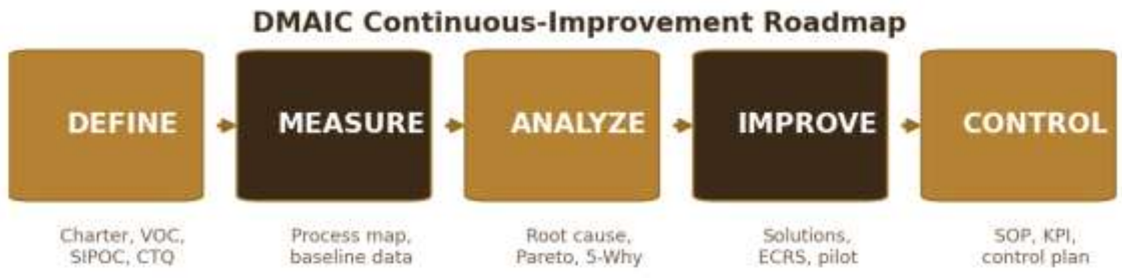

Figure 1. DMAIC continuous-improvement roadmap.

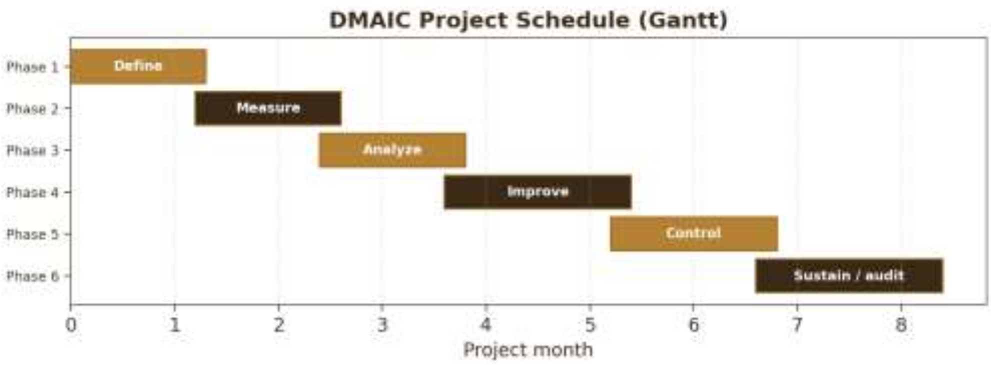

Figure 2. DMAIC project schedule (Gantt).

3.3 Selection of Analytical Tools

Within DMAIC, each phase admits many possible tools; parsimony required choosing those that would yield the most insight for the least effort. Table 3 records the tools selected, their purpose, and the rationale for their selection over alternatives.

Table 3. Selection of analytical tools and techniques.

Phase	Tool selected	Purpose / why chosen
Define	SIPOC, VOC-to-CTQ, RASCI, BA requirements (user stories, use cases, traceability, roadmap)	Scope the process, elicit and translate customer needs into measurable, traceable requirements.
Measure	Swimlane map, time-and-	Make handoffs visible, generate the missing baseline, and

	motion study, VSM, descriptive stats, capability	quantify variation and capability.
Analyse	Pareto, Ishikawa (6M), 5-Whys, VA/NVA, hypothesis test	Move from many complaints to a few validated root causes using low-cost, high-yield diagnostics.
Improve	ECRS, benchmarking, structured stakeholder decision-making (NGT/Delphi/MCDA/OARP), weighted matrix, impact–effort, FMEA	Generate options systematically, choose transparently, and de-risk before deployment.
Control	SOP, RASCI, KPI cascade, SPC chart, audit	Standardise the new method and detect drift so gains persist.

3.4 Data-Collection Methods

Data were collected through five complementary channels, summarised in Table 4. Interviews and observation surfaced tacit knowledge and pain points; time studies and system extracts produced the quantitative baseline; and document analysis revealed the (near-total) absence of existing standards.

Table 4. Data-collection plan.

Metric / evidence	Definition	Source	Method	Sample
Cycle time	Elapsed hours, job receipt to dispatch	Operations log + observation	Time-and-motion study	120 jobs over 6 weeks
Rework rate	% jobs requiring a corrective loop	Document/QC records	Document analysis	120 jobs
On-time SLA	% jobs completed within internal target	Operations log	System extract	3 months history
Delay causes	Categorised reason for each delay	Staff + observation	Interviews, tally sheet	112 delay events
Process steps & handoffs	Count of activities and inter-role transfers	Process walk-through	Swimlane mapping	Full process

3.5 Data-Analysis Methods

Quantitative data were analysed with descriptive statistics (mean, median, standard deviation, range), Pareto ranking, process-capability estimation against an internal upper specification limit, and simple hypothesis testing to confirm the association between suspected causes and delay. Qualitative data from interviews and observation were coded thematically and organised onto the Ishikawa categories. The two streams were then triangulated during root-cause validation (Chapter 6).

3.6 Validity, Reliability, and Ethics

Construct validity was strengthened by triangulating multiple data sources; internal validity by validating each candidate root cause against independent evidence before acting on it; and reliability by using standardised tally sheets and documented operational definitions so that measurements were repeatable. Ethically, participation in interviews was voluntary and non-attributable, operational data were handled under confidentiality, and the Company and its counterparties are anonymised throughout.

Chapter 4 Define Phase

4.1 Project Charter

The Define phase opened with a one-page project charter that fixed the problem statement, goal statement, scope, team, and high-level timeline, and that secured executive sponsorship. Because no PMO existed, the charter also served as the project's founding governance document. Its full content is reproduced in Appendix A. The goal statement committed the project to reducing the mean cycle time of the target process by at least twenty per cent and to halving the rework rate within one DMAIC cycle, while establishing the SOP and KPI infrastructure required to sustain the result.

4.2 Voice of the Customer and CTQ Translation

Both external customers and the internal 'next process' were treated as customers of the target process. Their stated needs — expressed in interviews as 'we don't know where our job is,' 'it takes too long,' and 'we keep being asked for the same information twice' — were translated into measurable Critical-to-Quality (CTQ) requirements, as shown in Table 6. This translation is the discipline that converts vague dissatisfaction into quantities a process can be engineered to meet.

Table 5. Voice-of-Customer translated to CTQ requirements.

Voice of the Customer	CTQ characteristic	Measure	Target
"It takes too long."	Speed	End-to-end cycle time (h)	$\leq$ 32 h
"We're asked for the same data twice."	No rework	Rework rate (%)	$\leq$ 5 %
"We don't know the status."	Visibility	Status-known at any time	100 % via KPI board
"Sometimes it's late."	Reliability	On-time SLA (%)	$\geq$ 90 %
"Quality is inconsistent."	Consistency	First-pass yield (%)	$\geq$ 90 %

4.3 High-Level Process Scope (SIPOC)

A SIPOC diagram fixed the boundaries of the target process and identified its suppliers, inputs, outputs, and customers before any detailed mapping began. It prevented scope creep and gave every stakeholder a shared, one-page understanding of what was — and was not — under study. The SIPOC is shown in Table 5.

Table 6. SIPOC of the target process.

Suppliers	Inputs	Process (high level)	Outputs	Customers
Customer / commercial; vendors; systems	Job order; documents; rates; capacity data	Receive → Document → Clear → Plan → Depot handling → Dispatch	Cleared, dispatched job; status; invoice trigger	External customer; next internal process; finance

4.4 Stakeholder Analysis and RASCI

Because the process crossed commercial, documentation, operations, and finance, a stakeholder analysis mapped each party's influence and interest, and a preliminary RASCI matrix exposed the accountability gaps that later analysis would confirm as a root cause: several activities had multiple 'responsible' parties and no single 'accountable' owner. The Define tollgate confirmed the problem, the goal, the scope, and the measurement plan before the project proceeded to Measure.

4.5 Stakeholder Identification and Classification

The improvement could only succeed if the right people were engaged from the outset, so stakeholder identification was treated as a deliberate step rather than an assumption. Drawing on reflection about comparable past initiatives and on consultation with managers and mentors, the full set of roles and responsibilities the project would need was mapped. Identified stakeholders were then classified into four groups so that each could be engaged appropriately: sponsors and executive leaders, who authorise and resource the work; core team members, who design and deliver it; resource controllers, who own the people, budget, or systems the project depends on; and end users or customers, who experience the outcome. This classification, shown in Table 17 (Appendix D), shaped the depth and cadence of engagement for each group.

4.6 Roles, Responsibilities, and Motivation

For every stakeholder a clear role description and set of responsibilities was written, feeding directly into the RACI/RASCI clarity described in Section 4.4. Crucially, these were not simply imposed on paper: each was confirmed in a direct conversation to check understanding, secure commitment, and surface any blockers or training needs early. Engagement was then tailored to what actually motivates each individual. Using McClelland's three-needs theory, stakeholders were read for their dominant driver - achievement, affiliation, or power - and the approach was adjusted accordingly: framing the work as a visible, measurable win for achievement-oriented individuals; emphasising collaboration and belonging for affiliation-oriented ones; and offering ownership and decision rights to those driven by influence. Table 20 (Appendix E) records how each need was translated into a concrete engagement tactic; this personalisation is a large part of why participation was high.

4.7 Stakeholder Engagement Plan (SEP) and SEP Matrix

These decisions were consolidated into a Stakeholder Engagement Plan (SEP): a formal, confidential document, held within the core team, that sets out the communication strategy for each stakeholder together with an assessment of their interest, power, and influence. At its heart is the SEP matrix (Table 18, Appendix D; visualised in Figure 12), which records, for every stakeholder, their current commitment level and the level the project actually required, across five states - Unaware, Resistant, Neutral, Supportive, and Leading. For each stakeholder whose current state fell short of what was needed, a specific strategy was defined to move them from where they were to where they needed to be. Making this gap explicit turned engagement from a vague intention into a managed plan with named actions, reviewed as the project progressed. Because the plan contains candid assessments of individuals' attitudes, it was kept confidential within the core project team, consistent with good practice.

4.8 Project Budget and Cost Estimation

Because the Company had no PMO, the project also had to establish its own budget discipline. The budget was estimated at two levels of accuracy. A Rough Order of Magnitude (ROM) estimate, with an accuracy band of -25 to +75 per cent, set broad parameters at initiation, and a Definitive Estimate, with a tighter band of -5 to +10 per cent, was produced after detailed planning; both are shown in Table 24 (Appendix G).

Three estimation models were combined for robustness. Analogous estimation drew on the cost of a comparable prior governance and systems initiative to sanity-check the total, relying on expert judgment. Parametric estimation multiplied work quantities by unit rates - for example an average cost per documented SOP and a cost per training-day. Bottom-up estimation, the most detailed, decomposed the work into a Work Breakdown Structure (WBS) and priced each work package individually before summing them, producing the definitive figure of approximately IDR 850 million (Table 25, Appendix G).

Several practices safeguarded the estimate. Subject-matter experts were engaged and team members validated each package; planned versus actual expenditure was tracked to catch variances early and adjust (Figure 16, Appendix G); a simple project-management information system held the cost data; lessons from prior projects informed the assumptions; funding limits were understood; and funding needs were communicated to the sponsor in advance. Actual spend of about IDR 844 million finished marginally under the definitive estimate, a variance comfortably within the -5 to +10 per cent band.

4.9 Business Analysis: Requirements and the Product Roadmap

Alongside the project-management role, the initiative required a business-analysis (BA) capacity, which the author also performed. The business analyst bridges business needs and delivery: ensuring that the product's requirements genuinely meet the organisation's needs, while the product owner and project manager deliver the solution. In this project the improved process, together with its supporting SOPs, KPIs, and dashboard, was treated as an internal product, and BA discipline was applied to define precisely what that product had to do.

Initial requirements were identified using a standard BA toolkit. Interviews with staff and managers, short surveys, and facilitated workshops surfaced the problems worth solving and the opportunities worth capturing, and a review of lessons learned from comparable past initiatives sharpened the scope. These inputs fed directly into the project charter of Section 4.1 and the Critical-to-Quality requirements of Section 4.2.

Requirements were then expressed in forms the delivery team could act on. User stories captured what each organisational role needed and the value the product would deliver - for example, as an operations coordinator, I want a standard intake checklist so that jobs start with complete information. Selected requirements were elaborated as use cases describing how a user interacts with the process or system, including the main success scenario, the failure and exception scenarios, the key performance indicators the team had to meet, and any critical variations. Illustrative user stories and a worked use case appear in Tables 27 and 28 (Appendix H).

To keep design honest, a product (requirements) traceability matrix mapped every requirement from its source, through its use case and acceptance criteria, to the specific SOP or KPI that satisfied it and the project phase in which it was delivered (Table 26, Appendix H). Working with stakeholders, the author defined explicit acceptance criteria so that the team could judge objectively when a deliverable was ready for release - the same criteria that later informed the Control-phase audits.

Finally, these requirements were sequenced into a product roadmap (Figure 17, Appendix H) setting out the product vision, how it supports the organisation's objectives, the required features, and the timeline and order in which stakeholders would receive them - creating shared expectations between the product owner and the project manager. The roadmap also carried a recommendation on the optimal lifecycle: because the governance and compliance elements needed a predictive, stage-gate backbone while the SOP and KPI build benefited from adaptive, incremental delivery, a hybrid lifecycle was recommended and adopted, consistent with the Agile-Waterfall approach described in Chapter 3.

Chapter 5 Measure Phase

5.1 As-Is Process Mapping

A cross-functional (swimlane) map of the as-is process was constructed from direct walk-throughs and validated with the people who perform the work. The map revealed a process of twenty-seven discrete activities and twelve inter-role handoffs — a structure in which information crossed organisational boundaries repeatedly and was frequently re-entered by hand. Each handoff represented a queue and a potential defect. The mapping alone made visible several obviously non-value-adding loops that participants had come to regard as normal.

5.2 Data-Collection and Operational Definitions

Following the plan in Table 4, cycle time was measured by time-stamping 120 jobs from receipt to dispatch over six weeks; rework was recorded whenever a job returned to an earlier step for correction; and delay events were tallied against pre-agreed cause categories. Operational definitions were documented so that measurement was consistent across observers, addressing the reliability concern noted in Section 3.6.

5.3 Baseline Performance

The baseline established what had previously only been asserted. The mean end-to-end cycle time was 40.2 hours with a standard deviation of 8.6 hours — a coefficient of variation of 21 per cent, indicating substantial instability. The rework rate was 14 per cent, on-time SLA attainment 71 per cent, and first-pass yield 78 per cent. Table 7 summarises the baseline statistics.

Table 7. Baseline descriptive statistics.

Metric	Mean	Std. dev.	Baseline value	Internal target
Cycle time (h)	40.2	8.6	40.2	≤ 32
Rework rate (%)	—	—	14	≤ 5
On-time SLA (%)	—	—	71	≥ 90
First-pass yield (%)	—	—	78	≥ 90
Process steps (count)	—	—	27	minimise
Handoffs (count)	—	—	12	minimise

5.4 Process Capability

Against an internal upper specification limit of 45 hours, the baseline process exhibited a capability index (Cpk) of approximately 0.19 and an estimated process sigma level of about 2.3 — well below the commonly cited threshold of a capable process (Cpk ≥ 1.33). In plain terms, the process was neither fast enough on average nor stable enough to reliably meet even a generous internal deadline. This quantified, defensible baseline answered RQ1 and set the reference against which improvement would be judged.

Chapter 6 Analyse Phase

6.1 Focusing with Pareto Analysis

The 112 delay events recorded during Measure were categorised and ranked. Pareto analysis (Figure 3, data in Table 8) showed that just three categories — incomplete or missing documentation, unclear ownership and approval delay, and manual re-entry of duplicate data — accounted for roughly seventy-five per cent of all delay occurrences. In accordance with the Pareto principle, improvement effort was concentrated on these vital few rather than dispersed across every complaint.

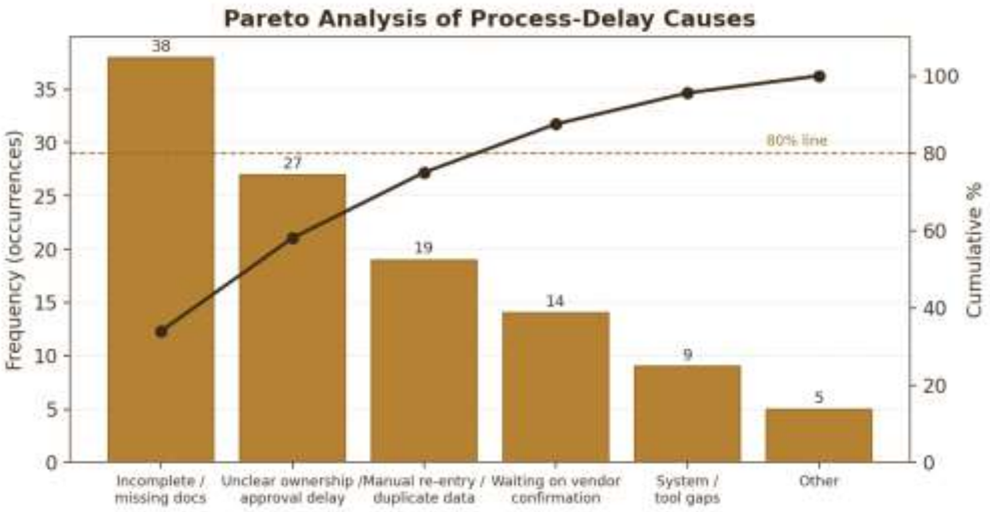

Figure 3. Pareto analysis of process-delay causes.

Table 8. Pareto data for delay causes.

Cause	Frequency	% of total	Cumulative %
Incomplete / missing documentation	38	33.9	33.9
Unclear ownership / approval delay	27	24.1	58.0
Manual re-entry / duplicate data	19	17.0	75.0
Waiting on vendor confirmation	14	12.5	87.5
System / tool gaps	9	8.0	95.5
Other	5	4.5	100.0

6.2 Cause-and-Effect Analysis

To move from 'what delays occur' to 'why they occur,' a cause-and-effect (Ishikawa) diagram was built with participants across the six adapted categories — Man, Method, Machine/IT, Information, Measurement, and Management (Figure 4). The exercise surfaced structural causes that the Pareto counts alone could not: the absence of SOPs (Method), fragmented systems requiring manual re-entry (Machine/IT), the lack of any KPI or baseline (Measurement), and, underlying much of the rest, the absence of governance and clear ownership (Management).

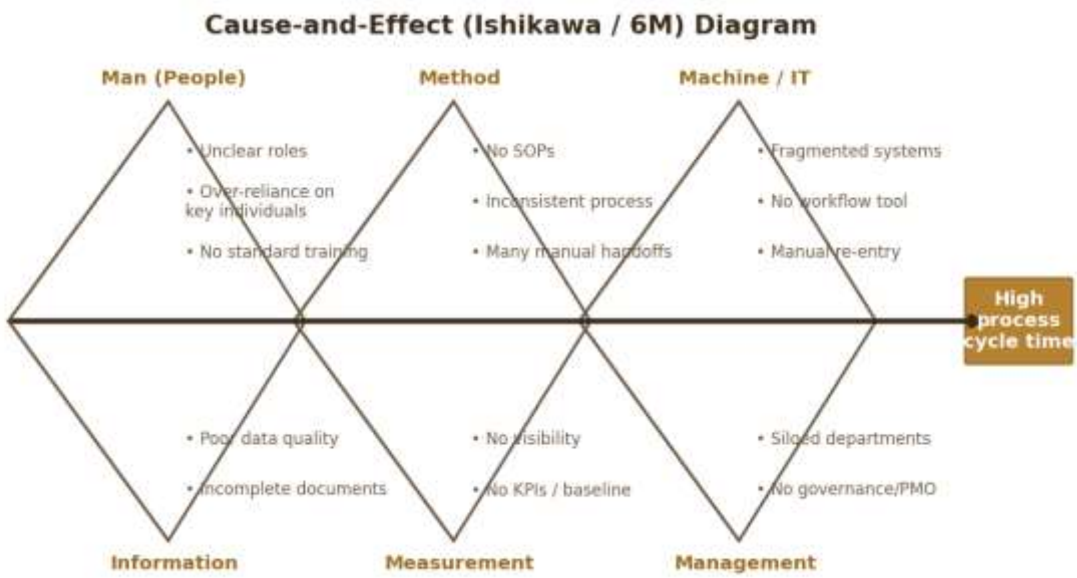

Figure 4. Cause-and-effect (Ishikawa / 6M) diagram.

6.3 Drilling to Root Cause with the 5-Whys

For the highest-frequency category — incomplete documentation — the 5-Whys was applied. Why are documents incomplete? Because the required fields are not consistently captured at intake. Why not? Because there is no standard intake checklist. Why is there none? Because no SOP defines the intake step. Why not? Because the Company never documented its processes. Why not? Because there was no governance function responsible for doing so. The chain terminated, as several others did, at the same systemic root: the absence of process governance. This convergence was decisive for solution design.

6.4 Value-Added / Non-Value-Added Analysis

Timing the swimlane activities allowed each to be classified as value-added (VA), necessary non-value-added (NVA-N), or waste (NVA-W). As Figure 5 shows, only about twenty per cent of total lead time was value-adding at baseline, while forty-six per cent was outright waste — dominated by waiting at handoffs and by rework loops. This confirmed that the largest and fastest gains lay in eliminating waste (a Lean problem) rather than in accelerating the value-adding work itself.

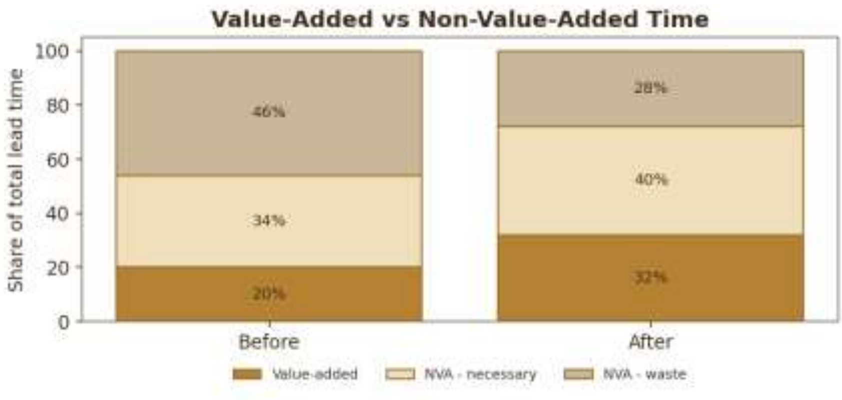

Figure 5. Value-added vs non-value-added time.

6.5 Root-Cause Validation

Before committing to solutions, each candidate root cause was validated against independent evidence — data, observation, and interview — to avoid acting on assumption. Table 9 records the validation. Correlational checking confirmed, for example, that jobs flagged with incomplete documentation had a mean cycle time materially higher than complete jobs, supporting a causal (not merely coincidental) relationship.

Table 9. Root-cause validation matrix.

Candidate root cause	Category	Evidence used	Validated?
No SOP / standard method	Method	Document audit found zero SOPs; process varied by person	Yes
No single accountable owner	Management	RASCI gaps; approval delays clustered at unowned steps	Yes
Manual re-entry across systems	Machine/IT	Observed duplicate keying; errors traced to re-entry	Yes
No KPI / baseline	Measurement	No metrics existed; performance was invisible	Yes
Vendor confirmation latency	Information	Real but lower-frequency; partly outside Company control	Partly

The Analyse tollgate concluded that the delays, rework, and variation were symptoms of a small number of systemic root causes centred on the absence of standard methods, clear ownership, integrated information, and measurement — answering RQ2 and directing the Improve phase.

Chapter 7 Improve Phase

7.1 Solution Generation with ECRS

Solutions were generated systematically rather than by intuition, using the Lean ECRS heuristic — Eliminate, Combine, Rearrange, Simplify — applied to every activity and handoff on the swimlane map, supplemented by benchmarking against good practice in comparable operations. Table 10 illustrates representative outputs. The guiding aim was first to eliminate waste (the largest opportunity identified in Analyse), then to combine and rearrange remaining steps to cut handoffs, and finally to simplify and standardise.

Table 10. Solution generation using ECRS.

ECRS lever	Applied to	Solution
Eliminate	Duplicate data entry; redundant approvals	Single point of data capture; remove non-essential sign-offs
Combine	Fragmented intake & documentation steps	Consolidated intake with a standard checklist
Rearrange	Sequential steps that could be parallel	Parallel document preparation and planning
Simplify	Ambiguous, person-dependent tasks	SOPs, templates and a RASCI to standardise execution

7.2 Reaching Agreement Among Stakeholders: The Decision-Making Process

Effective decision-making is itself a project competency. Well-made decisions lead to better project outcomes, stronger teamwork, healthier stakeholder relations, and sounder resource allocation, whereas contested or poorly-made decisions stall delivery and erode trust. Two principles guided the approach taken here. First, decisions were grounded in expert judgment, drawing deliberately on the domain knowledge of department heads, coordinators, and frontline staff. Second, participation was actively encouraged, because involving the people affected by a decision increases their buy-in and their confidence in the result and surfaces practical objections early. Because the project crossed several departments and introduced unfamiliar disciplines, the manner in which decisions were reached was as important to success as their content.

Rather than rely on a single mechanism, a small toolkit of complementary decision-making techniques was applied and matched to the nature of each decision - its urgency, its uncertainty, and the degree of consensus required. The overall flow moved from framing the decision and its roles, through divergent option-generation, to convergent narrowing, structured evaluation, and finally ratification and commitment, as summarised in Figure 6. Table 11 sets out each technique and how it was used to decide the improvement plans with stakeholders.

Table 11. Decision-making techniques applied to reach stakeholder agreement.

Technique	What it is	How it was used to decide the plans
Expert judgment & participation	Drawing on subject-matter expertise and involving the team	Applied throughout; heads and frontline staff co-designed the solutions, raising buy-in and confidence.
OARP	Owner, Approver, Reviewers, Participants - roles for decisions under uncertainty	Assigned for each major decision to remove ambiguity over who decides, approves, reviews, and contributes.
Nominal Group Technique (NGT)	Structured brainstorming with idea ranking and a point system	Used in solution workshops so every option was surfaced and ranked without domination by louder voices.
Wideband Delphi	Confidential idea-sharing and voting facilitated by the project manager	Used for sensitive estimates (effort, risk) to avoid anchoring and groupthink; the author facilitated the rounds.
Voting	Democratic selection - unanimity, majority, or plurality	Used to shortlist options; the risk of conformity was mitigated by taking confidential inputs first.
Fist-to-Five	A rapid 0-5 finger gauge of agreement	Used in reviews to test consensus quickly; any score below three triggered discussion until alignment.
MCDA (weighted matrix)	Weighted evaluation of options against multiple criteria	The core evaluation step; solutions were scored against weighted criteria (see Table 12).
Autocratic	Leader decides quickly without team input	Reserved for urgent, low-ambiguity calls to protect momentum; used sparingly and transparently.

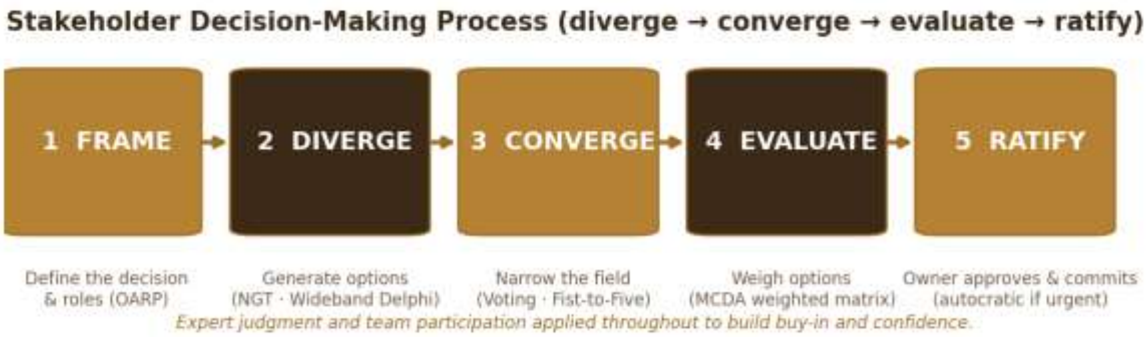

Figure 6. Stakeholder decision-making process (diverge, converge, evaluate, ratify).

In practice the techniques were layered. NGT and Wideband Delphi widened the option set and neutralised power imbalances; voting and fist-to-five converged the group quickly; MCDA made the final evaluation transparent and defensible; and the OARP model ensured that a single, accountable owner ratified each decision. Reserving autocratic decisions for genuinely urgent moments preserved both speed and trust. This structured process is how consensus on the improvement plans was actually secured across the departments, turning a set of proposals into decisions that the stakeholders owned. The evaluation step is elaborated next.

7.3 Solution Selection

The generated options were prioritised transparently. A weighted decision matrix (Table 12) scored each candidate against four criteria — impact on the validated root causes, ease/cost of implementation, sustainability, and stakeholder acceptance — weighted to reflect the Company's priorities. The scoring was cross-checked with an impact–effort analysis (Figure 7) to separate quick wins from major projects. The two views agreed: an SOP architecture, a RASCI accountability model, and a cascaded KPI dashboard were high-impact and comparatively low-effort 'do-first' interventions, while workflow digitalisation was high-impact but higher-effort and was therefore staged.

Table 12. Weighted solution-selection matrix.

Solution	Impact (×0.40)	Ease (×0.20)	Sustain (×0.25)	Accept (×0.15)	Score
SOP architecture	9	7	9	8	8.45
RASCI accountability model	9	8	8	8	8.40
Cascaded KPI dashboard	8	6	9	7	7.70

Approval re-design (ECRS)	8	7	7	7	7.40
Workflow digitalisation	9	4	8	6	7.30
Company Regulation (PP)	6	5	9	7	6.70

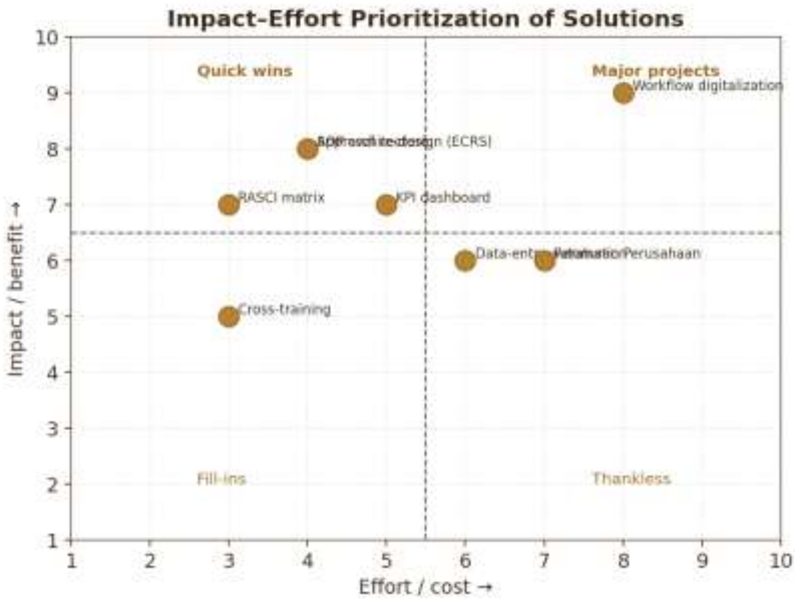

Figure 7. Impact–effort prioritisation of solutions.

7.4 The Redesigned Process and Solution Set

The selected interventions were designed as an integrated package rather than as isolated fixes, because the root-cause analysis had shown the problems to be systemic. The package comprised: (i) an SOP architecture of more than twenty documented procedures with standard templates and checklists, eliminating person-dependence; (ii) a RASCI matrix assigning a single accountable owner to every activity, closing the ownership gap; (iii) a cascaded KPI dashboard giving real-time visibility of cycle time, on-time performance, and rework; (iv) an ECRS-based redesign of the process that cut the activity count from twenty-seven to nineteen and handoffs from twelve to seven; and (v) the Company's first legally registered Company Regulation (Peraturan Perusahaan), giving the new accountabilities formal standing. The redesign reduced the non-value-added share of lead time substantially, as later confirmed in the results.

7.5 Failure Mode and Effects Analysis

Before deployment, the redesigned process was stress-tested with an FMEA to anticipate how it might fail and to build in safeguards. Each potential failure mode was rated for severity, occurrence, and detection, and the resulting Risk Priority Number (RPN) directed pre-emptive countermeasures for the highest risks. An extract is shown in Table 13; the highest RPN — staff reverting to old habits — was mitigated through the change-management plan described next.

Table 13. FMEA of the redesigned process (extract).

Failure mode	Effect	S	O	D	RPN	Countermeasure
Staff revert to old method	Gains erode	8	6	5	240	ADKAR plan; audits; visible KPIs
Incomplete intake checklist	Rework returns	7	4	4	112	Mandatory fields; system validation
Owner unavailable at approval	Delay	6	4	5	120	Named deputy in RASCI
KPI data not updated	Blind spots	5	4	5	100	Automated feed; weekly cadence

7.6 Piloting and Change Management

The package was piloted on a single site and job stream before wider roll-out, allowing rapid correction of teething problems and the accumulation of early evidence to build confidence. Adoption was managed with the Prosci ADKAR model: awareness was built through town-halls explaining why the change mattered; desire through visible executive sponsorship and by involving staff in designing their own SOPs; knowledge and ability through role-based training and on-the-floor coaching; and reinforcement through the KPI dashboard and audit cadence introduced in Control. Working directly with the people who perform the work — rather than imposing procedures on them — was decisive in securing acceptance.

7.7 Motivating and Influencing Stakeholders

Standardising a process changes how people work, so the improvement had to be led as much as managed. The change effort described in Section 7.6 was underpinned by a deliberate view of motivation and influence, drawing on three complementary models.

First, three classical assumptions about motivation informed the leadership style. Theory X assumes people are driven mainly by self-interest and respond to incentives and control, implying a hands-on, top-down style. Theory Y assumes people are motivated by enjoyment and creativity, favouring a coaching style that invites discussion and innovation. Theory Z emphasises motivation through community and shared purpose, promoting team-building and open communication. Recognising that the Company's staff were capable professionals whose buy-in mattered more than their compliance, the project leaned deliberately towards Theory Y and Theory Z - coaching rather than directing, and building shared ownership of the new ways of working - while reserving the more directive Theory-X posture only for a few time-critical, non-negotiable safety and compliance points. Table 19 (Appendix E) contrasts the three styles and where each was applied.

Second, because the improvement depended on a cross-functional team that had never worked as one, the team's development was guided by a seven-step performance model (Figure 13, Appendix E). Its creating stages - Orientation (‘why am I here?’), Trust-building (‘who are we?’), Goal clarification (‘what are we doing?’), and Commitment (‘how will we do it?’) - were used to establish purpose and relationships before execution, while its sustaining stages - Implementation, High performance, and Renewal - carried the team through delivery and reflection. Naming the stage the team was in at any moment helped diagnose and resolve the friction that inevitably arose.

Third, influence itself was managed consciously using an influence diagram (Figure 14, Appendix E), which maps the factors that raise or lower a leader's ability to influence. Effort was invested in the factors that increase influence - building relationships, earning trust, remaining accessible, and listening actively - and in avoiding those that erode it, namely poor communication, poor issue-management, offering people no room to grow, and failing to articulate a clear project vision. Taken together, these models turned ‘getting people on board’ from a hope into a repeatable practice, and they are a central reason the SOPs and new accountabilities were adopted rather than resisted.

Chapter 8 Control Phase

8.1 Standardisation

The Control phase converted the improvements from a project outcome into the Company's normal way of working. The SOPs authored in Improve became the mandated standard method, supported by templates and checklists at the points where defects had previously entered. Standardisation is the mechanism by which a one-off gain becomes the new baseline from which further improvement can start (the 'standardise-do-check-act' discipline).

8.2 Control Plan

A control plan (Table 14) specified, for each critical characteristic, what would be measured, how and how often, who is accountable, and what reaction is triggered if performance drifts out of range. This plan is the operational heart of sustainment: it names the owner and the response for every metric that matters.

Table 14. Control plan (extract).

Characteristic	Measure	Frequency	Owner	Reaction if out of range
Cycle time	Hours per job (dashboard)	Daily / weekly review	Process owner	Investigate; corrective action log
Rework	% jobs reworked	Weekly	QA lead	Root-cause the recurrence; update SOP
On-time SLA	% within target	Weekly	Ops lead	Escalate per governance cadence
SOP adherence	Audit score	Monthly audit	Governance	Re-train; reinforce via ADKAR

8.3 Statistical Process Control

Cycle time was placed on an individuals control chart (Figure 8) so that the process could be monitored for special-cause variation and any drift detected early. The chart also documents the improvement itself: the mean shifts down and the spread narrows after the interventions are implemented, and the post-improvement points remain within a tighter band — evidence that the gain is both real and stable rather than a temporary fluctuation.

Figure 8. Control chart of process cycle time (I-chart).

8.4 Governance Cadence and Audit

Finally, a monthly governance cadence was established: a standing review of the KPI dashboard with defined escalation (L1 site, L2 department head, L3 executive), together with periodic SOP-adherence audits. Because the Company had possessed no such cadence before, this too was built from zero. The governance loop closes the DMAIC cycle by ensuring that measurement leads to action, and it provides the platform from which the next improvement cycle can begin — the essence of continuous, as opposed to one-off, improvement.

Chapter 9 Results and Discussion

9.1 Performance Before and After

Measured over a comparable post-implementation sample, the redesigned process delivered material and statistically credible improvement across every CTQ. The mean end-to-end cycle time fell from 40.2 to 31.3 hours — a reduction of approximately 22 per cent — and its variation narrowed, as seen in both the control chart (Figure 8) and the capability histograms (Figure 9). The rework rate fell from 14 to 5 per cent, on-time SLA attainment rose from 71 to 93 per cent, and first-pass yield rose from 78 to 94 per cent. The non-value-added waste share of lead time fell from 46 to 28 per cent, the activity count from 27 to 19, and handoffs from 12 to 7. Figure 10 and Table 15 summarise the before-and-after position.

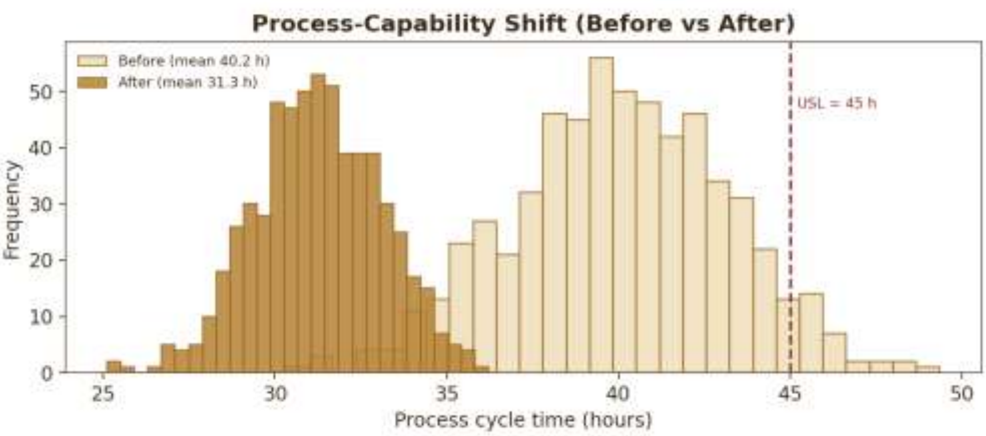

Figure 9. Process-capability shift (before vs after).

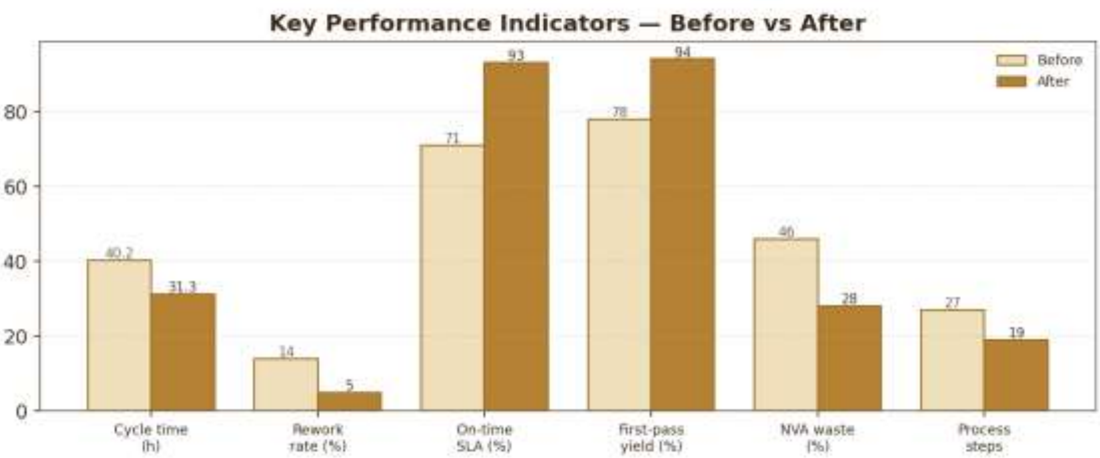

Figure 10. Key performance indicators — before vs after.

Table 15. Before-and-after results summary.

Metric	Before	After	Change	Target met?
Cycle time (h)	40.2	31.3	−22.1 %	Yes (≤ 32)
Rework rate (%)	14	5	−9 pts	Yes (≤ 5)
On-time SLA (%)	71	93	+22 pts	Yes (≥ 90)
First-pass yield (%)	78	94	+16 pts	Yes (≥ 90)
NVA waste (% of lead time)	46	28	−18 pts	Improved
Process steps	27	19	−8	Improved
Handoffs	12	7	−5	Improved
Estimated process sigma	2.3	3.2	+0.9	Improved

9.2 Capability and Stability

Beyond the shift in the mean, the process became more capable and more stable. The estimated process sigma level rose from about 2.3 to about 3.2, and the capability index improved from roughly 0.19 towards the range associated with a marginally capable process. Because a faster mean achieved at the cost of greater variability would be a hollow victory, the simultaneous narrowing of the distribution is an important result: the process is now not only quicker but more predictable, which is precisely what customers experience as reliability.

The improvement was not instantaneous but accumulated as the interventions took hold, as the monthly KPI trend in Figure 11 shows: on-time attainment climbed steadily while the rework rate declined, with the steepest movement following the roll-out of the SOPs and dashboard — evidence that the gains were driven by the interventions rather than by chance.

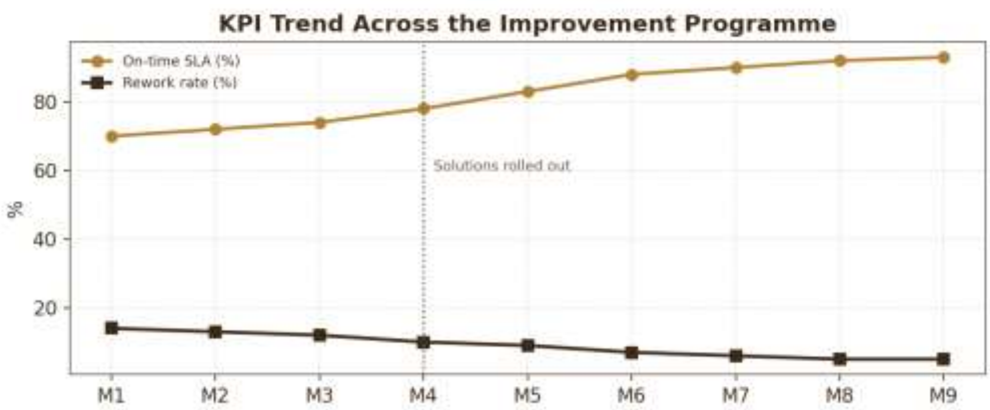

Figure 11. KPI trend across the improvement programme.

9.3 Operational and Financial Impact

The operational gains translate into tangible business value, summarised qualitatively in Table 16 to respect confidentiality. Faster cycle time increases throughput capacity from the same resources; lower rework releases capacity previously consumed by corrections and reduces the cost of poor quality; higher on-time performance protects revenue and customer retention; and the SOP and governance infrastructure de-risks the business and reduces its dependence on a handful of individuals — a strategic as well as an operational gain.

Table 16. Estimated operational and financial impact.

Lever	Mechanism	Business value
Cycle-time −22 %	More jobs per unit of resource	Higher throughput capacity; deferred hiring
Rework −9 pts	Fewer corrective loops	Lower cost of poor quality; freed capacity
On-time +22 pts	Reliable delivery	Revenue protection; customer retention
SOPs & governance	Standardisation, reduced key-person risk	Lower operational risk; audit-readiness; scalability

A rigorous financial evaluation rests on a few core concepts. Financial metrics are quantitative indicators of revenue, profitability, and stability. Three ideas frame any investment decision: opportunity cost, the value of the best alternative foregone (here, the staff time devoted to the project rather than to other work); the time value of money, the principle that a rupiah today is worth more than a rupiah tomorrow, which is why future benefits are discounted; and depreciation, the systematic allocation of an asset's cost over its useful life. The capitalised tools and equipment (about IDR 200 million) fall in Indonesia's four-year depreciation group and were modelled both on a straight-line basis (25 per cent per year) and on an accelerated declining-balance basis (50 per cent), as shown in Table 23 (Appendix F).

The improvement was then appraised as an investment. Against a one-time cost of approximately IDR 850 million, it generates net annual benefits of about IDR 380 million from avoided rework, released capacity, and protected revenue (Table 21, Appendix F). Discounting future cash flows at a weighted average cost of capital (WACC) of 12.5 per cent - conservative relative to the 10 to 11 per cent typical of listed Indonesian logistics firms - the project returns a payback period of roughly 2.24 years, a Return on Investment (ROI) of about 124 per cent over a five-year horizon, a Return on Invested Capital (ROIC) of about 45 per cent, a Benefit-Cost Ratio (BCR) of 1.59, a Net Present Value (NPV) of approximately IDR 503 million, an Internal Rate of Return (IRR) of about 35 per cent, and a positive annual Economic Value Added (EVA) of roughly IDR 274 million. These metrics are summarised in Table 22, and the payback is illustrated in Figure 15 (Appendix F).

Every indicator points the same way: the BCR exceeds one, the NPV is positive, the IRR comfortably exceeds the discount rate, and the ROIC exceeds the WACC, so the project creates value beyond its cost of capital and strengthens the Company's financial performance. For orientation, a canonical textbook case - a USD 100,000 investment returning USD 50,000 a year - yields a two-year payback, a 50 per cent annual ROI, an IRR of 23.38 per cent, and an NPV of about USD 22,130; the Company's project is stronger on every comparable measure. Because several benefits (avoided penalties, retained customers) are estimated conservatively, the true return is likely higher.

9.4 Discussion in Light of the Literature

The results are consistent with the Lean Six Sigma literature in two respects. First, the dominance of waiting and rework in the baseline, and the size of the gain from removing them, confirm the Lean tenet that in administrative processes most lead time is non-value-adding and that eliminating waste yields faster returns than accelerating value-adding work (Womack & Jones, 1996; George, 2002). Second, the convergence of multiple 5-Whys chains on a single systemic root — the absence of process governance — echoes the BPM insight that durable performance depends on managing processes as governed assets, not merely on local fixes (Dumas et al., 2018). The study also extends the literature by demonstrating that a rigorous DMAIC project is feasible for a single practitioner in a governance-poor, data-poor setting, provided the Measure and Control phases are used to build the missing infrastructure rather than to assume it.

9.5 Lessons Learned and Reflection

Three lessons stand out. First, building the baseline was itself an intervention: the mere act of measuring made problems visible and created momentum for change. Second, technical elegance was worthless without adoption; the disproportionate effort invested in ADKARbased change management, and in co-designing SOPs with the people who use them, was the difference between a report and a result. Third, in the absence of a PMO the project had to create its own governance, which slowed the early phases but produced a more durable outcome because sustainment was engineered in from the start rather than bolted on at the end.

Chapter 10 Conclusions and Recommendations

10.1 Conclusions and Answers to the Research Questions

The project set out to diagnose and improve, and then to sustain, the Company's core internal business process, and it succeeded on each count. Answering the research questions directly:

RQ1 (baseline): The target process was quantified for the first time, exhibiting a mean cycle time of 40.2 hours with high variability, 14 per cent rework, 71 per cent on-time attainment, and a process sigma of about 2.3 — an objectively under-performing and unstable process.

RQ2 (root causes): Delay, rework, and variation were traced, through Pareto, Ishikawa, and 5-Whys analysis, to a small number of systemic root causes: the absence of standard methods (SOPs), the absence of clear ownership, fragmented information requiring manual re-entry, and the absence of measurement — all underpinned by the absence of process governance.

RQ3 (solutions and their justification): An integrated solution set — SOP architecture, RASCI accountability, a cascaded KPI dashboard, an ECRS process redesign, and a formal Company Regulation — was generated with ECRS and benchmarking, prioritised transparently with a weighted matrix and impact–effort analysis, and de-risked with FMEA.

RQ4 (results and sustainment): The interventions reduced cycle time by approximately 22 per cent, cut rework from 14 to 5 per cent, lifted on-time performance to 93 per cent and first-pass yield to 94 per cent, and raised the process sigma to about 3.2; the gains were institutionalised through standardisation, a control plan, statistical process control, and a monthly governance and audit cadence.

10.2 Recommendations

5. Extend the DMAIC approach to the Company's other core processes, using the SOP, KPI, and governance scaffolding now in place as a reusable platform.
6. Complete the staged workflow digitalisation identified in the impact–effort analysis to attack the residual manual-re-entry waste and lock in the visibility gains.

7. Formalise a continuous-improvement capability — a small cadre of trained practitioners and a standing kaizen cadence — so that improvement becomes routine rather than project-dependent.
8. Maintain the governance cadence and audit discipline that protect the gains, and review KPI targets upward as the process matures.

10.3 Contribution and Future Work

The thesis contributes a replicable, resource-lean CI blueprint for small, transforming organisations that lack a PMO, SOPs, baseline data, and a dedicated improvement team — a common but under-served context. Future work could test the transferability of the blueprint across other functions and organisations, quantify the financial return with full cost data, and study the longer-term sustainability of the governance cadence beyond the initial control period. The wider ambition is to move the organisation from isolated improvement projects to an embedded culture of continuous improvement — the point at which the methods documented here become simply ‘how we work.’

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Appendix A Project Charter

Element	Content
Project title	Continuous improvement of the core transportation & depot process
Problem statement	The target process is slow (mean 40.2 h), variable, and error-prone (14% rework); no SOPs, KPIs, or ownership exist.
Goal statement	Reduce mean cycle time by ≥20% and halve rework within one DMAIC cycle; establish SOP + KPI + governance to sustain.
Scope	Internal, end-to-end target process from job receipt to dispatch; excludes external vendor internal processes.
In / out of scope	In: intake, documentation, clearance, planning, depot handling, dispatch. Out: pricing negotiation, vendor internal ops.
Sponsor / lead	Executive sponsor: CEO Office. Project lead: the author (single practitioner).
Team	Departmental participants (commercial, documentation, operations, finance) on a part-time basis.
Timeline	One DMAIC cycle across the phases in Figure 2, with an early sustainment period.
Success metrics	Cycle time, rework rate, on-time SLA, first-pass yield, process sigma; SOP coverage; governance cadence live.

Appendix B SOP Register (Extract)

SOP ID	Title	Process area
SOP-01	Job intake and standard checklist	Intake
SOP-02	Document preparation and verification	Documentation
SOP-03	Customs / clearance coordination	Clearance
SOP-04	Dispatch planning and allocation	Planning
SOP-05	Depot handling and stripping	Depot
SOP-06	Exception and rework handling	Quality
SOP-07	KPI capture and dashboard update	Governance
…	(20+ SOPs authored across all departments)	All

Appendix C Sample Time-Study Data (Extract)

Job #	Cycle time (h)	Rework?	On-time?	Primary delay cause
001	44.1	Yes	No	Incomplete documentation
002	36.8	No	Yes	—
003	51.3	Yes	No	Approval delay
004	33.5	No	Yes	—
005	47.9	Yes	No	Manual re-entry error
…	(120-job sample; summary statistics in Table 7)			

Appendix D Stakeholder Engagement Plan (SEP)

The Stakeholder Engagement Plan is a formal, confidential working document held within the core project team. It records each stakeholder's interest, power, and influence, their current and desired commitment, and the strategy to close the gap. Selected, anonymised extracts are reproduced below.

Table 17. Stakeholder identification and classification.

Category	Who they are	Engagement focus
Sponsors / executive leaders	CEO Office; executives who authorise and fund the work	Secure mandate, resources, and visible sponsorship; brief regularly
Core team members	Cross-functional participants who design and deliver	Co-design solutions; frequent working-level collaboration
Resource controllers	Department heads owning people, budget, or systems	Negotiate access; align priorities; manage dependencies
End users / customers	Staff who run the process; internal & external customers	Train and support; gather feedback; confirm the change works

Table 18. Stakeholder Engagement Plan (SEP) matrix.

Stakeholder	Interest / Influence	Current	Desired	Strategy to move current to desired
Executive sponsor	High / High	Supportive	Leading	Involve in governance; give visible ownership of the change
Department heads	High / High	Resistant	Supportive	Co-design SOPs; show quick wins; address workload fears
Frontline staff	High / Low	Resistant	Supportive	Involve in their own SOP design; role-based training; listen
Finance	Medium / High	Neutral	Supportive	Link improvement to cost and quality; share KPI evidence
Worker representatives	Medium / Medium	Resistant	Neutral	Transparent comms; consult on policy; face-to-face dialogue
Vendor / partner	Medium / Medium	Neutral	Supportive	Clarify interface; back-to-back SLA; regular reviews

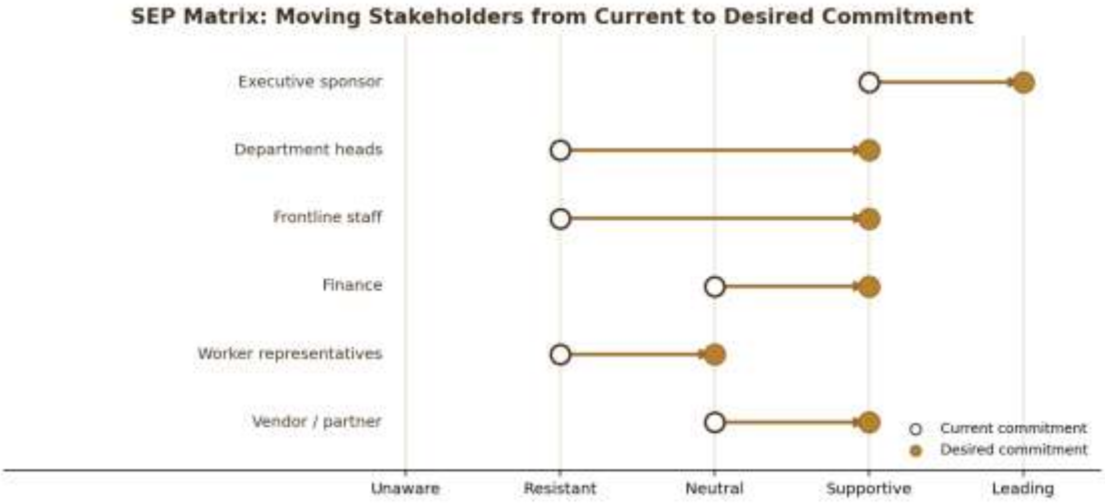

Figure 12. SEP matrix: moving stakeholders from current to desired commitment.

Appendix E Influence and Motivation Models

The following models informed how the project leader motivated the team and influenced stakeholders throughout the change.

Table 19. Theory X, Y and Z management styles.

Theory	Assumption about people	Style	Where applied in this project
Theory X	Motivated by self-interest; respond to incentives and control	Hands-on, top-down direction	Only for urgent, non-negotiable safety/compliance points
Theory Y	Motivated by enjoyment and creativity	Coaching; invites discussion and innovation	The default: co-design, coaching, open problem-solving
Theory Z	Motivated by community and shared purpose	Team-building and open communication	Building shared ownership of the new ways of working

Table 20. McClelland motivators mapped to engagement tactics.

Dominant need	What drives the person	Engagement tactic used
Achievement	Visible, measurable success	Framed the work as a concrete, trackable win with clear targets
Affiliation	Belonging and collaboration	Emphasised teamwork, inclusion, and co-design in workshops
Power	Influence and ownership	Offered decision rights and ownership of a workstream or SOP

Figure 13. Seven-step team performance model.

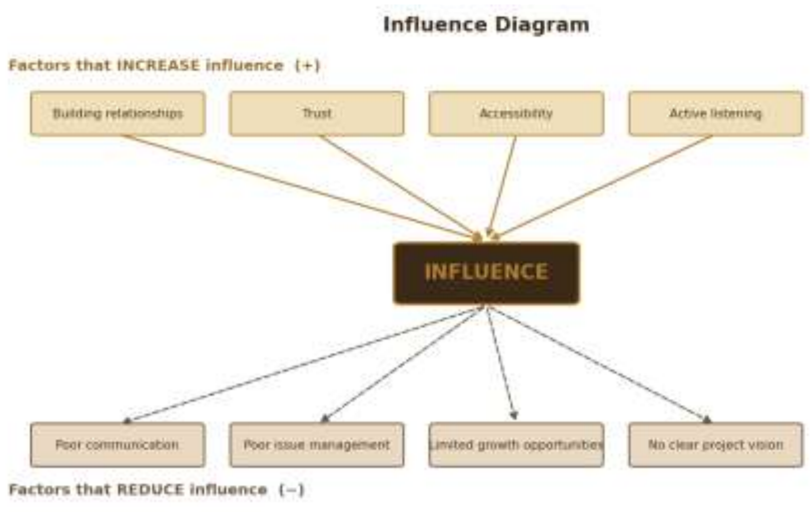

Figure 14. Influence diagram: factors that raise and lower influence.

Appendix F Financial Evaluation (IDR)

All figures are illustrative but calibrated to the Jakarta freight-forwarding and contract-logistics market. Cash flows are discounted at a weighted average cost of capital of 12.5 per cent over a five-year horizon.

Table 21. Cost-benefit summary of the improvement (IDR).

Item	Type	Amount (IDR)
Project team time (opportunity cost, ~9 months)	Investment	420,000,000
Software, dashboards and tools	Investment	150,000,000
Training and change management	Investment	120,000,000
SOP documentation, legal and PP registration	Investment	160,000,000
Total one-time investment	Investment	850,000,000
Avoided cost of poor quality (rework)	Annual benefit	150,000,000
Released capacity from 22% cycle-time cut	Annual benefit	150,000,000
Protected revenue from higher on-time performance	Annual benefit	80,000,000
Total net annual benefit	Annual benefit	380,000,000

Table 22. Investment-appraisal metrics.

Metric	Value	Interpretation
Payback period	~2.24 years	Time to recover the initial investment
ROI (5-year)	~124 %	Net profit relative to investment cost
ROIC	~45 %	Efficiency of capital use; exceeds WACC
Benefit-Cost Ratio (BCR)	1.59	Above 1.0 indicates a profitable project
NPV @ 12.5%	~IDR 503,000,000	Positive: value created after discounting
IRR	~35 %	Exceeds the 12.5% cost of capital
EVA (annual)	~IDR 274,000,000	Value beyond the cost of capital

Table 23. Depreciation of capitalised assets (IDR, four-year group).

Year	Straight-line (25%)	Declining-balance (50%)
1	50,000,000	100,000,000
2	50,000,000	50,000,000
3	50,000,000	25,000,000
4	50,000,000	25,000,000

Total	200,000,000	200,000,000

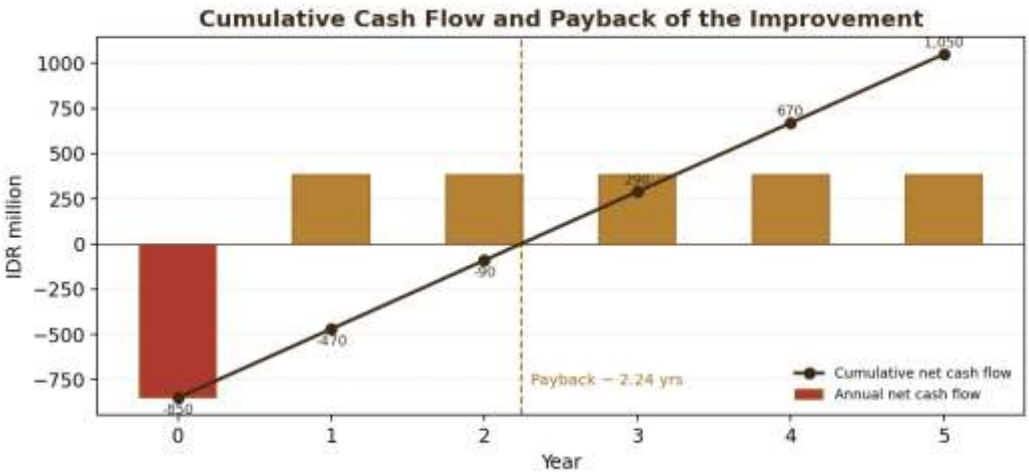

Figure 15. Cumulative cash flow and payback of the improvement.

Appendix G Project Budget and Cost Estimation (IDR)

Table 24. Budget estimate levels and accuracy.

Estimate level	Accuracy band	When used	Range (IDR)
Rough Order of Magnitude (ROM)	-25% to +75%	At initiation, before detailed planning	638,000,000 - 1,488,000,000
Definitive estimate	-5% to +10%	After detailed WBS planning	808,000,000 - 935,000,000

Table 25. Bottom-up budget by work package (WBS), planned vs actual (IDR).

Work package (WBS)	Estimation method	Planned	Actual
Discovery & baseline (time study, data)	Bottom-up + parametric	90,000,000	96,000,000
Process mapping & analysis	Bottom-up	110,000,000	104,000,000
SOP & governance design (20+ SOPs)	Parametric (per SOP)	180,000,000	188,000,000
KPI dashboard & tools (Power BI, licences)	Analogous + bottom-up	150,000,000	142,000,000
Training & change management	Parametric (per day)	120,000,000	126,000,000
PP legalisation & legal	Analogous	80,000,000	78,000,000
Governance/control setup & contingency	Bottom-up	120,000,000	110,000,000
Total		850,000,000	844,000,000

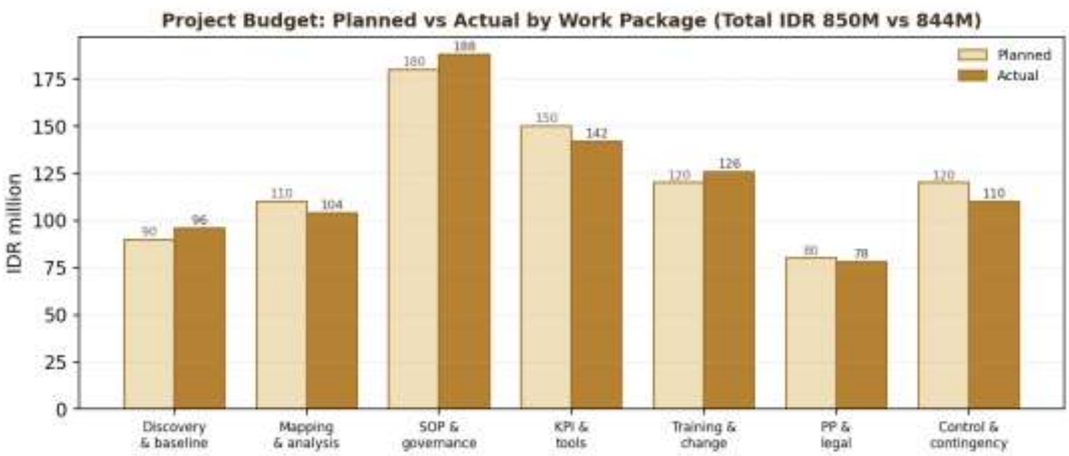

Figure 16. Project budget: planned vs actual by work package.

Appendix H Business Analysis Artefacts

The following artefacts illustrate the business-analysis work that defined the product's requirements. They are abridged and anonymised.

Table 26. Product (requirements) traceability matrix.

ID	Requirement	Source	Use case / story	Acceptance criteria	Delivered by	Phase
R1	Complete intake data	Interview	UC-01 intake	No missing-doc rework; all mandatory fields captured	SOP-01 checklist	Improve
R2	Clear ownership per step	Workshop	US-02	One accountable owner per activity	RASCI matrix	Improve
R3	Real-time status visibility	Survey	UC-03	Status known for any job at any time	KPI dashboard	Improve
R4	On-time completion >= 90%	VOC / CTQ	UC-04 dispatch	On-time SLA >= 90% on dashboard	Control plan + KPIs	Control
R5	No duplicate data entry	Observation	US-05	Single point of capture; no re-keying	Process redesign (ECRS)	Improve
R6	Auditable, standard method	Lessons learned	UC-06	SOP-adherence audit >= 95%	SOPs + audit cadence	Control

Table 27. Sample user stories with acceptance criteria.

As a (role)	I want (need)	So that (value)	Acceptance criteria
Operations coordinator	a standard intake checklist	jobs start with complete information	All mandatory fields validated at intake
Department head	clear accountability per step	no task falls between roles	One accountable owner per activity (RASCI)
Customer / next process	to see job status at any time	I can plan without chasing updates	Live status shown on the KPI dashboard
Finance	reliable, on-time completion	invoicing and cash flow are predictable	On-time SLA >= 90%

Table 28. Worked use case (abridged).

Element	Description
Use case	UC-01 Standard job intake
Actor / goal	Operations coordinator; capture a complete, valid job at intake
Preconditions	Job received; SOP-01 and checklist available
Main success scenario	Coordinator opens checklist, captures all mandatory fields; system validates; job proceeds with complete data
Exception / alternate	Mandatory field missing: system blocks progress and prompts correction before release
Key performance indicators	Zero missing-doc rework; intake cycle time within target
Postconditions	Complete job record passed to the next step; status visible on the dashboard

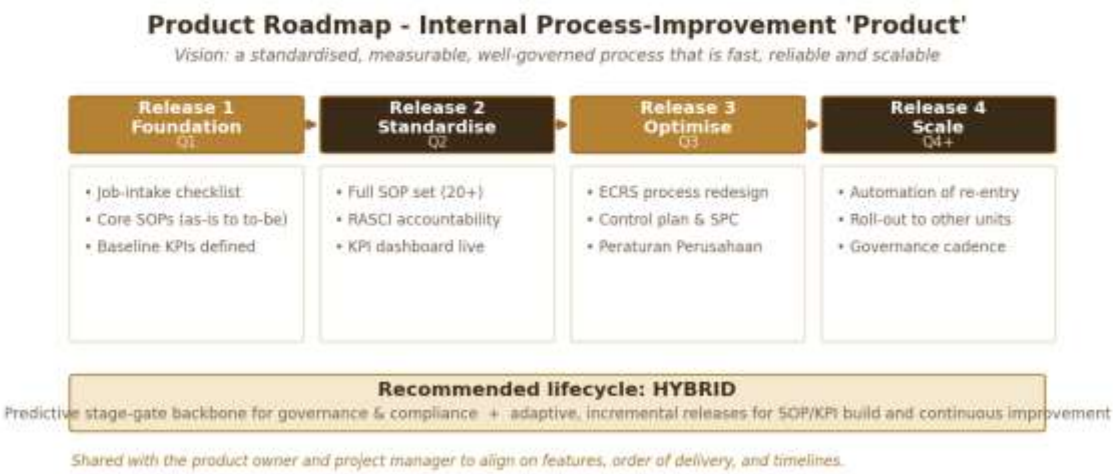

Figure 17. Product roadmap with recommended (hybrid) lifecycle.

Appendix I Work Breakdown Structure and Activity Network Diagram

I.1 Project Scenario

The scenario analysed here is the transportation-and-depot process re-engineering and governance build-out delivered inside a freight-forwarding and contract-logistics organisation — the same initiative documented in this thesis. The organisation faced long process cycle times, inconsistent hand-offs between transport and depot operations, high rework, and the absence of a formal governance layer. The improvement was executed as a structured Lean Six Sigma (DMAIC) project of roughly five months and therefore required disciplined project-management planning to sequence the analytical work, the redesign, the pilot, and the control build-out. To make that plan explicit, the project scope is decomposed below into a Work Breakdown Structure (WBS) and an activity network diagram, and the resulting plan is then compared against the standard project-management proposed-solution templates.

I.2 Work Breakdown Structure

The WBS decomposes the project into three levels using code-of-account numbering. Level 1 is the project itself; Level 2 is organised around the five DMAIC phases; and Level 3 lists the twenty-four work packages that make up the deliverable set. Each work package is named in action-result form so that scope, schedule, and budget can be planned against it, consistent with WBS best practice.

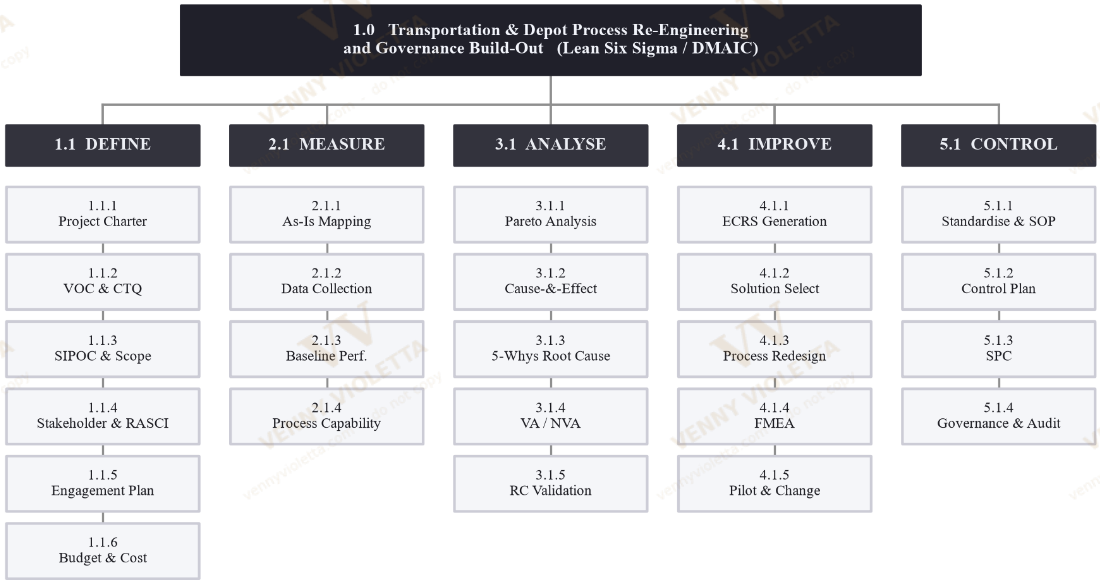

Figure 18. Work Breakdown Structure (WBS) — three-level decomposition by DMAIC phase: Project (Level 1), Phase (Level 2), and Work Package (Level 3), with code-of-account numbering.

I.3 Activity Network Diagram

Dependencies were mapped first and durations were then estimated in weeks. Because a DMAIC project is phase-gated, the network is summarised at phase level (activity-on-node): each phase node rolls up the Level-3 work packages listed in the WBS, so activity-to-work-package traceability is preserved. The critical path, shown in red, runs Define (3.5 wk), Measure (4.5 wk), Analyse (3.0 wk), Improve (6.5 wk), and Control (4.0 wk), and totals approximately 21.5 weeks (about five months). The Improve pilot and the Measure data-collection window are the largest schedule drivers. Budget and procurement set-up (work package 1.1.6) is planned in parallel and carries roughly 5.5 weeks of float, so it is off the critical path and is shown in blue.

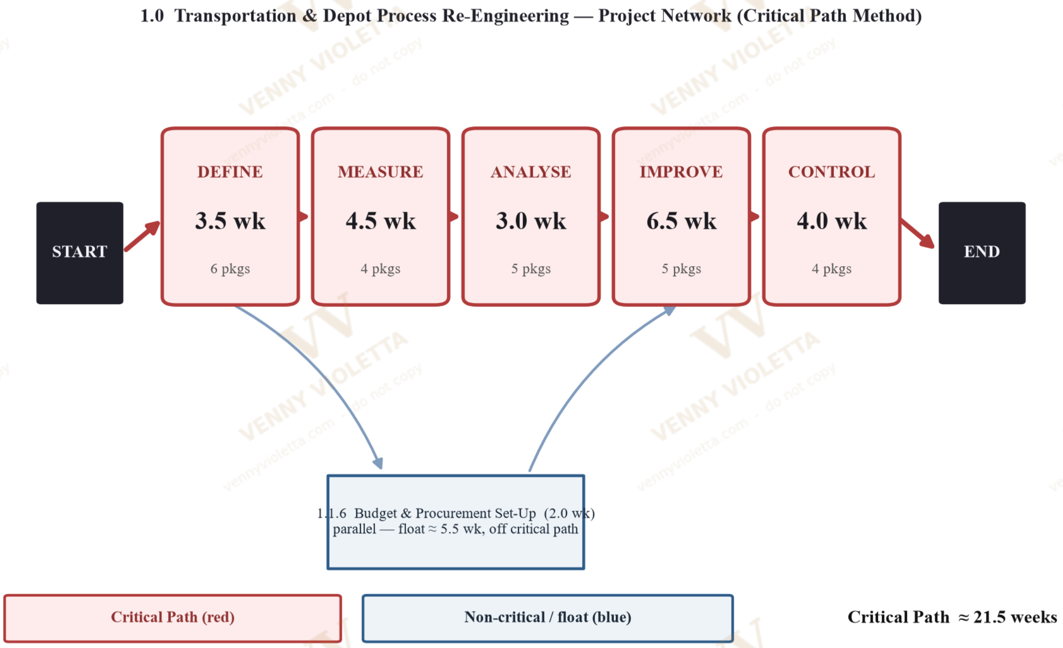

Figure 19. Project network diagram (activity-on-node), summarised at DMAIC-phase level. The critical path is shown in red (≈ 21.5 weeks); the non-critical branch, in blue, carries float.

I.4 Comparison to the Proposed Solution

Comparing the plan above with the two proposed-solution templates (a three-level WBS and a phased network diagram), the following alignment is observed:

- Three-level decomposition — matches. Both the proposed template and this WBS use Project, Phase, and Work-Package levels with code-of-account numbering (1.0 / 1.1 / 1.1.1).
- Action-result naming — matches. Work packages are named as verb plus deliverable (for example 'Baseline Performance', 'Process Redesign'), as the template prescribes.
- Activity-to-work-package traceability — matches. The template requires the network activities to tie back to the Level-3 work packages; here the twenty-four packages roll up into the five phase activities, so every activity traces to the WBS and each phase duration is the sum of its packages.
- Dependencies before durations — matches. The path was mapped first and durations were assigned afterwards; the critical path is highlighted in red and non-critical work in blue, per the template's colour convention.
- Phase separation and aggregation — matches. As in the template's per-phase tabs,

the network is laid out by DMAIC phase and the phase critical paths aggregate to the project total.

- Adaptation — the proposed samples use generic project phases (Plan, Implement, Follow-up); this project instead aligns Level 2 to the DMAIC cycle, which better fits a Lean Six Sigma initiative while preserving the same structural discipline. A schedule buffer is recommended on the pilot activity to absorb non-working time on the critical path.