



Vaasan yliopisto
UNIVERSITY OF VAASA

Mubasher Ali Moazzam Malik

**Implementing an Integrated Management System
(IMS) to Optimize Procurement and Supplier
Development Processes in a Manufacturing
Company: A Case Study**

School of Technology and Innovations
Master's thesis in Industrial Management
Master's Programme in Industrial Systems Analytics (ISA)

Vaasa 2024

UNIVERSITY OF VAASA**School of Technology and Innovations**

Author: Mubasher Ali Moazzam Malik
Title of the Thesis: Implementing an Integrated Management System (IMS) to Optimize Procurement and Supplier Development Processes in a Manufacturing Company: A Case Study
Degree: Master of Science in Technology
Programme: Industrial Systems Analytics (ISA)
Supervisor: Ahm Shamsuzzoha
Year: 2024 **Pages:** 141

ABSTRACT :

The adoption of Integrated Management Systems (IMS) in manufacturing is growing. However, empirical research on integrating procurement and supplier development processes within IMS frameworks remains limited, particularly in manufacturing contexts. This study addressed this gap by investigating IMS implementation in a manufacturing company's procurement and supply development operation, focusing specifically on the absence of frameworks aligning these functions with ISO standards and Sarbanes-Oxley (SOX) compliance requirements. The research aimed to develop and validate an IMS framework that optimizes procurement and supplier development processes while maintaining regulatory compliance. A single case study approach utilizing mixed methods combined qualitative data from questionnaires (n=7) and document analysis with quantitative assessments through structured survey (n=33). Business Process Reengineering methodologies (BPR) and Business Process Model and Notation (BPMN) were applied to redesign workflows, integrating category management, strategic sourcing, operational purchasing, and supplier development functions. The implementation resulted in significant improvements across key performance metrics: process clarity (78-94%), compliance adherence (71-88%), and stakeholder satisfaction (84-94%). The redesigned processes demonstrated effectiveness in supplier audits (94% satisfaction) and RFx processes (92% satisfaction). The study's primary contributions include an empirically validated IMS implementation framework, a practical methodology for BPMN application in process optimization, and a systematic approach for aligning procurement processes with international compliance requirements. The research was limited by its single case focus, short-term implementation assessment, and exclusion of new software system implementations. Future research should examine long-term implementation effects across different organizational contexts, explore cross-industry applications, and investigate the integration of emerging technologies like artificial intelligence and blockchain within IMS frameworks. These findings provide valuable insights for manufacturing organizations seeking to optimize their procurement and supplier development processes while maintaining international compliance standards.

KEYWORDS: Integrated Management System (IMS), Procurement Optimization, Supplier Development, Business Process Reengineering (BPR), Regulatory Compliance, Supply Chain Operations Reference (SCOR) Model.

Contents

1. Chapter 1: Introduction	10
1.1 Overview of the Research Topic	10
1.2 Research Background	11
1.2.1 Research Focus	12
1.3 Study Justification and Significance of the Study	12
1.4 Research Objectives	13
1.5 Problem Statement and Research Questions	14
1.5.1 Research Question:	15
1.6 Limitations of Study	15
1.7 Structure of the Thesis	15
2. Chapter 2: Literature Review and Theoretical Framework	17
2.1 Integrated Management Systems (IMS) in Manufacturing	17
2.1.1 Importance of IMS in Manufacturing	19
2.2 Procurement and Supplier Development Processes in Manufacturing	21
2.3 ISO Standards and SOX Compliance in Manufacturing	23
2.4 The SCOR Model and the Source Process	24
2.5 Business Process Re-engineering (BRP) in Procurement and Supplier Development	25
2.6 Theoretical Framework	26
2.6.1 Overview of the Systems Theory Paradigm	26
2.6.2 Integrated Management Systems (IMS) Theory	26
2.6.3 Business Process Re-engineering (BPR) Theory	27
2.6.4 Application to Procurement and Supplier Development	27
2.6.5 Conceptual Model of the Theoretical Framework	28
2.7 Study Gaps Identified from the Literature	31
3. Chapter 3: Case Company Overview and Existing Processes	32
3.1 Introduction to the Case Company	32
3.2 Procurement and Supplier Development Organizational Structure of the Case Company	33

3.3	Existing Procurement Processes in the IMS System of the Case Company	35
3.4	Challenges in Existing IMS Processes of the Case Company	43
4.	Chapter 4: Research Methodology	45
4.1	Research Design	45
4.2	Sampling Method	48
4.3	Data Collection Methods	50
4.4	Data Analysis Methods	52
4.5	Ethical Considerations	54
5.	Chapter 5: Process Mapping and IMS Processes Design of the Case Company	56
5.1	Current State Analysis and AS-IS Process Mapping of the Case Company	56
5.1.1	Operational Purchasing Process	56
5.1.2	Strategic Sourcing Process	62
5.1.3	Category Management Process	67
5.1.4	Supplier Development Process	72
5.2	TO-BE Process Design for Procurement and Supplier Development Using BPMN	78
5.2.1	Redesigned Top-Level Procurement Process	80
5.2.2	Redesigned Operational Purchasing Process	82
5.2.3	Redesigned Strategic Sourcing Process	85
5.2.4	Redesigned Category Management Process	87
5.2.5	New Supplier Development Processes	89
5.3	Summary of AS-IS and TO-BE Processes of the Case Company	92
6.	Chapter 6: IMS Processes Implementation	94
6.1	Implementation Process	94
6.2	Implementation Results	96
6.3	Implementation Challenges and Initial Impact	103
7.	Chapter 7: Results and Discussion	106
7.1	Achievement of Research Objectives	106
7.1.1	Process Mapping and Documentation Results (Objective 1)	106

7.1.2	IMS Process Design Outcomes (Objective 2)	107
7.1.3	Implementation Success Analysis (Objective 3)	107
7.1.4	Process Performance Analysis (Objective 4)	108
7.2	Theoretical Framework Validation	113
8.	Chapter 8: Conclusions and Recommendations	115
8.1	Main Research Question Addressed	115
8.2	Sub-Research Questions Addressed	116
8.3	Study Limitations	118
8.4	Research Implications	119
8.4.1	Theoretical Implications	119
8.4.2	Practical Implications	120
8.4.3	Managerial Implications	121
8.5	Recommendations	122
8.5.1	Case Company Recommendations	122
8.5.2	Future Research Directions	123
	References	125
	Appendix A: Case Company Employee Feedback on New Process Maps	132
	Appendix B: Category Manager Process Questionnaire	134
	Appendix C: Operational Purchasing Processes Questionnaire	136
	Appendix D: Strategic Purchaser Process Questionnaire	138
	Appendix E: Supplier Development Engineer Process Questionnaire	140

Pictures

Picture 1. Shows the four key phases in the sourcing process (Case Company, 2024)	36
Picture 2. Shows the Operational purchasing process for scheduling component deliveries (Case Company, 2024)	38
Picture 3. Shows the Strategic sourcing process for new products from existing suppliers (Case Company, 2024)	39
Picture 4. Shows the existing category management process (Case Company, 2024)	40
Picture 5. Shows the IMS implementation of the Procurement Top-Level Processes (Case Company, 2024)	96
Picture 6. Shows the Implemented (sE1.5) Supplier Selection and onboarding Process (Case Company, 2024)	97
Picture 7. Shows the Implemented (sS3.3) RFX Process (Case Company, 2024)	98
Picture 8. Shows the Implemented (sS1.1) Schedule Product Delivery Process (Case Company, 2024)	99
Picture 9. Shows the Implemented (sE3.4) Supplier Audits Process (Case Company, 2024)	100
Picture 10. Shows the Implemented (sE3.6) Corrective Actions and Continuous Improvement Process (Case Company, 2024)	102

Figures

Figure 1. Shows the Conceptual Model of the Theoretical Framework	28
Figure 2. Shows the Procurement and Supplier Development Organizational Structure of the Case Company	34
Figure 3. Shows the Research Methodology Framework	45
Figure 4. Shows the Mind Map Visualization of Operational Purchasing Process	57
Figure 5. Shows the Flowchart of Purchase Order Creation Processes	60
Figure 6. Shows the Fishbone Diagram for the operational Purchasing Process Challenges	61
Figure 7. Shows the Mind Map Visualization of the Strategic Sourcing Process	62
Figure 8. Shows the Strategic Sourcing RFX Process Flow	65

Figure 9. Shows the Fishbone Diagram for the strategic sourcing RFX Process Challenges	66
Figure 10. Shows the Mind Map Visualization of the Category Management Process	67
Figure 11. Shows the Supplier Selection and Onboarding Process Flowchart	70
Figure 12. Shows the Fishbone Diagram for the Category Management Challenges	71
Figure 13. Shows the Mind Map Visualization of the Supplier Development Process	72
Figure 14. Shows the Supplier Audit Process Flowchart	75
Figure 15. Shows the Supplier Claim Process Flowchart	76
Figure 16. Shows the Fishbone Diagram for the Supplier Development Challenges	77
Figure 17. Shows the Detailed TO-BE Process Design Methodology Flowchart	79
Figure 18. Shows the Redesigned Top-Level Procurement Process	81
Figure 19. Shows the Redesigned Operational Purchasing Process (ERP-Based PO)	83
Figure 20. Shows the Redesigned Operational Purchasing Process (Manual PO)	84
Figure 21. Shows the Redesigned Strategic Sourcing Process (RFX Process)	86
Figure 22. Shows the Redesigned Category Management Process (Supplier Selection and onboarding)	88
Figure 23. Shows the New Supplier Development Process (Supplier Audits)	89
Figure 24. Shows the New Supplier Development Process (Supplier Claims)	91
Figure 25. Shows the Implementation Process Flowchart	95
Figure 26. Shows the Stakeholder Satisfaction Ratings for Implemented IMS Processes	104
Figure 27. Shows the Process Clarity Analysis from Survey	109
Figure 28. Shows the Process Efficiency Evaluation from the Survey	110
Figure 29. Shows the Compliance Achievement Analysis from the Survey	111
Figure 30. Shows the Overall Satisfaction Assessment from the Survey	111
Figure 31. Shows the Case Company Employees Surveys Results on Process Ratings	112

Tables

Table 1. Shows the Definitions of Integrated Management Systems (IMS)	18
---	----

Table 2. Shows the summary of Key Aspects Highlighting the Importance of (IMS) in Manufacturing	19
Table 3. Shows the Sample Size Outcomes for Study Participants	49
Table 4. Shows the Summary of Key Findings from Questionnaire Responses on Operational Purchasing Processes	58
Table 5. Shows the Summary of Key Findings from Questionnaire Responses on Strategic Sourcing Processes	63
Table 6. Shows the Summary of Key Findings from Questionnaire Responses on Category Management Processes	68
Table 7. Shows the Summary of Key Findings from Questionnaire Responses on Supplier Development Engineer Processes	73
Table 8. Shows the Case Company Employees Survey Results on Process Ratings	109

Abbreviations

AEO - Authorized Economic Operator
BOM - Bill of Materials
BPR - Business Process Re-engineering
BPMN - Business Process Model and Notation
CAR - Capital Authorization Request
EMS - Environmental Management System
ERP - Enterprise Resource Planning
IMS - Integrated Management System
IoT - Internet of Things
ISO - International Organization for Standardization
KPI - Key Performance Indicator
NC - Non-Conformance
NDA - Non-Disclosure Agreement
NPS - Net Promoter Score
OEM - Original Equipment Manufacturer
OHS - Occupational Health and Safety
OHSMS - Occupational Health and Safety Management System
PAPP - Production Part Approval Process
PO - Purchase Order
QMS - Quality Management System
R&D - Research and Development
RFI - Request for Information
RFP - Request for Proposal
RFQ - Request for Quotation
RFx - Request for x (Information/Proposal/Quote)
SCOR - Supply Chain Operations Reference
SDE - Supplier Development Engineer
SME - Small and Medium-sized Enterprise
SOX - Sarbanes-Oxley Act
TCO - Total Cost of Ownership

1. Chapter 1: Introduction

The Chapter outlined the research topic, background, problem statement, research questions and objectives, significance and limitation of the study, and thesis structure.

1.1 Overview of the Research Topic

The study focuses on applying the IMS in a manufacturing case company concerned with better integrating the procurement and supplier development processes. An integrated management system (IMS) is a framework that covers various layers of management systems and turns them into a single organized management system (Nunhes et al., 2016). This paper attempts to incorporate procurement and supplier development into the existing IMS of a case company.

The adoption of integrated management systems (IMS) is gaining ground among various manufacturing sectors due to efficiency gains in operations. However, only some organizations can successfully implement the IMS strategy's functional areas of procurement and supplier development (Barbosa et al., 2021). This knowledge gap initiates a search for how organizations may better those core functions through IMS implementation.

The approach herein is based on business process reengineering, which postulates a radical redesign of the business process to significantly improve performance dimensions (Hammer & Champy, 1993). This paper discusses a case implementation by applying Business Process Modeling Notation (BPMN). It explicates the mapping and redesigning of the Procurement and Supplier Development processes of an IMS in a case company.

To do this research work, the manufacturing company under consideration is adopted as a case study to help implement IMS in procurement and supplier development. This will fill the extant gap in the literature on IMS adoption and provide hands-on advice to

practitioners on how management tools can be overlapped to realize optimized organizational performance.

1.2 Research Background

The recent changes in the manufacturing sector are noteworthy because of the impetus to streamline and improve operational procedures to ward off global trends and keep up with environmental progress. Major trends regarding changes are increasing awareness of and adoption of integrated management systems (IMS) to manage these different systems in terms of quality, environment, and safety under one framework. Implementing IMS is a strategic choice to facilitate work processes with regulatory compliance, enhancing overall operational efficiency (Pratikno & Kusnadi, 2020).

Established in 1992 as a Finnish producer of premium work lights, the case company has experienced upward growth. When becoming a large supplier, the company cooperated with a company from the United States. Consequently, this automatically meant that the company had to implement much more stringent and comprehensive procedures concerning procurement and suppliers.

Despite having a global distribution network and diversified procurement teams, the case company requires well-documented processes within its current IMS, especially for purchasing and supplier development. Given that global supply chains have become increasingly complex, the relevance of supplier relationship management has become more prominent in modern manufacturing. It is considered one of the critical success factors (Vanpoucke et al., 2017).

The extant literature acknowledges that manufacturing firms can benefit significantly from applying IMS. According to Pratikno and Kusnadi (2020), integrating multiple management systems can improve operational efficiency and reduce the administrative burden related to documentation. More importantly, it can enhance strategic alignment with business goals.

Moreover, according to Kafetzopoulos and Psomas (2015), firms implementing IMS have increased stakeholder satisfaction and risk management capabilities. This highlights the importance of developing and maintaining an effective IMS system in manufacturing, given the modern-day intricate nature of supply chains and operational requirements.

1.2.1 Research Focus

This study will establish an IMS to optimize procurement and supplier development processes in a Finnish Manufacturing case company. The study will use the IMS framework to concentrate on the following research areas:

- Current-state analysis of the procurement and supplier development process in the company case.
- Designing and implementing the specifically tailored IMS processes on identified gaps and inefficiencies.

1.3 Study Justification and Significance of the Study

This study seeks to bridge the gap in the literature on implementing IMS by conducting empirical research in the Finnish case company concerning the procurement and supplier development process. More studies are needed, especially on integrating IMS into specific areas within Finnish manufacturing. IMS has been acknowledged for its effectiveness in improving operational efficiency and regulatory compliance (Vuorinen, 2022).

The paper focuses on a case company's central issues when expanding its operations internationally and entering a partnership with a U.S. multinational corporation. The absence of a fully documented Integrated Management System (IMS) for procurement and supplier development has hampered the effectiveness of operations in the case company and its compliance efforts.

Therefore, this study's objective is to attempt to narrow this gap by formulating IMS processes based on the organization's specific needs while meeting the requirements of

international standards and regulatory bodies. This work continues to fill the gaps in the literature since there have been very few studies on integrating procurement and supplier development processes into IMS, especially for organizations growing globally.

The current industry dynamics further emphasize the importance of the IMS in the light of procurement and supplier development. According to Deloitte, in a study in 2021, organizations that integrated procurement processes reported lower supply chain disruptions. Besides, the research work by Sánchez-Rodríguez et al. (2020) proved that companies with well-developed systems of supplier management in their IMS witness improvement in performance by the suppliers and reduced procurement costs.

The results from this study can help the case company and other manufacturing companies. This paper discusses a helpful framework that enables manufacturers to balance operational efficiency with regulatory compliance, thus attaining insightful process improvements within the evolving landscape of globalized business.

1.4 Research Objectives

The primary objectives of this research are to:

1. To map and document existing processes.
2. To design tailored IMS Processes for procurement and supplier development.
3. To implement and document new processes.
4. To assess the initial impact on process efficiency and compliance.

- **To Map and Document Existing Processes**

The study mapped the purchasing and supplier development processes in the case company. Data were collected through questionnaires, interviews, and documentation reviews to understand the processes and challenges of the present day and areas for improvement.

- **To design tailored IMS Processes for procurement and supplier development**

The IMS process for the case company's procurement and supplier development functions will be developed based on the information from the previous step. It adopts what is good from the previous step, bridges the gap between phases, and fills in the identified shortcoming gaps.

- **To Implement and Document New Processes**

This was done using the company's existing IMS system infrastructure, and the new processes were documented for clarity and availability to all concerned parties.

- **To Assess the Initial Impact on Process Efficiency and Compliance**

The first impacts of IMS implementation will be measured in a survey run on Webropol. Opinions of the office workers belonging to the case company will be collected in this survey to have a good idea of the effectiveness and compliance of the processes.

1.5 Problem Statement and Research Questions

The case company is challenged by rapid growth and a new partnership with a U.S. multinational company. As described above, the existing procurement and supplier development processes must be elaborated and well-documented in the IMS system. This scenario creates operational efficiency hurdles. Also, the partnership with the U.S. firm brings new complexities, i.e., the SOX compliance requirement. Therefore, the current processes need to be in the IMS system to fulfill the compliance requirements, which results in consistency.

A robust IMS system will help the case company optimize its procurement and supplier development processes for such challenges. Developing IMS processes requires knowledge of the organization's existing practices, identifying deficiencies, and strategically integrating the various management systems.

1.5.1 Research Question:

How can an Integrated Management System (IMS) be used to optimize procurement and supplier development processes at a case company?

Sub-Questions:

1. What are the case company's current procurement and supplier development challenges?
2. How can the IMS be aligned with the case company's requirements?
3. What initial impacts do the proposed IMS processes have on optimizing process efficiencies and ensuring the case company's procurement and supplier development compliance?

1.6 Limitations of Study

1. **Single Case Study Limitation:** The research methodology employs a single case study approach, focusing exclusively on one organization. This limitation may affect the generalizability of findings to other organizations and industrial contexts.
2. **Scope Restriction:** The study focuses solely on procurement and supplier development processes within the case company, excluding other organizational functions.
3. **Performance Measurement:** Long-term outcomes and the development of new KPIs are beyond the study's scope.
4. **Technological Implementation:** The study addresses process integration into the existing IMS but does not involve implementing new software systems.

1.7 Structure of the Thesis

This thesis will consist of eight chapters, which will contribute in a sequentially structured manner toward the exploration of research problem, methodology, findings, and conclusion in the following manner:

1. **Introduction:** It introduces the research topic, background, problem statement, questions, and objectives.
2. **Literature Review and Theoretical Framework:** This section analyzes the relevant concepts to identify gaps the current study can fill. It also reviews the existing theories upon which the current study is based.
3. **Case Company Overview and Existing Processes:** Give a general description of the company and discuss its existing processes.
4. **Research Methodology:** It describes detailed procedures for research design, data collection, and analysis methods employed in the study.
5. **Process Mapping and IMS Processes Design:** The first step in this direction will be mapping the present processes and conducting a study that indicates their inefficiencies. Then, new processes aligned with IMS will be designed.
6. **IMS Processes Implementation:** Describes the implementation steps, challenges, and first outcomes.
7. **Results and Discussion:** Evaluation of improvements and feedback after implementation by stakeholders.
8. **Conclusion and Recommendation:** Summarize the significant findings and contributions and suggest further research.

2. Chapter 2: Literature Review and Theoretical Framework

The chapter addressed an overview of the literature on IMS, particularly in the manufacturing sector, with a clear focus on procurement and supplier development processes. It explored ISO standards and SOX compliance and disclosed BPR as a theoretical framework. The chapter formed the foundation for our examination of the case company. The Literature Review section focused on synthesizing existing research and knowledge about IMS implementation, procurement practices, and supplier development in manufacturing, identifying current trends, challenges, and gaps in the field. In contrast, the Theoretical Framework section established the conceptual foundation through three fundamental theories - Systems Theory, IMS Theory, and BPR Theory - providing a structured lens for analyzing and interpreting the research findings. While the Literature Review answered "what is known" in the field, the Theoretical Framework provided the analytical structure for understanding how these elements interact and inform the research process.

2.1 Integrated Management Systems (IMS) in Manufacturing

From the manufacturing perspective, an integrated management system (IMS) has been defined by several researchers. Bernardo et al. (2017) describe IMS as "a set of interconnected processes that share human resources, information, materials, infrastructure, and financial resources to achieve various objectives while satisfying stakeholder requirements." More strategically, Samy et al. (2015) define it as "a strategic management approach that integrates all organizational systems and processes into one complete framework, enabling an organization to work as a single unit with unified objectives" (see Table 1: Definitions of Integrated Management Systems). This integration approach requires operations to be implemented smoothly to achieve specified objectives. Incorporating several management systems like Quality Management Systems (QMS) with Environmental Management Systems (EMS) and Occupational Health and Safety Management Systems (OHSMS) enables an organization to improve its effectiveness through quality, sustainability, and safety performance (Nunhes & Oliveira, 2018). As Domingues

et al. (2017) emphasize, IMS provides "a systematic framework that combines multiple management standards and methodologies into one coherent management structure to optimize organizational performance."

Table 1. Shows the Definitions of Integrated Management Systems (IMS)

Author(s) & Year	Definition	Key Focus
Bernardo et al. (2017)	"A set of interconnected processes that share human resources, information, materials, infrastructure, and financial resources to achieve various objectives while satisfying stakeholder requirements."	Process Integration
Nunhes et al. (2016)	"A holistic approach to merging different management systems (quality, environmental, safety) into a single cohesive system with unified documentation, policies, and procedures."	System Unification
Domingues et al. (2017)	"A systematic framework that combines multiple management standards and methodologies into one coherent management structure to optimize organizational performance."	Systematic Framework
Samy et al. (2015)	"A strategic management approach that integrates all organizational systems and processes into one complete framework, enabling an organization to work as a single unit with unified objectives."	Strategic Integration

IMS has a potential competitive advantage. Organizations that can integrate their management systems are more adaptive to market changes, improve customer satisfaction, and excel at compliance with regulations. For instance, a matrix of quality management is founded in ISO 9001, from which the organization integrates other management systems that drive continuous improvement and operational excellence. As the complexity

of manufacturing continues to rise, coordination among the multiple processes becomes a strategic imperative for growth and acceptance of innovation (Tran et al., 2019).

2.1.1 Importance of IMS in Manufacturing

IMS is critical in today's manufacturing sectors because it integrates many management systems, such as QMS, EMS, and OHSMS. The following aspects highlighted the importance of IMS in manufacturing: operational efficiency, regulatory compliance, sustainability, competitiveness, and risk management.

Table 2. Shows the summary of Key Aspects Highlighting the Importance of (IMS) in Manufacturing

Key Aspect	Importance	Reference
Operational Efficiency	Reduces operational costs and improves productivity through better resource allocation and process optimization	Satolo et al. (2013)
Regulatory Compliance	Provides structured management of quality, environmental, and safety requirements while minimizing non-compliance risks	Barbosa et al. (2021); Ramos et al. (2020)
Sustainability	Enables tracking of ecological footprint and integration of environmental management practices with operations	Maletič et al. (2015)
Competitiveness	Supports continuous improvement and innovation, particularly in the industry 4.0 context with AI and IoT integration	Banitaan et al. (2023)
Risk Management	Creates comprehensive understanding of risks related to quality, environment, and safety, leading to better decision-making	Gao & Wang (2011)

- **Operational Efficiency:**

The significant advantage of using an IMS is that operational efficiency can be significantly enhanced. Because IMS integrates many management systems, the organization will identify and remove duplicative processes, resulting in lower operational costs and improved productivity. Satolo et al. (2013) state that implementing IMS in a sugar and ethanol production house unit reduced costs over time by providing better resource allocation and process optimization.

- **Regulatory Compliance:**

Manufacturers are imposed with many regulations on quality, environmental protection, and occupational health and safety. An Integrated Management System (IMS) helps in compliance by providing a structured way of managing requirements. Quality Management Systems (QMS) can thus be integrated with Environmental Management Systems (EMS) and Occupational Health and Safety Management Systems (OHSMS) for organizations to ensure they harmoniously meet all appropriate standards and requirements (Barbosa et al., 2021). This further minimizes non-compliance risks and enhances the organization's reputation with the stakeholders. Increased ease of audit and assessment due to IMS is facilitated because compliance management is handled systematically. All information for compliance is thus gathered in one place for easier accessibility, which contributes to improved occupational health and safety risk management processes in companies (Ramos et al., 2020).

- **Sustainability:**

Due to regulations and the public view of manufacturing in sustainable ways, sustainability has become one of manufacturers' paramount concerns. An IMS provides a base over which environmental management practices can be applied within operations that may help them track their ecological footprint more pragmatically against waste and resource consumption reduction strategies. Research has argued that integrating quality management with sustainability practices enhances enterprise performance and, hence, sustainability in development (Maletič et al., 2015). The use enables the assimilation of

operational and sustainability objectives regarding an overall improvement in the environmental performance of a manufacturer.

- **Enhanced Competitiveness:**

An organization must continuously innovate and improve to retain its market position in today's competitive scenario. IMS helps an organization to routinely appraise, revisit, and amend its procedures for continuous improvement. This issue is significant in Industry 4.0 since integrating artificial intelligence and IoT can substantially improve manufacturing capabilities (Banitaan et al., 2023). The IMS enables the manufacturer to change in demand with incredible speed, enhances product quality, and increases consumer satisfaction, improving their competitive position in the market.

- **Risk Management:**

An organization can effectively manage risks by integrating various management systems. The practice of risk management would create a broad-based understanding of the potential risks concerning quality, environment, and safety and define ways to reduce such risks for manufacturers. Research has underscored the importance of the integrated risk management framework within manufacturing projects, indicating that such frameworks could result in better decision-making effectiveness and improved outcomes of a project (Gao & Wang, 2011).

2.2 Procurement and Supplier Development Processes in Manufacturing

The Manufacturing sector views its procurement and Supplier Development processes as central to operational efficiency, cost management, and attaining a competitive edge. The following activities constitute part of operational purchasing, strategic sourcing, category management, and supplier development operations that collectively support the effectiveness of manufacturing concerns in meeting their quality and cost requirements for production while ensuring quality is fine-tuned. These processes are crucial for enhancing procurement performance and managing supplier relationships effectively (Ramos et al., 2020). Furthermore, integrating these activities within an organization's

management system can significantly improve operational efficiency and overall organizational performance (Barbosa et al., 2021).

- **Operational Purchasing**

Operational purchasing describes the day-to-day activities of acquiring any goods and services. It is a process, a transactional relationship with the suppliers that mainly emphasizes acquiring material on time according to the production schedule. Efficient operational purchasing was essential to minimize lead times and ensure the manufacturing process would progress without interference. The excellent integration of buyers and suppliers contributes to the adequate flow of material and information, thus improving manufacturing performance while reducing procurement lead times (Chenini et al., 2020). Overall, procurement operations must be mixed with supply chain management. It turns procurement from several separate activities into an integrated system that manages material flow from suppliers to producers (Esmailnezhad & Saidi-Mehrabad, 2023).

- **Strategic Sourcing**

In contrast, strategic sourcing is a more general view of procurement. It focuses on long-term relationships with the supply base and strategically selects suppliers based on their capabilities and how well they align with organizational goals. Thus, the process will emphasize both manufacturer and supplier collaboration and communication, which can improve the supplier's participation in new product development. As Chen (2023) explains, strategic procurement's better capabilities and partnerships increase supplier investment in innovation.

- **Category Management**

According to Shah and Hasan (2016), category management involves grouping products or services of a similar nature to optimize purchasing decisions and supplier relationships. Manufacturers must source raw materials from specified suppliers. Category management strategy affects its suppliers' performance; the suppliers need to adapt to support this strategic decision. This adaptation is necessary to enhance the suppliers'

performance and ensure they align with the buyer's strategic choices. Suppliers pay massive attention to developing their performance and exercising their innovation capabilities to receive some huge benefits, which are only achievable through the development of the suppliers. This approach will give a strategic view of procurement that aligns with the overall business strategy.

- **Supplier Development Processes**

Krause et al. (2007) explain that these processes form the basis for developing suppliers and their ability to meet the increasing demands of manufacturing companies. These relate to the process of supplier upgradation with efforts toward training, technology transfer, and joint problem-solving. The deterrence of supplier development conceptualizes suppliers as transactional partners and strategic ally co-partners in attaining sustainable competitive advantage. Effective supplier development is likely to improve quality, cut costs, and enhance the innovation of the supply chain. Supplier development might encourage suppliers and manufacturers to share knowledge regarding product development or process innovation.

2.3 ISO Standards and SOX Compliance in Manufacturing

Implementing ISO standards and the Sarbanes-Oxley Act represents the essential requirements of the manufacturing industry for consideration of quality excellence and regulatory compliance. The standard best practice for quality management systems came through ISO, notably the ISO 9001 series, which has over one million certifications across the globe for its contribution to organizational effectiveness and customer satisfaction. The implementation levels for ISO 9001 are very high, with more than one million certifications globally, illustrating how critical it has been in ensuring quality for different sectors, specifically in manufacturing (Llach et al., 2011). Companies benefit from ISO certification by aligning their processes and subsequent possible increases in product quality and work operational efficiency (Psomas & Kafetzopoulos, 2013).

SOX compliance is a significant regulatory mechanism that protects investors' interests by promoting accuracy and reliability in corporate disclosure. This is a considerable manufacturing concern wherein financial reporting and operational transparency play a vital role in keeping the stakeholders in good faith. Adopting enterprise resource planning (ERP) systems has been proven to help comply with SOX regulations by automating processes and ensuring accurate financial reporting. When manufacturing companies adopt such technologies, they adhere to the regulation standards and improve operational effectiveness (Mundy & Owen, 2013).

2.4 The SCOR Model and the Source Process

The Supply Chain Operations Reference (SCOR) model provides a strategic framework for analyzing and improving Supply Chain processes. In exploring its five central processes, which include Plan, Source, Make, Deliver, and Return, the most significant attention falls on the Source process since it deals with acquiring products and service inputs required for production (Setyadi et al., 2022). Not only does supplier selection fall under the Source process but also it integrates various other performance measures and best practices toward overall better efficiency in the supply chain (Wang et al., 2020).

Supplier relationship management occurs in the "Source" portion of SCOR as the following process. Purchasing good inputs needs perfect identification and management of suppliers by organizations. Studies reveal that effective supplier selection positively contributes to better supply chain performance (Wang et al., 2020). This further helps suppliers to undertake an evaluation of their efficiency, in terms of methodologies like the Analytic Hierarchy Process (AHP) and Data Envelopment Analysis (DEA), against dimensions such as cost, quality of the product, and delivery performance (Wang et al., 2018). Application of such methodologies can enable any organization to align its decision-making with plans geared toward strategy alignment besides improving the performance of suppliers (Wang et al., 2020).

The SCOR model places equal attention on measuring the Source process by labeling some key performance indicators: reliability, responsiveness, agility, cost, and asset management (Setyadi et al., 2022). These serve as a structured methodology for appraising supplier performance regarding meeting organizational needs and how well this contributes to the general effectiveness of the supply chain. Recently, a study revealed that the most critical KPI for suppliers' evaluation was the cost of goods and services since supplier choice has several financial implications (Iskandar, 2023).

Moreover, since the SCOR model standardizes operations, inserting the sustainability dimensions in the Source processes is easy. For instance, some recent research has investigated green procurement activities in the framework of SCOR, which implies that organizations can improve their ecological performance while maintaining efficiency in terms of the economy (Rashidi et al., 2020).

2.5 Business Process Re-engineering (BRP) in Procurement and Supplier Development

As an approach, Business Process Re-engineering (BPR) became a reconsideration of how work processes were developed to enhance effectiveness toward a better output related to cost, quality, service, and speed (Djunaidy et al., 2023). The scope of process reengineering within the procurement process that BPR effectively attains requires an understanding and precise definition of detailed steps involved in the process and a picturing eye for the final intended result. This consists of developing models for "as-is" and "to-be" states of the procurement process. This would help the organizations realize where they have inefficiencies and scope for further betterment. Manufacturers, through structured scrutiny and redesign, create enormous cost savings and efficiencies out of these processes coupled with enhanced agility and competitiveness of their supply chains (Tsakalidis & Vergidis, 2024).

Long-term sustainability in this journey would also demand continuous evaluation. Organizations should undertake a structured assessment of how their BPR initiatives have

affected procurement and supplier development (Tsakalidis & Vergidis, 2024). Key performance indicators need monitoring, and stakeholders should provide periodic feedback for process fine-tuning. A culture of continuous betterment will keep manufacturers abreast of what is happening in the market and allow them to have healthy relationships with suppliers.

2.6 Theoretical Framework

The theoretical framework for this study will be based on three fundamental theories: Systems Theory, Integrated Management Systems (IMS) Theory, and Business Process Re-engineering (BPR) Theory. These three theories will be synthesized to provide a basis for assessing IMS implementation in improving procurement and supplier development processes in the case company.

2.6.1 Overview of the Systems Theory Paradigm

In systems theory, organizations are viewed holistically, considering their complexity of nature and related components. Based on this perspective, this paper discussed how organizational processes interact to influence performance. It would show how a change in one area has ripple effects across the organization. A set relationship with such a viewpoint would explicate, for instance, the wide-ranging implications of amalgamating procurement with supplier development and integrating both into a general management system (Kast & Rosenzweig, 2017).

2.6.2 Integrated Management Systems (IMS) Theory

IMS Theory is a framework that mainly integrates multiple management systems into one coherent framework. The approach is most appropriate given the complexity of the current business environment, where one organization must deliver not only on quality but also on its environmental impact and safety. IMS Theory may help use one correct approach to integrate various management systems for improved organizational

efficiency and effectiveness (Nunhes et al., 2016). Particularly in the production sector, IMS Theory supports the day-to-day work under many norms and laws.

2.6.3 Business Process Re-engineering (BPR) Theory

BPR theory postulates the destruction of business processes at any structural or interstitial level of design where radical performance improvement is to be obtained. This paper uses this theory to implement IMS for the procurement and supplier development process. BPR would, however, allow for a structured approach to analyzing and redesigning processes to sieve out inefficiencies of current practice and improve workflow design (Davenport, 2013).

2.6.4 Application to Procurement and Supplier Development

These three theories provide a holistic model for analyzing IMS implementation within manufacturing concerning procurement and supplier development. The systems theory guarantees a holistic view by emphasizing the interconnection of an organization's operations. Further development would see the IMS Theory integrating multiple management systems with the coherence of procurement and supplier development with other organizational functions. The next element would be the redefinition of the IMS process in line with the steps of the BPR Theory.

Applying this theoretical framework to procurement and supplier development creates a basis for several gains. Integrating purchasing activities into a broader management system can enhance supplier relationships and business performance (Zsidisin et al., 2015). Therefore, since BPR principles are applied to supplier development, it could help create more strategic and collaborative relationships with suppliers (Vanpoucke et al., 2017).

This theoretical framework will adopt an integrated view of optimizing the case company's purchasing and supplier development process through IMS implementation. Its

effectiveness is in building a support base to investigate ongoing activities and scope for improvement and building efficiency and effectiveness from an Integrated Management perspective.

2.6.5 Conceptual Model of the Theoretical Framework

The conceptual model will show how systems theories, IMS, and BPR can effectively merge procurement and supplier development processes in a manufacturing environment and outline their relationships.

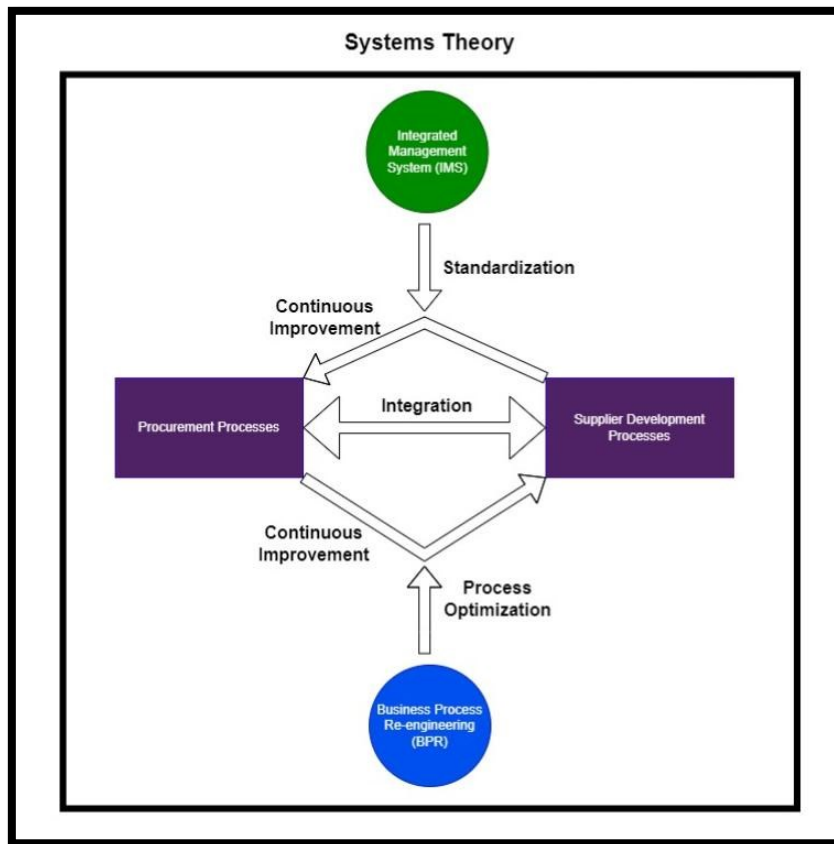


Figure 1. Shows the Conceptual Model of the Theoretical Framework

Key Variables, Relationships, and Their Value in Optimization

- **Systems Theory:** The big square represents Systems Theory as the overall paradigm, emphasizing the dependence and interaction of organizational parts for a holistic view of the case company. This theory recognizes that every change in one part

affects others, which is crucial for explaining IMS and BPR implementation in procurement and supplier development.

Value: According to Kast and Rosenzweig (2017), Systems Theory provides:

- ❖ Comprehensive understanding of cross-departmental interdependencies.
 - ❖ Recognition of how procurement changes impact overall performance.
 - ❖ Holistic view of supplier development initiatives' organizational effects.
 - ❖ Framework for managing complex organizational relationships.
- **Integrated Management System:** Represents an organized methodology for integrating organizational management systems. The down arrow 'Standardization' shows how IMS affects procurement and supplier development through coherent standards and procedures.

Value: As Nunhes et al. (2016) demonstrate, IMS delivers:

- ❖ Standardized procurement procedures.
 - ❖ Unified quality management frameworks.
 - ❖ Integrated compliance mechanisms.
 - ❖ Clear documentation and control systems.
 - ❖ Coherent operational standards.
- **Business Process Reengineering:** Located at the bottom of the model, BPR is a methodology for fundamentally rethinking and radically redesigning business processes. The up arrow indicates its role in improving procurement and supplier development.

Value: According to Hammer and Champy (1993), BPR enables:

- ❖ Fundamental process redesign.
- ❖ Implementation of optimized workflows.
- ❖ Enhanced operational efficiency.
- ❖ Radical performance improvements.

- **Procurement and Supplier Development Processes:** Represented by two large rectangular boxes showing primary operational focus areas. The horizontal "Integration" arrow indicates their interconnected nature and need for alignment.

Value: Vanpoucke et al. (2017) note that this integration provides:

- ❖ Streamlined operational efficiency.
 - ❖ Enhanced coordination.
 - ❖ Improved information flow.
 - ❖ Synchronized business processes.
- **Continuous Improvement:** Depicted by arcing arrows forming a cycle between procurement and supplier development processes, indicating constant improvement driven by IMS and BPR principles.

Value: As highlighted by Sánchez-Rodríguez et al. (2020), this creates:

- ❖ Systematic process evaluation
- ❖ Regular performance updates
- ❖ Adaptive operational improvements
- ❖ Sustained optimization
- ❖ Ongoing efficiency enhancements

The combined effect of these relationships and values creates a comprehensive framework for optimization where:

- ❖ Systems Theory provides a holistic foundation.
- ❖ IMS offers structural standardization.
- ❖ BPR enables transformational change.
- ❖ Process Integration ensures operational alignment.
- ❖ Continuous Improvement maintains ongoing optimization.

2.7 Study Gaps Identified from the Literature

The literature reveals several significant research gaps regarding integrating procurement and supplier development processes within Integrated Management Systems (IMS), particularly in the manufacturing sector.

Firstly, more empirical studies need to examine the integration of procurement and supplier development processes within the IMS framework in manufacturing. As Partanen (2020) points out in their master's thesis, while supplier development is crucial for operational performance, there is a shortage of research on how it can be effectively integrated into broader management systems, particularly in the engineering-to-order industry.

Secondly, while IMS implementation in manufacturing has been studied, more attention must be paid to the unique dynamics of procurement and supplier development in enhancing operational efficiency and supplier performance. Heikkilä et al. (2018) highlight this gap in their study on purchasing category management, emphasizing the need for more research on integrating purchasing with other business functions.

Thirdly, developing a coherent framework that effectively links procurement and supplier development areas within IMS is a significant challenge. Dubois et al. (2021) underscore this issue in their study on supplier development, noting the need for a comprehensive framework that integrates these critical areas within broader management systems.

In summary, the critical research gaps identified include 1) Lack of empirical studies on integrating procurement and supplier development within IMS in manufacturing, particularly in the Finnish context; 2) Limited focus on the unique dynamics of procurement and supplier development in enhancing operational efficiency; and 3) Absence of a coherent framework linking procurement and supplier development within IMS. These gaps provide opportunities for further research to enhance understanding of effective IMS implementation in manufacturing organizations.

3. Chapter 3: Case Company Overview and Existing Processes

Chapter 3 analyzes the case company's existing state, focusing on its procurement and supplier development processes. It examines the existing IMS system operational procedures and how well they are integrated with the company's Integrated Management System and identifies some challenges. This formed the basis for the process improvements suggested in the subsequent chapters.

3.1 Introduction to the Case Company

The case study concerns a Finnish company that produces complex lighting systems for heavy-duty equipment. Since the early 1990s, it has emerged as one of the leading global suppliers of high-performance lights to sectors such as mining, construction, forestry, logistics, and agriculture. A constructive player in innovation and quality, this company has developed vast experience cooperating closely with many leading OEMs in the heavy machinery sector.

The company has deep experience designing lights that require adverse working conditions and critical expertise in developing rugged lighting solutions for applications requiring continuous operation. With substantial investment in R&D, the company has special facilities for vibration analysis, photometric testing, electronic testing, and other imaging processes. As a result of these strengths, development engineering can ensure constant product innovations and sound quality management.

It is one of the many electronics conglomerates that fall under this broader group. The company's business model favors sustainable supply chain management and corporate responsibility. With quality (ISO 9001:2015), environmental (ISO 14001:2015), and OHS (ISO 45001:2018) certifications, it shows end-to-end solid operational excellence and value creation for all stakeholders.

It forms part of a broader strategic intent to reduce emissions by 30% on 2021 baseline levels. As shown in the following data points, which show a year-on-year decrease of 16%, the company is on this path. It also does much more than this in material recycling, intending to push the rate up above 60%, having stood at 42% in 2019. Energy efficiency has risen, with returns on the latest one indicating a 7% electricity consumption drop. Notably, the company sources all electricity from 100% renewable energy providers in its Finnish manufacturing operations.

Case company's operation lies on the financial point of view, and consultancy follows a business model concerning making decisions that achieve economic objectives under deep sustainability while recognizing environmental and social responsibilities. At the heart of the company's vision wholly views sustainability and a sustainable business that supports its long-term business strategy and operational philosophy is a laser-like focus on firm sustainability.

While developing, the company is interested in creating even better industrial lighting technologies and greener production methods. Sustainability woven with innovation makes this company a front-runner even in conservative sectors, such as heavy-duty vehicle lighting technologies.

3.2 Procurement and Supplier Development Organizational Structure of the Case Company

The procurement organization structure of the case company is designed to efficiently manage global procurement functions with clear lines of authority from the top down. It begins at the top with the chief executive officer, who provides the overall strategic directions to which procurement should be aligned. The CEO aligns all the procurement strategies to the company's overall business objectives and usually encompasses a long-term vision or perspective.

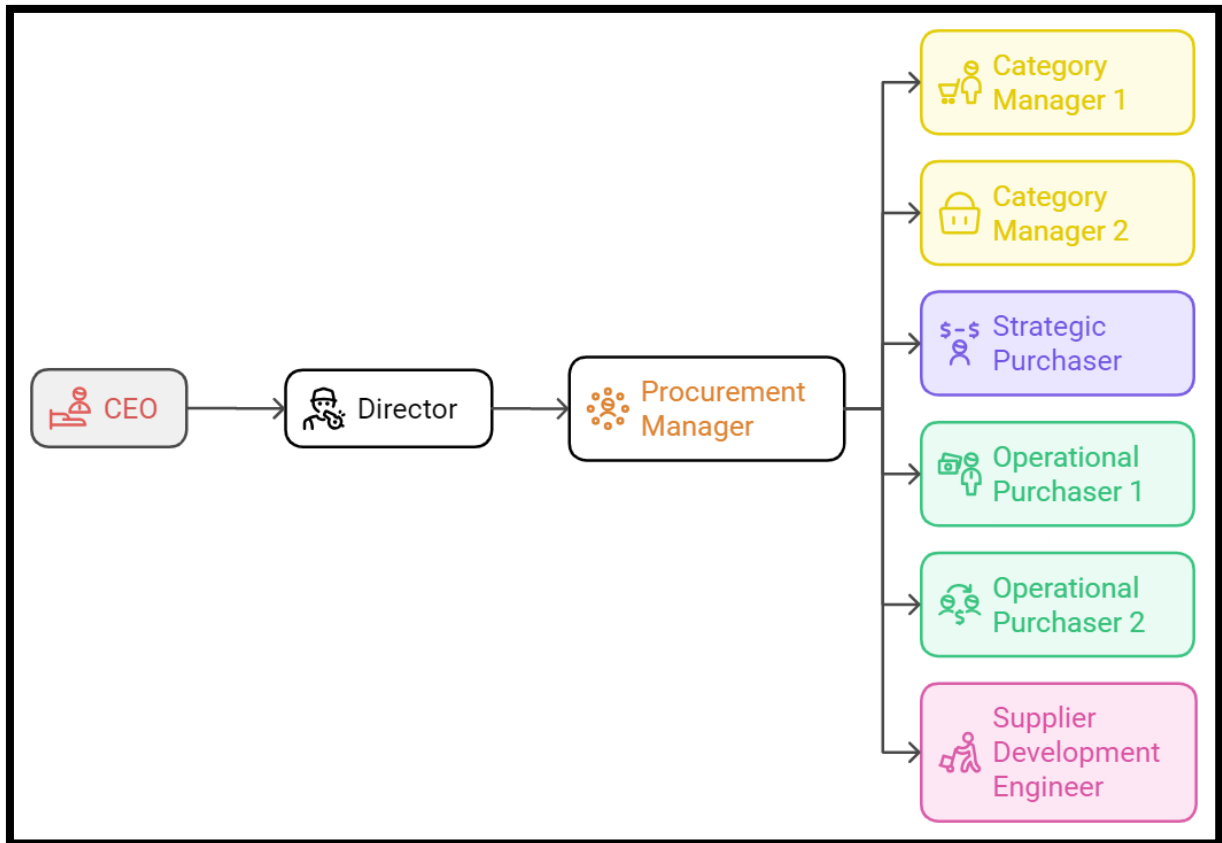


Figure 2. Shows the Procurement and Supplier Development Organizational Structure of the Case Company

Directly beneath the CEO is the Director, who serves as a crucial link between top-level management and the operational aspects of procurement. The director, the head of the various departments, including procurement, translates the CEO's vision into actionable plans for the procurement team.

The procurement manager reports to the Director and is responsible for leading and developing the procurement function globally, achieving target KPIs, and managing the budget. The central role of a procurement manager is based on operational excellence and strategies.

Reporting directly to the Procurement Manager are four key roles:

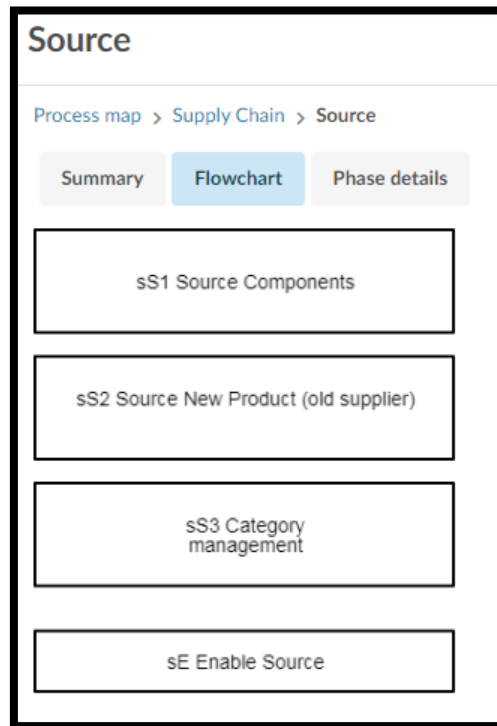
1. **Category Manager:** This position is responsible globally for main categories such as Aluminum, Plastic, Glass, Electronics, and Harnesses. The manager creates and implements global category strategies in cooperation with purchasing, R&D, and SDE while managing smaller categories locally.
2. **Strategic Sourcing:** This position is responsible for incoming freights, planning and managing smaller categories locally, and participating in specific projects like cost-out initiatives and development projects.
3. **Operational Purchaser:** This person handles day-to-day purchasing activities and manages and develops their specific responsibility areas (e.g., Customs/AEO, BOM data updates).
4. **Supplier Development Engineer:** Oversees the supplier reclamation process, participates in PAPP processes, and conducts supplier development and audits.

This provides the entire hierarchy for purchasing, striking a balance between global strategy and local execution. It embeds supplier development as part of the core buying function. It communicates the CEO's strategic vision through to the operational level to ensure procurement activities effectively respond to the company's overall goals.

3.3 Existing Procurement Processes in the IMS System of the Case Company

- **Procurement Department Top Level Process Map (Sourcing)**

These procurement processes are initiated within the case company's existing Integrated Management System (IMS) through a top-level department process map titled "Source". This high-level flowchart identifies four key phases (or sub-processes) for the sourcing function in alignment with the Supply Chain Operations Reference (SCOR) model. SCOR is a widely accepted framework for supply chain management processes (APICS, 2017).



Picture 1. Shows the four key phases in the sourcing process (Case Company, 2024)

The process map represents the following sequence:

1. **sS1 Source Components:** The first phase, sourcing, involves acquiring standard or usually sourced components required for the company to produce its products.
2. **sS2 Source New Product (old supplier):** The phase entails sourcing new products from old suppliers.
3. **sS3 Category management:** This strategic phase focuses on managing procurement categories.
4. **sE Enable Source:** In this final stage, activities that support and drive effective sourcing execution are embraced: supplier relationship management, performance management, and continuous improvement initiatives.

The prefix 'sS' probably refers to products of type 'Source Stocked,' while 'sE' refers to 'Enable Source' processes per the SCOR model naming convention (Lambert, 2008). This

conveys a holistic approach to sourcing in which procurement's operational and strategic dimensions are considered.

Some positive attributes of the process map are that it is clear and straightforward, giving an overview of the leading sourcing processes without overwhelming detail. Stakeholders easily understand this. Using SCOR-like nomenclature to align the process with industry best practices reflects the visibility of known supply chain management techniques that enhance cross-functional and inter-organizational communication. Also, category management is included (sS3), which means strategic along with operational sourcing, a balance essential for the long-term effectiveness of procurement (strategic procurement) (Christopher, 2016).

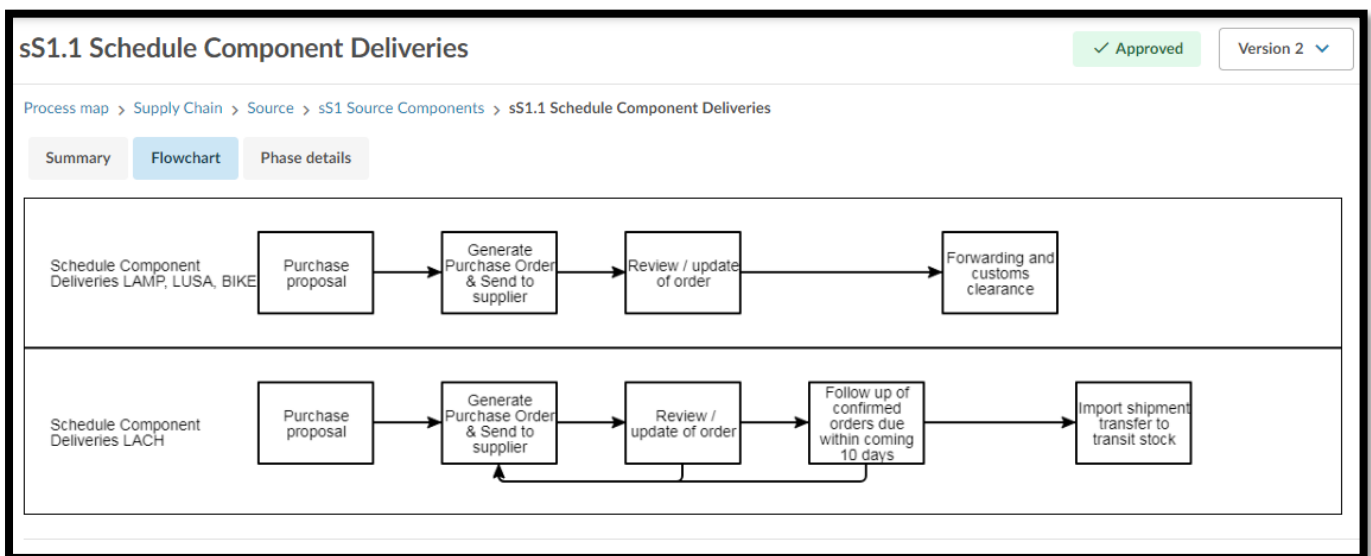
On the other hand, the process map is of limited guidance. The high-level nature of the map does not provide much detail for operational guidance and decision-making. Having more detailed sub-process maps for each phase would be more practical. Moreover, sourcing activities are typically highly iterative and integral elements, which were not brought out in the linear representation of the process. This further means that visible feedback loops within and between processes are one of the challenges of implementing continuous improvement in sourcing. Moreover, the limited and narrow focus on sourcing alone- without relating this function to other broader activities in the supply chain and multi-functional interfaces, portrays less than the total complexity in today's procurement environment.

- **Operational Purchasing: Issuing Purchase Orders (Schedule of Component Deliveries)**

This process map represents the existing operational purchasing process for the issue of purchase orders, specifically for scheduling component deliveries. It illustrates two parallel workflows, one for each type of component.

For the first group of components, it starts with creating a purchase proposal. After that, a purchase order is generated and sent to the supplier. The next step is reviewing and updating the order. Lastly, it forwards and does customs clearance.

Following the same initial steps as for the first group, that is, raising a purchase proposal to generate a purchase order, which is sent to the supplier, and then the order is received and updated, the purchase order of confirmed orders due within the coming ten days is acceptable. A shipment transfer for the same is made into transit stock.



Picture 2. Shows the Operational purchasing process for scheduling component deliveries (Case Company, 2024)

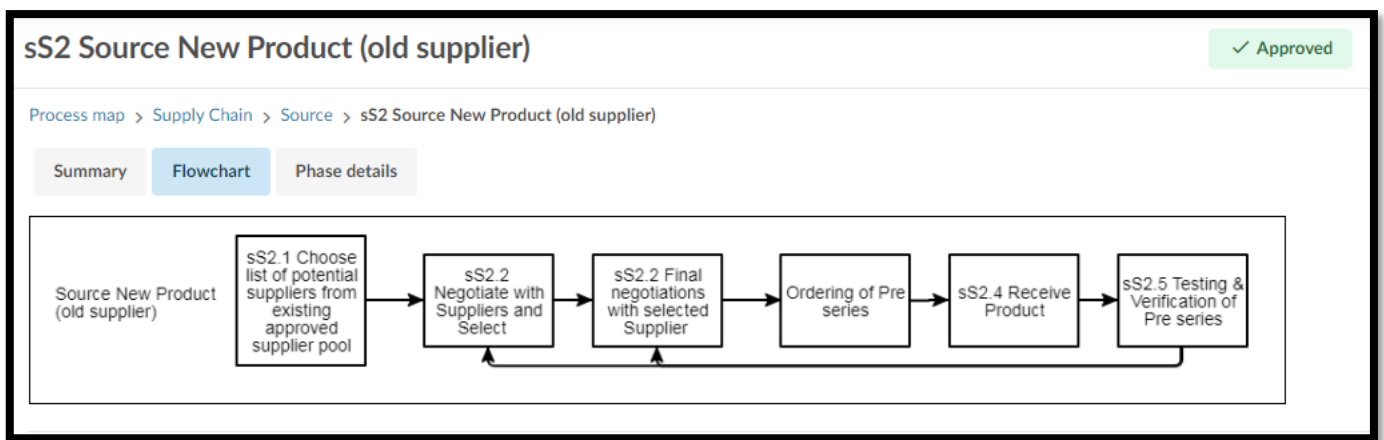
This process map has some positives. It presents a very clear visual of the purchasing workflow, making it easy for any stakeholder to understand the sequence of activities. It also shows the differentiation between the processes for the different component types, indicating the organization's recognition of the need for such differentiated approaches depending on the nature of the purchased components.

On the negative side, the process appears primarily linear, with scant evidence of feedback loops or iterative steps, which should be rightly needed for complex buying situations. The map also needs to transparently reveal points as and when decisions are made

and possible deviations in the process flow, which could oversimplify the actual complexity of the purchase process.

- **Strategic Sourcing Process for New Products from Existing Suppliers**

This process map illustrates the high-level steps of the strategic sourcing process for new products from existing suppliers. The workflow outlines how suppliers are chosen and managed for new product development within an established supplier network.



Picture 3. Shows the Strategic sourcing process for new products from existing suppliers (Case Company, 2024)

The first step in this process is stage sS2.1, where the company selects a shortlist of potential suppliers from its approved supplier pool. This first shortlisting is usually based on previously established relationships and knowledge about suppliers' capabilities (Chen, 2023). This is followed by the actual negotiations with the shortlisted suppliers in stage sS2.2. This would involve the discussion of product specifications, pricing, and delivery terms.

The next step in the process is sS2.3, which is the final negotiation with the supplier selected. This step narrows down to one supplier based on the results of earlier negotiations. After this agreement, pre-series products will be ordered. It is essential at this stage to implement the test and validation of the new product before production.

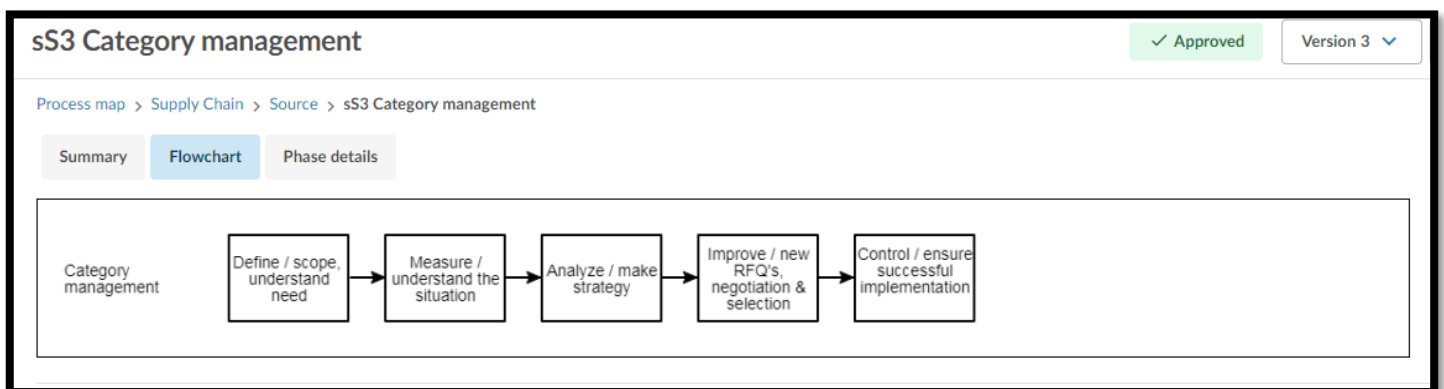
In step sS2.4, the company receives the pre-series products. Next is step sS2.5, in which the items are tested and verified. The process map must depict feedback loops from testing and verify the preliminary supplier selection activities. It lays down the iterative approach; supplier reconsideration is allowed if issues arise during testing or final negotiations.

The process map has several positive aspects. It depicts a logical flow from supplier selection to product testing that incorporates critical stages of negotiation and verification. Incorporating feedback loops demonstrates a dynamic system that could change due to the rise of constraints or unexpected issues during the sourcing process. This is according to best practices in strategic sourcing with continuous improvement and supplier relationship management.

Besides, such a process map must rectify a set of weaknesses. It does not explicitly consider the decision points and criteria for passing from one stage to another; hence, some ambiguity may be involved in decision-making. Even the specific activities within each of these steps are not detailed in the map, such as the criteria for selecting suppliers or the parameters for pre-series testing. This level of abstraction might not be sufficient to guide personnel in carrying out the process.

- **Existing Category Management Process**

This process map illustrates the existing category management process. Category management is a strategic approach to organizing procurement activities by grouping related



Picture 4. Shows the existing category management process (Case Company, 2024)

products or services. Therefore, the diagram outlines how workflow can be systematic for effective procurement category management within an organization.

This first step in the process is 'Define/scope, understand the need.' It involves identifying and limiting the exact category of products or services to be managed and understanding the organizational requirements for these items. The Define/scope step is paramount for laying the groundwork for a category management strategy.

The second step involves collecting and analyzing data on current spending, suppliers' market conditions, and internal stakeholder needs. This is essential to set the baseline and identify improvement opportunities:

The next stage is "Analyze/make strategy." At this stage, the category management team will integrate all the information collected to develop a strategic approach to managing the category. This could be done by creating a cost-saving opportunity, quality-improving opportunity, or supply-risk-mitigating strategy.

Step 4, "Improve / new RFQs, negotiation & selection," means issuing new Requests for Quotations, negotiating with suppliers, and choosing the most appropriate vendors. This stage is value-critical, about realizing the value identified in the strategic analysis.

"Control / ensure successful implementation" monitors how the category management strategy is executed and the expected benefits that should accrue. Performance tracking, supplier relationship management, and continual improvement efforts may be considered.

This process map has several positives. It presents a clear, logical progression of steps by established category management practices. The fact that analytical and action-oriented stages are included in the process marks a balanced approach to category management.

As such, its final controlling step speaks to managing, improving, and sustaining that category's strategy.

However, the process map presented some limitations. It seemed a linear process with no visible feedback loops or iterations; hence, the dynamic nature of category management might need to be fully reflected in practice. Such maps need to describe the tools or methodologies employed within each step to provide accurate guidance for practitioners in implementation.

- **Existing IMS supplier development processes**

The case company's IMS needed to have supplier development processes in place. This void is a significant gap in the organization's supply chain management strategy, specifically in critical areas of claim handling and supplier audits. Since supplier development still needs to be formalized, the organization's endeavors to improve supplier performance would also be considered a significant input affecting product quality, cost, and other supply chain efficiency.

For several reasons, the supplier development process is critical to an effective procurement department's IMS. First and most apparent, supplier development significantly boosts how well a supplier conducts himself, directly affecting product/service quality and dependability. According to Krause et al. (2007), quality supplier development may enhance quality, delivery, and flexibility core competencies required to compete in a dynamic business environment.

Secondly, the supplier development process mitigates risks within the supply chain. Organizations can develop regular, systematic approaches to claims and audit them on time to identify issues before they become a higher-level problem. This proactiveness aspect aligns with the findings of Zsidisin et al. (2015), which highlighted the importance of supplier development in mitigating the vulnerabilities of the supply chain and enhancing general resilience.

Besides, including supplier development processes in the IMS would help companies strike stronger collaborative relations with their suppliers. According to Chen (2023), strong collaboration may increase innovation and knowledge sharing between buyers and suppliers for new product development and process innovation.

A big red flag is the need for formal claims and supplier audit handling processes. Claim management is critical to resolving any quality, delivery, or other imbalances brought up by the suppliers. An organization may lose if this is not well handled because a study of structured claims management shows improved responsiveness and accountability of the supplier with little financial loss for an organization (Sánchez-Rodríguez et al., 2020).

3.4 Challenges in Existing IMS Processes of the Case Company

The current Integrated Management System (IMS) used by the procurement department presents several major impediments to effectiveness and efficiency. The most significant gap in the system is the need for formalized processes for supplier development, especially in claims and supplier audits. This lack can result in an inconsistent supplier management approach, increased supply chain risk, and missed performance improvement opportunities since suppliers play a huge role.

Furthermore, existing processes must be more detailed and aligned with current practices. This can cause staff misinterpretations, operational inefficiencies, and even compliance issues. Process documentation must be clear and accurate to support business process management and organizational performance effectively.

In addition, the current IMS processes only partially correspond to the compliance requirements, especially concerning the standards of ISO and parts of the Sarbanes-Oxley regulations. This gap in aligning compliance holds risks at an appreciable level of proper organizational adherence to regulations and general operational integrity.

Based on these challenges, there is a pressing need to develop and implement the following processes:

- **Top-Level Procurement Process Map:** This overarching map will provide a comprehensive view of the procurement function.
- **Operational Purchasing—Purchase Order Process Map:** A detailed map of this core process will improve day-to-day purchasing activities and bring uniformity to order issuance.
- **Strategic Purchasing—RFx Process Map:** The map will help standardize the Request for Information/Proposal/Quote process, which is critical to effective supplier selection and negotiation.
- **Category Management—Choosing the New Supplier Process Map:** A structured approach to the processes will streamline and enhance the process of choosing the new supplier for the category management strategy.
- **Supplier Development—Handling Claim Process Map:** This will fill the gap in claim management, a critical aspect of supplier performance and relationship quality.
- **Supplier Development—Supplier Audits Process Map:** The audit process is being formalized to uniformly cover the evaluation aspect, supporting risk management and continuous improvement.

Addressing these areas through the development of process maps will ensure standardization and full compliance, closing the identified gaps and misalignments with expected performance. Adequately designed and well-integrated processes can support innovation and improve supplier relations to improve the company's competitive position.

4. Chapter 4: Research Methodology

This section represents the research methodology followed in conducting the study. In this context, we depict the type of research design undertaken in this case study. We identified how the participants in our research were selected by describing the sampling method. Further, the chapter elaborates on the data collection and analysis. We explicate the rules of ethics that we followed in our research.

4.1 Research Design

This study uses a single case study approach with mixed methods to investigate the implementation of IMS in procurement and supplier development processes in a Finnish manufacturing case company. The study will provide the required in-depth understanding of implementing IMS and its effectiveness within a specific organizational setting (Yin, 2018). According to Guetterman and Fetters (2018), the single case design in mixed methods research provides the best framework to explore complex organizational phenomena while retaining triangulation-based rigor in methods.

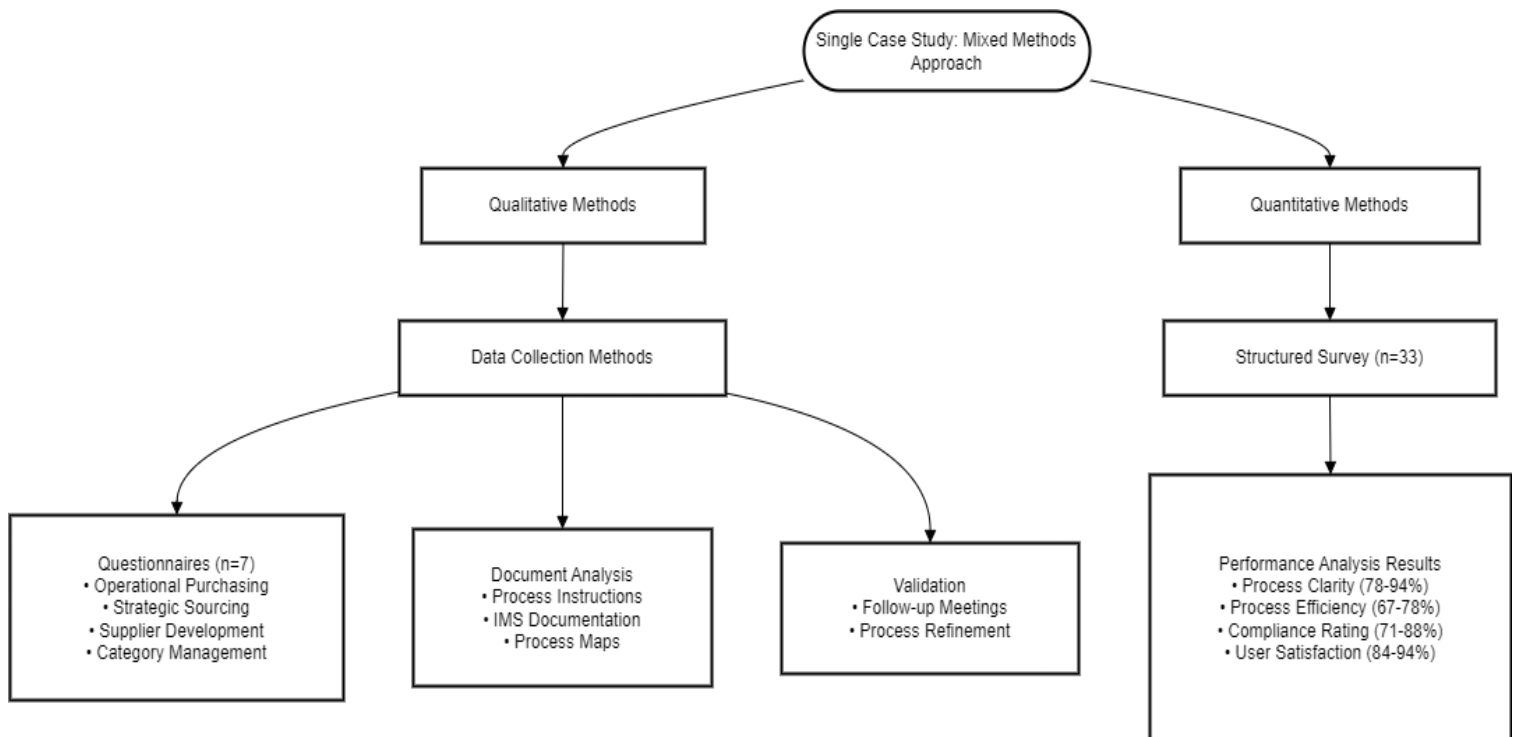


Figure 3. Shows the Research Methodology Framework

Research was conducted using qualitative and quantitative data collection techniques. Qualitatively, open-ended questionnaires were sent to the procurement team, and unstructured meetings were held to iterate and validate processes. The questionnaires were developed through consultation with the procurement manager and piloted to ensure they captured the full scope of current operations. This approach allowed questions to be framed in an open-ended manner, enabling participants to freely express their actual working methods and challenges faced in daily operations. According to Creswell and Plano Clark (2017), such qualitative methodologies help explore complex organizational processes and stakeholders' viewpoints deeply while allowing for authentic responses that might not emerge through more structured approaches. In addition, a review of process instructions, process descriptions, and IMS manuals enabled systematic insight into the current state of practice and areas needing improvement.

To quantitatively assess the impact of the new process maps, a structured survey was administered among a broad group of case company employees, each with direct experience with the updated procedures. The survey questions were formatted to capture various perspectives, asking employees to rate aspects such as clarity, efficiency, compliance with standards, and overall satisfaction on a scale of 1 to 5, from "Lowest" to "Highest."

This survey involved 33 employees across multiple departments, including R&D, Quality, Product Care, Planning, and Production, with experience levels ranging from 3 to 20 years. These participants provided insights based on their unique departmental roles and backgrounds. Integrating qualitative and quantitative methods exemplifies what Saunders et al. (2019) termed methodological triangulation, enabling a more comprehensive analysis through multiple data collection approaches. This approach achieves rich contextual understanding and offers an objective measure of implementation effectiveness, adding depth to the evaluation.

- **Justification of Research Design**

The single case study approach offers distinct advantages for investigating complex, real-world scenarios, particularly in contexts where control over variables is limited, and the relationship between phenomenon and context is blurred. Yin (2018) argues that single case studies are well-suited for developing or testing theoretical propositions in such situations, allowing researchers to examine the effects of real-life events without manipulation. In this case, the unique Finnish context, characterized by a deterministic Integrated Management System (IMS) and concurrent management of extensive organizational change, provides an ideal setting for a detailed, in-depth analysis. By focusing on this context, the study can reveal insights relevant to similar organizations that encounter analogous challenges in managing procurement and supplier development processes.

Moreover, the single case approach achieves what Stake (2015) describes as "particularization," which involves gaining a deep, contextualized understanding of the case's specifics. This depth of analysis enables other companies in the same sector to see parallels and recognize relevant lessons. For instance, different organizations in regulated, deterministic environments might identify similarities in IMS implementation challenges and strategies, benefiting from this focused case's insights. Flyvbjerg (2006) supports this notion, emphasizing that context-dependent knowledge gained from single case studies is precious in understanding complex social and organizational phenomena that are not easily generalized through statistical means.

As Yin (2018) described, analytical generalization further allows insights from this single case to apply to theoretical frameworks relevant to other companies in similar sectors. This generalization does not assume broad representativeness but seeks to transfer insights based on shared characteristics, such as the structured, regulated nature of IMS systems in procurement. Consequently, findings from this Finnish case study can provide theoretical guidance for companies in similar contexts by clarifying the complexities of managing IMS during organizational change.

The mixed methods design is justified within this single-case context framework for two reasons. First, it achieves what Johnson et al. (2007) refer to as complementarities; different methods bring out various dimensions of the phenomenon under study. It provides deep insights into process challenges and requirements for implementing solutions, while the quantitative survey offers measurable validation of solutions. Second, this is "integration through methods," as Fetters et al. (2013) termed it, in which multiple data collection strategies support more complete insight into the research problem.

4.2 Sampling Method

As a single case study, the sampling strategy is limited to employees within the case company, aligning with the purposive sampling techniques Robinson (2014) recommends for case studies. This approach ensures that data is gathered from respondents who are directly knowledgeable about and engaged in the processes under review, thereby enhancing the reliability and relevance of the results. Collecting focused qualitative data from key procurement team members complements broader quantitative feedback from other employees affected by the processes, providing a comprehensive view of the IMS's impact across the organization.

- **Sampling Strategy and Participant Selection**

A strategic sampling approach was employed for the study, tailored to the two phases that the study would take, with complete stakeholder data captured from the case company. The procurement and supplier development team applied a total population sampling approach for the first phase, which aimed at understanding and mapping current processes. This has been recommended by Robinson (2014) for case study research, where the entire population relevant to the relatively small, accessible, and recommended phenomenon under the study is of use. The selection criteria are the employees currently working for the company in its procurement or supplier development team, directly participating in the processes under review.

The study's second phase, which assessed the newly implemented processes for efficacy, adopted a broader sampling strategy. The increased scope was intended to collect a variety of views on process effectiveness and compliance and included stakeholders from different departments interacting with procurement and supplier development processes. Its selection criteria covered current employment in the case company, acquaintance with or indirect involvement in procurement processes, and voluntary study participation.

- **Sample Size Determination**

Sample size calculations were conducted using Israel's (1992) formula for finite populations:

$$n = N / (1 + N(e)^2)$$

Where:

n represents the sample size

N represents the population size

e represents the margin of error (as a decimal)

The calculations assumed a 95% confidence level with a 5% margin of error for both groups. Table 3 presents the detailed outcomes and actual sample sizes.

Table 3. Shows the Sample Size Outcomes for Study Participants

Group	Description	Population Size (N)	Margin of Error (e)	Calculated Sample Size (n)	Actual Sample Size
A	Procurement Team	7	0.05	6.97	7
B	Office Workers	35	0.05	32.12	33

For Group A (procurement team), the calculated sample size of 6.97 (rounded to 7) coincidentally matched the total population, enabling complete population coverage. For

Group B (office workers), the calculation yielded a required sample size of 32.12 (rounded to 32) from a total population of 35. The sample was 33 participants, exceeding the minimum needed size and ensuring adequate statistical validity representation.

This sampling approach and size determination align with established methodological principles for case study research (Yin, 2018) and provide sufficient data points for qualitative process analysis and quantitative evaluation of implementation effectiveness. The high participation rate in both groups enhances the reliability and comprehensiveness of the findings.

4.3 Data Collection Methods

This study employed two data collection methods to investigate the IMS implementation process. Consistent with mixed methods research recommended by Creswell and Plano Clark (2017), this approach entails using diverse data collection techniques to gain complementary insights into complex organizational phenomena.

- **Qualitative Data Collection**

The primary qualitative data collection began with detailed questionnaires administered to the procurement and supplier development team. Webropol, an online survey platform, was used. The questionnaires were structured with open-ended questions across four key functional areas: operational purchasing (see Appendix C), strategic sourcing (see Appendix D), supplier development (see Appendix E), and category management (see Appendix B). These sections included 20 questions in 5 sections for operational purchasing, 26 questions in 6 sections for strategic sourcing, 20 questions in 3 sections for supplier development, and 24 questions in 8 sections for category management.

After the questionnaires, the same team members were contacted for unstructured follow-up meetings. The meetings had a dual objective: to elaborate and understand the questionnaire responses to cross-validate the data collected for facts and iron out any inconsistencies or misinterpretations. Yin (2018) supports this idea, stating that such

further discussions are significant for data accuracy and increasing the depth of comprehension of complicated procedures in research. These meetings supported going through the process's redesign iteratively because the input on the proposed methods was continuously written into the subsequently revised processes.

Another vital component of the qualitative data collection was document analysis. This entailed systematically reviewing company documents, including process instructions, descriptions, and department/IMS manuals. Following Krippendorff's (2018) approach to content analysis would help identify formal process structures and expectations and point out possible gaps between documented procedures and actual practices.

- **Quantitative Data Collection**

The quantitative data collection phase involved administering a structured survey to a broader audience within the case company. This survey employed a Likert scale format, where respondents rated various aspects of process maps on a scale from 1 to 5, assessing criteria such as clarity, efficiency, compliance, and overall satisfaction. These metrics provided quantitative insights into how employees perceive the functionality and impact of the newly implemented processes. Specifically, 33 employees from different departments interacting with procurement and supplier development processes were surveyed to obtain objective data on the effectiveness of these processes in enhancing operational efficiency and meeting compliance standards (Appendix A).

- **Justifications for Data Collection Methods**

The mixed-methods approach to data collection offers multiple advantages in research. First, it allows for methodological triangulation, where various data collection methods provide complementary perspectives on the topic under study (Saunders et al., 2019). This approach enables an in-depth understanding of current practices through qualitative methods and simultaneously offers a measurable assessment of implementation success via quantitative analysis (Creswell & Plano Clark, 2017). Furthermore, the iterative nature of data collection, especially through follow-up meetings, continually refines

and validates findings, thus enhancing the credibility and robustness of the research outcomes (Yin, 2018). Integrating these data collection techniques provides a strong foundation for examining procurement and supplier development processes, particularly in assessing how well Integrated Management System (IMS) solutions have been implemented. This holistic methodology aligns with the study's goals to ensure that new processes are effective and compliant within the organizational context.

4.4 Data Analysis Methods

This study applied a comprehensive analytical approach using qualitative and quantitative methods to analyze the vast diversity of data collected via questionnaires, meetings, document analysis, and surveys. It worked on meeting the research objectives while maintaining the required level of methodology rigor.

- **Qualitative Data Analysis**

Qualitative data analysis was initiated through a systematic review of questionnaire responses following the thematic analysis framework described by Braun and Clarke (2006). This incorporated several vital stages: familiarization with the data, initial coding, and theme development and refinement. Open-ended responses in the questionnaires were first analyzed to identify and describe the patterns and themes concerning current process issues, challenges, and opportunities for improvement within the procurement and supplier development functions. Such is in line with what Saunders et al. (2019) call interpretative analysis, in which the focus lies in understanding the explicit and implicit meanings within the data.

Document analysis was done according to Krippendorff's (2018) content analysis, where extant process documentation task descriptions and IMS manuals were systematically reviewed. This helped establish the formal structure of current processes and find the gaps between documented procedures and actual practice. The results were organized using mind mapping to visually represent the relationships between different elements of processes and their associated challenges. Also, fishbone diagrams were developed

to understand the root causes of the identified issues according to the established quality management analytical approaches.

Data obtained from the follow-up meetings were analyzed using the constant comparative method, whereby new insights were continually compared with earlier findings to reform understanding and validate interpretations. This view coincides with Yin (2018), who noted that an iterative view helps refine process designs based on stakeholder feedback and operational requirements for case study research.

- **Quantitative Data Analysis**

The quantitative analysis of survey data, as outlined in Chapter 7, utilized descriptive statistical methods to evaluate stakeholder responses regarding the effectiveness of newly implemented processes. This involved calculating response distributions, averages, and percentage scores across four key performance areas: process clarity, efficiency, compliance, and user satisfaction. By systematically analyzing these survey ratings, the study aimed to identify trends, satisfaction levels, and compliance adherence within the Integrated Management System (IMS). Such descriptive statistics provided objective, numerical insights that facilitated a structured evaluation of the IMS impact across different departments, aligning with best practices for quantitative data analysis (Creswell & Plano Clark, 2017; Yin, 2018)

- **Validation and Reliability**

Several validation strategies were implemented to ensure the study's analytical rigor and credibility. First, qualitative data gathered from follow-up meetings was subjected to member-checking, a technique that allows participants to confirm the accuracy of the interpretations made by the researcher. This practice aligns with Lincoln and Guba's (1985) criteria for establishing trustworthiness in qualitative research, which involves allowing participants to verify findings and interpretations. Additionally, findings were triangulated across various data sources, including open-ended questionnaire responses, survey data, and document analysis, to corroborate evidence and identify consistent

themes and patterns. The triangulation process provided a comprehensive, multi-perspective validation that enhanced the study's reliability.

Furthermore, peer review was conducted for the analytical processes, adding an external validation layer and ensuring that interpretations remained aligned with the study's objectives. This multifaceted approach, involving member-checking, triangulation, and peer review, provided a robust framework for establishing validity and reliability, effectively blending qualitative and quantitative rigor. This comprehensive validation reinforced the study's credibility. It facilitated an in-depth understanding of the success of the Integrated Management System (IMS) implementation, supporting the research objectives of optimizing procurement and supplier development processes through an evidence-based framework.

4.5 Ethical Considerations

Ethical considerations are essential in any research, especially organizational data and processes. This study adhered to strict ethical guidelines to protect the case company's and its employees' interests while maintaining research integrity (Saunders et al., 2019). All information related to the case company was used with explicit approval from the company's authorized representative, aligning with the principle of informed consent, a cornerstone of ethical research (Israel, 2015). This involved the initial approval to start the study, continuous communication on the data collection and its usage, and a final review of the draft report by the case company before its publication. Such an iterative review process in approval guaranteed that the company received complete information on how its details would be used and presented in the study.

Some actions were taken to safeguard the privacy and commercial interests of the case company. These included anonymizing the company's identity throughout the report, censoring the company's system pictures to conceal sensitive information, and removing identifying details from process descriptions and data presentations. These steps are

crucial in maintaining confidentiality, a critical ethical consideration in organizational research (Bell et al., 2022).

Following data protection principles, we implemented measures to secure the collected data. These included secure storage of all digital data, including questionnaire responses and interview transcripts, limited access to raw data restricted to the primary researchers, and destruction of unnecessary data after the study. These measures guaranteed that research information, especially its sensitivity, was protected and the research process integrity maintained (Townsend & Wallace, 2016).

5. Chapter 5: Process Mapping and IMS Processes Design of the Case Company

Based on the findings and the identified challenges regarding Chapter 4, this chapter focuses on mapping current IMS processes and designing optimized IMS processes for the case company's procurement and supplier development. Current operations and proposed changes that aimed to enhance compliance and improve operational efficiency were described using BPMN notation.

5.1 Current State Analysis and AS-IS Process Mapping of the Case Company

This section uses data sets to comprehensively analyze procurement and supplier development processes and identify current operations challenges. The primary data collection was done through in-depth questionnaires administered to the procurement team, covering operational purchasing, strategic sourcing, category management, and supplier development functions. This was supported by analyzing organizational documentation, such as process descriptions, task descriptions, and existing IMS documentation.

Mind mapping visualizes the relationships that each process has with its stakeholders. Next, detailed flowcharts for the AS-IS state were developed. Fishbone diagrams were created to identify challenges and bottlenecks and provide a more structured understanding of the root causes of these issues. Such a systematic view ensures that any subsequent process improvement is handled with a detailed knowledge of the current operations and the related challenges.

5.1.1 Operational Purchasing Process

- **Analysis of Collected Data**

Questionnaire responses from the operational purchasing team and documentation review portray the current operational purchasing processes (refer to the mind map in

Figure 4). It helps reveal the intricate relationships between process elements and their associated challenges.

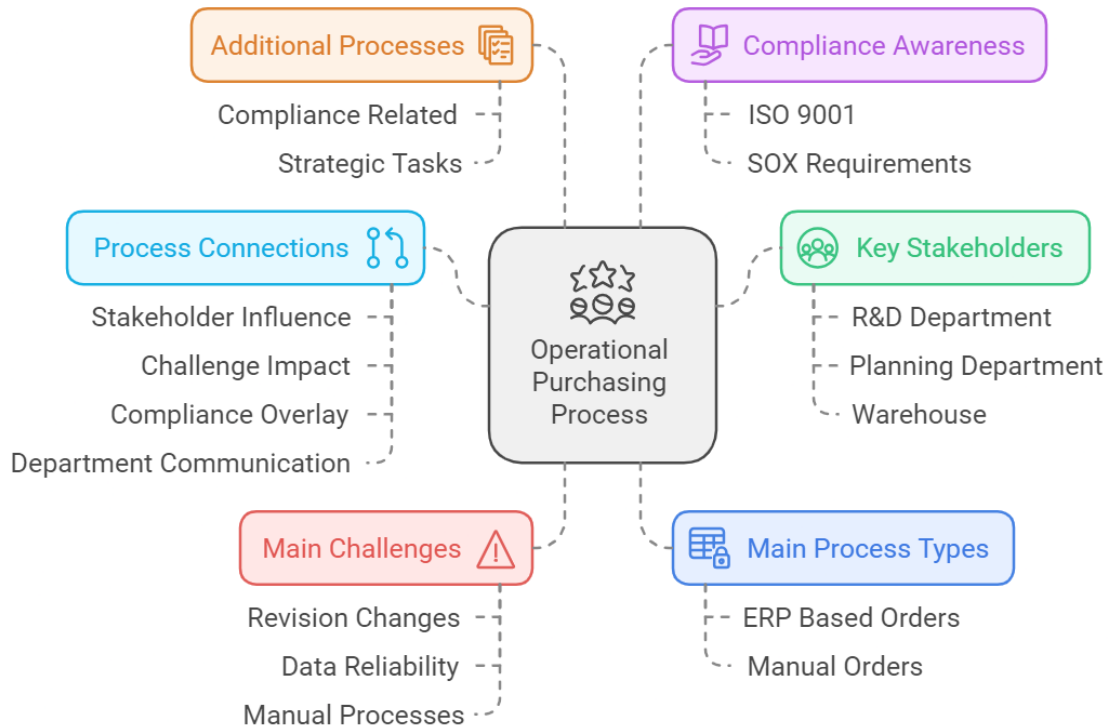


Figure 4. Shows the Mind Map Visualization of Operational Purchasing Process

The data indicated two significant types of processes: ERP-based orders and manual orders. Users rated ERP-based orders much more favorably (NPS score of 100% versus 67% for manual orders). Critical stakeholders identified are the R&D Department, Planning Department, and Warehouse, in their respective capacities within the procurement lifecycle. The significant challenges the respondents pointed out revolved around revision changes, data reliability in the ERP system, and time-consuming manual work. Regarding compliance awareness, the analysis shows moderate familiarity with SOX requirements (66.7% moderately familiar) and similar familiarity with ISO 9001 standards (66.7% moderately familiar). This would again point to possible areas for process improvement and training.

Table 4 below summarizes these responses, capturing key aspects of order processes, interdepartmental relationships, common challenges, compliance awareness, and potential improvement areas.

Table 4. Shows the Summary of Key Findings from Questionnaire Responses on Operational Purchasing Processes

Aspect	Detailed Summary of Key Responses
Order Types and Processes	Two main purchasing process types are identified: ERP-based orders and manual orders. Due to efficiency and automated workflows, ERP-based orders are rated more favorably, with an NPS of 100%. Manual orders, with an NPS of 67%, face challenges with additional approvals and time-intensive processing.
Interdepartmental Relationships	Involvement from multiple departments highlights a complex, interdependent process flow: <ul style="list-style-type: none"> - R&D Department: Updates on item revisions, impacting orders and quantities. - Planning Department: Manages forecasts that drive purchasing needs. - Warehouse: Handles ongoing inventory checks and informs procurement of stock levels.
Challenges and Bottlenecks	Key issues identified include: <ul style="list-style-type: none"> - Frequent Revision Changes: Leads to delays and requires constant updates. - Data Reliability in ERP: Inconsistent data and delayed entries create risks of inaccurate forecasting. - Manual Processes: Time-consuming checks and approval workflows for manual orders add to the workload and delay processing.
Compliance Awareness	Compliance familiarity is moderate among team members: 66.7% report moderate familiarity with SOX and ISO 9001 requirements. This indicates a need for further training and awareness programs to ensure adherence to compliance standards across all purchasing activities.
Improvement Suggestions	Key suggestions include: <ul style="list-style-type: none"> - Automated Alerts: Notifications for high-value order approvals to streamline the process. - Enhanced Data Accuracy: Reducing manual data entry in ERP to improve reliability. - Better Forecasting: Ensuring Planning provides accurate demand forecasts to reduce inventory issues and delays.
Potential Tools/Technologies	Respondents suggested implementing: <ul style="list-style-type: none"> - AI-based Solutions for predictive analytics in demand forecasting. - Automated Shipment Tracking: Interfaces with freight forwarders to provide real-time updates on order status. - Invoice Automation: To streamline approval processes and reduce manual workload.

- **Current Purchase Order Process Flowchart**

The ERP-based process starts with the review of system-generated proposals, whereby the purchasers look at the action dates and the need-by dates. An essential early step is to check the current balances and confirmed orders to prevent duplication of placing the same material again. Upon revision or change of an item, re-verification of stock levels

of both old and new items is required. Several purchase requisitions for the same vendor will be combined to create better order possibilities.

In contrast, in most cases, the manual process is initiated by direct requests from various departments, predominantly R&D. These requests must verify proper approvals before creating the proposal. Being a manual process, it will have longer processing times and will need more documentation based on the feedback received from respondents.

Both processes merge at the stage of purchase order creation and follow the same approval workflow from here. Purchase orders above €50,000 also require approval from the Category Manager; orders above €100,000 would need approvals in line with their company's approval matrix. After approvals, applications follow the standard process of confirmation from the supplier, tracking the delivery, and processing the invoice until it finally closes all the fully delivered and invoiced lines.

The following flowchart (Figure 5) describes these parallel activities and their merging points; it presents a systematic approach to creating purchase orders within an organization's procurement operations. This visual will help us understand how complex and intertwined the company's purchasing processes are and, at the same time, make visible where there is a possibility for optimization and standardization.

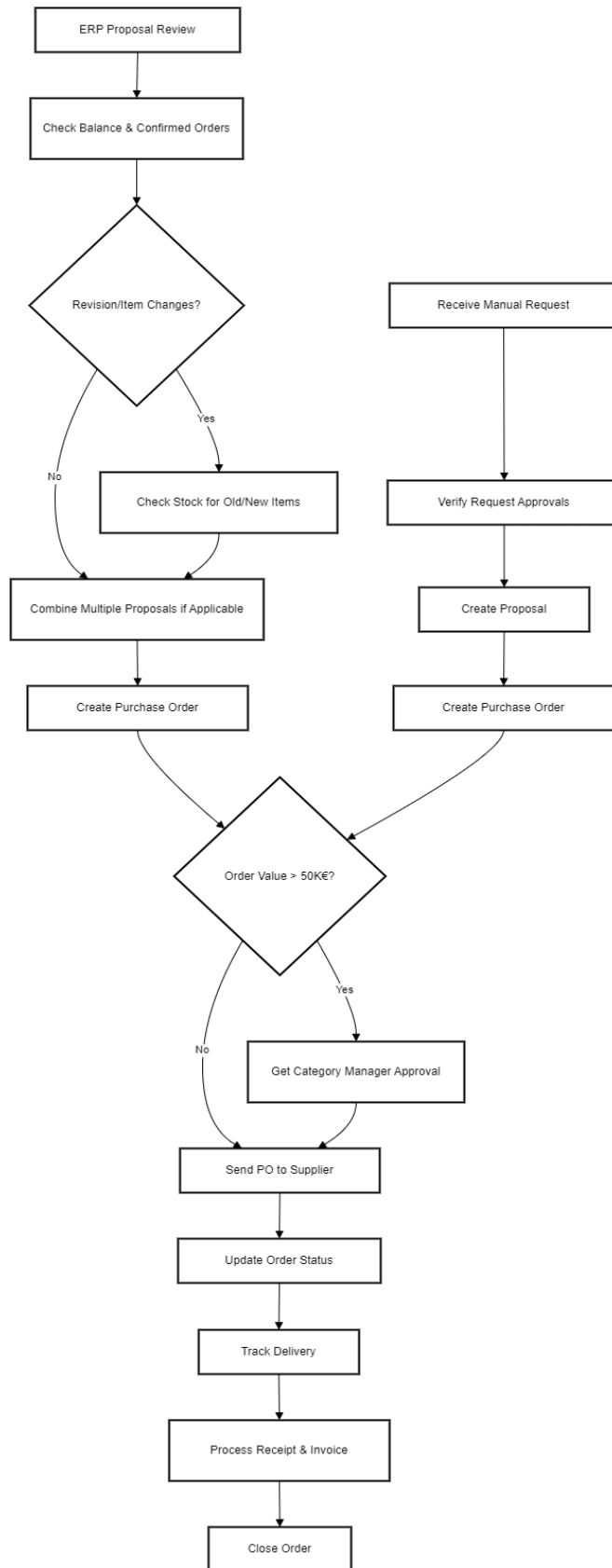


Figure 5. Shows the Flowchart of Purchase Order Creation Processes

- **Identified Bottlenecks and Challenges**

Questionnaire response analysis and process mapping revealed the significant challenges within the operational purchasing process, as illustrated in the fishbone diagram (Figure 6). The diagram highlights the challenges categorized into four major areas: system/Technology, Process, People/Communication, and Documentation.

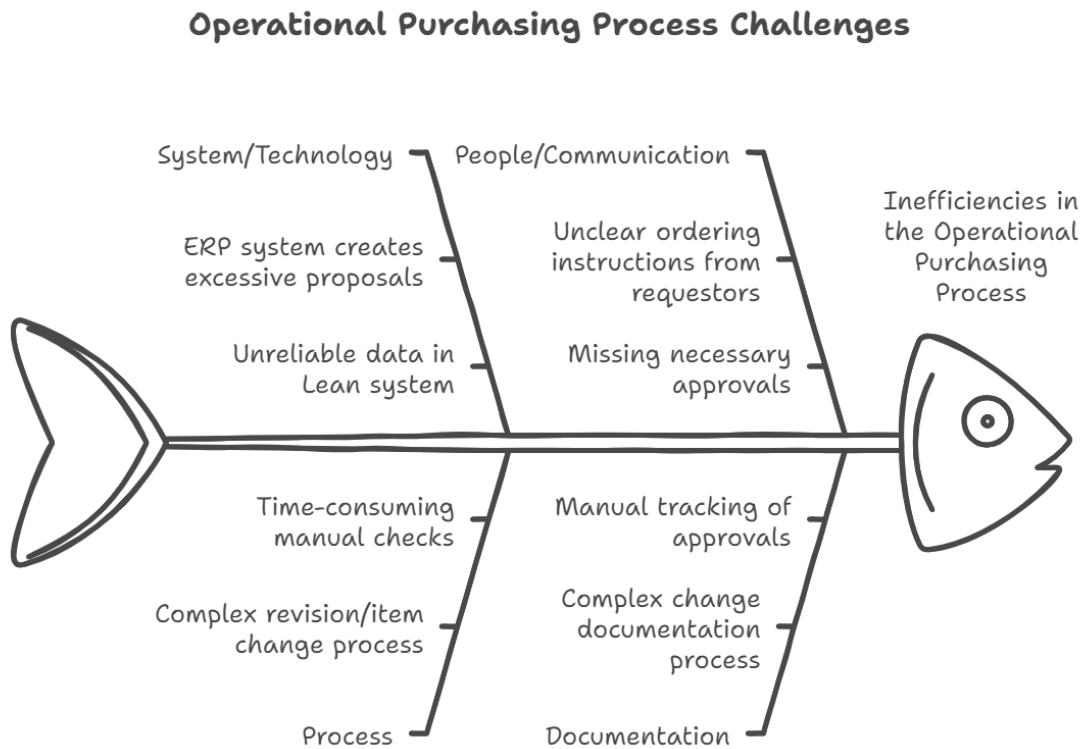


Figure 6. Shows the Fishbone Diagram for the operational Purchasing Process Challenges

Primary bottlenecks are too many proposals generated by the ERP system, unreliable data in the Lean system, time-consuming manual checks, and manual revision processes. Communication challenges include unclear ordering instructions and missing approvals. Documentation issues include manual tracking and arduous change management procedures. Identified challenges impinge process efficiency at the primary level and further improvements afterward.

5.1.2 Strategic Sourcing Process

- **Analysis of Collected Data**

The questionnaire responses regarding strategic sourcing were analyzed. The accompanying mind map (Figure 7) illustrates several critical aspects of the strategic sourcing process. This diagram depicts all the elements interconnected with strategic sourcing, core processes, challenges, and organizational interfaces.

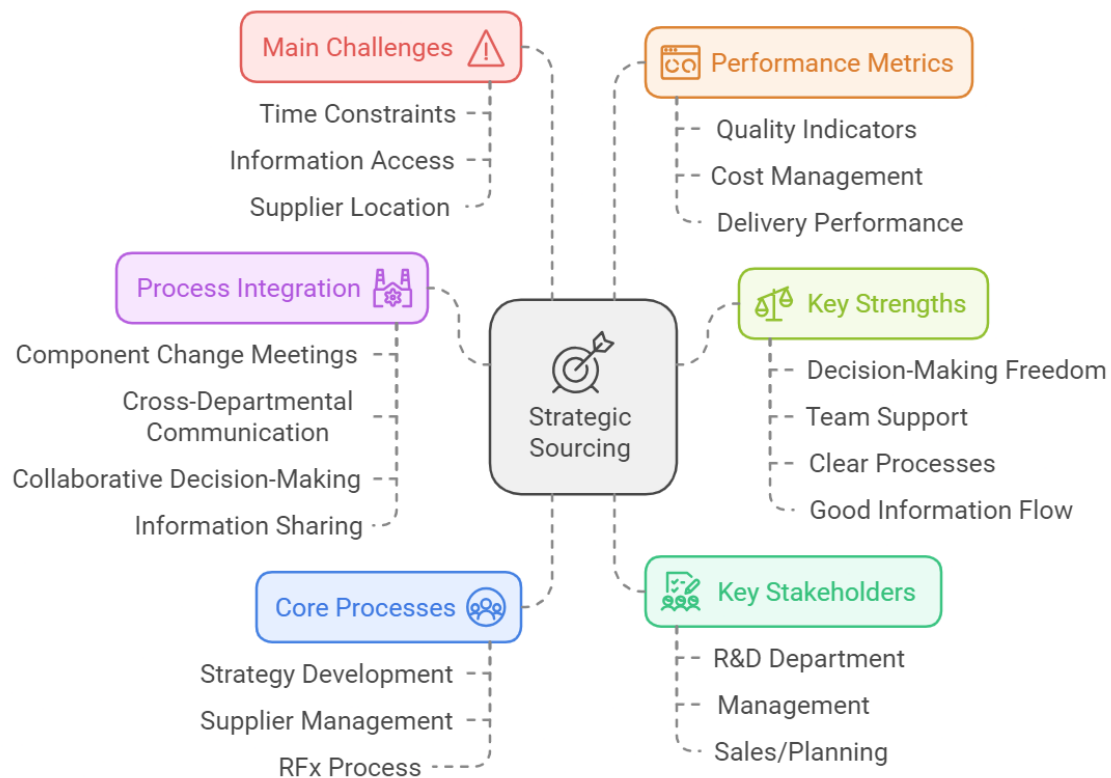


Figure 7. Shows the Mind Map Visualization of the Strategic Sourcing Process

One primary emphasis emerges in the RFX process, which is part and parcel of the core strategic sourcing activities. The data shows that supplier appraisal criteria integrate all these multiple factors, including price and technological capabilities, location, and delivery terms. Nonetheless, the process is saddled with notable challenges, especially time-bound and resource-constrained supplier scouting for comprehensive scouting in European markets.

The above mind map (Figure 7) outlines critical performance metrics for evaluating sourcing effectiveness, incorporating quality indicators, cost management, and delivery performance. Critical elements in cross-departmental communication are routine component change meetings and decision-sharing processes with collaboration from stakeholders in R&D, Sales/Planning, and Management. The strengths identified are decisional autonomy and strong team support, though the challenges of information accessibility and time management run alongside them. The mind map visualizes the operational and area relationships that need efficiency in the strategic sourcing process.

Table 5 below summarizes responses from the strategic sourcing process, highlighting essential aspects of strategy development, market analysis, supplier relationship management, risk mitigation, performance monitoring, compliance awareness, and areas for improvement.

Table 5. Shows the Summary of Key Findings from Questionnaire Responses on Strategic Sourcing Processes

Aspect	Detailed Summary of Key Responses
Strategy Development Process	Collaboration with management, R&D, and other category managers aligns development with company goals. Strategic focus includes identifying second sources and considering available time for category management.
Market Analysis and Forecasting	Market trends are analyzed by tracking raw material prices (mainly steel), consulting suppliers, and using ERP data. Monthly demand/supply meetings with Sales and Planning provide updates.
Supplier Relationship Management	Supplier relationships are managed through regular communication, mainly via email and occasional in-person visits. Cultural and logistical challenges, particularly with overseas suppliers, are handled with local support when possible.
Contract Negotiation	Contract negotiations involve preparing detailed presentations and consulting management before final decisions. No recent new supplier contracts were noted, but approval processes are followed.
Risk Management	Risk factors include geographical and political issues (e.g., bans on Russian materials and the EU Carbon Border Adjustment Mechanism). Risk is assessed based on cost, availability, and ease of sourcing alternatives.

Performance Monitoring	Performance is monitored informally, with data gathered from various sources rather than specialized software. Though ERP limitations exist, KPIs include quality reports, price tracking, and delivery timelines.
Compliance Awareness	Moderate familiarity with SOX compliance and ISO standards, following approval limits and internal SOX guidelines to ensure adherence to company policies.
Challenges and Improvement Suggestions	Main challenges include limited time for strategic tasks, bureaucratic constraints, and scattered data sources. Suggested improvements focus on consolidating information, streamlining rules, and reducing administrative tasks.

- **Current RFx process flowchart**

RFx represents the strategic sourcing process for supplier selection and evaluation. A review of the questionnaire responses and process documentation confirmed that this workflow is captured in the flowchart below (Figure 8).

The process starts with R&D requirements and technical specifications and moves on to preparing the RFx document and identifying the supplier from the existing supplier pool. Technical and commercial evaluations are the primary assessment stages, with the facility of additional requests for information when clarifications on the specifications are required. Negotiation cycles with suppliers are initiated for proposals that are not considered feasible. This standardized approach brings comprehensive supplier evaluation. This flowchart will help adequately illustrate key decision points and feedback loops for effective supplier selection and negotiation.

The Figure 8 flowchart below depicts this streamlined process, including the critical decision points and feedback loops essential for effective supplier selection and negotiation. This systematic approach will involve a thorough evaluation, with process efficiency maintained hand in hand.

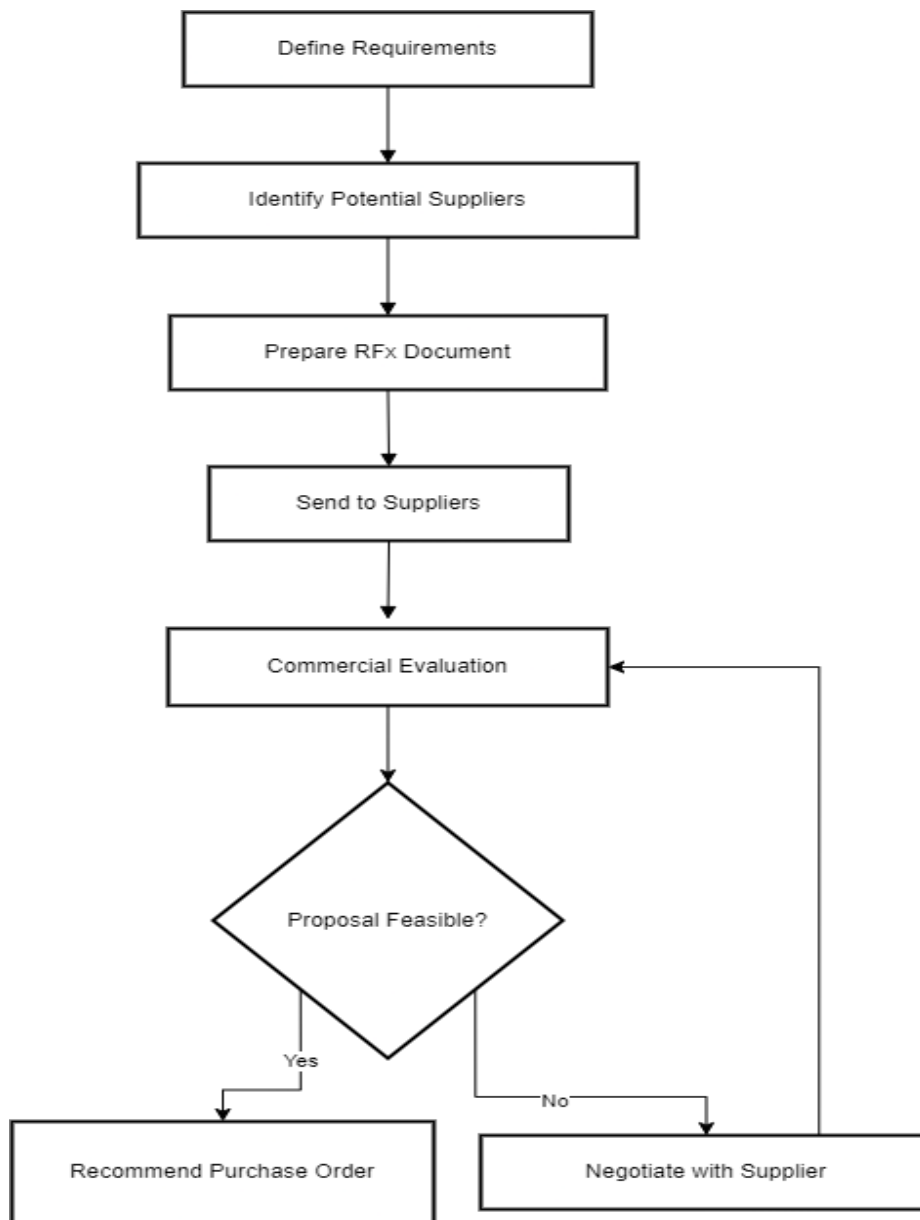


Figure 8. Shows the Strategic Sourcing RFX Process Flow

- **Identified Bottlenecks and Challenges**

The responses to the strategic sourcing questionnaire illustrated several critical challenges, as shown in the fishbone diagram (Figure 9). The diagram divides these challenges into four categories: Process Management, Resource Issues, Communication, and Data and systems.

Strategic Sourcing RFX Process Challenges

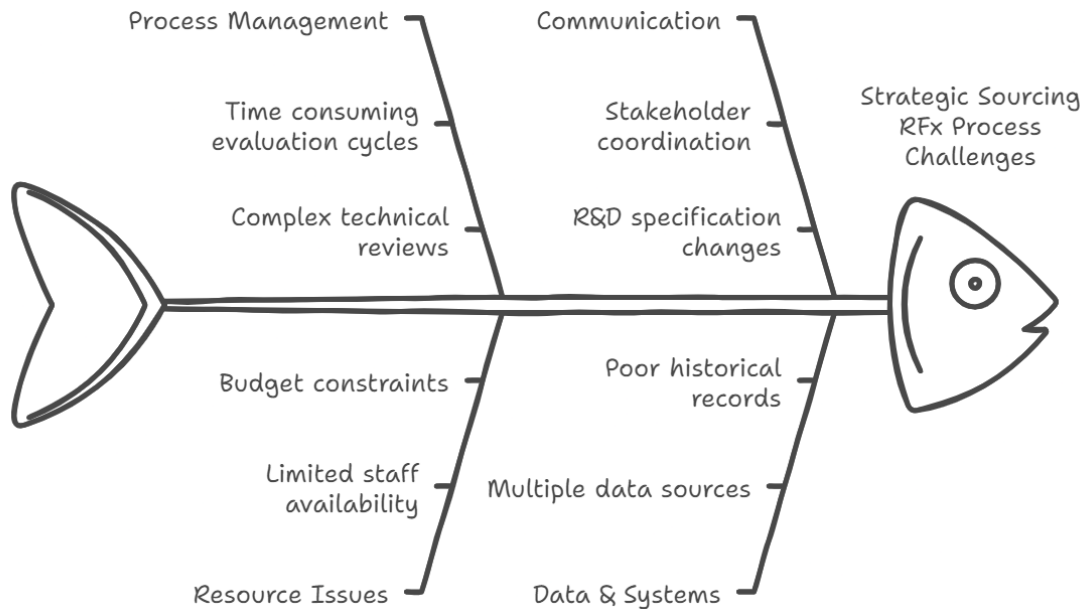


Figure 9. Shows the Fishbone Diagram for the strategic sourcing RFX Process Challenges

Long evaluation cycles and labor-intensive technical reviews are significant bottlenecks in process management. Resource Issues include limited staff availability and budgetary constraints, significantly impacting scouting and development activities with European suppliers.

Communication challenges mainly resulted in difficulties coordinating stakeholders and changing specifications for R&D, which demanded several iterations in the RFX process. Some issues raised under the Data & Systems category needed to be improved by historical data and data from various sources. The respondent noted that the information is in "3-5 places."

The fishbone diagram formally compiles these interrelated challenges, making factors that impact efficiency in the RFX process visually clear. These bottlenecks will be the identified foundation for any future process optimization efforts.

5.1.3 Category Management Process

- **Analysis of Collected Data**

The category management questionnaire responses depict a structured approach to selecting and onboarding suppliers, as in the mind map below (Figure 10). It covers all stakeholders, several evaluation criteria, and the success factors and challenges that will be highlighted.

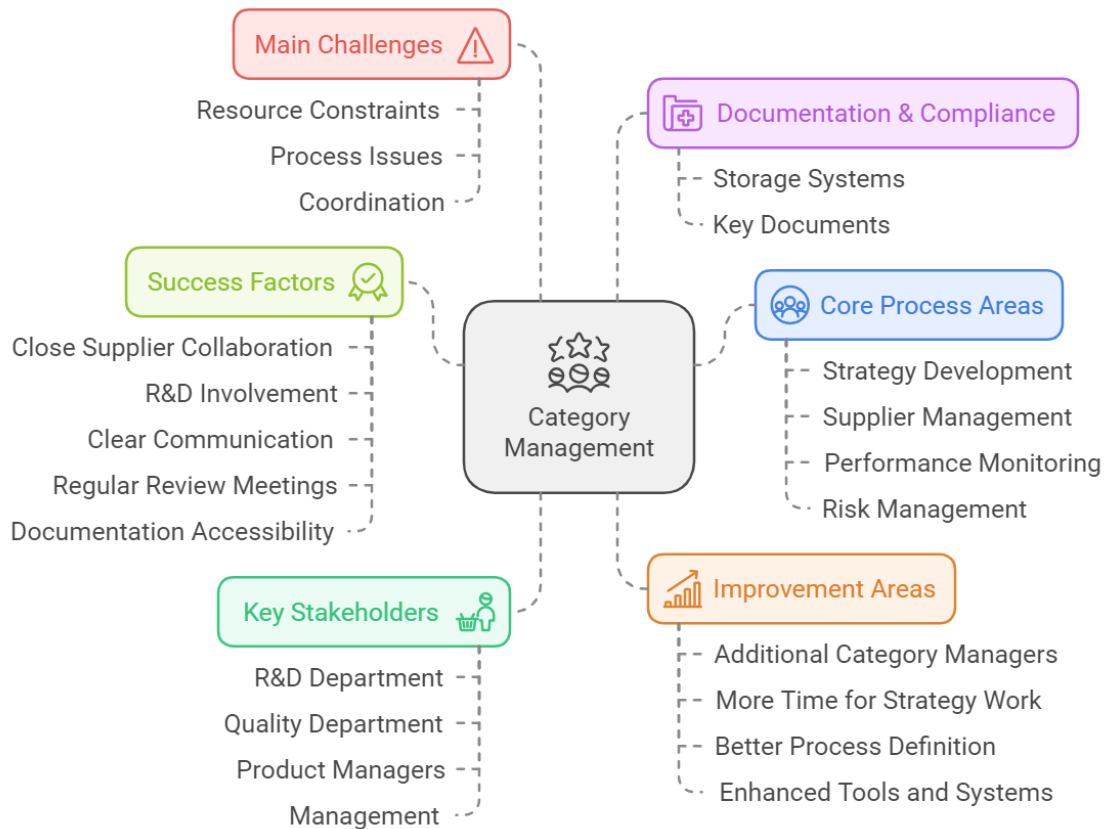


Figure 10. Shows the Mind Map Visualization of the Category Management Process

The supplier selection process is infused with certification, financial stability, geography, technological capabilities, and agreement with business terms and a Supplier Code of Conduct. An official onboarding process involves completing Supplier Evaluation

Questionnaires, executing NDAs, site visits, and audits. As denoted by the mind map, the critical stakeholders would be the R&D Department, Supplier development, Product Managers, and Management.

Identified success factors include working closely with suppliers and having strong R&D participation in the selection process from start to finish. However, the data uncovers challenges under resource constraints; respondents note "too many categories for one person" and the lack of time to be strategic. Documentation and compliance requirements will be managed with established storage systems, primarily utilizing MS Teams for category strategies and the shared drives for contracts and agreements.

The mind map (Figure 10) effectively visualizes these interconnected category management elements, highlighting operational strengths and areas needing enhancement through additional category managers and improved process definition.

Table 6 below summarizes responses from the category management process, capturing key areas such as strategy development, supplier evaluation, contract management, risk management, performance monitoring, compliance awareness, and suggested improvements.

Table 6. Shows the Summary of Key Findings from Questionnaire Responses on Category Management Processes

Aspect	Detailed Summary of Key Responses
Category Strategy Development	Strategy development aligns with company objectives and involves spend analysis, stakeholder input, and market assessment. Strategies are reviewed bi-annually or annually and reflect both short— and long-term actions.
Supplier Selection and Evaluation	Supplier selection involves multi-criteria evaluation (e.g., certifications, financial stability, quality, and geographic risks) with audits and approvals. Sustainability is assessed during initial evaluations with a focus on ISO 14001 compliance.
Contract Management	Contracts include quality, environmental, and safety clauses. Approvals involve both internal review and formal signing by management. Contract adjustments are made via appendices to ensure document integrity and version control.

Risk Management	Risk management emphasizes second sourcing, supplier audits, and monitoring financial health. Annual reviews identify high-risk suppliers, and buffer stock agreements are pursued with suppliers to address potential disruptions.
Performance Monitoring	Supplier performance is monitored monthly through KPIs (e.g., quality, price, delivery times) in Tableau and meeting memos stored in Teams. Regular updates ensure alignment with quality and delivery expectations.
Compliance Awareness	Moderate familiarity with SOX and ISO 9001 standards, focusing on clear documentation and accessibility. Supplier audit trails and performance records are maintained for compliance.
Challenges and Improvement Suggestions	Main challenges include limited time for managing multiple categories, unclear strategies, and administrative workload. Suggested improvements include fewer categories per manager and adding resources for strategic tasks.

- **Current Supplier Selection and Onboarding Process Flowchart**

The supplier selection and onboarding category management process is designed to adopt a structured approach for technical and commercial evaluations. Questionnaire responses and process documentation analysis indicate a structured workflow to ensure a comprehensive supplier appraisal and meet organizational requirements.

The process starts with market analysis and first supplier appraisal via standard questionnaires. Significant areas of focus in this step include ISO certifications, financial stability, and technological capabilities. Both technical and commercial capabilities run concurrently to emphasize supplier location, production capacity, and quality management systems. Evidence from the questionnaires generally supports the demand that potential suppliers obtain, at minimum, ISO 9001 certification.

With a successful initial evaluation and signed NDA, the process steps into detailed commercial assessment through RFQ processes and technical reviews. If the initial proposals do not satisfy the requirements, negotiations are initiated at the central decision point feasibility assessment stage. The process culminates in formal supplier audits and finalization of the commercial agreement, with documentation stored in designated systems according to compliance requirements.

The flowchart below (Figure 11) depicts this streamlined process, highlighting key decision points and essential supplier selection and onboarding steps.

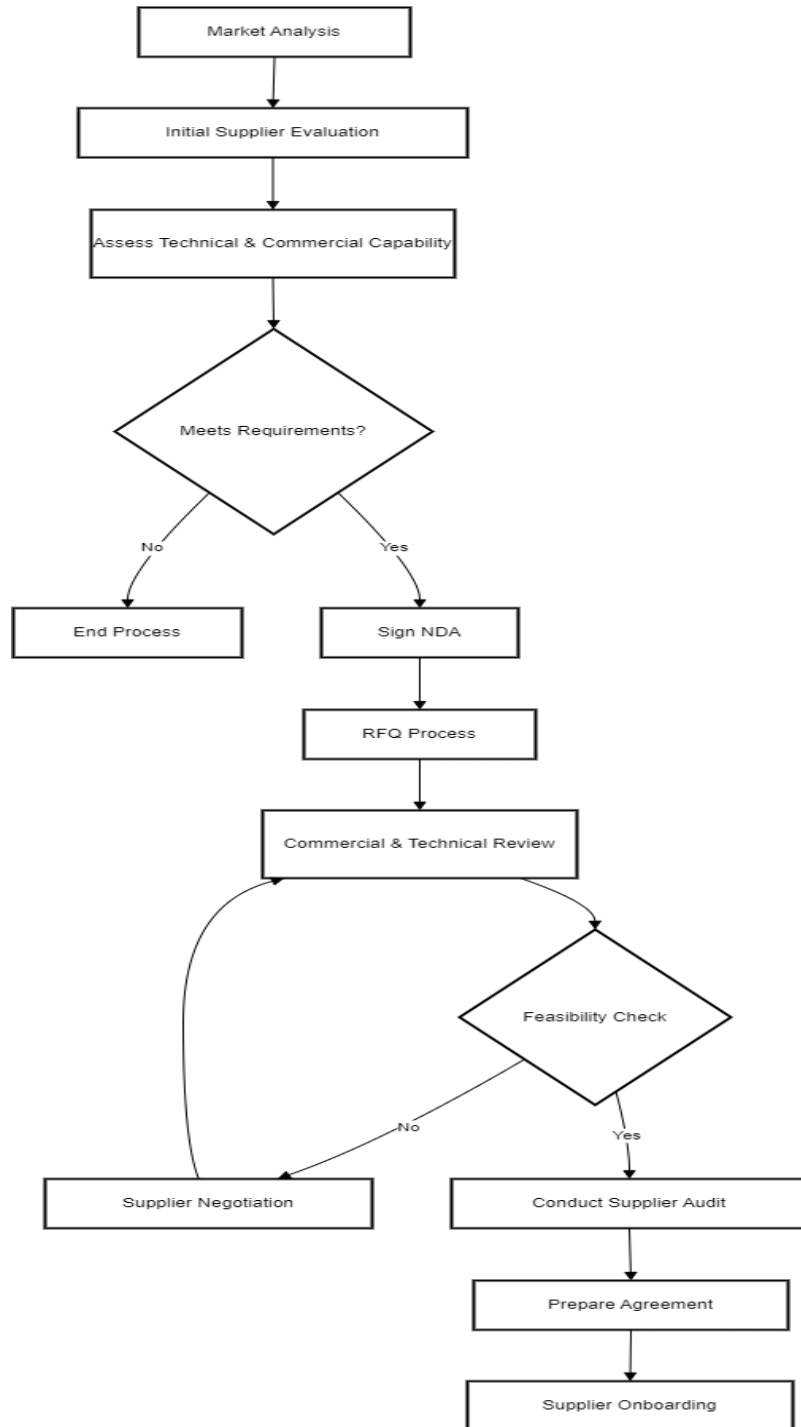


Figure 11. Shows the Supplier Selection and Onboarding Process Flowchart

- **Identified Bottlenecks and Challenges**

Analysis of the category management questionnaire responses unveiled four significant challenges in the supplier selection and onboarding process, as depicted in the fishbone diagram (Figure 12) below. These include resource constraints, process issues, coordination challenges, and documentation and compliance matters.

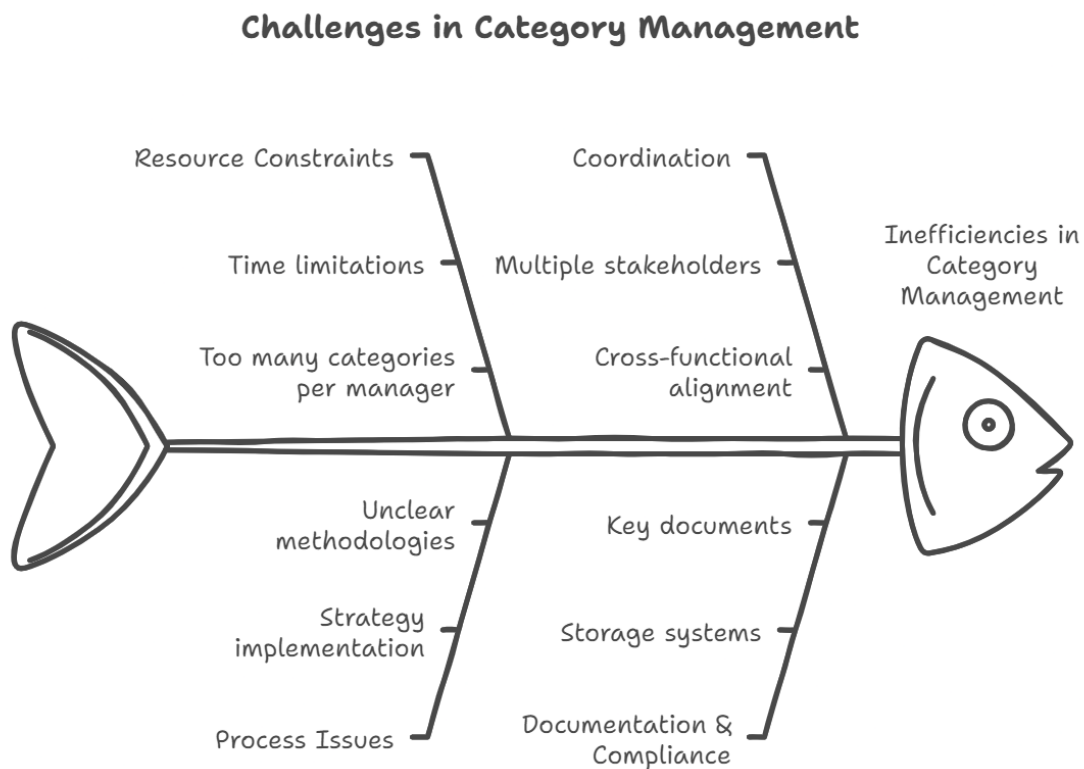


Figure 12. Shows the Fishbone Diagram for the Category Management Challenges

A significant bottleneck is presented by resource constraints, with respondents noting “too many categories per manager” and time frames that are just too short. Process failures are evident through ambiguous methods and complicated strategy execution, with the statement of “unclear strategy and changing actions” from the respondents. Coordination challenges arise in managing multiple stakeholders and cross-functional alignment in activities, particularly between R&D, Quality, and Product Management departments when making supplier selection decisions.

The fragmented storage systems and critical document management add further complexity to the documentation and compliance aspects. As per the questionnaire, documentation is 'across MS Teams and shared drives,' which can impose possible inefficiencies in accessing information and verifying compliance during the supplier onboarding process.

5.1.4 Supplier Development Process

- **Analysis of Collected Data**

The supplier development questionnaire responses and related document analysis, shown in the mind map (Figure 13), evidence a detailed but developing approach to supplier audits and claim management. The process covers the core process areas of claim management, root cause analysis, supplier audits, and corrective actions, supported by various tools and stakeholders.



Figure 13. Shows the Mind Map Visualization of the Supplier Development Process

The supplier claims process is captured at the first notice of contact and purportedly utilizes LEAN, though respondents note system limitations. The claims handling process has improved over the years and now has a structured approach whereby the quality department initiates it and the finance department closes it. Root cause investigation, however, is one of the areas that "has no defined tools" and shows a lack of standardization in the investigation methods for supplier-related issues.

Supplier audits were more structured and followed a more structured approach using iAuditor software for comprehensive reporting and documentation. Auditing includes ISO standard requirements with the involvement of critical stakeholders from production, quality, and R&D departments. However, resource constraints impact the effectiveness of audits as "time available for review is always very short" to better follow-up processes for corrective actions.

Table 7 below summarizes responses from the Supplier Development Engineer process, covering key areas such as claim handling, audit planning, corrective actions, risk management, performance monitoring, compliance awareness, and improvement suggestions.

Table 7. Shows the Summary of Key Findings from Questionnaire Responses on Supplier Development Engineer Processes

Aspect	Detailed Summary of Key Responses
Claim Handling Process	Claims are reported through email and documented in a designated folder. Priority is set based on failure frequency and impact. We are moving to a supplier portal (Supplios) to streamline communication.
Audit Planning and Execution	Audits are planned annually with a checklist for consistency, covering quality, production, and environment. Evidence is gathered through document reviews, observations, and interviews. iAuditor is used for reporting.
Corrective Actions	Corrective actions are discussed in monthly meetings and tracked informally. Objective assessment remains challenging, and future plans include using a portal to improve tracking and communication.
Risk Management	Key risks identified include supplier financial stability, supply disruptions, and compliance issues. Regular reviews are conducted with suppliers, focusing on buffer agreements and secondary sourcing for critical components.

Performance Monitoring	Supplier performance is reviewed monthly, using KPIs like on-time delivery and defect rates. Key information and meeting notes are stored in a shared system (Teams).
Compliance Awareness	Moderate familiarity with SOX and ISO standards, focusing on traceability and audit trails. Documentation in ERP and Teams; future plans to improve SOX alignment.
Challenges and Improvement Suggestions	Challenges include limited data availability from the LEAN system, reliance on manual investigations, and a lack of resources. Suggested improvements include more standardized processes and additional manpower.

- **Current Supplier Audit Process Flowchart**

The supplier development audit process is structured to assess and improve supplier performance. Questionnaire responses indicate the presence of such a structured workflow that encompasses both assessment and improvement dimensions.

The process starts with annual audit planning, and suppliers are chosen based on the component's importance and purchase value. The audit preparation stage distributes a comprehensive QMS core audit checklist for quality management, resources, planning, and production. Documents are required during on-site audits to review observations, interviews, and photographic evidence to evaluate supplier capabilities.

The flowchart below (Figure 14) illustrates this systematic approach to supplier auditing; it also seamlessly integrates with audit documentation and reporting by generating structured reports with audit scores and deviations, including areas for improvement. Follow-up activities track corrective actions through monthly meetings and re-audits within this activity. However, the questionnaire data indicates room for improvement in

audit planning and follow-up activities. Specifically, it calls for more clearly defined long-term plans.

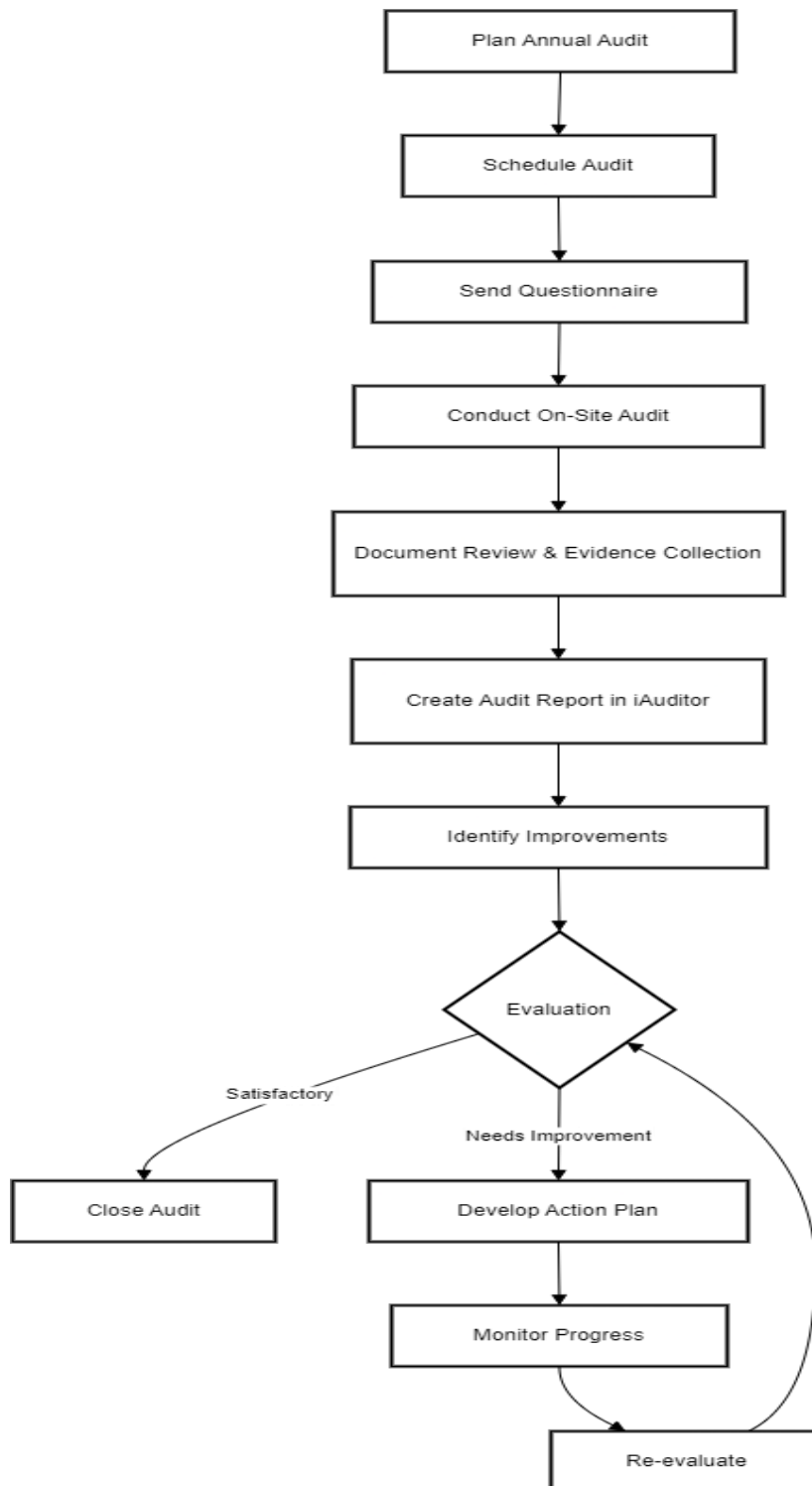


Figure 14. Shows the Supplier Audit Process Flowchart

- **Current Supplier Claim Process Flowchart**

It is a structured process for managing quality issues and supplier non-conformances. Questionnaire responses create what appears to be a step-by-step workflow from the initiation of a claim to final closure and performance recording.

The process is initiated after the quality issues are identified from warehouse checks, production quality checks, and random sampling inspections. A primary tool for recording these non-conformances is used within the LEAN system. Claims would then be categorized by monetary value (>1000 EUR, 100-1000 EUR, <100 EUR), though the respondents note better ways to do the classifications.

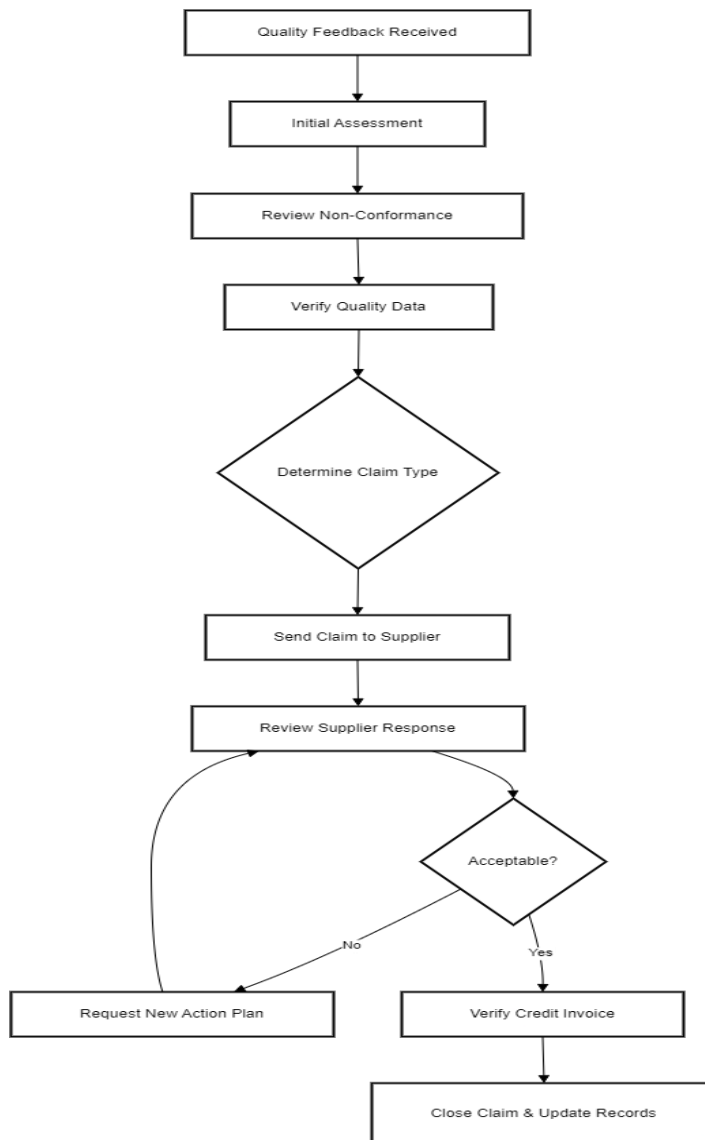


Figure 15. Shows the Supplier Claim Process Flowchart

The flowchart above (Figure 15) illustrates this systematic approach to supplier claims. An investigation was conducted on the 8D report methodology, and findings were documented and shared with suppliers via email. The report concludes with credit invoice verification and claim closure in the LEAN system.

- **Identified Bottlenecks and Challenges**

The supplier development questionnaire responses analysis indicated some critical issues facing supplier audits and claims management, as illustrated in the fishbone diagram below—these range from resource constraints and process issues to system limitations and documentation concerns.

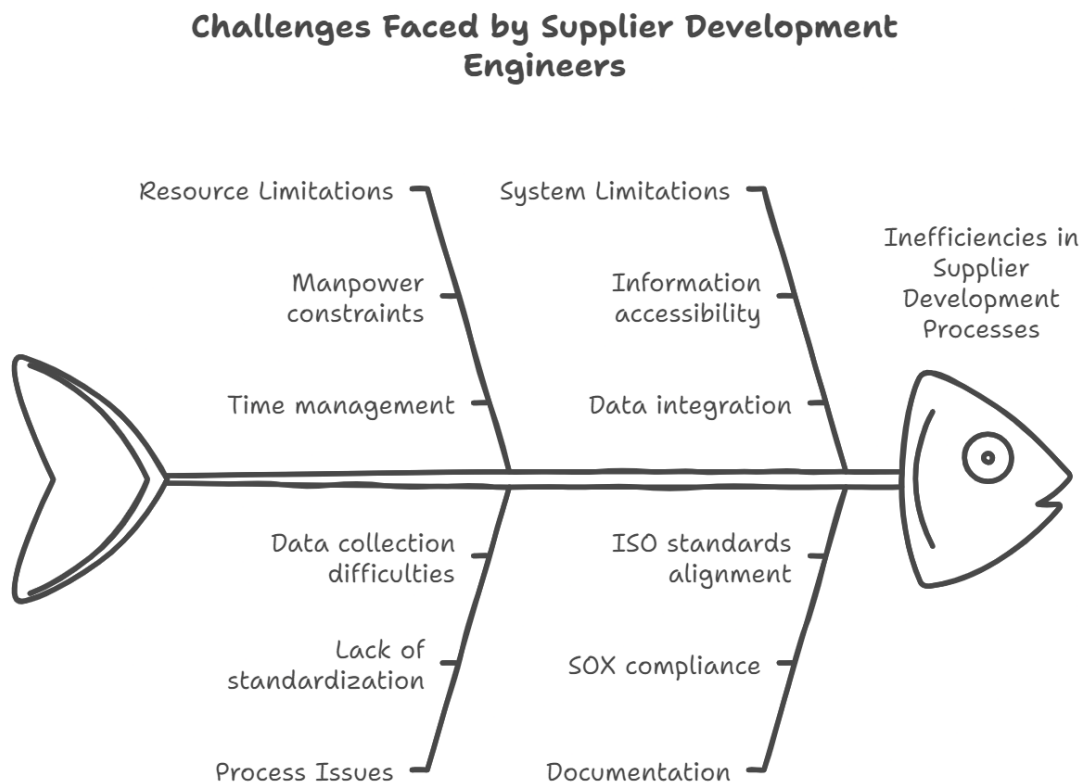


Figure 16. Shows the Fishbone Diagram for the Supplier Development Challenges

Resource limitation is the major constraint; respondents state, "cannot perform every task of the SDE role successfully," explicitly noting "more manpower is needed" and that they surveil through investigations but cannot track every lead, and "cannot perform every task of the SDE role successfully." Process problems lead to a lack of

standardization, especially in claim investigation, where there are "no defined tools" and structured methodologies for root cause analyses. The questionnaire data depict significant data collection challenges. The LEAN system provides only part of the required information for valid claims.

System limitations impact audit and claims processes, with challenges of information accessibility and data integration across multiple platforms. Documentation concerns become specifically apparent in compliance areas, with respondents explicitly noting doubt about aligning with the requirements of SOX and ISO standards. As one respondent put it, "ISO 9001 requirements are well-covered," but there could be more questions regarding ISO 14001 and 45001.

The fishbone diagram effectively highlights the interconnections of the challenges for supplier development processes and provides a basis for identifying ways of solving them.

5.2 TO-BE Process Design for Procurement and Supplier Development Using BPMN

Optimized TO-BE procurement and supplier development processes are developed following a systematic iteration approach to ensure they meet organizational requirements and resolve some challenges. This entails the iterative design of robust processes through several feedback loops following an initial analysis to meet operational needs and comply with the aspired service level.

Commences with a comprehensive needs assessment via document analysis and structured questionnaires from various procurement functions. Data collection phase questionnaires were administered systematically to the operational purchasing, strategic sourcing, category management, and supplier development teams. At the same time, document analysis forms an overview of the existing process documentation and IMS requirements.

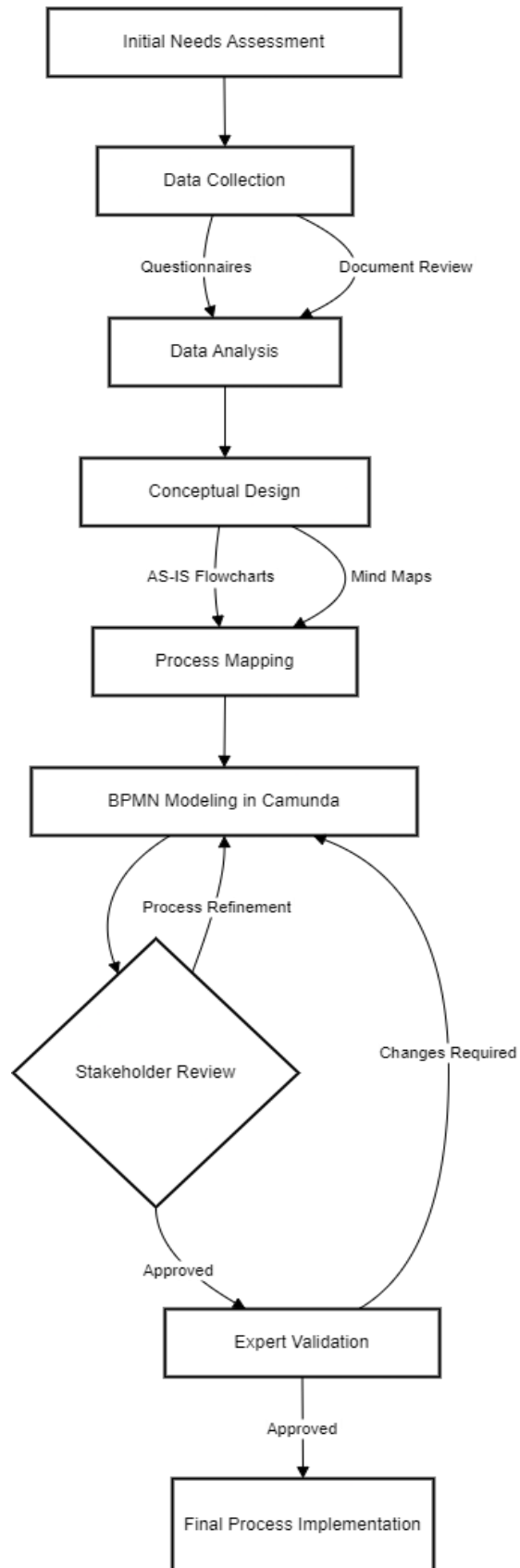


Figure 17. Shows the Detailed TO-BE Process Design Methodology Flowchart

The conceptual design phase uses AS-IS flowcharts and mind maps/Fishbone diagrams to visualize current processes and their interconnections. These visual tools are intermediate between current state analysis and detailed BPMN modeling. The Camunda Modeler is then used to convert these conceptual designs into formal BPMN processes with the necessary notation standardization and detailed process specifications.

Two critical feedback loops guarantee adjustments within the optimization process. The first entails iterative reviews with procurement stakeholders to refine further and add granularity based on practical operational insights. The second loop is expert validation from supply chain management leadership, ensuring strategic alignment plus compliance requirements. Done through unstructured interviews, this dual validation approach ensures operational effectiveness and strategic alignment. The following BPMN process designs have been approved. They have met all requirements and are ready for implementation in the existing IMS system.

5.2.1 Redesigned Top-Level Procurement Process

The top-level procurement process is redesigned to introduce an integrated hierarchy that combines category management, strategic sourcing, operational purchasing functions, and supplier development. Using BPMN, this process map at a hierarchical level adheres to keeping compatibility with the existing SCOR model while dealing with the earlier revealed operational challenges.

The process architecture is split into four main streams: Category Management (sE1), Strategic Sourcing (sE2) and (sS3), Operational Purchasing (sS1), and Supplier Development (sE3). Category Management covers the complete sequence from strategy to performance monitoring with critical areas of market analysis, cost management, and value engineering. Strategic Sourcing focuses on new product development and supplier relationship management until the RFX process and strategic communication.

Supplier Development wanted to implement a structured approach from selection to continuous improvement. At the same time, Operational Purchasing preferred to maintain a simplified four-step process from scheduling deliveries to approving payment. The process map would make explicit cross-functional interfaces with the R&D, Production, and Warehouse departments by clearly defined touchpoints, thereby enhancing organizational alignment.

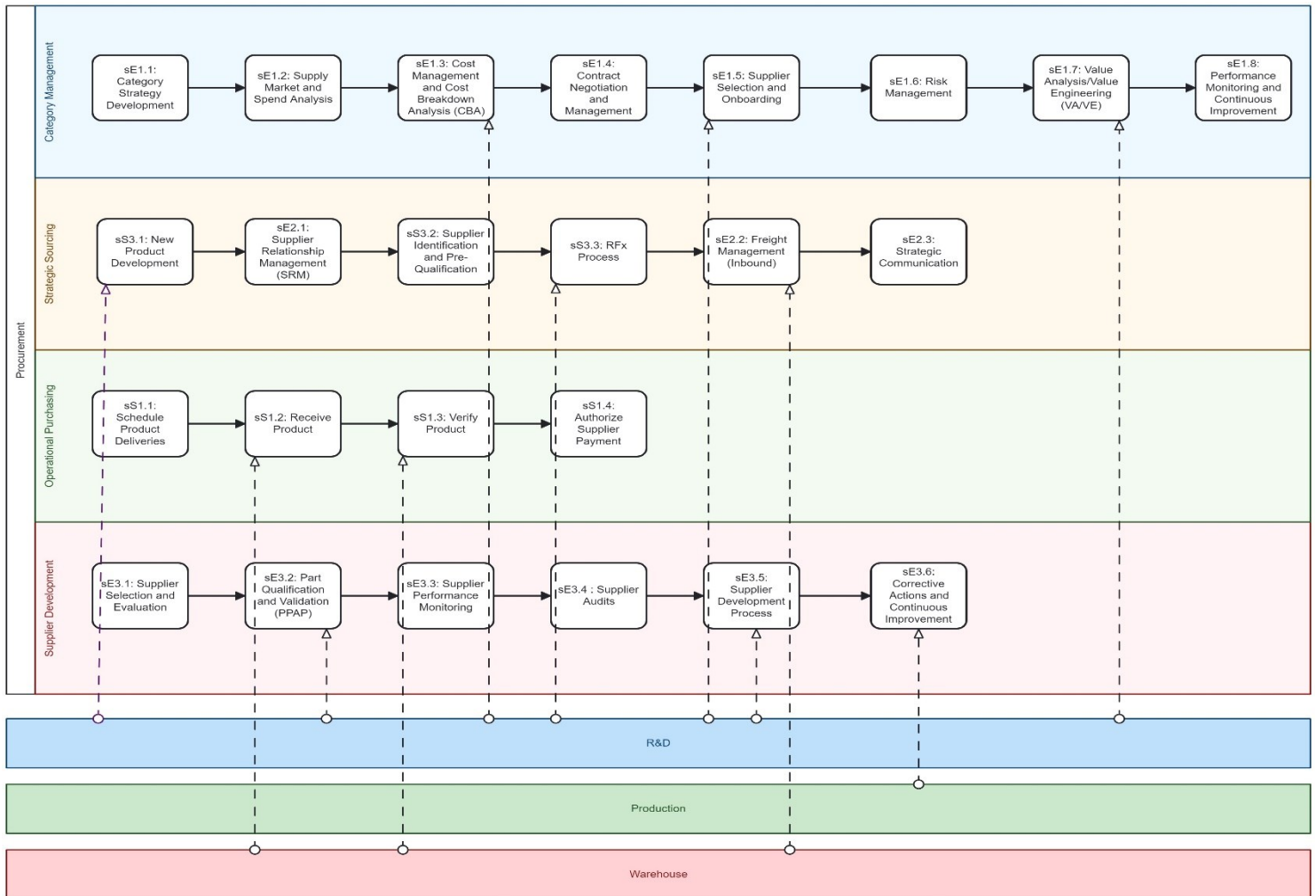


Figure 18. Shows the Redesigned Top-Level Procurement Process

The redesigned process corrects some of the critical challenges identified in earlier analyses. Research has shown that companies implementing an integrated procurement process have better operational efficiencies and reduced supply chain disruptions (Deloitte, 2021). Structured supplier development with ownership assigned to the processes

makes suppliers perform better and reduces procurement costs (Sánchez-Rodríguez et al., 2020). Additionally, standard documentation and defined process flow will ensure better management and mitigation of risks through compliance (Foerstl et al., 2017); category management links well with supplier development processes to better strategic source decisions (Chen, 2023).

5.2.2 Redesigned Operational Purchasing Process

- **Purchase Order Creation Through ERP-based Proposals**

The re-engineered operational procurement process for ERP-based orders unveils a streamlined procurement workflow and integrates it with planning and finance functions. The process map, designed in BPMN, helps create a disciplined mechanism for creating and managing purchase orders with ERP-generated proposals.

It starts with ERP proposal creation and then proceeds in a structured flow after activities like order type selection and verification of the SOX approval matrix. A significant enhancement would be to incorporate clear decision points and compliance checkpoints. The workflow then goes through order finalization, supplier communication, and delivery tracking with ERP updates and supplier follow-up at well-defined touchpoints.

It integrates the complete cycle of invoice management from the receipt of goods to the final payment approval. Some fundamental changes were structuring verification steps for invoice matching and having clear escalation paths for discrepancies. The process ends with SOX-compliant approval steps and automatic order closure for complete documentation and traceability.

Research shows that processing through a structured procurement process with incorporated compliance checks reduced errors in processing and improved operational efficiency (Tripathi & Gupta, 2020). The uniform approach to order processing and lucid compliance checkpoints addresses some critical challenges in procurement operations (Kibe & Odundo, 2016). Also, integrating ERP systems with structured approval

workflows enhances control and transparency for purchasing operations (Mundy & Owen, 2013). Meanwhile, the capability to propose automatically and follow up on proposals sharply reduces manual work and errors (Esmailnezhad & Saidi-Mehrabad, 2023).

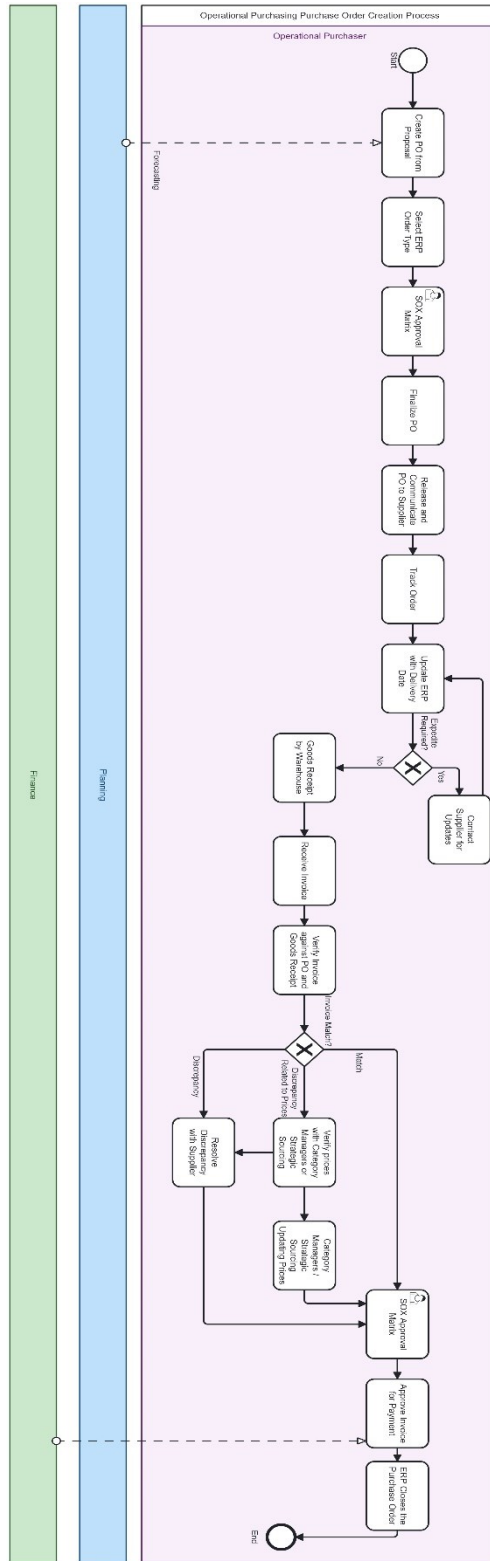


Figure 19. Shows the Redesigned Operational Purchasing Process (ERP-Based PO)

- **Manual Purchase Order Creation**

After reengineering, the manual purchase order process creation is carried out systematically for non-ERP-initiated purchase requisitions, incorporating clear paths of

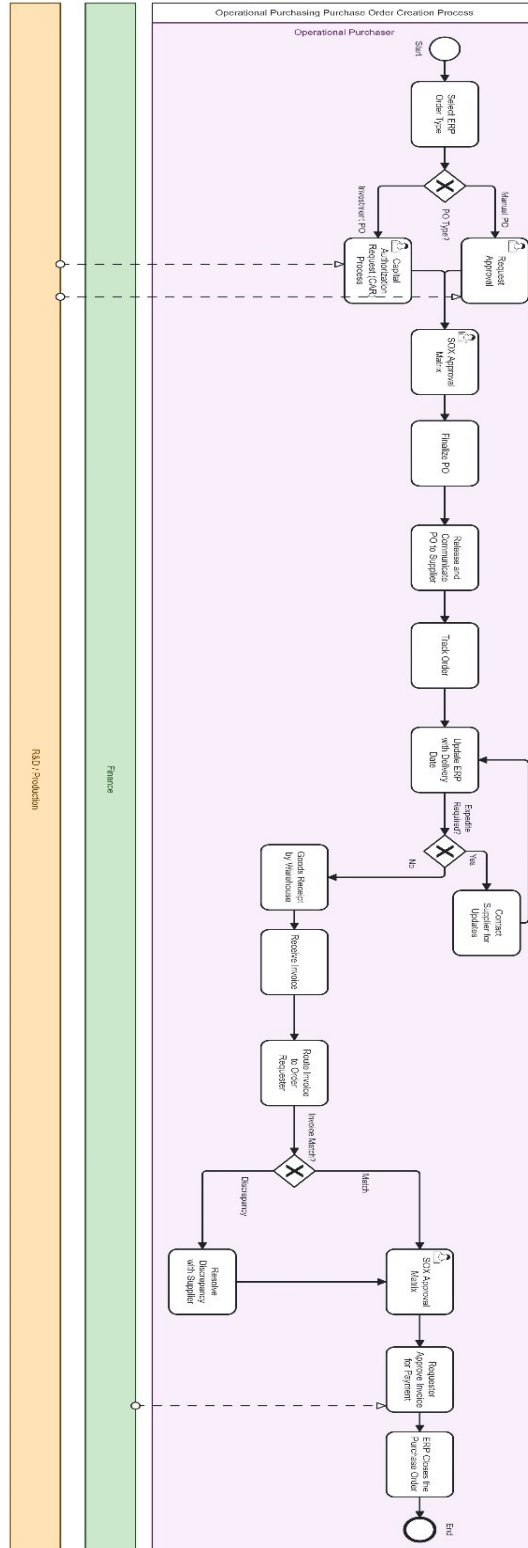


Figure 20. Shows the Redesigned Operational Purchasing Process (Manual PO)

approvals and compliance checks. This process map was developed using BPMN, considering the unique requirements for manual PO creation.

The process begins with selecting the order type and then a critical decision point that controls the path based on the type of purchase order: manual PO or investment PO using the capital authorization process (CAR) methodology. Each path includes specific approval steps that align with the SOX approval matrix for proper authorization levels. The procedure has defined steps for purchase order finalization and communication with the supplier, adhering to the ERP process-based nature wherever feasible.

One significant improvement is incorporating R&D/Production participation for technical reviews and Finance department surveillance for budget control. The workflow automatically tracks and visualizes the update and invoicing process. It ends with standard steps for invoice matching, discrepancy resolution, and final approval to ensure completeness, documentation, and traceability.

5.2.3 Redesigned Strategic Sourcing Process

The RFX process was designed to elicit the adoption of a supplier from the standpoint of R&D and not solely as a sourcing exercise. The process should be viewed as the step towards selecting a supplier systematically and then evaluating them. The process map was developed using BPMN towards a straightforward workflow to ensure all technical and commercial evaluations are adequately performed and to align the execution with all relevant category management objectives.

The process's initiation requires the parallel streams of product requirement definition from R&D and technical specification receipt from strategic sourcing to be running. These streams come together in the RFI document preparation phase, with input from potential suppliers identified from the existing supplier pool. The process moves through structured evaluation stages that have defined decision points for requests for additional information and reviews of the technical specifications. One important aspect to note is

that it allows for iterative cycles of technical evaluation to ensure a complete assessment of supplier capabilities.

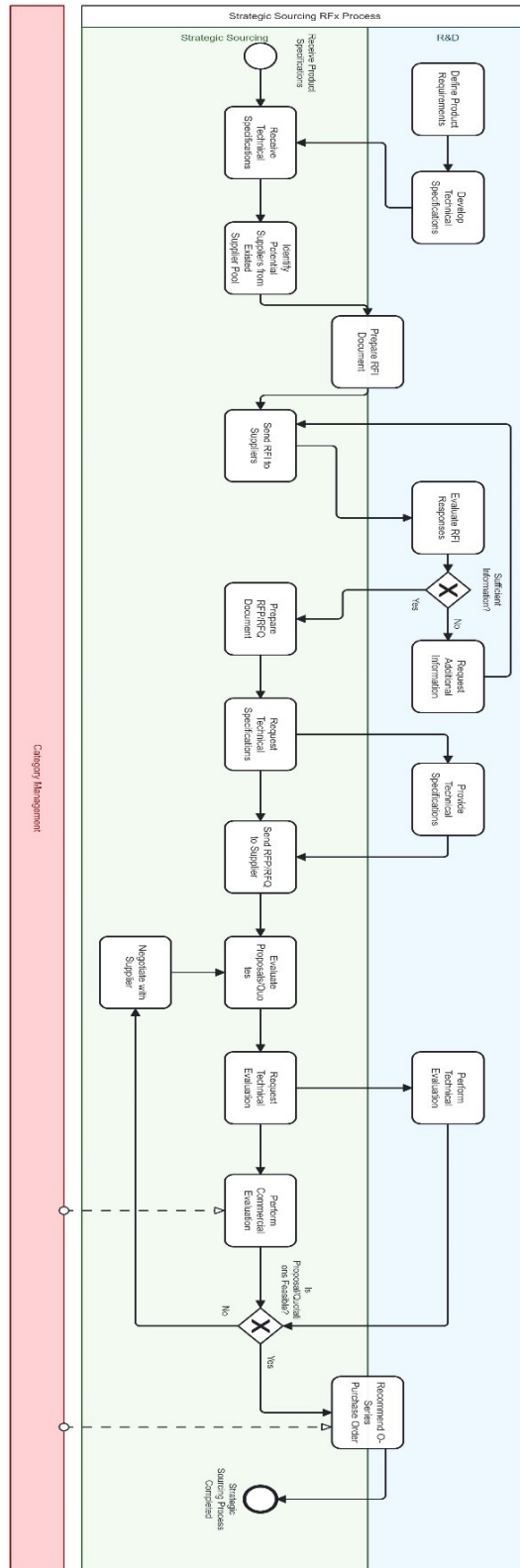


Figure 21. Shows the Redesigned Strategic Sourcing Process (RFX Process)

The process culminates in a dual evaluation of technical and commercial assessments. The final phase includes negotiation loops, where necessary, to establish clear criteria for assessing proposal feasibility before proceeding to purchase order recommendation. Continuously working with category management during the supplier selection process will be retained to ensure that strategic alignment is aligned.

It has been researched that structured RFX processes and technical evaluations lead to much-improved supplier selection outcomes and reduced risks in procurement (Chen, 2023). Standardizing the evaluations further addresses the gap in strategic sourcing (Vanpoucke et al., 2017) and improves decision quality by integrating technical and commercial assessments (Zsidisin et al., 2015). Further, the clear separation of R&D involvement and category management control provides a much better alignment of technical requirements with our strategic objective (Dubois et al., 2021), helping improve supplier selection outcomes.

5.2.4 Redesigned Category Management Process

The supplier selection and onboarding process was re-engineered to set up a composite framework of market analysis, supplier evaluation, and technical capability assessment. Based on BPMN, this process map develops a structured methodology for supplier selection that fully considers alignment with technical requirements and strategic objectives.

Supplier questionnaires are initiated after market analysis. An ordered progression moves through the first supplier evaluations, which include risk assessment, detailed supplier data reviews, and verification of certifications. The process consists of reviewing technological capabilities as a critical assessment, with parallel technical and commercial evaluation streams. Engineering and R&D support enter essential decision points for holistic supplier capability assessments.

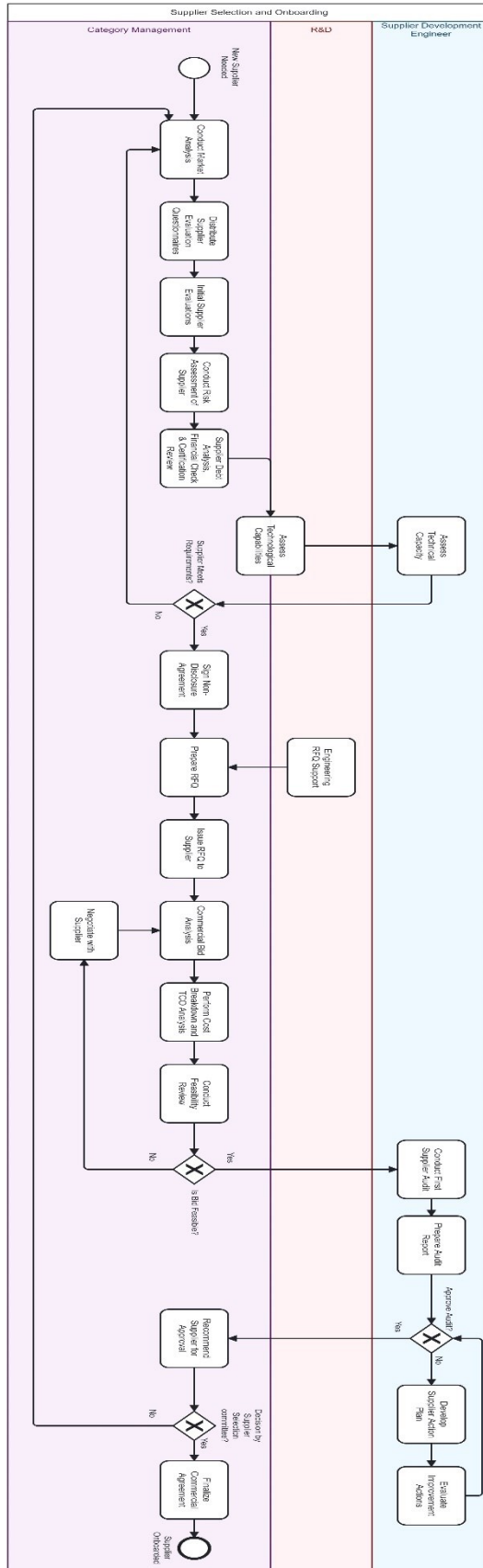


Figure 22. Shows the Redesigned Category Management Process (Supplier Selection and onboarding)

The workflow progresses through formal steps after NDA execution, including the RFQ process and commercial analysis. Notable features include phases that break down costs and analyze TCO (Total Cost of Ownership), with the feasibility reviews to follow. Supplier approval decisions and the finalization of commercial agreements are concluded within this process, with clear paths for improvement actions when needed.

Research indicates that highly structured supplier selection processes and capability assessments enhance supplier performance and reduce risks in the supply chain (Shah & Hasan, 2016). It enables a complete category management evaluation procedure for addressing significant challenges in categories (Pratikno & Kusnadi, 2020) while it enhances the quality of decision-making through the combination of technical and commercial assessments (Maletič et al., 2015). Additionally, the systematic onboarding of suppliers with proper documentation further enhances compliance management and mitigation of risks (Sánchez-Rodríguez et al., 2020), resulting in effective supplier relationships and better procurement outcomes.

5.2.5 New Supplier Development Processes

• Supplier Audit Process

This supplier audit process sets up a holistic framework for the systematic assessment of supplier capabilities and for driving continuous improvement. This process map, based

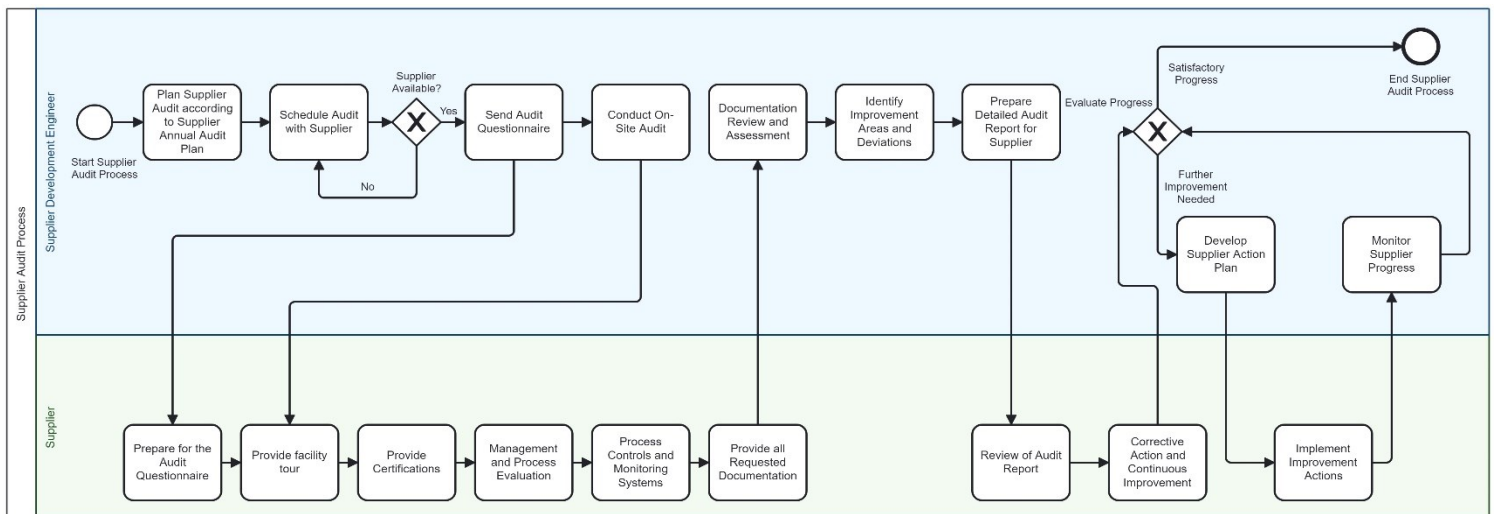


Figure 23. Shows the New Supplier Development Process (Supplier Audits)

on BPMN, develops parallel workflows for both the Supplier Development Engineer (SDE) and the supplier in execution to ensure clear responsibilities and expectations at each stage of the audit.

It starts with planning the audit according to the annual plan, followed by scheduling and distributing questionnaires. A structured approach involves supplier preparation activities, such as facility tour arrangements and certification documentation. In the audit execution phase, management systems, process control, and documentation are reviewed in detail, and improvement areas and deviations are identified systematically.

It ends with detailed reporting that explains the evaluation criteria and how to improve. Key features include structured feedback loops to monitor supplier progress on corrective action implementation. It maintains continuous monitoring of improvement implementation. Audits or additional improvement cycles are closed as needed and according to apparent criteria.

Research has shown that structured audit processes and integrated improvement monitoring significantly improve supplier performance and compliance management (Krause et al., 2007). Adopting standardized audit operations helps address critical weaknesses in supplier development processes (Zsidisin et al., 2015), while the well-defined documentation requirements and regular follow-ups enhance audit efficiency (Wang et al., 2020). Further, integration with the follow-up of corrective action monitoring and supplier improvement tracking paves the way for sustained performance enhancement (Rashidi et al., 2020). This would go a long way in developing strong supplier relationships by getting quality outcomes.

- **Supplier Claim Process**

Supplier claims for the newly designed process shall be supported through a framework that embraces feedback from multiple sources in a well-defined path based on claim value categorization. BPMN-based process mapping will ensure structured workflows

among three principal stakeholders in this process: the production/Quality Department, the Supplier Development Engineer (SDE), and the Supplier.

It starts with receiving quality feedback and initial assessment before branching into multiple verification channels, including warehouse quality checks, manual quality feedback, production quality checks, and random sampling inspections. Running these independent channels as verifications ensures a complete quality assessment of a claim before initiating it. It included a systematic approach to NC (non-conformance) review and quality feedback verification, followed by categorization of claims according to monetary value thresholds (>1000 EUR, 100-1000 EUR, <100 EUR).

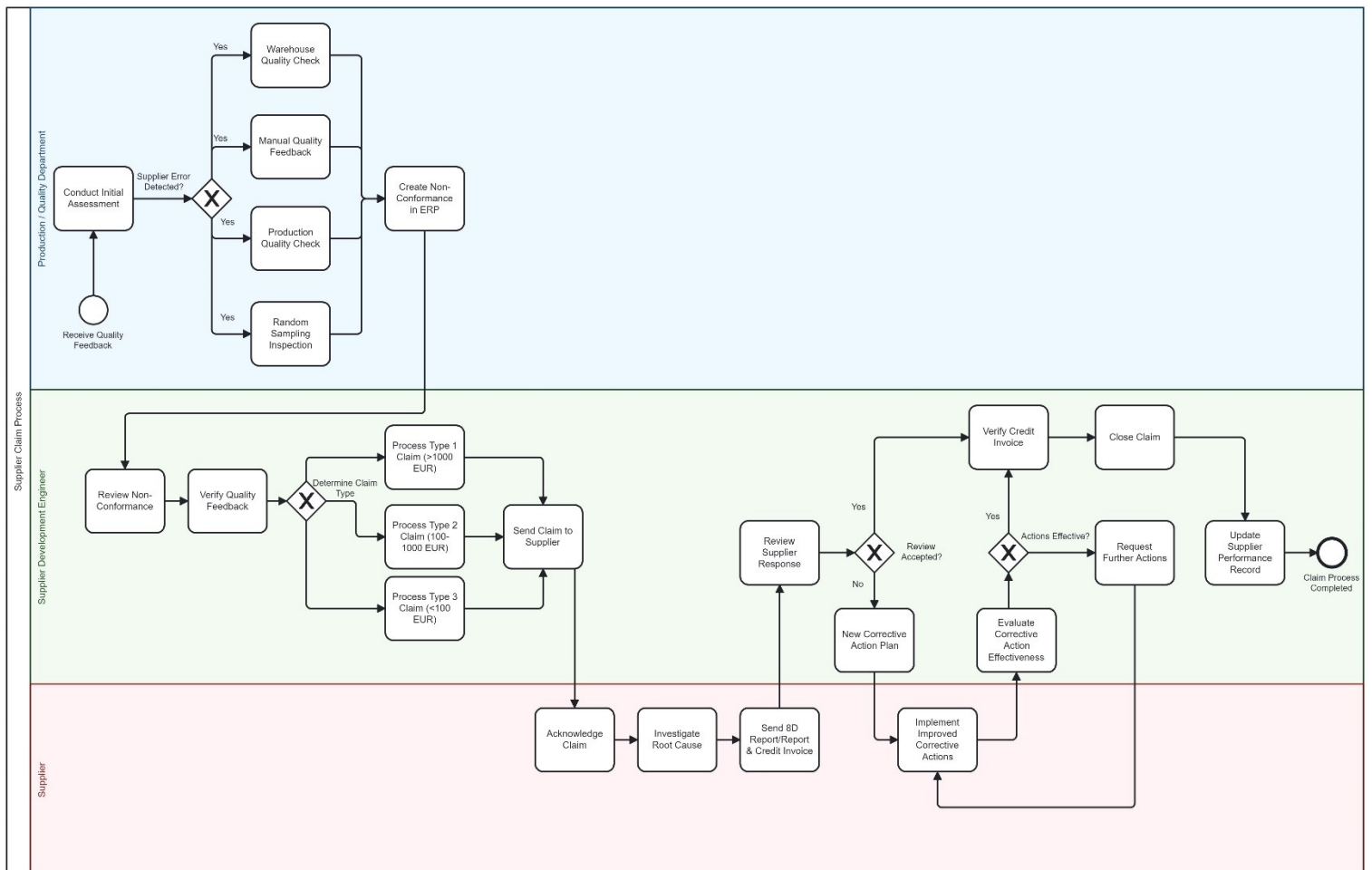


Figure 24. Shows the New Supplier Development Process (Supplier Claims)

The supplier’s portion of the workflow includes formal steps for acknowledging the claim, initiating root cause investigation, and implementing corrective action. The process has

defined gates for assessing effectiveness and closing, with feedback loops for more corrective actions if needed. The process ends after completing the verification of the credit invoice and performance record updating, which assures completeness of documentation and traceability.

Research results indicate that structured claim management processes with integrated root cause analysis lead to better supplier quality performance and lower recurrence of issues (Krause et al., 2007). Standardized claim procedures address significant supplier development challenges (Sánchez-Rodríguez et al., 2020). In contrast, detailed categorization and escalation paths provide a boost to processing efficiency (Wang et al., 2020). Moreover, multiple quality feedback channels, in combination with systematic follow-up procedures, improve the quality of management and supplier development outcomes (Vanpoucke et al., 2017) towards much more efficient supplier performance improvement and lower quality issues.

5.3 Summary of AS-IS and TO-BE Processes of the Case Company

The AS-IS procurement and supplier development processes, documented through flowcharts, mind maps, and fishbone diagrams, highlighted several inefficiencies, including manual tasks, data redundancy, and fragmented information storage across departments (see Chapter 6). Key insights were drawn from examining the processes within operational purchasing, strategic sourcing, category management, and supplier development. In contrast, the TO-BE processes, developed using the Business Process Model and Notation (BPMN), proposed streamlined protocols, structured workflows, and standardized documentation to address these identified issues. The redesigned processes enhance cross-functional connections, particularly between procurement and supporting departments like R&D, planning, and finance, to improve interdepartmental communication and alignment (Yin, 2018). Additionally, compliance checks were integrated to support ISO and SOX regulatory standards, reinforcing a foundation of regulatory adherence. This updated process design aims to optimize efficiency, increase

compliance, and promote a cohesive procurement system within the organization (Lincoln & Guba, 1985; Creswell & Plano Clark, 2017).

6. Chapter 6: IMS Processes Implementation

Based on the optimized process designs developed in Chapter 5, this chapter focuses on implementing the redesigned processes into the case company's existing IMS system. The implementation methodology, integration process, and initial outcomes are to be documented, particularly on deploying BPMN-modeled procurement and supplier development processes. The chapter concludes with an analysis of implementation challenges and early impact assessment through a structured survey of stakeholders.

6.1 Implementation Process

The first step in the implementation is to integrate the new processes with the existing ones to ensure alignment and continuity of work within the organization. This initial step is crucial as it sets how the latest methods and existing systems interact.

After integration, process maps were developed using the IMS software Blueprint Tool. This tool offers a standardized platform for visualizing workflows. It provides clear illustrations of process hierarchies and relationships, which facilitate understanding the process flow from the stakeholders' point of view.

Next, the process details and tasks are defined. Process links that connect related documents and procedures are established, followed by updating the documentation links to ensure all related information is cross-referenced correctly within the system. After confirming the process links, detailed information was available for each task phase. Each step achieved this by creating specific information, requirements, and metrics.

The final stage is the higher supply chain management review and approval. If changes are required, they are made and continued for review at the final approval level. After getting approved, they are treated as implemented, and those new processes are part of the organization's standard operating procedures.

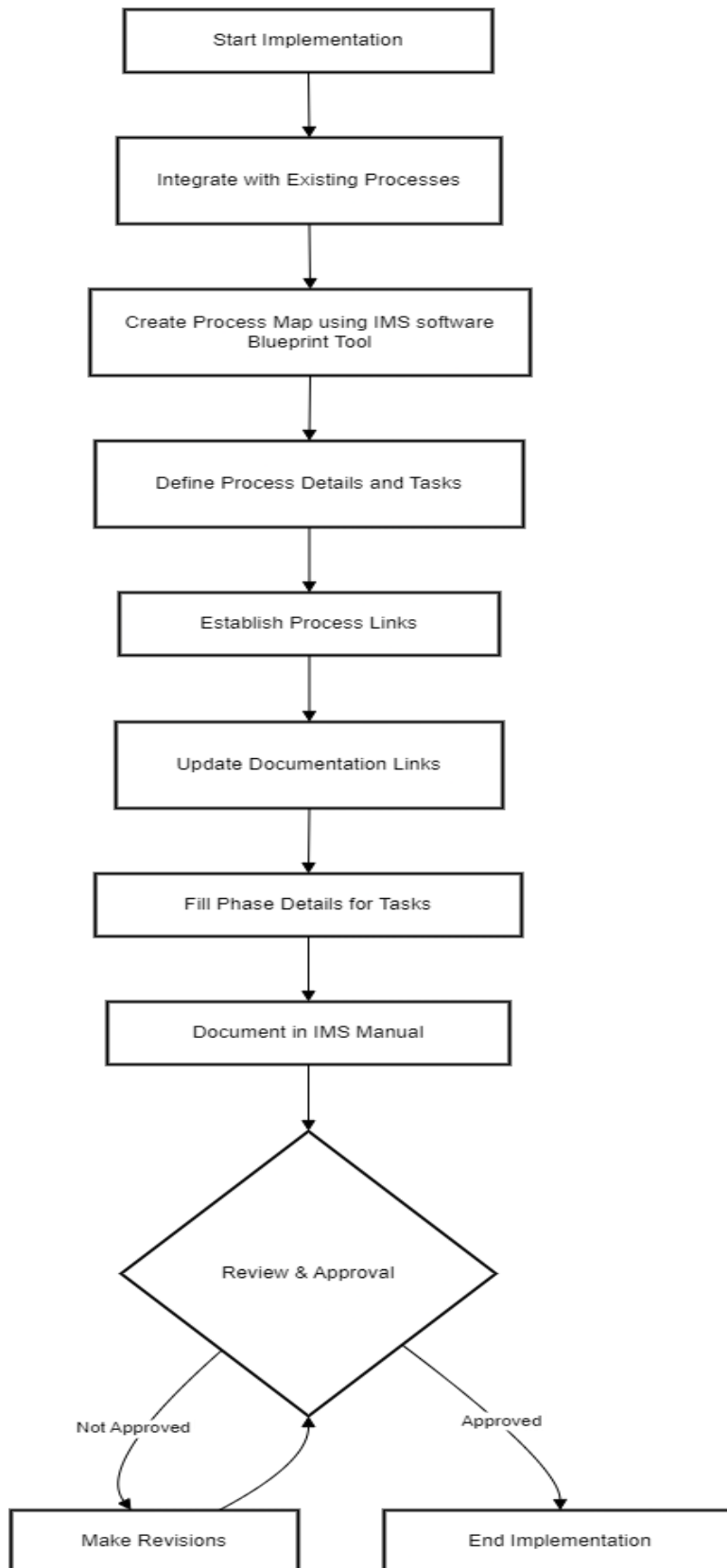
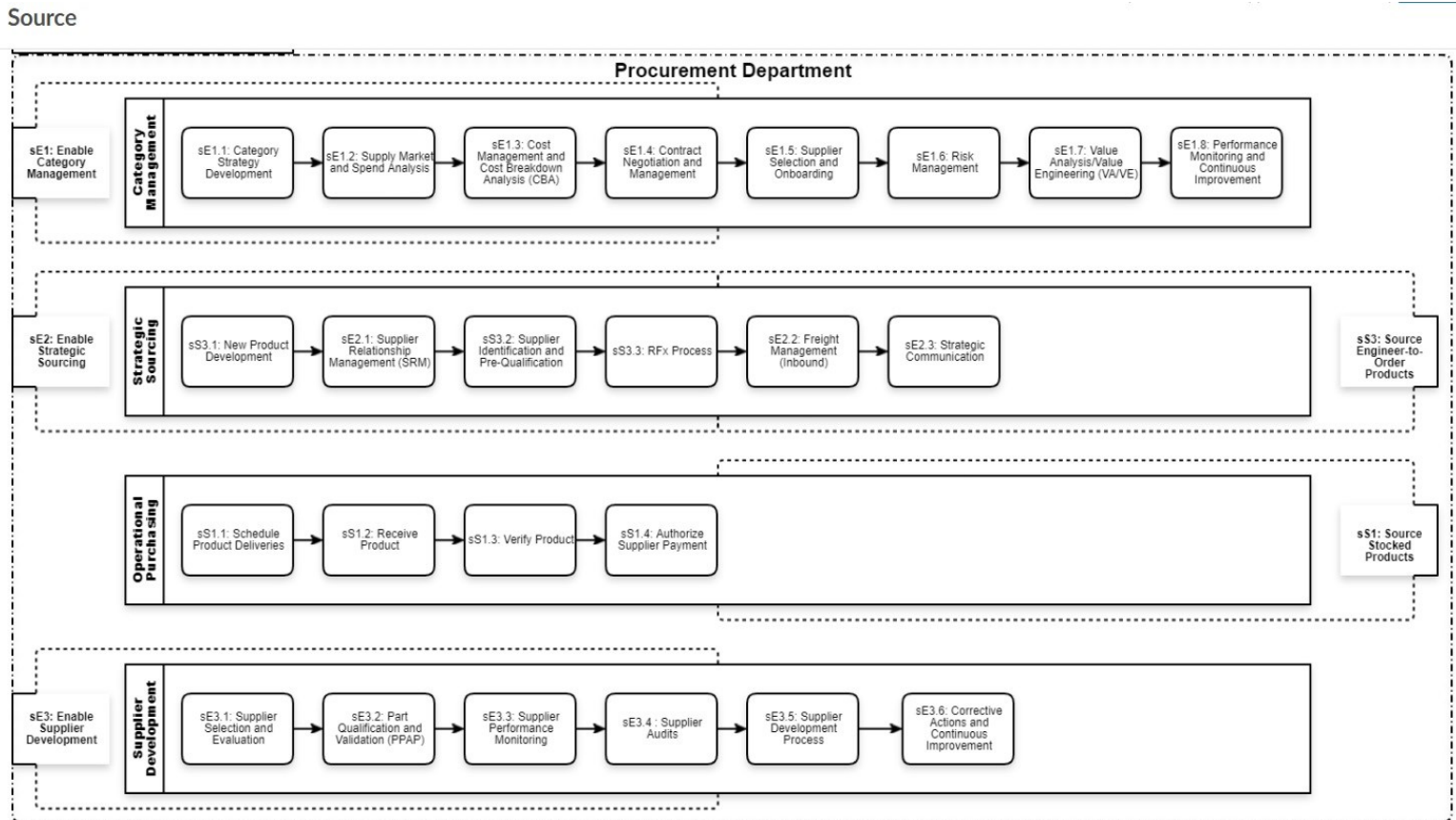


Figure 25. Shows the Implementation Process Flowchart

6.2 Implementation Results

- **Implemented Top-Level Procurement Process**

The implementation results (Picture 5) show that the redesigned procurement processes are well integrated within the IMS system supply chain process tree, 'Source' category. The top-level procurement process map shows four major functional streams: Category Management (sE1), Strategic Sourcing (sE2) and (sS3), Operational Purchasing (sS1), and Supplier Development (sE3).

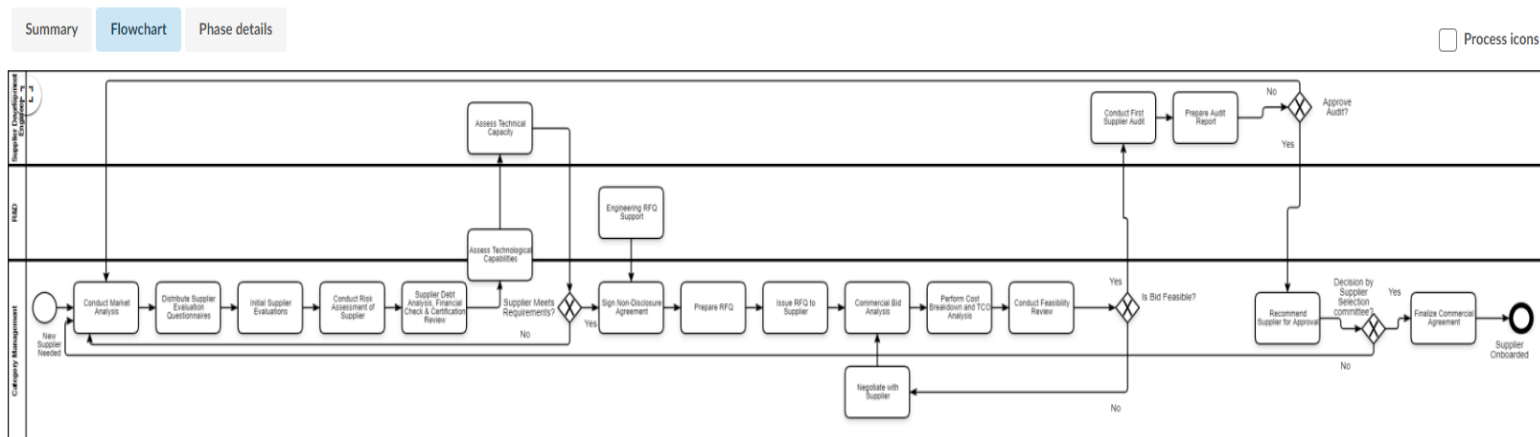


Picture 5. Shows the IMS implementation of the Procurement Top-Level Processes (Case Company, 2024)

Process streams have interfaces with clear links to interfacing departments. Strategic sourcing is linked to product development in R&D, and operational purchasing is linked to production and planning to manage deliveries. Category Management processes link to Finance for cost control, Supplier Development links to Quality department procedures, and interdepartmental links are established through hyperlinks within the IMS system. Easy access to all relevant procedures and documentation is made available.

- **Implemented (sE1.5) Supplier Selection and onboarding Process**

Picture 6 below shows the implementation result: The detailed supplier selection and onboarding process was successfully deployed within the Category Management stream of the IMS system (sE1.5). This process map in BPMN notation demonstrates the end-to-end workflow of supplier selection and onboarding, with clear swim lanes depicting responsibility distribution among the Supplier Development Engineer and the R&D and Category Management teams.



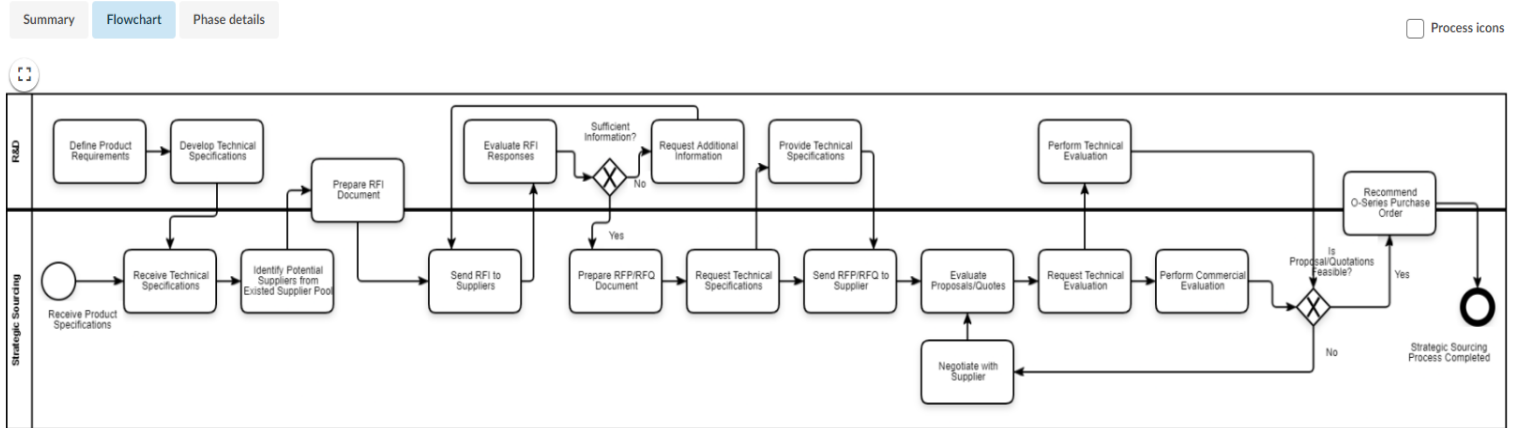
Picture 6. Shows the Implemented (sE1.5) Supplier Selection and onboarding Process (Case Company, 2024)

Workflow led by Category Management starts with Market Research and Initial Supplier Evaluation and moves through Supplier Qualification Assessment and RFQ. The swim lane for R&D shows involvement in Technical Capability Assessment and Engineering Support for selected suppliers to meet technical requirements. Supplier Development Engineer Lane includes Audit preparation and execution responsibilities to showcase their role in Supplier Qualification and Compliance Verification.

Each process step is linked to documentation in the IMS system, connecting to appropriate procedures, forms, and specifications. Very clear decision gates and feedback loops into the process are discussion topics on several aspects of supplier qualification and commercial feasibility assessments for final supplier approval and commercial agreement finalization.

- **Implemented (sS3.3) RFX Process**

Picture 7 below shows the implementation of the detailed RFX process (sS3.3) successfully deployed in the Strategic Sourcing stream of the IMS system. Modeled in BPMN, this process map describes the work strategic sourcing shall perform when selecting Suppliers via any RFX process. It shows who owns the process and where their interactions are regarding R&D and Strategic Sourcing teams.



Picture 7. Shows the Implemented (sS3.3) RFX Process (Case Company, 2024)

The process map showed parallel activities between the two departments. R&D's swim lane starts with defining product requirements and then creating technical specifications to prepare the RFI document. The Strategic Sourcing swim lane dealt with operations, which involved receiving technical specifications, identifying potential suppliers from an approved supplier pool, and managing the communication of RFX with suppliers.

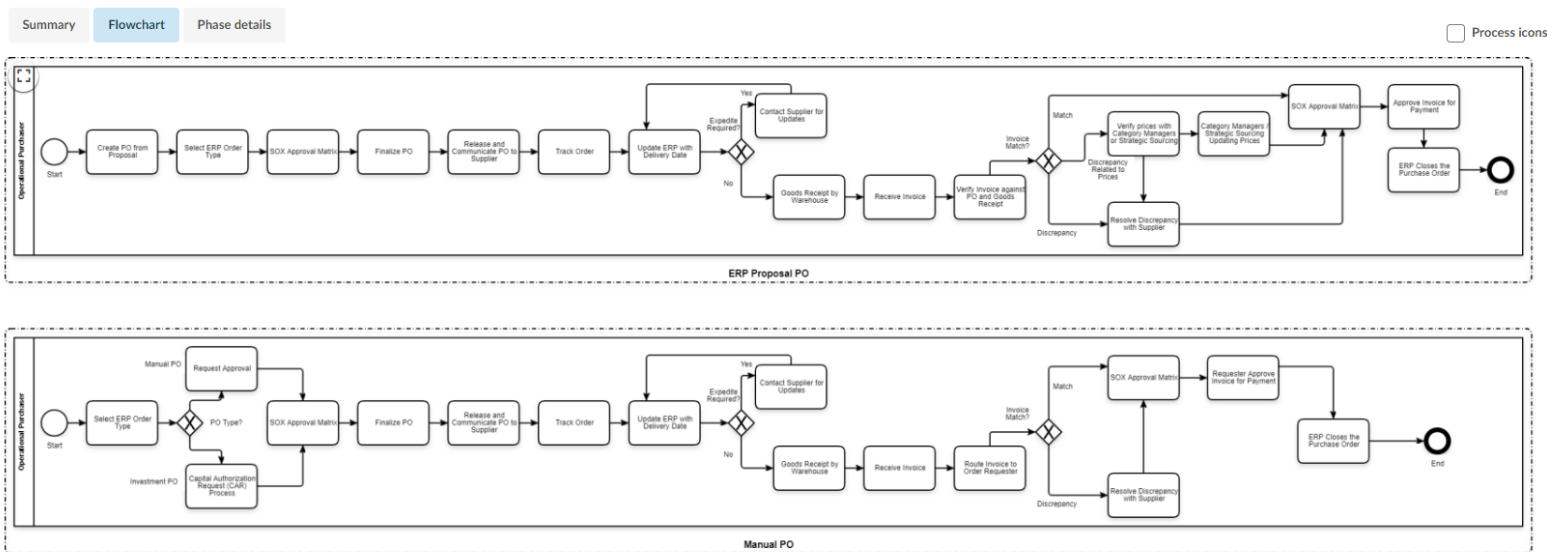
Several decision gates and feedback loops are built into the workflow, especially for the sufficiency of information and practicability of the proposal. Key interlinked activities include technical evaluation, commercial assessment, and supplier negotiations. Each process step is linked to the relevant documentation and templates within the IMS system for standard execution of the RFX process.

This detailed implementation develops a defined framework for supplier selection via the RFX process while keeping the technical and commercial evaluations effective

partners. The process is completed by issuing a purchase order or looping back for more negotiations to finalize supplier selection.

- **Implemented (sS1.1) Scheduled Product Delivery Process**

Picture 8 shows the implementation of the scheduled product delivery process (sS1.1) used in the IMS system's Operational Purchasing stream. The process map in BPMN notation shows two parallel flows for Purchase Order processing: ERP Proposal PO and Manual PO, both carried out by Operational Purchasing.



Picture 8. Shows the Implemented (sS1.1) Schedule Product Delivery Process (Case Company, 2024)

The ERP Proposal PO workflow begins with purchase orders from proposals generated by the ERP system, followed by order type selection and verification against the SOX Approval Matrix. Clear steps for order finalization, communication with the supplier, and tracking of the delivery updated by ERP. It includes matching and verifying invoices within the workflow, with paths defined to handle discrepancies and Category Manager approval for price validation.

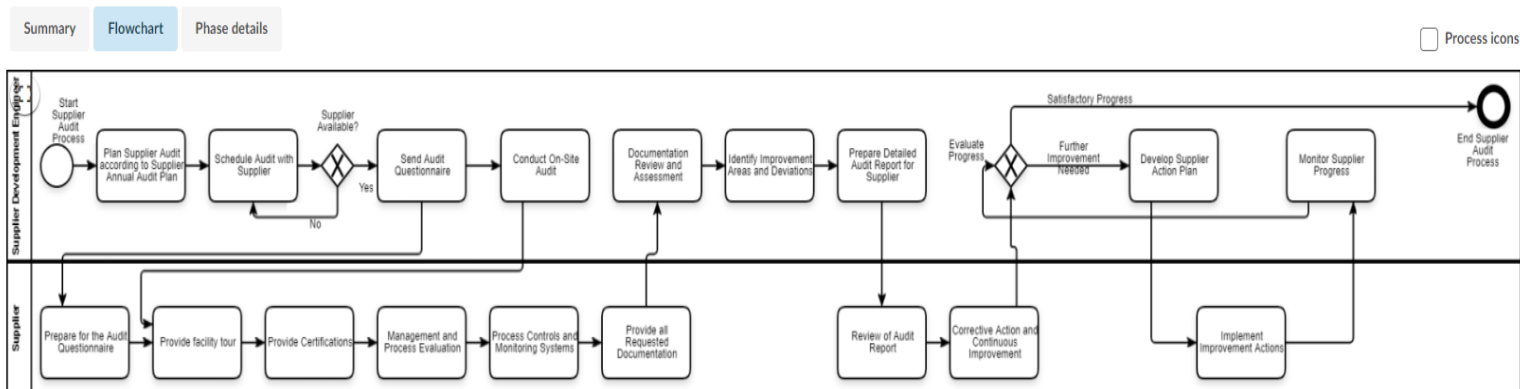
The Manual PO workflow is set up much like the one described above, with some additional initial steps for the various types of POs (Manual or Investment PO). Investment POs need to follow a Capital Authorization Request (CAR) process. Both have SOX

compliance checkpoints and are followed in a system for tracking orders, receipts of goods, and invoice processing.

Each process step is linked to the appropriate documentation within the IMS system, which should be set up to connect to proper procedures and approval matrices. The implementation would ensure standard execution of purchase order processing with the maintenance of necessary controls for both system-generated and manual orders, culminating with the ERP closure of the purchase order.

- **Implemented (sE3.4) Supplier Audits Process**

The Supplier Audits Process (sE3.4) was successfully deployed within the Supplier Development stream of the IMS system. The process was mapped using BPMN notation to demonstrate the work sE3.4 Supplier Audits entailed, with specific swim lanes to demarcate responsibility delineation between the Supplier Development Engineer and the Supplier.



Picture 9. Shows the Implemented (sE3.4) Supplier Audits Process (Case Company, 2024)

The process map showed parallel activities between the two parties. For the Supplier Development Engineer, a swim lane would start with planning the audit per the annual audit plan and then scheduling and evaluating it. It involved the points of critical supplier availability, progress evaluation decisions, and paths for satisfactory and unsatisfactory audit outcomes. The Supplier's swim lane detailed their responsibilities in audit

preparation, setting up the facility tour, providing documentation, and executing improvement actions.

Key linked activities are the execution of on-site audits, documentation reviews, and identifying improvement areas. It includes structured feedback loops for continuous improvement, with clear paths to monitor supplier progress and develop action plans. Each process step will be reviewed for applicability within the IMS system to determine links to the relevant documentation, such as audit questionnaires, evaluation forms, and reporting templates.

This detailed implementation shall ensure a standardized approach to supplier audits by balancing effectiveness and applying the approach to the collaboration between the organization and its suppliers for continuous improvement and compliance verification.

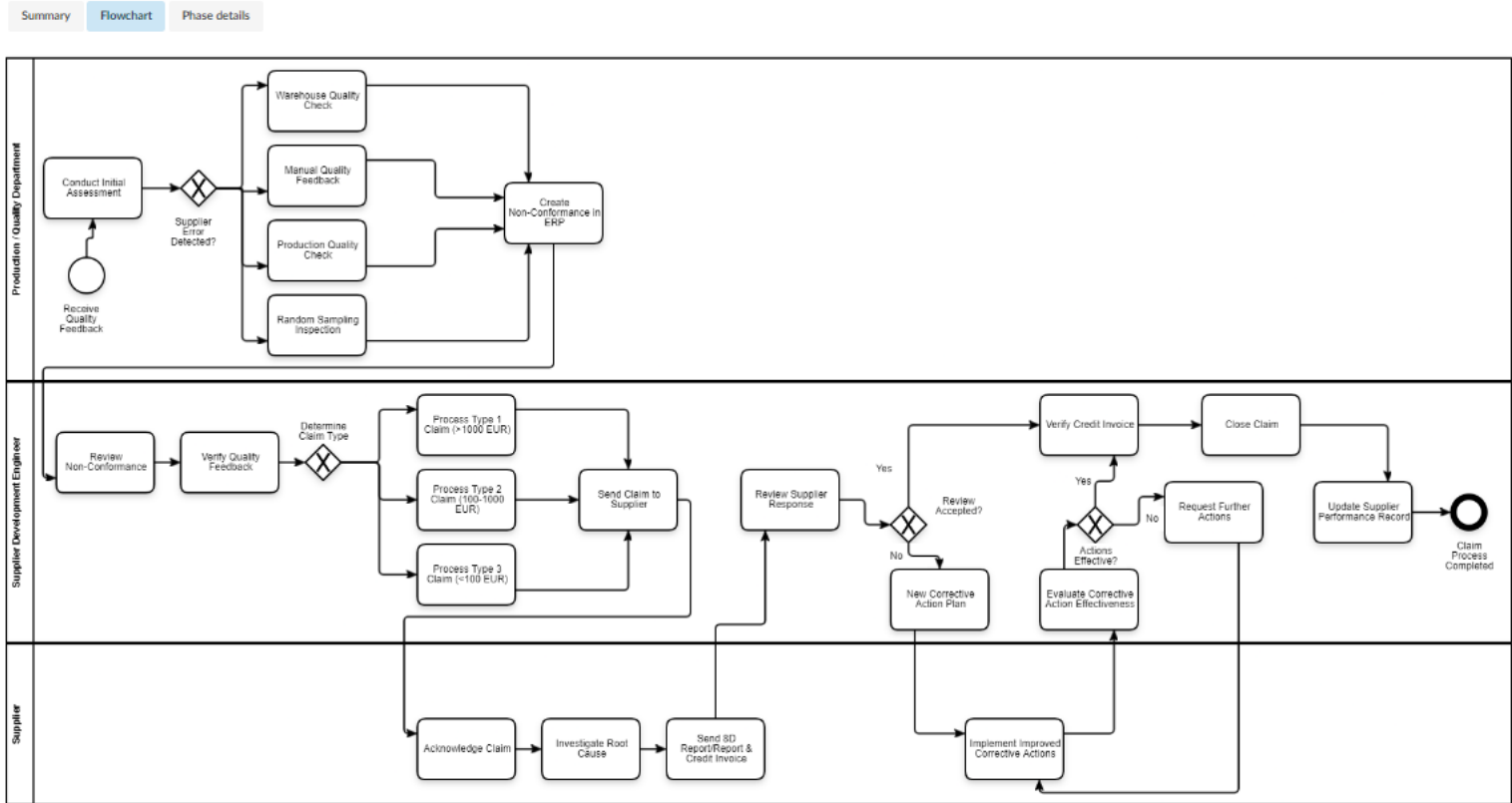
- **Implemented (sE3.6) Corrective Actions and Continuous Improvement Process**

Picture 10 shows the implementation of the "Supplier Development" IMS stream for the Corrective Actions and Continuous Improvement process (sE3.6) collected from various organizations. BPMN has modeled this process to show a clear view of the entire process flow in "Supplier Claims and Improvements," along with specific swim lanes for each activity representing responsibilities about Production/Quality Control, Supplier Development Engineer, and Supplier.

The Production/Quality Control swim lane starts the process with Multiple quality detection channels: warehouse quality checks, manual quality feedback, production quality checks, and random sampling inspections. The convergence of these parallel paths results in non-conformances in the ERP system.

The Supplier Development Engineer's swim lane leads the claim processing flow for the initial review, verification, and categorization of claims based on monetary value thresholds (>1000 EUR, 100-1000 EUR, <100 EUR). The process shall provide clear decision

points on reviewing supplier responses and the effectiveness of corrective action with paths for additional actions if necessary. It should define who will review the supplier Responses and what scoring/grading guidelines will be used.



Picture 10. Shows the Implemented (sE3.6) Corrective Actions and Continuous Improvement Process (Case Company, 2024)

The Supplier's swim lane acknowledges claims and investigates root causes. It also includes documenting all corrective actions implemented for a given process step within the IMS system to realize standard execution of claim management and continuous improvement activities.

This level of implementation detail presents a formal management approach for quality issues and fosters continuous improvement through systemic monitoring of corrective action and tracking supplier performance.

6.3 Implementation Challenges and Initial Impact

- **Implementation Challenges**

There were several significant challenges in implementing the new procurement and supplier development processes into the already existing IMS system. The first major challenge was that the new processes had to be fitted into the existing SCOR model framework. The primary factor of consideration was that the case company had already mapped its production and planning processes using the SCOR model. Therefore, maintaining coherence while integrating new procurement processes requires careful thought and several iterative processes to get it right. The relevance of this alignment was for the harmonization of processes and retaining the already established hierarchical order within the IMS system.

Some technical challenges were met during the implementation phase, especially with the Blueprint tool's automated alignment functionality. Even though the tool helps provide standardized process visualization, its flexibility prevented adequately positioning and aligning processes in the desired configuration from being well executed. Therefore, maintaining proper process positioning and logical flow sequences would demand more effort, especially for complex processes with multiple stakeholders and decision points.

An even more significant challenge was process interlinking. This meant that cross-functional processes emanating from several departments required much checking and validation to be accurately linked. Most procurement-related processes are so intertwined with supplier development that any change in one directly affects another process. All process links crosswise must be checked thoroughly and, if needed, realigned to uphold system integrity.

The difficulties encountered during implementation only show how complex merging new processes into an already existing IMS framework can be. Nevertheless, these challenges would provide helpful input for implementing processes in the future and updating systems.

- **Initial Impact**

A survey was conducted via Webropol among employees of the case company in various departments to assess the initial impact of the implemented processes. It helped quantify satisfaction levels regarding the newly implemented process maps and provided quantitative feedback on how well the implementation was executed.

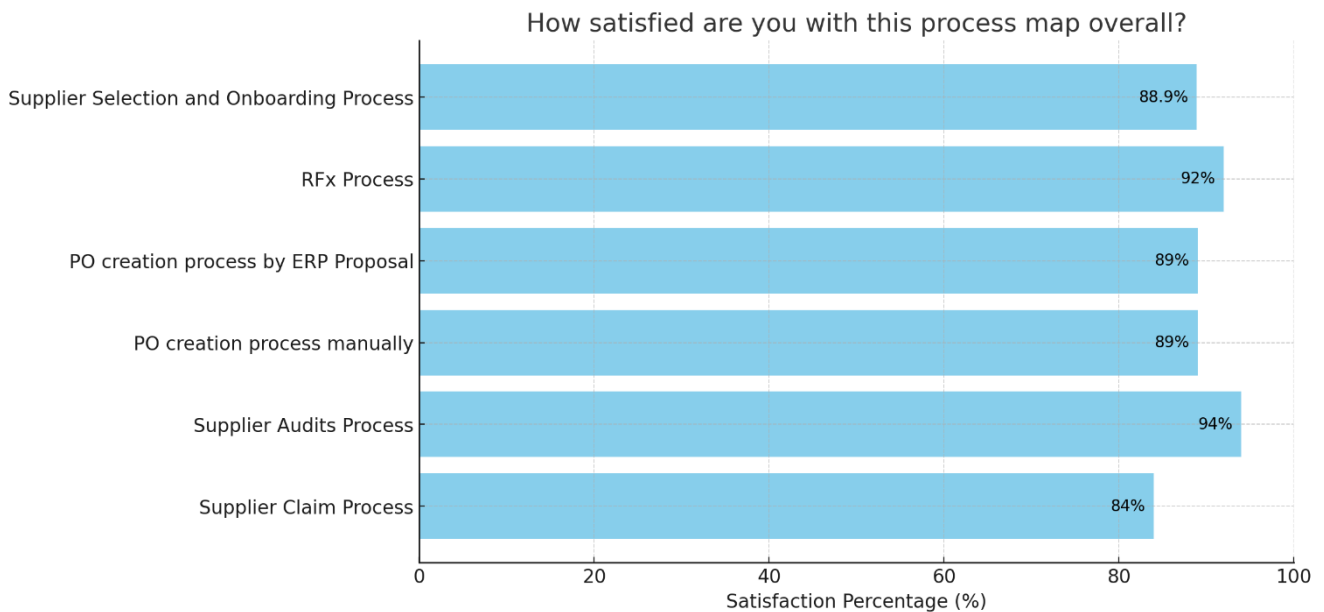


Figure 26. Shows the Stakeholder Satisfaction Ratings for Implemented IMS Processes

These survey results speak to a notably positive reception of the new processes. Of all the latest processes, the Supplier Audits Process scored best regarding satisfaction (94%), evidencing stakeholders immensely appreciated the implemented approach for supplier evaluation and continuous improvement. Following close behind was the RFX Process, which garnered a 92% satisfaction score, again showing strong approval for streamlining the supplier selection and evaluation workflow. The ERP-based PO creation process and manual PO creation process both achieved an 89% satisfaction rating. The Supplier Selection and onboarding process received powerfully strong scores within an 88.9% score, while the supplier claim process scored the lowest at 84%.

These preliminary results indicate that most of the earlier identified procurement and supplier development challenges have been adequately addressed through

implementation. The unequivocally high satisfaction rates for all implemented processes (84% to 94%) point to the effectiveness of the new process maps in meeting user and operational requirements. The next chapter provides a more detailed analysis of these results and their implications.

This initial feedback allows building on what has been done so far regarding the implemented processes; it also validates that the right approach to implementation was practical.

7. Chapter 7: Results and Discussion

This chapter discusses how effective and impactful the newly implemented Integrated Management System processes are in the case company's procurement and supplier development operations. The assessment is on four dimensions of crucial performance in meeting research objectives: clarity of process (78-94%), efficiency (67-78%), compliance improvement (71-88%), and user satisfaction (84-94%). Next, based on an in-depth analysis of survey data, this chapter studies how reengineered processes addressed inefficiencies identified in Chapter 5, results that seem to vary across processes. A systematic analysis of the implementation outcomes is made in this chapter by examining each research objective's attainment first and then theoretical framework validation.

7.1 Achievement of Research Objectives

7.1.1 Process Mapping and Documentation Results (Objective 1)

The AS-IS process mapping captured the current state of the procurement and supplier development functions within the Integrated Management System of the case company. Flowcharts, mind maps, and fishbone diagrams were used to represent workflows and dependencies visually. As described in Chapter 5, such mapping helped identify inefficiencies and bottlenecks, including but not limited to data redundancy, challenges due to manual entry, and fragmented data storage.

Another aspect addressed was the documentation completeness assessment, which ensured that all process steps, inputs, outputs, and stakeholder responsibilities were fully described and aligned with actual practices. This level of documentation quality provided excellent visibility for the optimized TO-BE processes, noting no critical steps left undocumented and for moving towards standardization.

Gap identification further clarified areas needing improvement, such as inconsistencies in data management, late approvals, and limited feedback loops, as discussed in Chapter

5. These were used to design the TO-BE process to ensure more streamlined workflows, standardize all documentation, and improve department communication.

Finally, process visualization added substantial value by offering a clear view of interactions and dependencies, fostering shared understanding across departments and a collaborative approach to process improvement. These process mapping and documentation efforts, as initially outlined in Chapter 6, begin the framework for developing a more efficient, integrated, and compliant IMS.

7.1.2 IMS Process Design Outcomes (Objective 2)

The TO-BE processes within the IMS were designed to remove identified inefficiencies and non-standard processes in the procurement and supplier development functions. The TO-BE processes defined very straightforward stages with streamlined protocols that minimized bottlenecks for operational purchasing, category management, supplier development, and strategic sourcing. This brought along better order accuracy and a responsive, organized procurement structure. Department-level process standardization enhanced collaboration and communication by aligning all stakeholders closely with procurement goals and timelines.

Furthermore, the process design incorporated the specific compliance checkpoints noted in Chapter 5, with the IMS aligning to ISO standards and SOX regulations. These ensured that all regulatory aspects were systematically considered for all procurement and supplier development activities. Strengthening adherence to standards and reducing compliant risks, however, reduced risks.

7.1.3 Implementation Success Analysis (Objective 3)

High satisfaction across essential functions is evidence of successfully implementing redesigned IMS processes. The satisfaction survey (Figure 25) indicated that well-integrated processes garnered 84% and 94% satisfaction across distinct process areas. Every

process, including supplier selection and onboarding, RFX, purchase order creation (both ERP and manual), supplier audit, and supplier claim, was well documented, with links to the other departments' other functions to ensure holistic process management.

Among them, the RFX and Supplier audit processes achieved 92% and 94% satisfaction ratings, reflecting how clear protocols and structured workflows drove adoption and supported operations. All IMS PO creation workflows, in addition to those for processes (both ERP-driven and manual) described above, were fully integrated into the IMS system at the time. Therefore, as a result, cross-functional activities were much better coordinated and had greater visibility. While at a slightly lower satisfaction level of 84%, the Supplier Claim process was showing strong alignment with IMS objectives in providing structured channels through which to manage issues related to suppliers.

Comprehensive documentation and cross-functional links ensured that every process was followed in a standard manner and was readily available to be executed, fostering visibility and supporting streamlined and compliant operations in the Case Company. Implementation Management achieved organizational alignment and efficiency.

7.1.4 Process Performance Analysis (Objective 4)

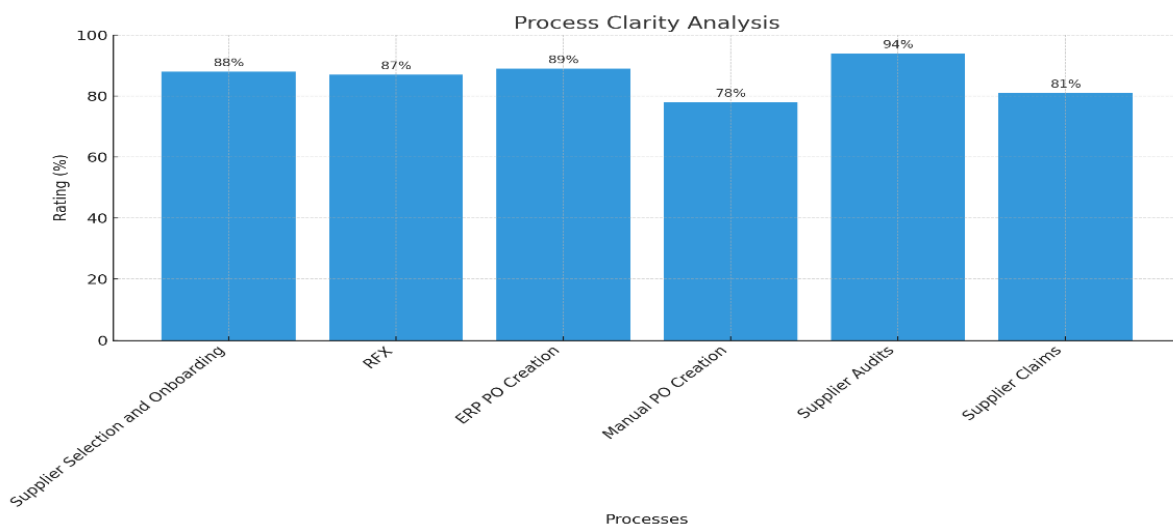
The implemented IMS processes were analyzed against four key performance dimensions: Process Clarity, Process Efficiency, Compliance Enhancement, and User Satisfaction. A structured survey collecting feedback on each process based on these dimensions, with a rating of effectiveness and user experience, was used to assess overall performance. Table 2 presents a summary of these processes based on feedback scores. This creates a relative backdrop for comparing the performance of each process from the standpoint of these critical metrics.

Table 8. Shows the Case Company Employees Survey Results on Process Ratings

Processes	Process Clarity (%)	Process Efficiency (%)	Compliance Enhancement (%)	User Satisfaction (%)
Supplier selection and onboarding process	88	72	81	88.9
RFX process	87	71	81	92
PO creation from ERP proposal Process	89	69	72	89
Manual PO creation Process	78	68	76	89
Supplier Audits Process	94	67	88	94
Supplier claims Process	81	78	71	84

- **Process Clarity**

Process clarity refers to a significant degree of ease with which users can comprehend and follow each process map. Supplier Audits Process scored the top rating in clarity of 94%, indicating that it was well-structured and easy to follow. The identical high scores, indicating effectiveness in communicating workflows, were identifiable with PO Creation (ERP-based) and Supplier Selection and Onboarding, which scored 89% and 88% in clarity. The lowest score for clarity, 78%, went to the Manual PO Creation Process, implying that elements in this process may require further elaboration for the user to understand.

**Figure 27. Shows the Process Clarity Analysis from Survey**

- **Process Efficiency**

Efficiency ratings measured the perceived impact of each process on reducing resource consumption and operational delays. A high score for efficiency in the Supplier Claims Process of 78% indicated that the process would strike a chord in reducing resource consumption. The same gained 72% and 71% efficiencies for Supplier Selection and Onboarding and RFX, respectively, effectively lowering duplications and speeding up operations. Lower scores came with PO Creation (69% for ERP-based and 68% for Manual) and for Supplier Audits (67%), which suggested that the efficiencies for these two processes might still be improved further.

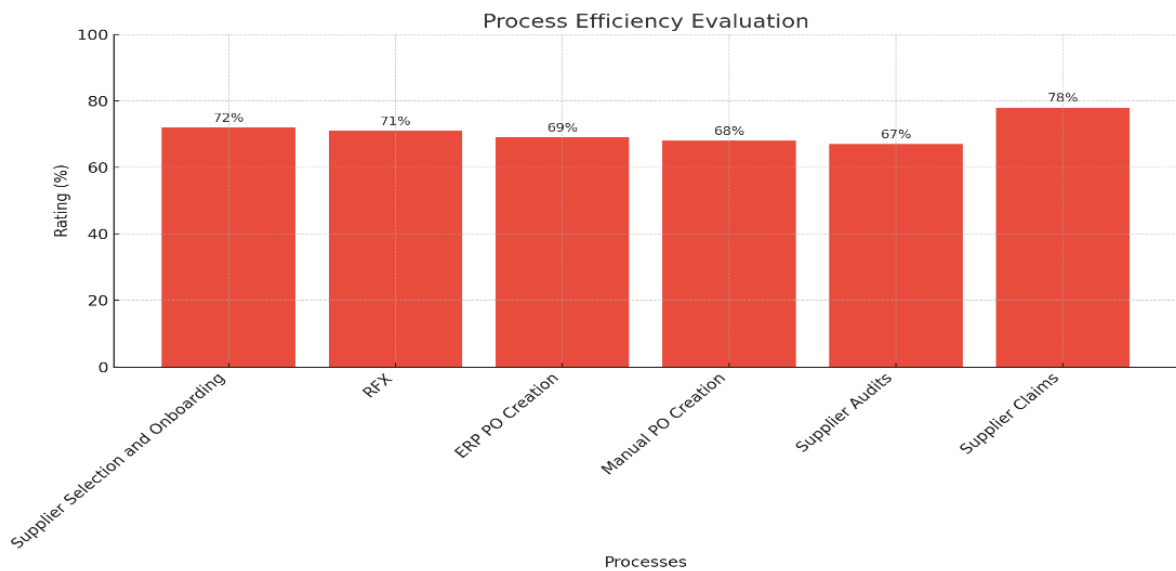


Figure 28. Shows the Process Efficiency Evaluation from the Survey

- **Compliance Enhancement**

Compliance enhancement assessed the level to which procurement and supplier development standards were met with each process. Supplier Audits Process scored another very high compliance rating, at 88%, showing strong adherence to regulatory and internal standards. Supplier Selection & Onboarding and RFX achieved an 81% score for compliance. This portrays minimal deviation from the required standards. Less impressive

ratings for PO Creation (ERP-based) and Supplier Claims, at 72% and 71%, highlight areas where more checkpoints or standardization might bring value.

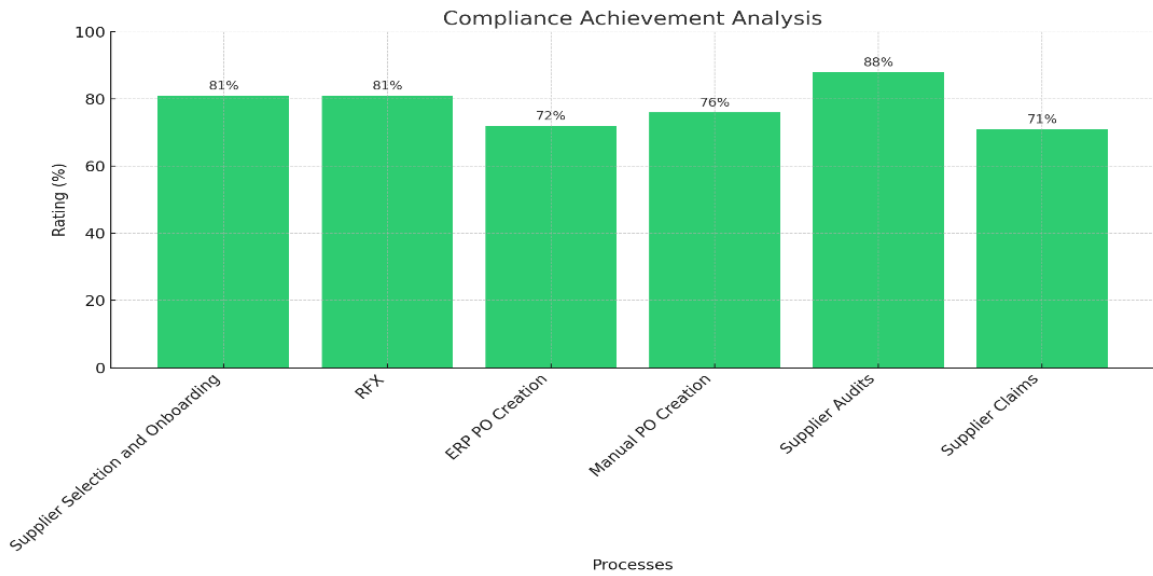


Figure 29. Shows the Compliance Achievement Analysis from the Survey

- User Satisfaction**

It allowed visibility into holistic views of each process involving clarity, efficiency, and compliance dimensions. A score of 94% in user satisfaction was awarded to the Supplier

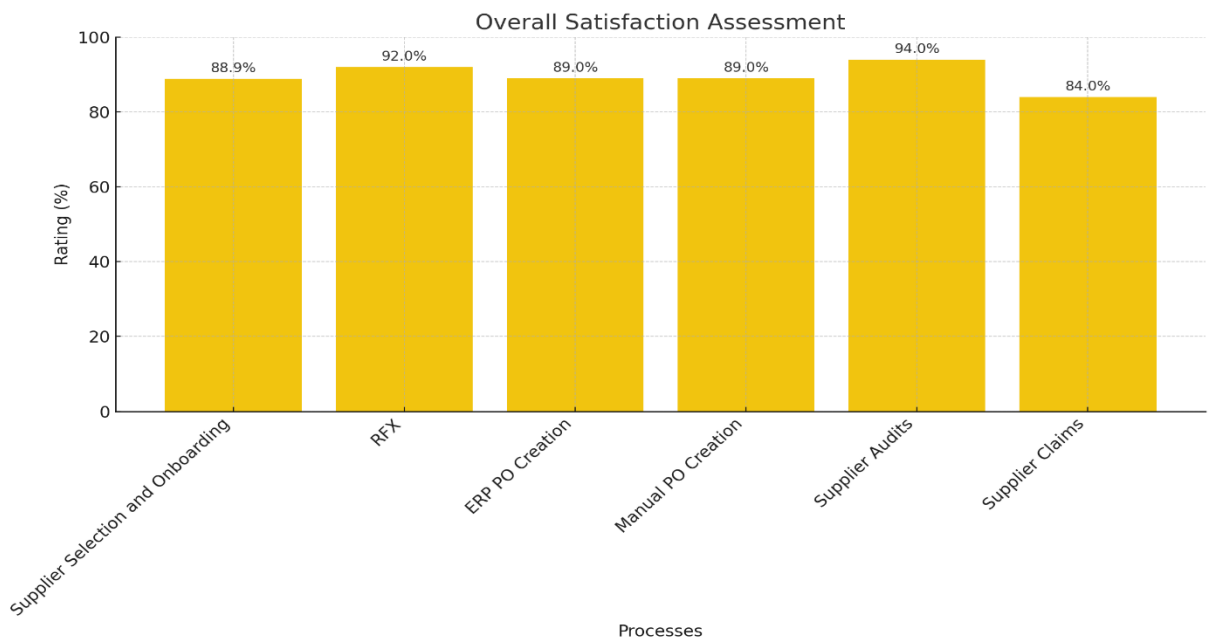


Figure 30. Shows the Overall Satisfaction Assessment from the Survey

Audits Process, representing good performance across the board. This was followed by the RFX Process, which scored highly in satisfaction at 92%, indicating that it was considered very well-designed and practical. Also scoring well, at under an 89% satisfaction level, were the Supplier Selection and Onboarding Process and PO Creation (ERP-based and Manual). Even though quite efficient, the Supplier Claims Process scored the lowest in satisfaction at 84%; hence, areas for improvement to increase user satisfaction could be identified based on this score.

- **Summary**

Summing up the above, the process performance analysis resulted in high scores for most processes regarding clarity and compliance, with outstanding ratings, particularly for supplier audits and the RFX process. Where efficiency was rated, there was room for improvement, especially in the PO Creation and Supplier Audit processes. The scores of

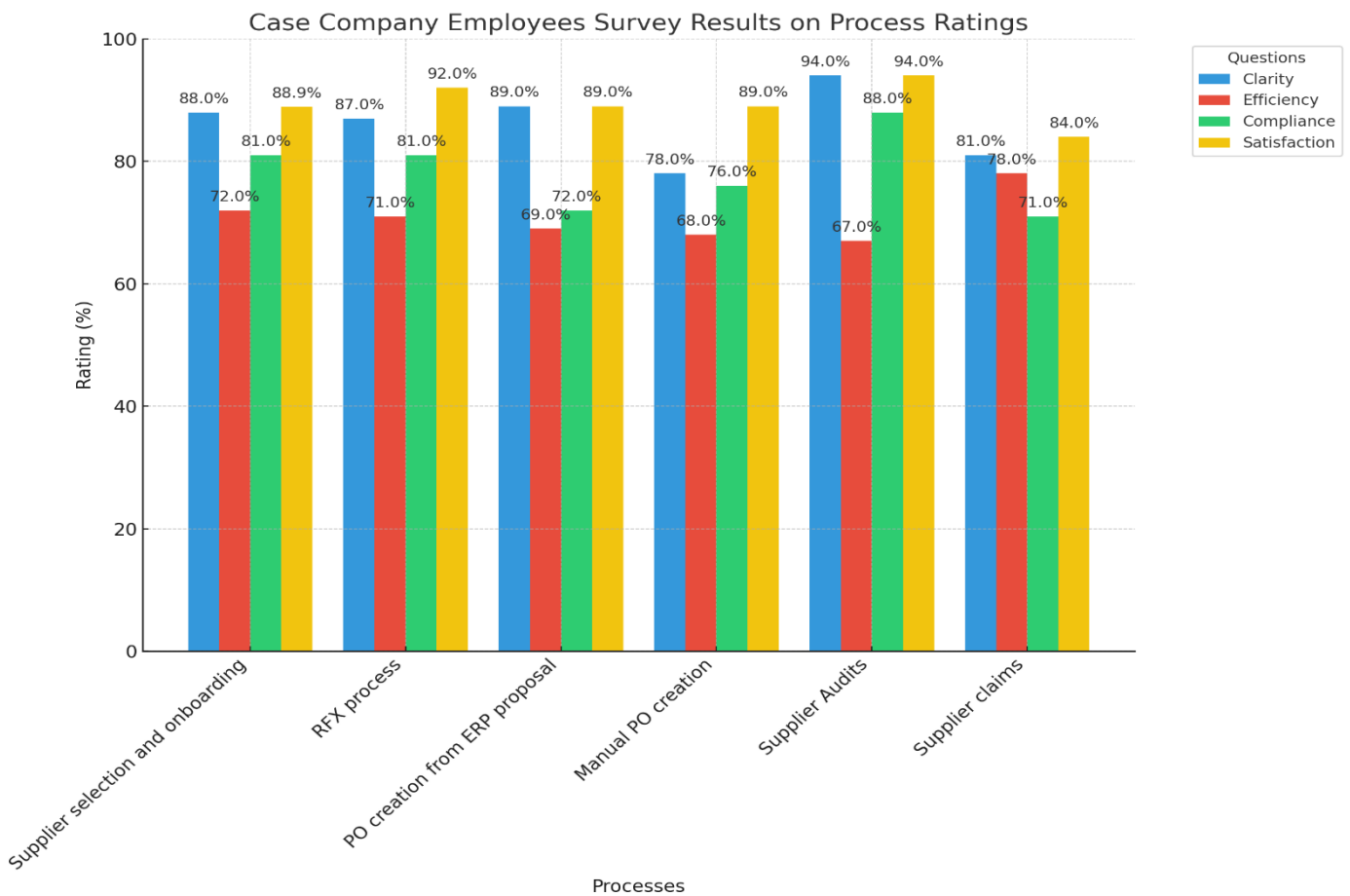


Figure 31. Shows the Case Company Employees Surveys Results on Process Ratings

this measurement indicated that speed could be better achieved for executing operations. Also, it was confirmed that users reported such results as evident and compliant processes, with the highest satisfaction ratings in general. Overall, the new IMS processes proved effective in critical aspects. More opportunities remain concerning the user experience in all workflows, from effectiveness to efficiency.

7.2 Theoretical Framework Validation

The implementation outcomes validate the merged theoretical framework of Systems Theory, Integrated Management System Theory, and BPR Theory. In other words, new processes were successfully implemented after this theoretical integration, leading to the following performance metrics.

The Systems Theory approach helped see and manage the dependencies between procurement processes. Evidence of this is seen in the ability to bring together, within the framework of the SCOR model, the four key process streams: Category Management (sE1), Strategic Sourcing (sE2 and sS3), Operational Purchasing (sS1), and Supplier Development (sE3). High satisfaction ratings (84-94%) across these interrelated processes confirm that the approach is workable, viewing procurement and supplier development as one system, not separate functions.

The results of implementation strongly support IMS Theory principles. The increased clarity of processes from 78% to 94% and compliance from 71% to 88% ratings indicate that IMS implementation improves operational efficiency and regulatory compliance (Nunhes et al., 2016). This was most evident in the process of Supplier Audits, with 94% for the highest clarity and 88% for compliance ratings, proving adequate quality, compliance, and operational requirements integration.

BPR Theory's radical redesign approach (Hammer & Champy, 1993) effectively transformed previously very unstructured supplier development processes. Implementations of formal supplier audit and claims processes with satisfaction ratings of 94% and 84%

prove the theory's applicability in optimizing processes. Such results are evidence that structured process redesign brings about operational effectiveness improvements.

The combined application of these three theories provides a robust framework for effective IMS implementation in procurement and supplier development, validating its role in driving process optimization with essential standardization and compliance in manufacturing operations.

8. Chapter 8: Conclusions and Recommendations

The chapter discusses the research results by responding to the main research questions and assessing the effectiveness of implemented IMS solutions and their implications. It also considers the study's limitations and proposes directions for future research on the case company.

8.1 Main Research Question Addressed

The Finnish case company effectively implemented an IMS to optimize procurement and supplier development through several vital mechanisms. The systematic approach to IMS implementation, combined with the framework of the SCOR model, provided a structured foundation and later process of integration and standardization.

The implementation followed the methodology set out in a step-by-step manner, starting with comprehensive process mapping and documentation and then moving on to the redesign with BPMN notation and, finally, full integration within the existing IMS framework. This approach guaranteed a high level of process organizational objective alignment; at the same time, considerations regarding any regulatory requirements were considered. The implementation results proved that integration with the SCOR model framework was effective. The top-level procurement process was organized into four major functional streams: Category Management (sE1), Strategic Sourcing (sE2 and sS3), Operational Purchasing (sS1), and Supplier Development (sE3).

The clarity scores within implemented processes (78-94%) are proof of significant standardization accomplishments. The Supplier Audits Process scored highly in achieving 94% clarity, which meant excellent process definition and user understanding. Such standardization brings about improved operational efficiency and less variation in the process. It supported works by Sánchez-Rodríguez et al. (2020), who found evidence that standardized procurement procedures improve business performance.

Performance improvements were significant in many respects. The implementation delivered high process satisfaction from users, ranging between 84% and 94% in all processes. There were marked efficiencies in supplier claims management (78%) and improved compliance scores, especially in supplier audits (88%). These echo early work by Nunhes et al. (2016), who identified that well-implemented IMS contributes to excellence in operations and meeting regulations.

Critical success factors include strong stakeholder engagement, clear process documentation, effective cross-functional integration, and robust compliance mechanisms. High satisfaction ratings for the more complex processes, such as the RFX process (92%) and supplier audits (94%), particularly demonstrate the effectiveness of an integrated approach in managing procurement and supplier development activities.

8.2 Sub-Research Questions Addressed

This forms the basis for answering the sub-research questions. The company's current procurement and supplier development challenges will be assessed, the extent to which the IMS aligns with immediate process requirements will be determined, and the first impacts on process efficiency and compliance will be evaluated.

- **What are the case company's current procurement and supplier development challenges?**

These were identified by thoroughly examining the existing IMS processes. The analysis identified several significant issues, including claims and supplier audits needing specific formal processes for supplier development to stop the inconsistent management of suppliers and increase the risks in the supply chain (Krause et al., 2007). This would also involve detailed alignment with current practice requirements for existing processes, which have been blamed for staff 'misunderstandings,' inefficiencies, and violation of rules (Rosemann & vom Brocke, 2015). Further, the current IMS processes were found to meet only part of the compliance requirements according to the ISO standard and requirements of the Sarbanes-Oxley Act.

- **How can the IMS be aligned with the case company's requirements?**

In this research, as articulated in Chapter 6, the approaches to IMS implementation provided a systematic review of the alignment of IMS with the requirements of the case company. A new process must fit hand in hand with the existing framework of models utilizing the SCOR in the case company for consistency and to keep the established hierarchy order (Lambert, 2008). The process design incorporated specific compliance checkpoints to align with the ISO standard and SOX regulations, enhancing adherence to standards and lessening compliance risks (Foerstl et al., 2017). The BPMN model of the top-level procurement process was redesigned to bring in an integrated hierarchy that combines category management, strategic sourcing, operational purchasing, and supplier development functions (Tsakalidis & Vergidis, 2024). These were redesigned to eliminate the inefficiencies and gaps in analyzing as-is processes (Chenini et al., 2020).

- **What initial impacts do the proposed IMS processes have on optimizing process efficiencies and ensuring the case company's procurement and supplier development compliance?**

Chapter 6 presented the structured survey of case company employees on the initial impacts of the new IMS processes. As such, the study assessed first the implementation clarity, which indicates a high degree of standardization and ease of user comprehension (Sánchez-Rodríguez et al., 2020). The efficiency ratings highlighted that resources and operational times were saved by the new processes, with the process for supplier claims being the most efficient (Tripathi & Gupta, 2020). Scores obtained for compliance proved high with regulatory and internal standards, whereas the supplier audits process scored highest for compliance (Mundy & Owen, 2013). The overall user satisfaction scores were recorded as high, with the supplier audits and RFX processes achieving the highest satisfaction levels.

These results show that implementing the new IMS processes improved process clarity, efficiency, compliance, and user satisfaction. The high satisfaction levels across

implemented processes confirm that they meet the efficiency and compliance needs of case companies' operations with newly developed process maps.

8.3 Study Limitations

This study's findings must be interpreted in light of certain limitations. First, the research employs a single-case study methodology, focusing on one organization. While this approach offers detailed insights into the unique conditions within the case company, it inherently limits the generalizability of the results to other organizations or industry contexts. Yin (2018) notes that single-case studies provide in-depth knowledge specific to a particular setting, but findings may not be universally applicable across different sectors or organizational environments.

The study's scope is also restricted to procurement and supplier development processes, intentionally excluding other organizational functions. This concentrated focus allows for a thorough exploration of these particular areas; however, it may omit insights relevant to different departments within the company. Consequently, the findings may only partially represent the broader organizational impact or cross-departmental dynamics that could arise from similar process changes.

The study is also limited by its exclusion of long-term outcome assessment and the development of new key performance indicators (KPIs). Since these aspects are beyond the research scope, the study does not address the sustained effects of the implemented changes or the potential need for ongoing adjustments in procurement processes over time. Future studies incorporating long-term performance metrics would provide valuable insights into the durability and evolution of such process improvements.

Lastly, while this study addresses process integration within the existing Integrated Management System (IMS), it does not encompass implementing new software systems. This restriction means that challenges or efficiencies associated with adopting new technological systems in IMS integration still need to be explored. This aspect could be a

significant consideration for organizations implementing similar process changes within more technologically dynamic environments. Future research could examine the role of new software systems in supporting and enhancing IMS integration (Fetters et al., 2013).

These limitations suggest avenues for further research, including longitudinal studies on process effectiveness, the development of relevant KPIs, and investigations into the impacts of technological innovations on IMS integration.

8.4 Research Implications

8.4.1 Theoretical Implications

The theoretical implications are in the following major dimensions:

Contribution to IMS Implementation Knowledge

This study contributes to knowledge of Integrated Management Systems (IMS) implementation within manufacturing organizations. Empirical evidence from detailed case study analysis on integrating procurement and supplier development functions within an IMS framework contributes to the relatively scant literature concerning IMS implementation in Finnish manufacturing firms (Vuorinen, 2022).

Framework Effectiveness Validation

The study validates the integrated theoretical framework of Systems Theory, IMS Theory, and BPR Theory. High levels of process clarity, efficiency, compliance, and user satisfaction attained via the implementation of the redesigned IMS processes serve to empirically endorse this holistic approach to optimizing procurement and supplier development operations (Chen, 2023).

Process Integration Insights

It is a rich account of the difficulties and successful practices of fusing procurement and supplier development processes within IMS. This will also help organizations align

processes by providing clear documentation, standardization, and cross-functional collaboration toward IMS success (Sánchez-Rodríguez et al., 2020).

It contributes to understanding the IMS implementation and effective integration of procurement and supplier development functions with a manufacturing organization's overall management system.

8.4.2 Practical Implications

This research study also offers organizations that wish to implement IMS and align their procurement and supplier development process several critical practical implications:

Implementation Methodology Success

The present study proves the effectiveness of the case company's systematic and step-by-step approach to IMS implementation. This involves comprehensive process mapping, detailed process redesign using BPMN, stakeholder feedback, and expert validation in an iterative manner (Tsakalidis & Vergidis, 2024). New process implementations were successfully integrated into the existing IMS framework, thus providing a methodology that can be replicated for other organizations.

Critical Success Factors

Several critical success factors for IMS implementation were highlighted: solid stakeholder engagement, clear process documentation, effective cross-functional integration, and robust compliance mechanisms (Sanchez-Rodriguez et al., 2020). These can guide other manufacturing firms toward successful IMS implementation, procurement, and optimization of supplier development.

Change Management Insights

Aligning the new processes with the existing frameworks, integrating the wide-level stakeholders, and maintaining the process linkages were the challenges that needed to be considered during the implementation process. These could be valuable insights for change management practice (Tripathi & Gupta, 2020). The lessons could help the

organization preplan and proactively manage the growing complexities of transformation in procurement and supplier development practices under the purview of IMS.

The practical implications of this research can be summarized as providing a guideline for implementing IMS in any manufacturing organization and subsequent enhancement of its procurement and supplier development functions. This can empower strategic decision-makers through effective change management, leading to operational efficiency and better regulatory compliance.

8.4.3 Managerial Implications

The research findings present three significant managerial implications for manufacturing organizations implementing Integrated Management Systems (IMS) in their procurement and supplier development processes.

Firstly, managers should adopt a systematic approach to IMS implementation that integrates procurement and supplier development processes within existing frameworks like SCOR. The research demonstrates that structured integration improves operational efficiency (67-78%) and compliance rates (71-88%). This aligns with findings from Sánchez-Rodríguez et al. (2020), who emphasize that standardized procurement procedures enhance business performance. Organizations should embed compliance checkpoints directly into process workflows, as evidenced by the high compliance ratings (88%) in processes like supplier audits.

Secondly, management must prioritize change management and stakeholder engagement throughout the IMS implementation process. The high satisfaction rates (84-94%) achieved in this study align with Tsakalidis and Vergidis's (2024) findings on the importance of stakeholder involvement in process redesign. Organizations should implement iterative feedback mechanisms and ensure adequate resource allocation, particularly in specialized areas like supplier development. This corresponds with Krause et al.'s

(2007) research highlighting the critical role of resource allocation in supplier development success.

Thirdly, organizations should establish comprehensive performance monitoring systems tracking operational efficiency and compliance metrics. The study's evaluation framework, measuring process clarity, efficiency, compliance, and user satisfaction, provides an empirical basis for performance monitoring. This should be coupled with structured cross-functional collaboration, as Vanpoucke et al. (2017) demonstrate that effective cross-functional integration supports better process outcomes.

These implications are particularly relevant for manufacturing organizations operating in regulated environments where operational efficiency and compliance requirements must be balanced. The findings provide practical insights for organizations seeking to optimize their procurement and supplier development processes through integrated management systems.

8.5 Recommendations

8.5.1 Case Company Recommendations

The research study provides several critical recommendations for the case company to further enhance the effectiveness of IMS implementation, procurement, and supplier development processes.

Firstly, the case company should enhance its monitoring of process efficiency. Although the implemented processes are reported to have achieved high satisfaction and compliance ratings, they could be more efficient, especially in the PO creation and supplier audit processes. The case company should design robust performance measurement systems for critical workflows to monitor these areas of workflow with continuous efforts to enhance efficiency (Tripathi & Gupta, 2020).

Next, the case company should scale its supplier development capabilities. The study found that the supplier claims process for suppliers scored the lowest satisfaction and was very well structured among implemented processes. The case company should further invest in its supplier development capabilities by hiring more Supplier Development Engineers and standardizing the root-cause analysis method (Krause et al., 2007).

Another area for the case company to develop is cross-functional interaction. Cross-functional collaboration, especially between procurement, R&D, and quality departments, proved a critical success factor in implementing the redesigned IMS processes. The case company should continue promoting such a collaborative culture and seek ways to improve cross-functional communication and alignment (Vanpoucke et al., 2017).

Finally, the case company should develop a continuous monitoring and upgrading framework for IMS processes. The fast-growing business environment and stringent regulatory needs make it particularly important to match these functions with an organization's strategic goals (Tsakalidis & Vergidis, 2024).

8.5.2 Future Research Directions

The study also indicates several directions with promising research for the future in IMS implementation and procurement/supplier development optimization.

One central area for more detailed research is examining the long-term effects of the implemented IMS processes. Longitudinal research is needed to assess sustained performance improvements based on user satisfaction and the uptake of new processes within an organization's overarching management system. It will be necessary to move beyond just the immediate impact evaluated within the present study (Sánchez-Rodríguez et al., 2020).

Moreover, the integrated theoretical framework and implementation methodology can be applied to other manufacturing industries in this single case study. Cross-industry

studies would be critical and capable of providing valuable comparative insights and validating the generalizability of the findings (Yin, 2018).

Moreover, according to Tripathi and Gupta (2020), future research can identify the possibilities of integrating automation, artificial intelligence, and Blockchain Technology into the IMS-integrated procurement and supplier development processes for better performance. This will further enhance the scope of efficient use of data-based decision-making and sustainability of supply chain traceability and compliance.

For example, it can help streamline repetitive and high-volume tasks related to creating purchase orders and managing supplier claims. AI-based analytics may empower more profound insights into supplier assessment and performance monitoring. Blockchain technology can bring more transparency and traceability into transactions and supplier documentation.

Such technology-enabled improvements in the IMS framework could have widened the scope of the present study's theoretical and practical implications for better solutions for procurement optimization and supplier development in the manufacturing sector.

References

- APICS. (2017). Supply Chain Operations Reference (SCOR) model. APICS.
- Banitaan, S., Al-Refai, G., Almatarneh, S., & Alquran, H. (2023). A review on artificial intelligence in the context of industry 4.0. *International Journal of Advanced Computer Science and Applications*, 14(2). <https://doi.org/10.14569/ijacsa.2023.0140204>
- Barbosa, A. de S., Bueno da Silva, L., de Souza, V. F., & Morioka, S. N. (2021). Integrated Management Systems: their organizational impacts. *Total Quality Management & Business Excellence*, 33(7–8), 794–817. <https://doi.org/10.1080/14783363.2021.1893685>
- Bell, E., Bryman, A., & Harley, B. (2022). *Business research methods* (6th ed.). Oxford University Press.
- Bernardo, M., Gianni, M., Gotzamani, K., & Simon, A. (2017). Is there a common pattern to integrate multiple management systems? A comparative analysis between organizations in Greece and Spain. *Journal of Cleaner Production*, 151, 121-133. <https://doi.org/10.1016/j.jclepro.2017.03.036>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77-101.
- Chen, Y. (2023). Enhancing supplier participation in new product development through strategic procurement: A study of Chinese manufacturing enterprises. *International Journal of Science and Business*, 24(1), 1-15. <https://doi.org/10.58970/ijsb.2111>
- Chenini, A., Iqbal, J., Khan, Q., Mahmood, M., & Aldehayyat, J. (2020). Strategic procurement, supplier integration, and speed - to - market: The mediating role of procurement lead - time performance and manufacturing performance. *Journal of Public Affairs*, 21(3). <https://doi.org/10.1002/pa.2248>
- Christopher, M. (2016). *Logistics & supply chain management* (5th ed.). Pearson UK.
- Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research* (3rd ed.). SAGE Publications.

- Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.
- Davenport, T. H. (2013). *Process innovation: Reengineering work through information technology*. Harvard Business Press.
- Deloitte. (2021). *Global Chief Procurement Officer Survey 2021*. Deloitte Consulting LLP.
- Djunaidy, A., Hariyanti, E., & Siahaan, D. (2023). Adaptive modeling for security vulnerability propagation to predict the impact of business process redesign. *F1000Research*, 12, 462. <https://doi.org/10.12688/f1000research.132780.1>
- Domingues, P., Sampaio, P. and Arezes, P.M. (2017), "Management systems integration: survey results", *International Journal of Quality & Reliability Management*, Vol. 34 No. 8, pp. 1252-1294. <https://doi.org/10.1108/IJQRM-03-2015-0032>
- Dubois, A., Gadde, L., & Mattsson, L. (2021). Purchasing behaviour and supplier base evolution – A longitudinal case study. *Journal of Business and Industrial Marketing*, 36(5), 689-705. <https://doi.org/10.1108/jbim-11-2018-0328>
- Esmailnezhad, B., & Saidi-Mehrabad, M. (2023). A two-stage stochastic supply chain scheduling problem with production in cellular manufacturing environment: A case study. *Scientia Iranica*, 30(4), 1399-1422. <https://doi.org/10.24200/sci.2021.53506.3277>
- Fetters, M. D., Curry, L. A., & Creswell, J. W. (2013). Achieving integration in mixed methods designs—principles and practices. *Health Services Research*, 48(6 Pt 2), 2134-2156. <https://doi.org/10.1111/1475-6773.12117>
- Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry*, 12(2), 219-245. <https://doi.org/10.1177/1077800405284363>
- Foerstl, K., Schleper, M. C., & Henke, M. (2017). Purchasing and supply management: From efficiency to effectiveness in an integrated supply chain. *Journal of Purchasing and Supply Management*, 23(4), 223-228. <https://doi.org/10.1016/j.pur-sup.2017.08.004>
- Gao, Y., & Wang, Q. (2011). Research on integrated risk management framework of manufacturing engineering project. *Advanced Materials Research*, 323, 217-221. <https://doi.org/10.4028/www.scientific.net/amr.323.217>

- Guetterman, T. C., & Fetters, M. D. (2018). Two methodological approaches to the integration of mixed methods and case study designs: A systematic review. *American Behavioral Scientist*, 62(7), 900-918. <https://doi.org/10.1177/0002764218772641>
- Hammer, M., & Champy, J. (1993). *Reengineering the corporation: A manifesto for business revolution*. Harper Business.
- Heikkilä, J., Kaipia, R., & Ojala, M. (2018). Purchasing category management: Providing value to organizations through a structured approach. *International Journal of Procurement Management*, 11(1), 1-27.
- Iskandar, Y. (2023). Key performance indicator analysis using integrated scor-ahp: A case study of indonesian's reverse supply chain industry. <https://doi.org/10.4108/eai.23-11-2022.2339152>
- Israel, G. D. (1992). *Determining sample size*. University of Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS.
- Israel, M. (2015). *Research ethics and integrity for social scientists: Beyond regulatory compliance (2nd ed.)*. SAGE Publications.
- Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a definition of mixed methods research. *Journal of Mixed Methods Research*, 1(2), 112-133. <https://doi.org/10.1177/1558689806298224>
- Kafetzopoulos, D., & Psomas, E. (2015). The impact of innovation capability on the performance of manufacturing companies: The Greek case. *Journal of Manufacturing Technology Management*, 26(1), 104–130.
- Kast, F. E., & Rosenzweig, J. E. (2017). *General systems theory: Applications for organization and management*. *Academy of Management Journal*, 15(4), 447-465.
- Kibe, F., & Odundo, P. (2016). Influence of internal control on financial application system on procurement management at SOS Hermann Gmeiner School, Uasin Gishu, Kenya. *China-USA Business Review*, 15(8). <https://doi.org/10.17265/1537-1514/2016.08.001>

- Krause, D. R., Handfield, R. B., & Tyler, B. B. (2007). The antecedents of supplier development: A contingency approach. *Journal of Operations Management*, 25(2), 528-545.
- Krippendorff, K. (2018). *Content analysis: An introduction to its methodology* (4th ed.). Sage Publications.
- Kweyama, Y. (2023). Factors influencing the usage of e-procurement in the South African Navy. *Multidisciplinary Science Journal*, 6(3), 2024025. <https://doi.org/10.31893/multiscience.2024025>
- Lambert, D. M. (2008). *Supply chain management: Processes, partnerships, performance* (3rd ed.). Supply Chain Management Institute.
- Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. SAGE Publications.
- Llach, J., Marimón, F., & Bernardo, M. (2011). ISO 9001 diffusion analysis according to activity sectors. *Industrial Management & Data Systems*, 111(2), 298-316. <https://doi.org/10.1108/02635571111115191>
- Maletič, M., Dahlgard, J., Dahlgard - Park, S., & Gomišček, B. (2015). Effect of sustainability-oriented innovation practices on the overall organizational performance: An empirical examination. *Total Quality Management & Business Excellence*, 27(9-10), 1171-1190. <https://doi.org/10.1080/14783363.2015.1064767>
- Mundy, J., & Owen, C. A. (2013). The use of an ERP system to facilitate regulatory compliance. *Information Systems Management*, 30(3), 182-197. <https://doi.org/10.1080/10580530.2013.794601>
- Nunhes, T. V., & Oliveira, O. J. (2018). Analysis of Integrated Management Systems research: identifying core themes and trends for future studies. *Total Quality Management & Business Excellence*, 31(11-12), 1243-1265. <https://doi.org/10.1080/14783363.2018.1471981>
- Nunhes, T. V., Motta Barbosa, L. C. F., & de Oliveira, O. J. (2016). Identification and analysis of the elements and functions integrable in integrated management systems. *Journal of Cleaner Production*, 142, 3225-3235.
- Partanen, M. (2020). *Supplier development process in engineering-to-order industry – Case study* [Master's thesis, Aalto University]. Aaltodoc.

- Pratikno, Y., & Kusnadi. (2020). The advantages of implementation of integrated management system on ISO45001 and ISO14001 in the manufacturing industry. *Di-nasti International Journal of Digital Business Management*, 1(3), 423-430.
- Psomas, E., Kafetzopoulos, D., & Fotopoulos, C. (2013). Developing and validating a measurement instrument of ISO 9001 effectiveness in food manufacturing SMEs. *Journal of Manufacturing Technology Management*, 24(1), 52–77. <https://doi.org/10.1108/17410381311287481>
- Ramos, D., Afonso, P., & Rodrigues, M. A. (2020). Integrated management systems as a key facilitator of occupational health and safety risk management: A case study in a medium sized waste management firm. *Journal of Cleaner Production*, 262, Article 121346. <https://doi.org/10.1016/j.jclepro.2020.121346>
- Rashidi, K., Noorizadeh, A., Kannan, D., & Cullinane, K. (2020). Applying the triple bottom line in sustainable supplier selection: A meta-review of the state-of-the-art. *Journal of Cleaner Production*, 269, 122001. <https://doi.org/10.1016/j.jclepro.2020.122001>
- Robinson, O. C. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. *Qualitative Research in Psychology*, 11(1), 25-41. <https://doi.org/10.1080/14780887.2013.801543>
- Rosemann, M., & vom Brocke, J. (2015). The six core elements of business process management. In J. vom Brocke & M. Rosemann (Eds.), *Handbook on business process management 1* (pp. 105-122). Springer.
- Samy, G. M., Samy, C. P., & Ammasaiappan, M. (2015). Integrated management systems for better environmental performance and sustainable development: A review. *Environmental Engineering and Management Journal*, 14(5), 985-1000. <https://doi.org/10.13140/RG.2.2.35566.51528>
- Sánchez-Rodríguez, C., Hemswoth, D., Martínez-Lorente, Á. R., & Clavel, J. G. (2020). An empirical study on the impact of standardization of materials and purchasing procedures on purchasing and business performance. *Supply Chain Management: An International Journal*, 25(4), 479-497.

- Satolo, E., Calarge, F., & Miguel, P. (2013). Experience with an integrated management system in a sugar and ethanol manufacturing unit. *Management of Environmental Quality: An International Journal*, 24(6), 710-725. <https://doi.org/10.1108/meq-10-2012-0068>
- Saunders, M. N. K., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson.
- Setyadi, A., Rimawan, E., Kristanto, I., & Rohmah, P. (2022). A proposed conceptual framework of supply chain operations reference (scor) model in Indonesian industries: A literature review. *Sinergi*, 26(3), 385. <https://doi.org/10.22441/sinergi.2022.3.014>
- Shah, S., & Hasan, S. (2016). Procurement practices in project-based manufacturing environments. *Matec Web of Conferences*, 76, 02007. <https://doi.org/10.1051/mateconf/20167602007>
- Stake, R. E. (2015). *The art of case study research*. SAGE Publications.
- Townsend, L., & Wallace, C. (2016). *Social media research: A guide to ethics*. University of Aberdeen.
- Tsakalidis, G., & Vergidis, K. (2024). Business Process Redesign: A Systematic Review of Evaluation Approaches. *Decision Making: Applications in Management and Engineering*, 7(1), 79–98. <https://doi.org/10.31181/dmame712024889>
- Tran, N., Park, H., Nguyen, Q., & Hoang, T. (2019). Development of a smart cyber-physical manufacturing system in the Industry 4.0 context. *Applied Sciences*, 9(16), 3325. <https://doi.org/10.3390/app9163325>
- Tripathi, S., & Gupta, M. (2020). A framework for procurement process re-engineering in industry 4.0. *Business Process Management Journal*, 27(2), 439–458. <https://doi.org/10.1108/bpmj-07-2020-0321>
- Truong, D. (2019). Distrust issues in business-to-business e-procurement decisions. *Journal of Enterprise Information Management*, 32(6), 1071–1088. <https://doi.org/10.1108/jeim-01-2019-0020>

- Vanpoucke, E., Vereecke, A., & Muylle, S. (2017). Leveraging the impact of supply chain integration through information technology. *International Journal of Operations & Production Management*, 37(4), 510-530.
- Vuorinen, T. (2022). Development of purchasing process to improve supplier relationship management and mitigate supply risks. Turku University of Applied Sciences.
- Wang, C., Nguyễn, V., Thai, H., Tran, N., & Tran, T. (2018). Sustainable supplier selection process in edible oil production by a hybrid fuzzy analytical hierarchy process and green data envelopment analysis for the smes food processing industry. *Mathematics*, 6(12), 302. <https://doi.org/10.3390/math6120302>
- Wang, C., Viet, V., Ho, T., Nguyễn, V., & Nguyen, V. (2020). Multi-criteria decision model for the selection of suppliers in the textile industry. *Symmetry*, 12(6), 979. <https://doi.org/10.3390/sym12060979>
- Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). SAGE Publications.
- Zsidisin, G., Hartley, J., Bernardes, E., & Saunders, L. (2015). Examining supply market scanning and internal communication climate as facilitators of supply chain integration. *Supply Chain Management: An International Journal*, 20(5), 549-560. <https://doi.org/10.1108/scm-10-2014-0364>

Appendix A: Case Company Employee Feedback on New Process Maps

1 New Supplier Selection Process Map

1. How clear and understandable is this process map to you? (1 to 5 scale, Lowest to Highest)
2. How much do you believe this process map will improve process efficiency? (1 to 5 scale)
3. How effectively does this process map ensure compliance with procurement and supplier development standards? (1 to 5 scale)
4. How satisfied are you with this process map overall? (1 to 5 scale)

2 RFX Workflow under Strategic Sourcing

5. How clear and understandable is this process map to you? (1 to 5 scale)
6. How much do you believe this process map will improve process efficiency? (1 to 5 scale)
7. How effectively does this process map ensure compliance with procurement and supplier development standards? (1 to 5 scale)
8. How satisfied are you with this process map overall? (1 to 5 scale)

3 PO Creation from ERP Proposals

9. How clear and understandable is this process map to you? (1 to 5 scale)
10. How much do you believe this process map will improve process efficiency? (1 to 5 scale)
11. How effectively does this process map ensure compliance with procurement and supplier development standards? (1 to 5 scale)
12. How satisfied are you with this process map overall? (1 to 5 scale)

4 Manual PO Creation Workflow

13. How clear and understandable is this process map to you? (1 to 5 scale)
14. How much do you believe this process map will improve process efficiency? (1 to 5 scale)

15. How effectively does this process map ensure compliance with procurement and supplier development standards? (1 to 5 scale)

16. How satisfied are you with this process map overall? (1 to 5 scale)

5 Supplier Audit Workflow

17. How clear and understandable is this process map to you? (1 to 5 scale)

18. How much do you believe this process map will improve process efficiency? (1 to 5 scale)

19. How effectively does this process map ensure compliance with procurement and supplier development standards? (1 to 5 scale)

20. How satisfied are you with this process map overall? (1 to 5 scale)

6 Quality Claims Workflow

21. How clear and understandable is this process map to you? (1 to 5 scale)

22. How much do you believe this process map will improve process efficiency? (1 to 5 scale)

23. How effectively does this process map ensure compliance with procurement and supplier development standards? (1 to 5 scale)

24. How satisfied are you with this process map overall? (1 to 5 scale)

Appendix B: Category Manager Process Questionnaire

1 Category Strategy Development

1. Please describe your step-by-step process for developing a category strategy, including analysis methods, stakeholder integration, and alignment with business objectives.
2. How often do you review and update category strategies?
3. How do you ensure alignment with ISO 9001:2015 principles of customer focus and continual improvement in category strategies?
4. How is documentation and accessibility of category strategies managed to meet SOX requirements?

2 Supplier Evaluation and Selection

5. Outline your process for identifying, evaluating, and selecting suppliers, covering criteria, competition, and decision-making.
6. How do you incorporate sustainability (ISO 14001) into the supplier selection process?
7. Describe how documentation of supplier evaluations is maintained for SOX compliance.

3 Contract Management

8. Describe your contract management process, including negotiation, approval workflows, storage, and renewal or termination procedures.
9. How do you ensure relevant ISO clauses are included in contracts?
10. Explain how segregation of duties is maintained in contract management per SOX guidelines.

4 Performance Monitoring and Supplier Relationship Management

11. Describe your approach to monitoring supplier performance, including KPIs, review frequency, and tools used.
12. How do you manage relationships with key suppliers, including communication and collaboration methods?
13. Explain how supplier performance documentation is maintained to ensure auditability.

5 Risk Management

14. Outline your process for identifying and mitigating risks within your category, including strategies for different types of risks.
15. Describe how risk management processes are documented for SOX compliance.

6 Cost Savings and Value Creation

16. Describe your methods for identifying and implementing cost-saving initiatives within your category.
17. How do you document and verify cost savings to ensure financial accuracy and auditability?
18. How do you balance cost savings with other value-creation objectives, as per ISO 9001?

7 Cross-functional Collaboration

19. Describe how you collaborate with other departments in category management, including communication methods and joint decision-making.
20. How do you ensure cross-functional collaboration supports ISO 9001 principles?

8 Overall Process Evaluation

21. What are the most effective elements of your category management processes?
22. What are the main challenges or inefficiencies in your current category management processes?
23. If you could redesign any part of your category management processes, what would you change and why?
24. What additional resources or support would help you perform your role more effectively?

Appendix C: Operational Purchasing Processes Questionnaire

1 Purchase Order Creation from ERP Proposal

1. Please describe the step-by-step process you follow when creating a purchase order based on an ERP proposal.
2. Which other departments are involved in this process? How do they contribute?
3. What are the main challenges or bottlenecks you face in this process?
4. How could this process be improved?
5. Are you aware of any ISO standards or SOX guidelines that should be applied to this process but currently aren't? If yes, please explain.

2 Manual Purchase Order Creation without ERP Proposal

6. Describe the step-by-step process for creating a purchase order manually when there's no ERP proposal.
7. Which other departments are involved in this process? How do they contribute?
8. What are the main challenges or bottlenecks you face in this process?
9. How could this process be improved?
10. Are you aware of any ISO standards or SOX guidelines that should be applied to this process but currently aren't? If yes, please explain.

3 Additional Processes

11. Are there any other significant processes you perform as an operational purchaser that haven't been covered? If yes, please describe them in detail.
12. For each additional process you mentioned:
 - a) Which other departments are involved?
 - b) What challenges do you face?
 - c) How could the process be improved?
 - d) Are there any relevant ISO standards or SOX guidelines that should be applied?

4 Process Evaluation

13. Rate the efficiency of *Purchase Order Creation from ERP Proposal* on a scale of 0-10.
14. Rate the efficiency of *Manual Purchase Order Creation* on a scale of 0-10.

15. What do you think are the biggest overall challenges in our current procurement processes?

16. Do you have any suggestions for overall improvement in our procurement system?

17. Are there any tools or technologies you think could help streamline our processes?

5 Compliance and Standards

18. How familiar are you with ISO 9001 standards related to procurement?

19. How familiar are you with SOX compliance requirements related to procurement?

20. In your opinion, what are the main gaps in our current processes regarding ISO standards or SOX compliance?

Appendix D: Strategic Purchaser Process Questionnaire

1 Strategic Planning

1. Describe your step-by-step process for developing purchasing strategies that align with the company's overall business strategy.
2. How do you analyze market trends and forecast demand? What tools or methods do you use?
3. How often do you review and update purchasing strategies?
4. What are the main challenges you face in strategic planning? How could this process be improved?

2 Supplier Relationship Management

5. Outline your process for identifying, evaluating, and selecting key suppliers, including criteria and scoring systems.
6. How do you build and maintain relationships with key suppliers? Describe any regular activities or communications.
7. What is your process for negotiating contracts with suppliers? List the steps from preparation to finalization.
8. How do you ensure a reliable supply of materials? What strategies do you employ?
9. What challenges do you face in supplier relationship management? How could these processes be improved?

3 Risk Management

10. Describe your process for identifying potential risks in the supply chain.
11. How do you assess and prioritize these risks? Explain any risk assessment tools or matrices you use.
12. What strategies do you use to mitigate supply chain risks? Provide examples.
13. How often do you review and update your risk management strategies?
14. What are the main challenges in risk management? How could this process be improved?

4 Performance Monitoring

15. List the key performance indicators (KPIs) you use to measure the effectiveness of purchasing strategies.

16. Describe your process for tracking and analyzing these KPIs. What tools do you use?
17. How often do you review performance metrics?
18. How do you identify areas for improvement based on these metrics?
19. What challenges do you face in performance monitoring? How could this process be enhanced?

5 Integration and Compliance

20. How do your processes integrate with other departments (e.g., operations, finance, quality control)?
21. Are you aware of any ISO standards or SOX guidelines that should be applied to your processes but currently aren't? If yes, please explain.
22. How do you ensure compliance with relevant regulations and standards in your processes?

6 Overall Process Evaluation

23. What do you consider to be the strongest aspects of your current processes?
24. What are the biggest overall challenges or inefficiencies in your current processes?
25. If you could redesign any part of your processes, what would you change and why?
26. Are there any additional tools, resources, or support that would help you perform your role more effectively?

Appendix E: Supplier Development Engineer Process Questionnaire

1 Supplier Claim Handling Process

1. Describe your step-by-step process for initiating and recording a supplier claim, including reporting channels, information collection, and prioritization.
2. Which other departments are typically involved in the claim initiation process, and how do you interact with them?
3. Outline your process for investigating claims and conducting root cause analysis, including collaboration with suppliers and documentation methods.
4. How do you ensure objectivity and thoroughness in investigations? Are there specific guidelines or checklists you follow?
5. Describe your process for developing and implementing corrective actions, including collaboration with suppliers, tracking, and ensuring SOX compliance.
6. How do you document corrective actions and their implementation to meet SOX requirements for traceability and auditability?
7. Explain your process for closing a claim and conducting necessary follow-up, including verification of corrective actions and long-term monitoring.
8. How do you communicate claim closure to relevant stakeholders, both internal and external?

2 Supplier Auditing Process

9. Describe your process for planning and preparing for supplier audits, including determining which suppliers to audit, pre-audit preparation, and communication with suppliers.
10. Which other departments are typically involved in audit planning, and how do you incorporate their input?
11. Outline your step-by-step process for conducting a supplier audit, covering assessment areas, evidence-gathering methods, and maintaining objectivity.
12. How do you ensure your audit process addresses relevant ISO standards and any industry-specific requirements?

13. Describe your process for creating and communicating audit reports, including report components, prioritization of findings, and communication methods.
14. How do you ensure audit reports and related documentation meet SOX requirements for traceability and auditability?
15. Explain your process for managing corrective actions resulting from audits, including supplier collaboration, tracking, and verifying improvements.
16. How do you use audit results to drive continuous improvement in supplier development processes?

3 Overall Process Evaluation

17. What do you consider to be the strongest aspects of your current supplier claim handling and audit processes?
18. What are the biggest challenges or inefficiencies in these processes?
19. If you could redesign any part of these processes, what would you change and why?
20. Are there any additional resources, tools, or support that would help you perform your role more effectively?