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Best practices in the area of Goods Reception and the 3-way match process

A Case Study of Indirect Procurement in the Context of Outsourcing and
Automation

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ABSTRACT:

Driven by a commitment to high efficiency and low costs, the automation of procure-to-pay process and the outsourcing of indirect procurement are widely advocated. Ideally, automated three-way match (Purchase order, invoice and goods reception) process, the key financial control mechanism in P2P cycle, should require little to no manual intervention, while the outsourcing of indirect procurement should lead to significant reductions in procurement operating costs. However, the straight-through processing rate for automated three-way match (3WM) still needs to be improved, and the outsourcing increases communication friction. This thesis takes the practical challenges faced by the case company, explore the goods receipt (GR) related 3WM stagnation and mismatches with integrating agency theory, organizational control theory, technology acceptance model, and transaction cost economics.

To diagnose and resolve the root causes of GR issues, this study employs an abductive reasoning approach to qualitatively investigate the case company. Data collection was conducted using a triangulation approach, combining direct observations, document review, and semi-structured interviews with key stakeholders. The collected data were analysed and organised using thematic analysis, process mapping, and root-cause analysis.

The study finds that the root causes of GR barriers include information asymmetry, inconsistent data quality, communication silos, insufficient automation, and role misalignment, collectively caused by technical flaws, impractical organisational design, and non-compliant human behaviours. To address these issues, a practice framework is proposed. It is suggested to include logistics information as the data foundation to trigger automated GR and post-GR invoicing reminders, institutionalise a cross-boundary stakeholder communication protocol, and strengthen the consequence-driven user management.

This thesis has both academic and practical significance. By examining the operational, technical, and behavioural reasons for GR failures, this thesis validates agency theory and transaction cost economics and extends the technology acceptance model from an organisational control perspective. The practical recommendations are helpful in shifting 3WM management from a reactive approach to a proactive and preemptive one.

This study is limited by its single-case design, and its generalizability is unclear; furthermore, it does not distinguish between physical and virtual products. Future research could address these two aspects, consider product segmentation, and conduct cross-company or cross-industry research.

KEYWORDS: Indirect procurement, goods receiving process, three-way matching, procure-to-pay (P2P) automation, outsourced procurement

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Lei Zhao

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Abbreviations

3WM	Three-way-matching
AP	Accounts Payable
AI	Artificial Intelligence
EDI	Electronic Data Interchange
FO	Framework Order
CIPS	Chartered Institute of Procurement and Supply
GR	Goods Receipt/Goods Receiving
GRN	Goods Receipt Note
IP	Indirect Purchasing
IPO	Indirect Procurement Outsourcing
KPI	Key Performance Indicator
ML	Machine Learning
OCR	Optical Character Recognition
OSP	Outsourced Service Providers
OCT	Organisational Control Theory
P2P	Procure/Purchase to Pay
PO	Purchase Order
PPI	Process Performance Indicators
PR	Purchase Requisition
RFID	Radio Frequency Identification
RPA	Robotic Process Automation
SoD	Segregation of Duties
STP	Straight Through Processing
TAM	Technology Acceptance Model
TCE	Transaction Cost Economics

1 Introduction

1.1 Background

1.1.1 Research background

In today's business environment, digital transformation and strategic outsourcing have become the two trends driving operational efficiency in supply chain management. Indirect procurement, characterised by high volume, low value, and dispersed spending, is increasingly being outsourced to indirect procurement outsourcing (IPO) partners. Also, the procure-to-pay (P2P) process is accompanied by the implementation of automated three-way matching (3WM) systems. Ideally, the integration of enterprise systems should enable straight-through processing (STP), whereby purchase orders (POs), goods receipts (GRs), and invoices are automatically matched without manual intervention.

However, the reality appears to be less than ideal. Constrained by actual operational conditions, the case company found that GR discrepancies are the most common bottleneck causing the 3WM process to stall. Although the company and prior literature have devoted significant effort to automating the invoice-processing stage, GR, a critical step in the P2P cycle, remains highly error-prone, causing unmatched invoices to get stuck in the financial process.

In the context of outsourcing and multi-platform automation, the case company's 3WM processes face complex challenges. Firstly, the actual recipients are the only ones involved who know the delivery status of products, yet they typically lack professional procurement expertise, are preoccupied with their primary business responsibilities, and are unable to devote themselves to the P2P process. The outsourced service provider is the coordinator in the P2P process, yet their interests do not fully align with those of the case company. Moreover, two different platforms are used for PO processing and 3WM, and PO and GR information must be transmitted between them, which frequently leads to data inheritance errors.

1.1.2 Research motivation

This thesis topic was assigned by a company. The case company had developed a well-organised P2P process and leveraged electronic and automated workflows, but the GR and 3WM processes remained key drivers of P2P efficiency. Recently, it was undergoing an outsourcing transition of the IP team, which brought unknown effects.

However, undertaking this research at this stage provides a valuable opportunity to identify existing issues and enhance current practices. Firstly, the specialised outsourcing provider could bring a professional and independent perspective on evaluation and improvement. Secondly, it allows substantial improvements to be implemented through a single initiative. Moreover, as P2P automation increasingly coexists with indirect procurement outsourcing, this case may offer useful insights for companies encountering similar operational contexts.

1.2 Problem statement

The key issue addressed in this thesis is the heavy procurement workload and financial inefficiencies caused by GR discrepancies in the case company's automated 3WM processes. A preliminary investigation of the case company revealed that, although technologies have improved the performance of the 3WM process, there is still room for improvement. However, neither the case company nor the existing literature provides a systematic framework for analysing how these technological, process, and behavioural factors interact, or for managing them through the integration of best-practice models. Consequently, resolving this governance dilemma is not merely a matter of technical configuration but rather a complex governance challenge that requires in-depth academic research.

1.3 Research objectives and questions

The primary objective of this thesis is to design an efficient practice for the GR process in an automated outsourcing environment for indirect procurement, thereby reducing the stagnation in 3WM and improving the financial efficiency.

To achieve this objective, this study is divided into the following three sub-objectives:

Sub-objective 1: Identify and analyse the technical, procedural, and behavioural root causes of GR discrepancies in the case company's daily operations.

Sub-objective 2: Evaluate these empirical findings through the theoretical lenses to explore the academic explanation for the inefficiency of technology and workflow collaboration.

Sub-objective 3: Design data-driven, flexible, and organisation-aligned practices to improve the STP rate for 3WM.

To achieve the research objective, this thesis focuses on a core research question: How can companies optimise their GR processes to ensure the efficiency and effectiveness of automated 3WM systems when adopting an outsourced indirect procurement model?

This question can be divided into three sub-research questions.

Sub-question 1: What are the primary process role misalignments, technical deficiencies, and user compliance patterns in the case company's outsourced P2P process that lead to GR failures?

Sub-question 2: How do agency theory, transaction cost economics (TCE), technology acceptance model (TAM), and organisational control theory (OTC) explain the conflict between technological automation and human boundaries at the goods receipt interface?

Sub-question 3: What technical, structural, behavioural, and control approaches can be applied to improve GR performance, and what kinds of resistance might they encounter?

1.4 Significance of the Study

This study has both practical and theoretical significance. From a practical perspective, it provides the case company with concrete suggestions for optimising GR performance, reducing manual intervention in the 3WM, and improving STP in financial management. Theoretically, this thesis fills a critical research gap regarding how micro-level operational tasks are affected when technological automation crosses organisational boundaries. By providing a proactive, front-end-centric control framework, it broadens the perspective of the traditional P2P literature, which has focused on the post-processing of exceptions.

1.5 Thesis structure

The overall structure of this thesis is shown in Figure 1. This thesis is divided into seven chapters, with the remaining chapters structured as follows:

Chapter 2 is a literature review. This chapter reviews existing literature on procurement, P2P automation, and outsourcing, establishes agency theory and TCE as the theoretical foundation, and identifies key research gaps.

Chapter 3 is the methodology explanation. This chapter presents the methodology with the Research Onion model. It explains the single-case study design, the abductive reasoning approach, the triangulated data collection method, and the data analysis approaches, which support the study's reliability and ethics.

Chapter 4, empirical findings, presents the results of thematic analysis, process mapping, and root cause analysis, revealing five specific root causes of the case company's GR issue, thereby answering sub-research question 1.

Chapter 5, discussion and critical evaluation, elevates the empirical findings to a theoretical level by applying Agent Theory and TCE to analyse the results and explain systemic and behavioural conflicts, thereby answering sub-research question 2.

Chapter 6, the recommendations, proposes best-practice suggestions that address sub-research question 3. The recommendations include data-driven automated GR triggers, post-receipt invoice processing, and cross-functional communication protocols, thereby

Chapter 7 is the conclusion part, which comprehensively summarises the research findings, outlines the managerial and theoretical implications, identifies the study's limitations, and offers suggestions for future research.

frameworkthe Introduction

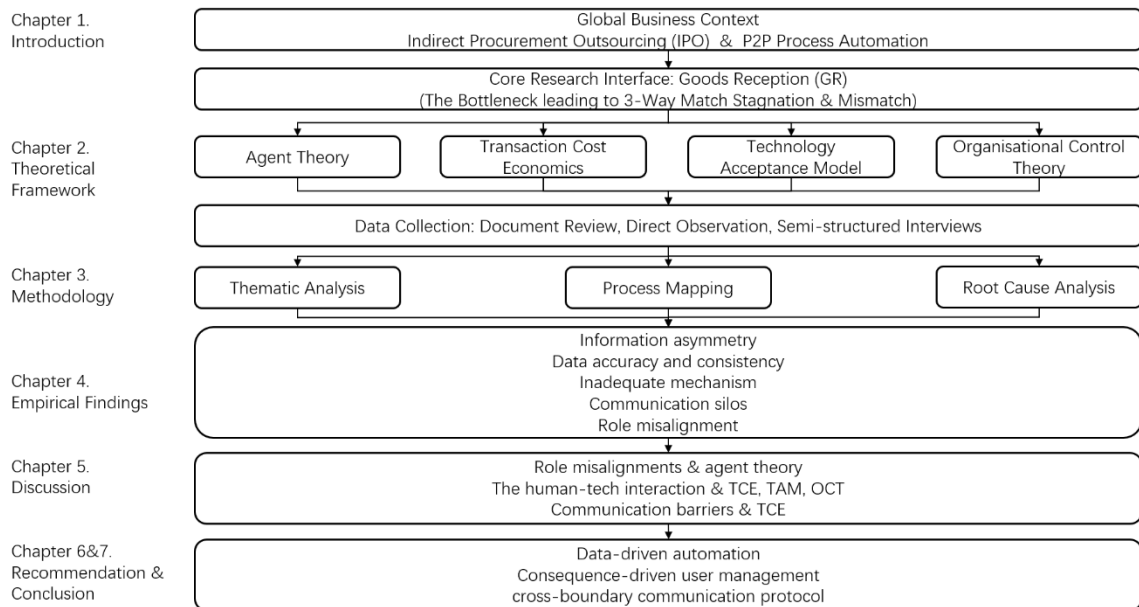


Figure 1. Research Framework Diagram

2 Literature Review

This chapter presents related literature using a combination of funnel-shaped and thematic approaches. It begins with broader concepts related to indirect procurement and the P2P process and then narrows and deepens the focus to GR and 3WM.

2.1 Procurement Outsourcing (IPO) and the Governance Challenge

2.1.1 Indirect procurement and its characteristics

Indirect procurement (IP) is defined as the purchasing of goods and services that are not directly related to the final products sold by an organisation (Xideas & Moschuris, 1998). It is distinguished from direct procurement, which purchases items used directly in final products. Although IP is often considered a “non-revenue-generating” activity (Cox et al., 2005), it is no less important than direct procurement. The bulk of an organisation's purchases are made through indirect spend (Cox et al., 2005). IP is characterised by low volume and high variety (Kher & Hira, 2020). Also, it exhibits characteristics such as decentralisation, unclear processes or a lack of Key Performance Indicators (KPIs), and a high number of suppliers (Jayaram & Curkovic, 2018).

2.1.2 The misalignments in IPO

Agency theory, proposed by Jensen and Meckling (1976) and further expanded by Eisenhardt (1989), provides an analytical framework for understanding the governance challenges of IPOs. The purchase order (PO) requisitioners, outsourced service providers (OSPs), and the internal financial team form a tripartite structure comprising competing principals and agents. The end users initiating procurement requests prioritise completing the procurement over compliance. OSPs are contractually bound, and their incentives for standardisation may conflict with the personalised needs of internal requisitioners. Internal finance teams prioritise regulatory compliance and audit readiness, which often conflict with speed. This tripartite structure could lead to the service level

misalignment described by Grover et al. (1994), and Lahiri et al. (2011) argue that misalignment is a primary driver of outsourcing relationship failure.

2.1.3 The uncertainty regarding the realisation of cost-saving

The motivation for IPO can usually be explained from the perspective of transaction cost economics (TCE). Williamson (1989) argued that when the transaction costs of market exchanges exceed the efficiency gains from specialisation, firms will choose to internalise the relevant activities. Conversely, such activities can be performed more efficiently by specialised third parties operating at scale. Aberdeen Group (2001) finds that outsourcing procurement could reduce purchasing expenditure, thereby enabling specialised OSP to realise economies of scale across multiple client organisations.

While outsourcing can reduce operational procurement costs, it may also increase transaction costs. The cost-saving target may not be realised, referring to the assumptions of bounded rationality and opportunism in TCE (Williamson, 1989). IP often suffers from fragmentation, weak internal support, and maverick buying (Israel & Curkovic, 2020), not to mention the tripartite agency conflict described above, which can lead to high transaction costs. However, Barthélémy (2001) finds that the hidden costs of outsourcing are systematically underestimated during contract negotiations. These coordination costs are concentrated at the information interfaces, and the GR function is precisely located there.

2.2 The opportunities and mismatches in automated P2P

2.2.1 The P2P cycle and automation

The purchase-to-pay (P2P) process is a vital part of procurement. Van (2018) raises a purchasing process model (see Figure 2) and divides the process into source, purchase and pay. The purchase-to-pay process is the focus of this study. Chartered Institute of Procurement and Supply (CIPS, n.d.) defines the P2P process as shown in Figure 3.

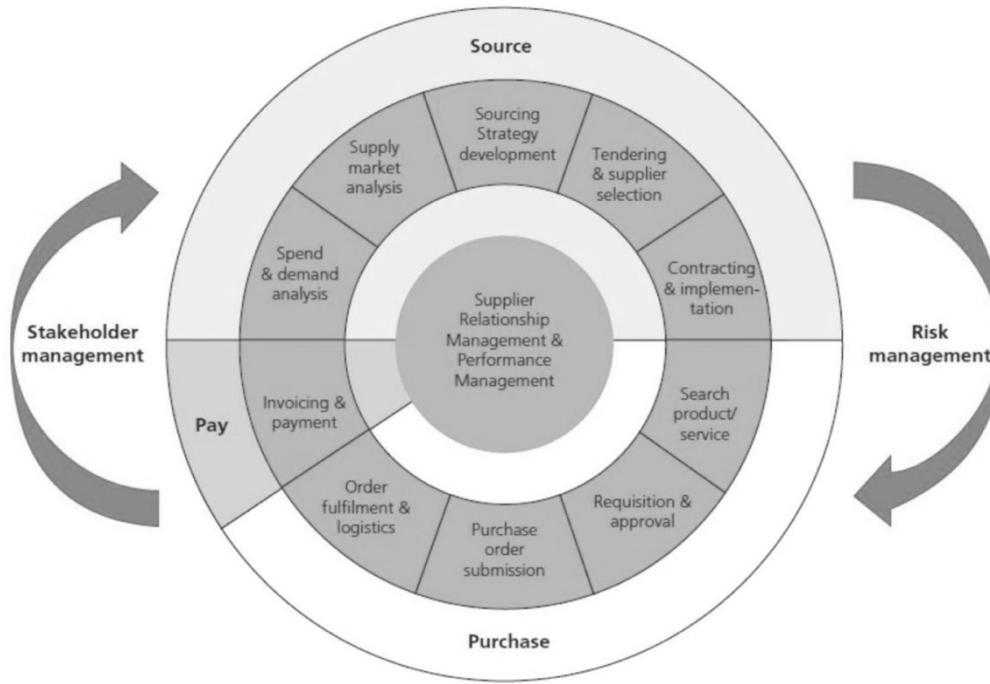


Figure 2. Extended purchasing process model (Van, 2018)

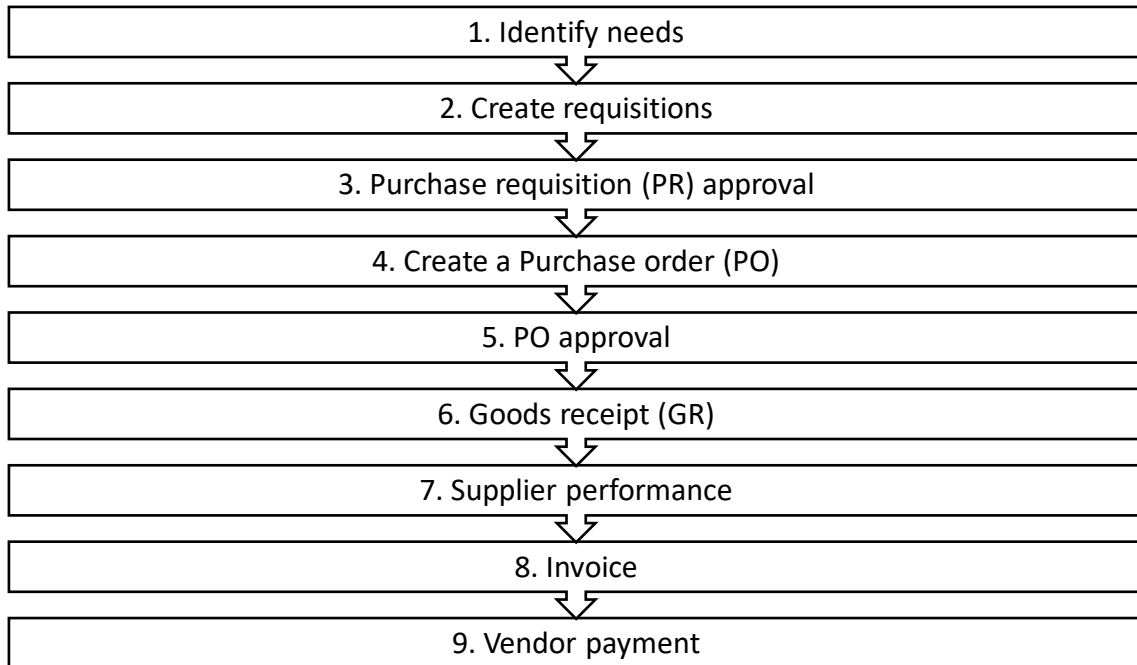


Figure 3. Procure-to-pay process map (CIPS, n.d.)

With technological development, the P2P process is undergoing digital transformation. The PwC Digital Procurement Survey found that 96% of companies have digital solutions to procurement (Li & Edmunds, 2024). Davenport (1998) discusses enterprise systems, which are known as Enterprise Resource Planning (ERP), and it provides a foundational data architecture for P2P. Robotic Process Automation (RPA) tools have been used to automate repetitive, rule-based tasks, such as invoice data extraction (Van Der Aalst et al., 2018). Additionally, AI-driven analytics and blockchain tamper-proof records are used to create the conditions for creating strategic value (Khayyat & Haddud, 2025).

2.2.2 The optimistic consensus of P2P automation

Academic and practical literature on P2P automation is generally optimistic. Efficiency improvement, process transparency, and procurement performance optimisation are three key drivers identified in a PwC survey (Li & Edmunds, 2024). Cost reduction is also an important advantage, as it reduces human processing, penalties and losses from non-compliance, supports fraud prevention, and enhances the quality and efficiency of supplier interactions (IBM, n.d.). Moreover, AI-driven analytics and blockchain tamper-proof records could create the conditions for creating strategic value (Khayyat & Haddud, 2025).

2.2.3 Technology and human tension in P2P automation

Despite the optimistic consensus, P2P automation also faces limitations. Automated has some fundamental limitations, which may be even more pronounced in the field of IP. Davenport (1998) points out that enterprise systems rely on integrated information flows, which means that data quality and consistency are critical to effective system-supported processes. However, the multitude of stakeholders, the diversity of platforms, and the variety of data types make it difficult to ensure data consistency (GEP, 2026). Themistocleous et al. (2004) highlight ERP integration challenges. Also, over-customisation of the P2P system would bring risks of increased implementation costs, complexity, and constraints on future system upgrades (GEP, 2026).

ZYCUS (2024) points out that successful digital transformation requires more than technology implementation. It could be explained with the technology acceptance model (TAM) and organisational control theory (OCT). The TAM explains technology acceptance from the perspective of users' perceived usefulness and perceived ease of use (Davis, 1989), involving human behaviour as a key player in the technology adoption. Complementarily, the OCT provides a lens for understanding how e-procurement systems shape employee behaviour through formal rules, process standardisation, monitoring, and accountability mechanisms (Ouchi, 1979; Eisenhardt, 1985; Kirsch, 1996).

2.3 Relationship between goods reception (GR) and 3-way match (3WM)

2.3.1 GR and its functions

The GR process is a crucial stage in the P2P cycle, occurring between delivery and payment. It connects financial settlement, physical delivery flow, and purchase intent (Shah & Kirche, 2025). Second, by using verified physical data, GR reliably captures inventory and helps avoid stockouts and inventory accumulation (Dakshanamurthy, 2026). Additionally, a data record called a Goods Receipt Note (GRN) is produced by the GR procedure. The GRN records the goods received and can be used to track supplier performance (Cflow, 2026), offer written proof in the event of a disagreement (ZYCUS, n.d.), and assist with tax compliance and financial audits (Allerson, 2025).

2.3.2 3WM and its automation

3WM is a control mechanism in the accounts payable (AP) (Hoing, 2025). It begins with the PO and cross-checks the GRN and invoice to ensure that the key information on all three documents is completely consistent before proceeding to the payment step (Flanagan, 2024). The risk of fraudulent and duplicate invoices can be reduced by 3WM with the verification of multiple documents. 3WM could increase the likelihood that suppliers would receive early payment discounts and help avoid late payment penalties (Rillion, n.d.).

Automation has facilitated the application of 3WM. Although the 3WM principle seems simple, its manual processing could be extremely time-consuming, particularly when discrepancies require further investigation (Bichachi, 2022). Automation of the 3WM process can reduce manual work of data entry and matching, improve the consistency of invoice verification, and enhance transaction traceability by maintaining digital records of matching outcomes, approvals, and exceptions (IBM, n.d.).

2.3.3 GR as a crucial and vulnerable core of 3WM

3WM depends on GR in multiple dimensions. GRN serves as the empirical foundation in 3WM. The 3WM process cannot be triggered without a GRN. As Dakshanamurthy (2026) describes, the GR records what is received, while the PO shows what is intended, and the invoice shows what is billed. GR the point links the product, follow, and information flow.

Despite its importance, GR is also vulnerable. Firstly, the timeliness of GR affects the execution of 3WM. O'Neill (n.d.) points out that delays in GR will create bottlenecks in the AP workflow, resulting in late payments, strained relationships with suppliers, and missed early payment discounts. Secondly, the accuracy of the data in GRN directly determines the result of the matching process. If a receiving document is inaccurate or missing, errors can quickly propagate through inventory records and financial systems (Dakshanamurthy, 2026). The third is document completeness, which is related to data discrepancies, payment errors, and audit issues (Syafira et al., 2024). Also, traceability is essential for maintaining financial transparency (Syafira et al., 2024). Simanjuntak and Devano (2025) apply the performance prism on GR to provide a broader perspective, emphasising evaluation across multiple stakeholder-relevant dimensions. This perspective is also relevant to this thesis, as managers, purchasers, end users, finance personnel, and vendors have different perceptions of the effectiveness of GR and 3WM.

2.3.4 The tradeoff of efficiency and control within outsourced purchasing

The dependency is rooted in the principle of Segregation of Duties (SoD). SoD advocates breaking down processes so that no single person is responsible for all stages, thereby reducing the risk of errors and fraud (COSO, 2013, p. 44). This is reflected in the fact that PO, GR, and supplier invoices are verified by different parties. When purchasing is outsourced, the balance of control and efficiency in 3WM becomes complex. On the one hand, Bals and Turkulainen (2017) note that outsourcing purchasing and supply management can improve efficiency and effectiveness, with organisational design as a key factor. On the other hand, COSO (2013, pp.87-89) states that control activities should, in principle, be treated equally regardless of whether they are performed by internal staff or outsourced service providers; however, outsourcing introduces specific risks and typically requires additional controls to ensure the integrity, accuracy, and validity of information conveyed.

2.4 Research gap

From the theoretical vantage points of TCE, agency theory, TAM, organisational control theory, and SoD, the literature review investigates the governance of IPOs and P2P automation, as well as control frameworks for GR and 3WM. However, most insights are generated within discrete disciplinary contexts, and the relationships among automation, outsourcing, and internal control systems are insufficiently considered.

The TCE on outsourcing has highlighted the risks of coordination costs at organisational boundaries but has not examined how the introduction of automated P2P systems at these boundaries alters the calculation of coordination costs. The automation literature has demonstrated the efficiency potential of 3WM automation as well as the compliance challenges posed by non-expert users, but has not examined how outsourcing procurement models affects the data quality upon which automation relies. The internal control literature has established governance frameworks for SoD and outsourcing, but has not examined how effective these frameworks are when separated roles are distributed

across different organisations with distinct systems, incentive structures, and communication channels.

The synthesis of these three fields reveals a research gap (see Figure 4) in the existing academic literature that there is no integrated theoretical or empirical account of how the combination of organisational boundary crossing and technological heterogeneity generates the specific category of GR issues that impacts 3WM integrity in practice. This gap lies at the intersection of organisational theory, information systems research, and management accounting, an area that calls for interdisciplinary, integrated research, which the existing literature has yet to provide.

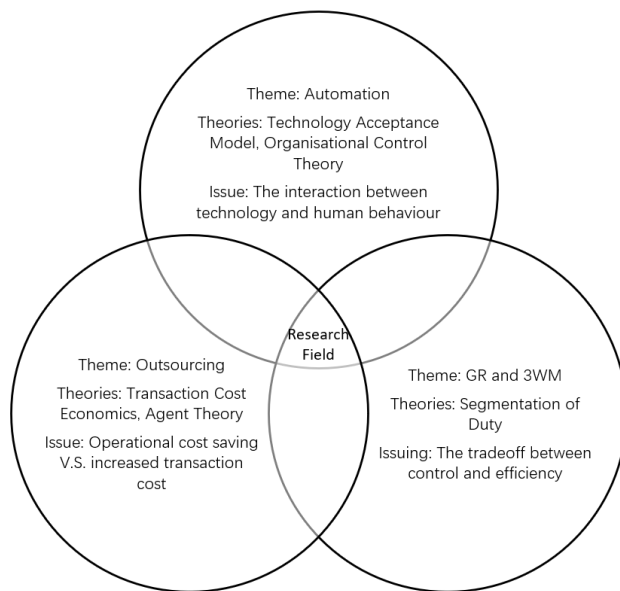


Figure 4. Research issues

3 Methodology

This chapter adopts the Research Onion model developed by Saunders et al. (2019) as the outline, sequentially presenting the research design, data collection, data analysis, and reliability and ethics.

3.1 Research philosophy, approach and strategy

The research design includes six layers (shown in Figure 4), and it starts from the outside in. For philosophy, this study adopts pragmatism, as its objectives are to understand current practices and to provide practical recommendations for the GR and 3WM processes in a real-world business environment. Concretely, this thesis combines academic rigour with a problem-solving orientation. The focus is to evaluate and improve the performance of GR and 3WM practices in P2P with the context of outsourcing and automation.

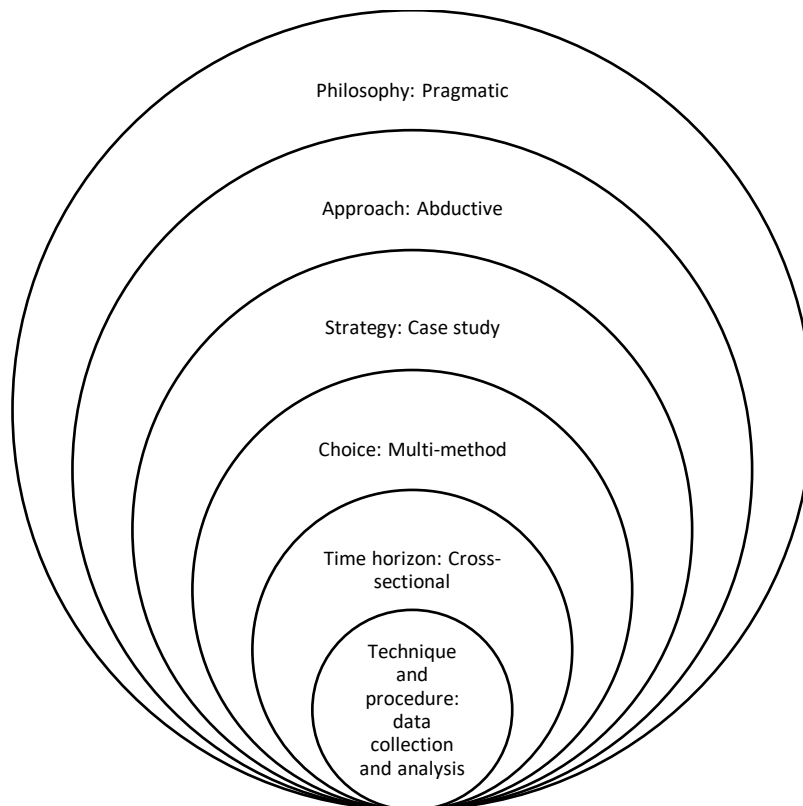


Figure 5. Research onion - Methodological layers of the study (Saunders et al., 2019, p. 108)

This research employs an abductive approach. This approach allows the iterative movement between theory and empirical observations. The theoretical foundation is based on literature on three main perspectives. They are a process perspective on GR and P2P activities, a control perspective on 3WM as a financial verification mechanism, and a performance perspective related to process development. At the same time, empirical findings from the case companies are used to refine and elucidate these theoretical insights. It aims to interpret a practical organisational problem through the interaction of literature and empirical evidence.

The study employs a qualitative methodology and a case study approach to investigate the intricate organisational procedures of GR and 3WM in a global outsourcing context. Yin (2018) asserts that case studies are the best method for examining "how" and "why" issues in a real-world setting. A qualitative approach was also used in light of the research goal and the small number of stakeholders.

3.2 Research positioning

A multi-method qualitative choice was selected. Semi-structured interviews, document reviews, and direct observation were used to collect qualitative data (Figure 5). Document reviews were used to understand process design. The direct observation method was used to understand how the GR and 3WM processes were carried out. It provided a direct view of the actual operational processes, participants' interaction with the system, and potential problems. Given the organisational complexity with multiple stakeholders, semi-structured interviews were chosen to collect participants' experiences, perceptions, and suggestions.

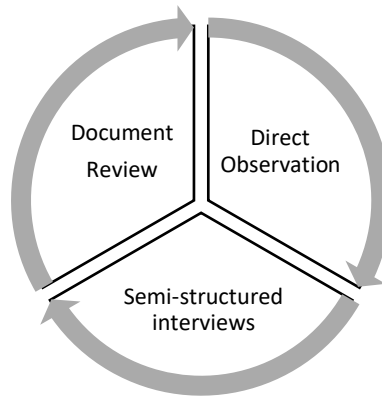


Figure 6. Research methods

The research employs a cross-sectional design and collects data within a constrained timeframe. Even though the company is continually improving, this study only examines a specific time frame.

3.3 Data collection

The main data collection followed a planned sequence of document review, direct observation, and semi-structured interviews. During the preliminary analysis, some possible root causes were found to require further clarification. For this reason, additional focused observations and follow-up discussions with relevant participants were conducted.

3.3.1 Document review

Document review was used to obtain formal process information on indirect purchasing (IP), goods reception (GR), and 3-way matching (3WM) at the case company. The reviewed materials, along with their functions and roles, are listed in Table 1. These documents provided an overall understanding of the formal process structure, system-supported workflow logic, role responsibilities, and dimensions of process performance measurement. The planning of observation and interview questions was based on this

document review. Additionally, the comparison between formal process design and actual process execution is also built on it.

Table 1. Reviewed materials

Document Name	Function	Roles in this thesis
IP Operating Model Summary	Provides an overview of the IP operating model, including processes, responsibilities and process interfaces	Used to understand the overall process structure, outsourcing context, and organisational setting
IP handbook	Describes formal rules, principles, and practices of IP	Used to identify formal process requirements and role expectations
Instructions for the IP platforms	Explains how the IP-related systems are working	Used to understand system logic, digital workflow, and platform-supported process steps
IP categories	Defines IP products and categories	Used to understand the purchasing characteristics and category-related complexity
IP end-user responsibility	Clarifies end-user responsibilities in the IP process	Used to analyse formal ownership and responsibilities related to GR
Invoice processing guide	Describes invoice handling and matching procedures	Used to understand the formal role of 3WM and its dependency on GR
Supplier guidelines	Explains supplier-facing requirements and expectations	Used to understand delivery and invoicing-related process expectations to suppliers

3.3.2 Direct observation

Direct observation was conducted after the document review. It focused mainly on GR-related activities and their connection to 3WM. Attention was paid to how the receipt was recognised in practice, how and when GR was confirmed and recorded in the system, who performed the relevant actions, and how system logic and automation influenced the execution of the process. A total of 10 observation sessions were carried out, each lasting approximately 30 minutes.

3.3.3 Semi-structured interviews

The interview data were collected from five main stakeholder groups involved in the 3WM process. The interviewees were selected through purposive sampling based on expertise, representativeness, and accessibility. The reason for this sampling approach is that the study aimed to include knowledgeable informants with direct experience of the relevant process, rather than statistical representativeness.

As indicated in Table 2, the sample comprised five major stakeholder groups, each representing a distinct viewpoint on the procurement process and accounting for 16 of the total participants. They included end customers, AP personnel, employees of external procurement service providers, internal procurement professionals, and procurement managers. This choice is intended to ensure that the analysis accounts for both operational and management viewpoints, as well as the process's upstream and downstream interfaces.

Table 2. Interviewees

Stakeholder Group	Role in process	Number of participants
Purchasing Managers	Performance Manager	2
Internal Purchasers	Previous 3WM mismatching manual solver	4

Stakeholder Group	Role in process	Number of participants
Outsourced Purchasers	Current 3WM mismatching manual solver	4
End users	PO requisitioner	4
APs	3WM mismatching the auditor and the resolution reviewer	2

Firstly, two purchasing managers were interviewed. Their initial interviews were used to build an overall understanding of the process and to refine the interview themes for subsequent interviews. After the preliminary analysis had been completed, the same managers were interviewed again to validate the findings and assess the proposed recommendations. This two-stage interview design supported both data collection and validation. The interview questions are in Appendix 1.

Secondly, eight purchasers were interviewed, including four internal purchasers and four external ones. These participants were selected because they were directly involved in the daily execution of purchasing-related activities. Among the four internal purchasers, two had already left their positions at the time of the interview. However, they were still included because of their prior direct involvement in the process and their ability to provide valuable retrospective insights. The interview questions are in Appendix 2 and 3.

Thirdly, four end users were interviewed. They were chosen from different regions with different roles and lengths of work experience. The rationale for this strategy was to increase the range of perspectives and experiences. The interview questions are in Appendix 4.

Finally, two AP employees were interviewed in order to incorporate the downstream financial control perspective, particularly in relation to invoice handling and the practical implications of 3WM. The interview questions are in Appendix 5.

3.4 Data analysis

To identify process issues, understand their causes, and propose practical recommendations, a portfolio of methods was used to analyse the data. Firstly, thematic analysis was used to analyse the interview data, observation notes, and relevant literature. Process mapping was used to visualise the current workflow for GR and 3WM. It was used to identify the interfaces, dependencies, and potential deviations between process steps. Root cause analysis was applied for in-depth exploration to determine why the identified problems occur.

3.4.1 Thematic analysis

This thesis employed thematic analysis to analyse the empirical data. The topic-related notes from documentary review, observations and interviews were coded and grouped separately (see Appendix 6, 7, 8). This coded data was further organised in Table 3 referring to sub-questions demonstrated in problem statements, including challenges, root reasons, and proposed suggestions.

Table 3. Integrated theme table

Category	Evidence	Interpretation	Theme
Issue	O1, I3	The most common issue is late GR.	Late GR
Issue	O5	No GR action or response after reminders.	GR missing
Issue	I2	Batch GR requires the correct UoM (Unit of Measurement), and invoices should be issued accordingly.	Batch GR
Issue & Reason	I1, I2, I3, I5	GR mismatch reasons include the invoice being posted incorrectly, the unit on the invoice differing from that in the PO, and GR being applied to the wrong lines.	GR mismatch
Issue	I2, I4	RPAs are helpful, but manual reminding is still needed in the current situation.	Automation
Issue	I3	Some outsourced purchasers might not be familiar with the RPAs	Automation/outsourcing

Issue	I4	Constant GR reminders can be a nuisance for those who can't process GR immediately	Customer satisfaction
Issue	I4	Late payment caused by invoicing missing (GR done) leads to suspended service; more human intervention is needed.	Customer satisfaction/human intervention
Issue & Suggestion	I2	Urgent cases also need automation, and it could be realised by sending reminders or doing auto GR according to payment terms.	Automation/human intervention
Reason	O2, I1, I2, I4	The recipients are unable to make GR immediately after physically receiving it because they have other tasks to do, and they are not in the office.	Late GR
Reason	I1	The invoices come before expected.	Late GR
Reason	I1, I2, I3, I4	GR is missing because recipients have left the company, and PO requisitioners are not the actual recipients.	GR missing
Reason	O5, I2, I3	Sometimes, purchasers can't get in touch with the actual recipient.	GR missing
Reason	D1, D2, D6	End users are responsible for GR; outsourced purchasers for PO approval and invoice support. AP personnel will take care of 3WM, but the unmatched ones will go to purchasers for resolution.	Responsibility
Reason	D5, I2	PO requisitioners are defined as end users, but in practice, the actual end users may not be the person doing GR, nor the requisitioner.	Responsibility
Reason	D5, I4	FO is designed for POs with multiple invoices that do not require GR, but it is not well understood or utilised.	PO type choosing
Reason	D1, O3	Two platforms are used. One is for PO approval and GR making. The other is for invoice posting, GR and 3WM. Some recipients don't have access to Platform Two.	System
Reason	D1, O3, I3	Integration errors in PO and GR synchronisation cause trouble.	System
Reason	D1	Regional management is used, and purchasers are responsible for their representative regions.	Responsibility
Reason	D3, I1	GR instruction is available on the IP homepage, reminding emails (both auto and manual ones), but some users still don't know how to do GR or do not know how to do it	Communication

Reason	D1	The outsourced PO process involves a division of work, PO approving and invoicing supporting	Communication
Reason	I3	Vendors are expected to cooperate efficiently when it is needed to change invoices and provide tracking information.	Supplier cooperation
Suggestion	I1	The outsourcing partner is doing an increasingly good job after a period of training and practice.	Outsourcing
Suggestion	D1	Measurement dimensions include effectiveness, quality, efficiency and cost. Concretely blocked invoices, manual intervention, automation and customer satisfaction	3WM Performance measurement
Suggestion	O7, D6	Punctuality and accuracy of payment are important for suppliers, but every process takes a certain time.	3WM Performance measurement
Suggestion	D7	There are many requirements for invoices. An agent is used for purchasing from one-time vendors. It may be helpful to have valid invoices	Invoicing
Suggestion	I3, I5	It is recommended to have GR before posting the invoice. The payment terms should account for the processing time.	Step sequence
Suggestion	I4	Encouraging users to process GR immediately, it may be helpful to have access to do GR at the pickup point.	Late GR
Suggestion	I3	It would be helpful if the system could flag the POs which cannot have GR done in a short time.	Late GR
Suggestion	I3	Maintaining end-user information on platform two to improve auto-reminding.	Automation
Suggestion	O4, I1	RPAs help with doing auto GR for certain items and sending GR reminders regularly. AI assists in assigning tasks to responsible people.	Automation
Suggestion	I3	PO of rents is recommended to have an auto GR	Automation
Suggestion	I3	The auto reminding list is recommended to be shared with responsible purchasers	Automation
Suggestion	O5, O6, O7, I2	PO approving purchasers and invoice supporting purchasers need to coordinate for PO type, and requisitioners and AP personnel's help is also needed.	Communication
Suggestion	I2	It is important to consider the user's perspective	Communication

Suggestion	I2	Responses are received more quickly if communicating by message or phone call.	Communication
Suggestion	I2	Working in a local office facilitates communication	Communication
Suggestion	I4	Understanding the importance of GR facilities, recipients' GR actions	Communication

3.4.2 Process Mapping

Process mapping was employed to visualise the case company's current Goods Reception (GR) process and its relationship with the downstream 3-Way Matching (3WM) process. This chart (Figure 6) was used to illustrate how the process operates in practice, how responsibilities are allocated, and where the key interfaces and handoff points are located. To identify upstream and downstream impacts, the entire process, from needs identification to payment, was included.

The 3WM, which is located downstream of the process, requires a PO, an invoice, and a GR. These three files are generated by upstream processes and are dependent on the smooth integration of the two platforms. POs are automatically generated from PRs, which specify key details such as the PO type (standard PO or FO), UoM (Unit of Measurement), quantity, unit price, payment terms and so on. The PR generation process requires coordination among the purchaser, the requisitioner, and the vendor. Invoices are expected after the goods are received, but in many cases, they arrive at the same time as the goods. They will be posted to PO if the terms match and the amount is no greater than the PO. GR involves the flow of information and material. The flows originate from PR and cross internal and external ends. GR is primarily handled by the end user. Once GR is completed, it is reconciled with the invoice. If the records match, the payment process proceeds; otherwise, another purchaser will be involved in resolving the issue. The PR approval process and the 3WM process are operated on two separate platforms and need to be integrated.

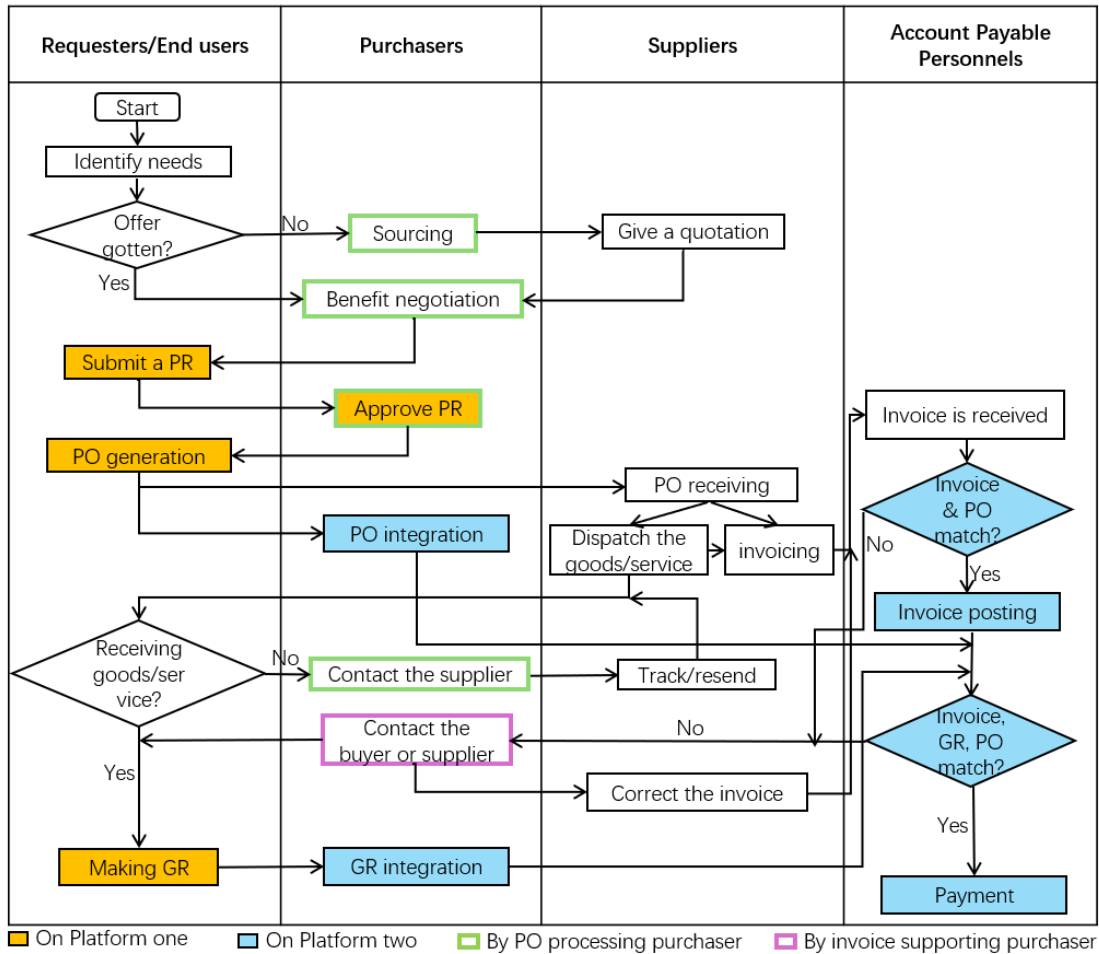


Figure 7. Current procure-to-pay process

3.4.3 Root cause analysis

Root-cause analysis (Table 4) was used to explain why the GR problems occurred. The issues are identified through theme analysis and process mapping, including direct GR issues and GR efficiency needs originating from the performance measurement. Direct GR issues are missing GR, late GR, incomplete GR, and GR-related mismatches. The distinction between “missing GR” and “late GR” is whether the GR is completed before the payment due date. An incomplete GR is related to a batch GR. GR-related mismatch refers to a discrepancy between the GR records and the matching requirements. GR issues related to performance measurement include human intervention, level of automation, and customer satisfaction, as outlined in company documents.

During the analysis, it was found that some of the identified issues were not yet adequately explained by the initial material alone. To strengthen the analysis, supplementary observations and follow-up clarifications were conducted with key participants. Additionally, since the purpose of this thesis is to improve payment, issues related to 3WM that do not affect payments, and 3WM issues not related to GR, are outside the scope of this discussion.

Table 4. Root cause analysis

Issue	Direct reason	intermediate cause	Root cause
GR is missing	No GR is entered in the system	Departure of the responsible person	Outdated contact person information
		Difficulty finding the right person	Unclear responsibility and contact person
	Items have not been received yet	Goods lost	Lack of delivery tracking
	GR cannot be marked as received yet	Quality defects	Uncooperative invoicing
		Retention	Platform one's no retention function
	GR does not show on platform two	GR's done before PO integration	Poor system integration and unresolved integration errors.
GR is late	GR is not entered immediately after actual receipt (non-intentionally)	Users forget to do GR	The accessibility of doing GR
	GR is entered late	Users are busy doing their main tasks	Users' insufficient recognition of the importance of GR
	Suppliers issue the invoice before the items are received	Suppliers do not follow company procedures	Lack of transparency of the actual receiving status. Insufficient coordination

Incomplete GR	Ship in batches	Wrong UoM	To-be-improved cooperation between upstream and downstream purchasers
GR-related Mismatch	The GR quantity does not match that on the invoice, but the total amount matches	FO needs to be used for the service PO with multiple invoices	The PO approver was not aware of the downstream issue
		GR is correct, but the quantity on the invoice is posted wrongly	The reading accuracy of invoice posting RPA needs to be improved
		Different UoM are used in GR (PO) and the invoice	Inadequate communication among purchasers, vendors, and requisitioners
The need to reduce human intervention	Current GR automation only works for certain items.	Lack of transparency regarding the actual delivery status	Lack of delivery tracking
	The current GR reminder does not work for urgent cases	GR reminders are sent on scheduled days	The automated emails did not consider the urgency of payment
Unfamiliarity with in-use RPAs	The training does not have the expected results	Many outsourced purchasers came after the training session, and did not thoroughly review the training material	Outsourced staff do not directly participate in the automation process
The need to improve customer satisfaction	Frequent and constant GR notification	Lack of GR	lack of transparency in the actual delivery status
	GR is done, but the invoice has not been paid on time	Invoice missing	No timely reminder for POs with GR, but no invoice

3.5 Recommendation development

In this stage, recommendations were developed. The DMAIC methodology was used as a framework to structure the process, from problem definition to recommendation development. DMAIC used here did not serve as a strict Six Sigma project method but provided an improvement logic. The DMAIC approach has five phases: Define, Measure, Analyse, Improve, and Control. In this thesis, the Define phase involved describing the current process and identifying key practical issues. The Measure phase applied the performance dimensions of effectiveness, quality, efficiency, and cost. The Analyse phase was reflected in thematic, process, and root cause analyses. The Improve phase was developing recommendations for improvement. The Control phase was used in the discussion of the application of the recommended improvements

A process-oriented approach was used in formulating the recommendations. Building on the flowcharts created during process mapping (Figure 6). Key control points for improvement were identified by considering the sequence of activities, the roles involved, and the flow of information and physical materials. Based on the process's inherent logic, the focus is on changes to strengthen controls, reduce unnecessary manual operations, clarify responsibilities, and improve exception handling. The flowchart in Figure 7 shows the intervention points with stars.

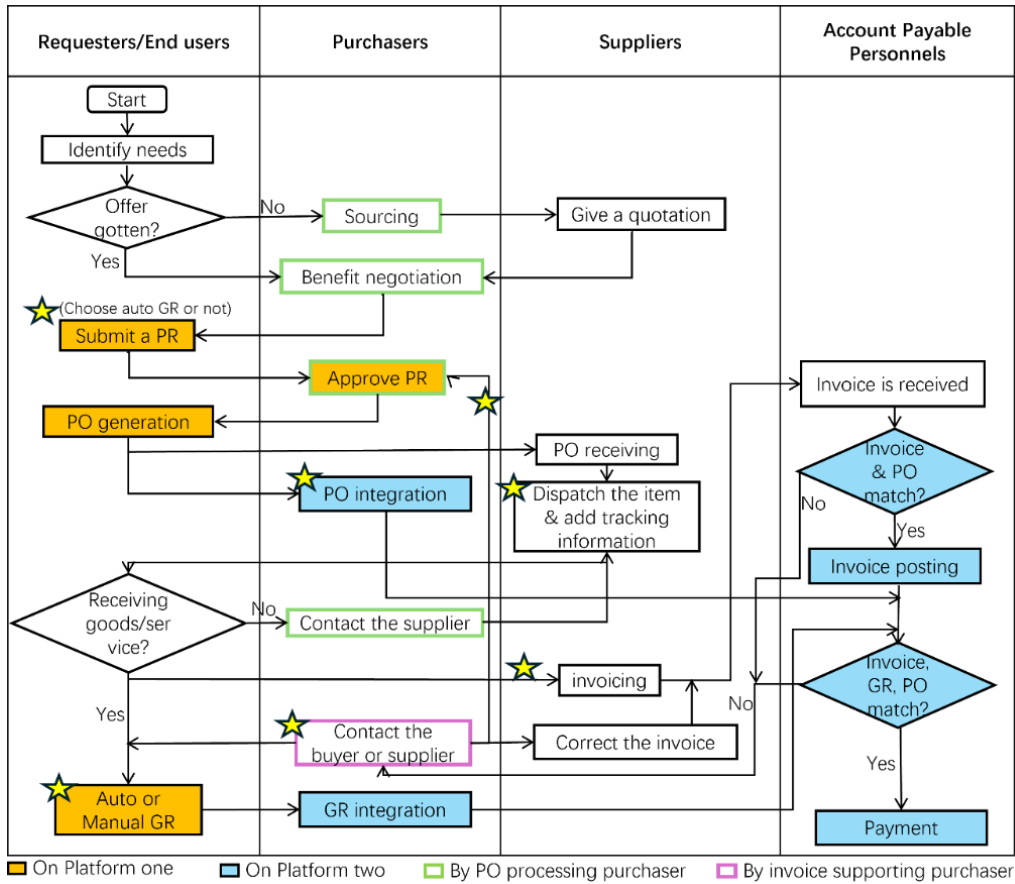


Figure 8. Proposed future procure-to-pay process

3.6 Reliability and ethics

Credibility is ensured by using multiple sources. Information gathered from interviews, direct observation, and document review can corroborate and supplement one another. Also, the process documentation is included in the appendix, which provides transparency of the study method and data.

The ethics were reflected in the obtaining of this topic and the processing of relevant data. Firstly, this topic was approved by the company’s management. Secondly, participation in interviews was voluntary, and the purpose and use of the interviews were explained. Thirdly, all data was collected anonymously and treated confidentially.

4 Empirical Findings

4.1 Summary of the Process Mismatch and Bottleneck

By synthesising the results of thematic analysis, process mapping, and root cause analysis (RCA), this study found that stagnations in the automated 3WM process frequently occur at specific steps and boundaries, and that the causes of GR mismatches are largely consistent. Figure 9 provides a simplified structural overview showing the two locations where bottlenecks commonly occur. Figure 10 illustrates the mismatch scenarios.

As shown in Figure 9, the operational stagnations do not lie in physical delivery, but in the process of converting physical flow into digital flow. The automated 3WM engine cannot find a matching GR record, thereby immediately blocking the transaction. As shown in Figure 10, GR mismatches are primarily caused by inappropriate units of measure (UoM), UoM mismatches, and partial shipments. Analysis reveals five core root causes for these GR issues.

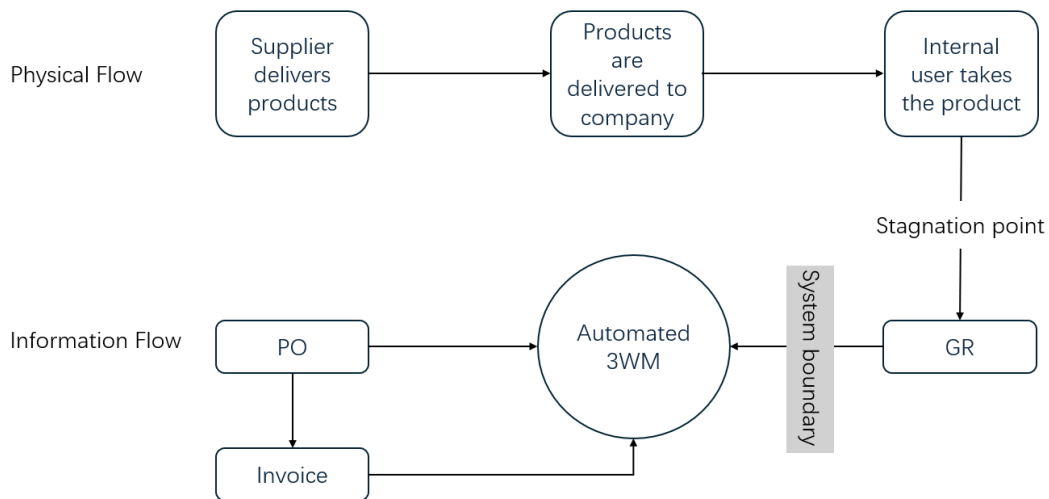


Figure 9. Simplified interface stagnation in 3WM

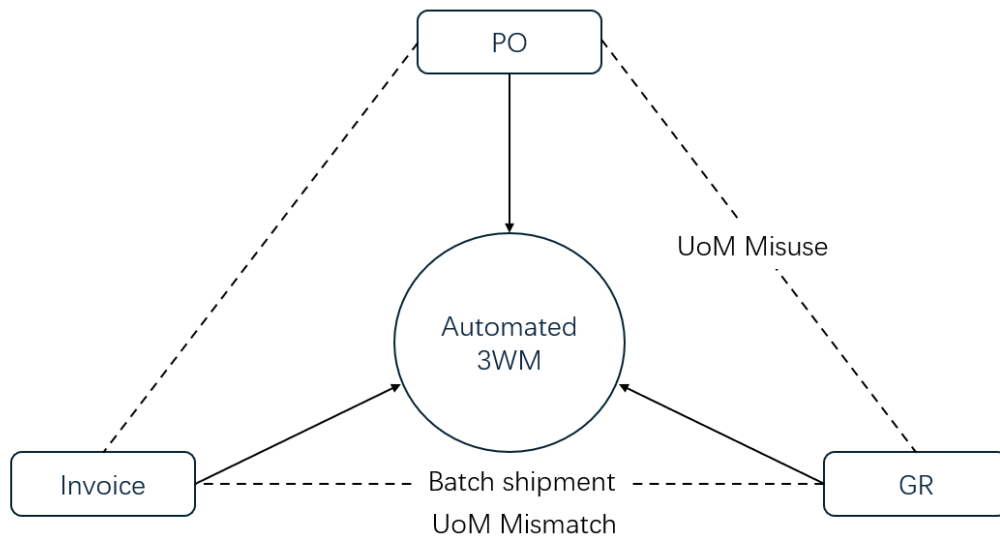


Figure 10. Simplified GR mismatches in 3WM

4.2 Root causes of identified problems

4.2.1 Information asymmetry in upstream-downstream misalignment and GR execution

Information asymmetry is a key root cause of missing or delayed GR entries. First, there is a lack of shared logistics information. Since the recipients are the only ones who know whether products have actually been received, other personnel have no way to verify receipt status when they are on leave or have left the company, unless the recipients respond. Faced with a lack of information or formal handover records, other employees would refuse to confirm GR to avoid administrative liability arising from blind recording, thereby pausing the GR entry process.

Secondly, the outsourcing service provider segments the purchaser's role into PO approval and invoice support, which has broken the P2P process and led to information asymmetry between upstream and downstream stages. Information such as PO type and unit of measure (UoM) is not critical to the order itself, but it directly determines downstream GR processes. This is because, in the case company's current system,

inappropriate selections can lead to integration errors between systems, preventing partial GR and other issues. By separating the purchase order approver from the 3WM coordinator, the outsourcing provider has created a situation in which upstream and downstream purchasers lack an understanding of each other's operations. This results in upstream processes affecting downstream ones, while downstream teams struggle to provide feedback for corrective action.

4.2.2 Data accuracy and consistency in the systems

Data accuracy and consistency are problems in the company's dual-platform purchasing. PO and 3WM are managed on two separate platforms, yet PO-end personnel typically lack access to the 3WM platform, and integration issues frequently arise between them. As recipients are not expected to have specialised procurement knowledge, nor is ordering goods their primary responsibility, they lack the awareness, motivation, and authority to verify that GR information is transmitted correctly from the PO platform to the 3WM platform. This can result in situations where a user has completed a GR, but the GR information is transmitted incorrectly, requiring manual correction by the purchaser and even involving other stakeholders, such as the cost controller.

In addition, data accuracy and consistency are constrained by technical and platform limitations. In some cases, even if the GR is correct, a 3WM mismatch would occur because the quantity shown on the invoice is entered incorrectly into the system. Furthermore, the PO platform does not provide a standard feature for handling retention funds, so requisitions need to create a separate line as a workaround. Although this workaround allows the process to continue, it adds complexity and increases the risk of data inconsistencies.

4.2.3 Inadequate GR trigger and prioritisation mechanism

Another fundamental reason is that the mechanisms that trigger and prioritise GR are insufficiently robust. First, there are no automatic alerts when a GR has been processed,

but no matching invoice has been posted. This means that if an invoice is lost during transmission, it cannot be detected in a timely manner, leading to unnecessary late payments. Additionally, the scheduled automated GR reminder emails do not flexibly adjust based on the proximity of payment deadlines, so they may fail to adequately convey the urgency of specific payments. GR follow-ups become routine rather than driven by risk or urgency.

4.2.4 Communication silos across internal, external, and outsourced stakeholders

The outsourced procurement model creates a complex communication structure, as the outsourced service provider acts as an intermediary between internal users and external suppliers. However, the outsourced purchasers can only communicate with internal and external stakeholders through existing online channels, as they are not on-site, and the available contact information is not always complete or up to date. This makes it difficult to locate the right person in a timely manner.

4.2.5 Misalignment between designed role assumptions and actual workflows

Empirical findings indicate that the design process assumes the PO requester, recipient, and end user are the same person. However, in practice, these roles may be filled by different individuals. In actual operations, there are situations where a PO requester creates an order, receives the goods in their own name, and ultimately passes them to the actual user. Additionally, the person placing the PO is often different from the recipient. This leads to situations where it is unclear who to contact when a GR is missing. Actually, this issue is not merely a communication problem, but rather a mismatch between the role assumptions implicit in the process design and actual working practices.

5 Discussion and Theoretical Evaluation

Based on the five root causes identified in Chapter 4, the disruptions within the three-way match (3WM) and goods receipt (GR) frameworks can be categorised into three main theoretical themes. The following is the interpretation using the theoretical perspectives of the economics of transaction costs (TCE), the Technology Acceptance Model (TAM), agency theory, and organisational control theory.

5.1 Role misalignments as evidence of agent theory

The formal division of the PO-approving purchaser and the invoice-supporting purchaser (4.2.1), and the spontaneous division of the requisitioner, recipient, and end user (4.2.5), could be explained by service-level misalignment derived from agent theory. The segment of the purchasers' duty by the outsourced service provider (OSP) reveals a mismatch in service levels between the company (the principal) and the OSP provider (the agent): the principal requires a communicative procurement process to ensure operational efficiency, but the outsourcing agent, driven by self-interest and cost minimization, delivers a fragmented, siloed service level by rigidly separating the roles of purchasers in P2P process.

For the spontaneous division, the service-level misalignment is between the company and employees with purchasing needs, with employees serving as agents. According to traditional agency theory, this spontaneous separation by employees might be explained by opportunism or shirking, but this study finds that it could be a bottom-up response to the limitations of formal control designs, suggesting that employees' operational needs do not align with the company's efficiency needs.

5.2 The human-tech interaction synthesising TCE, TAM, and OCT

The findings on data quality deterioration caused by platform failures (4.2.2) and human reactions to system flaws (4.2.5) are aligned with transaction cost economics (TCE) and

the technology acceptance model (TAM) from a control perspective. First, the integration errors between the PO and 3WM platforms and RPA-driven mis-recording of invoice data directly support Davenport's (1998) view that effective modern enterprise systems are structurally dependent on highly accurate and consistent information flows. From the perspective of TCE, such data misreading and information fragmentation could create significant technical friction, turning the automated process into costly manual verification and thereby undermining the efficiency gains that digital infrastructure is intended to deliver.

Secondly, the creative workarounds developed by employees to address system flaws corroborate Davis's (1989) argument that electronic procurement systems reshape employee behaviour through organisational control, thereby providing a complementary extension to the TAM from the perspective of organisational control theory (OCT). Traditional TAM literature posits that a decline in perceived ease of use (PEOU) and a reduction in data quality led to system rejection or user abandonment. This study revises this rigid assumption within a mandatory corporate environment.

5.3 Communication barriers as support for TCE

Beyond human-tech interaction, the information silos and communication barriers among stakeholders identified in this case study (4.2.4 & 4.2.5) could be illustrated with the principles of TCE. According to Williamson (1989), organisations outsource to achieve cost reductions. In the TCE literature, when individuals' bounded rationality interacts with market uncertainty, transaction frictions will increase, thereby raising transaction costs. This study identified increased costs associated with cross-border communication resulting from outsourcing. The underestimation of outsourcing's hidden costs has been noted by Barthélémy (2001), though it is difficult to determine whether these increased costs fully offset the cost reductions achieved through outsourcing.

6 Recommendations and Evaluation

6.1.1 Implement data-driven "automated GR triggers" and post-GR invoicing

To maintain data quality, improve operational efficiency, and reduce communication costs, increasing the visibility of delivery data could help. The case study company could integrate an interface for entering logistics information into its PO platform and use technologies such as optical character recognition (OCR) to capture it. For services or direct deliveries, delivery receipts can be used. This approach could offer multiple benefits. First, it resolves information asymmetry about the actual receipt status, thereby reducing the need for human intervention. Secondly, it could enable early detection of issues such as delayed shipments or lost packages, enabling timely intervention and resolution with minimal impact on the 3WM process. Additionally, tracking information helps bridge the information gap that currently requires human GR input, laying the groundwork for automated GR processing.

With transparent logistics information, a further automated GR mechanism could be designed, in which GRs are processed automatically under standard scenarios and manually under exceptional ones. Specifically, the receipt confirmation in the logistics process could serve as the default basis for automatically completing the GR in the system. For situations involving uncertainty or risk, manual GRs would be retained as an exception. An automatic GR mechanism with exceptions should help reduce human errors and time delays while providing some flexibility.

Based on the above approaches to improving item traceability, process visibility, and automation GR support, it could be further considered to require suppliers to generate invoices after the GR completion notification and to send reminders to suppliers in accordance with the payment terms for POs that have a GR but no invoice. Using the three approaches above, a framework is built to achieve a seamless, touchless 3WM and eliminate manual accounting errors.

The resistance to implementing the above framework may come from uncooperative suppliers, particularly large suppliers with high bargaining power. With the flexibility set, some exceptions are allowed, but to achieve wide implementation, protocols are recommended.

6.1.2 Institutionalise a cross-boundary stakeholder communication protocol

In addition to supplier protocols, a cross-departmental stakeholder communication mechanism needs to be established to address communication issues among personnel involved in GR and 3WM. This protocol should clearly identify key stakeholders in GR and 3WM, including PO requisitioners, product recipients, end users, the AP department, OSP, and suppliers. For each type of issue, the protocol should clearly specify whom to contact first, what information to include, which communication channel to use, and when to escalate. To ensure the feasibility of this process, the company should also maintain an up-to-date list of key internal staff and external supplier contacts, or a matrix of responsibilities.

This recommendation is particularly important because OSP's authority differs from that of internal process owners. Without a unified communication protocol, service providers may be required to coordinate the entire process without sufficient authority, information, or escalation support.

The main challenge in implementing this recommendation may be creating communication templates and a responsibility matrix, which requires a deep understanding of various receiving-process scenarios, responsible parties, escalation pathways, and payment-urgency levels. However, such knowledge may not be fully documented, particularly when employees who previously handled these cases have left the company. Due to heavy workloads, the remaining internal team may also lack the capacity to develop these processes. Although outsourcing service providers can offer practical insights from their day-to-day follow-up work, their knowledge is limited by their limited understanding of internal receiving operations and the informal nature of their methods. Therefore,

it is recommended to develop this process collaboratively by internal process owners, the AP and Procurement departments, key users, and service providers, and implement the process in phases, starting with the most common types of receiving issues and then gradually refining the templates based on actual cases and feedback.

6.1.3 Strengthen consequence-driven user management

Technical shortcomings that fail to meet user needs are prompting the case company to shift its approach to user management from technical oversight to results-oriented coordination. RPA-driven GR reminders could be improved by providing not only clear behavioural guidance but also an explanation of the direct operational consequences of non-compliance. Training modules and automated notifications need to clearly demonstrate the broader supply chain implications, thereby directly enhancing employees' perceived usefulness of administrative tasks. Additionally, incentive mechanisms are recommended to establish clear consequences by linking 3WM compliance rates to departmental and individual performance.

The practical implementation of this recommendation might inevitably face significant user resistance. Operational staff and front-line users are likely to view this new accountability mechanism as an unfair increase in their administrative workload. This is why incentive mechanisms are recommended here rather than punitive measures. Furthermore, when this recommendation is implemented alongside the automatic receipt triggering in recommendation 6.1.1, the perceived increase in workload will be largely mitigated, as the automated GR triggering would significantly reduce the actual manual workload.

7 Conclusion

7.1 Summary of findings

This study examined goods reception (GR)-related three-way match (3WM) issues in indirect procurement (IP) centres in the context of outsourcing and automation. It identified three core categories of causes: inconsistencies between designed roles and responsibilities and those in actual workflows; issues with information symmetry, accuracy, and consistency resulting from system configurations, organisational settings, and human behaviour; and blind spots and mechanised follow-ups in automated GR monitoring processes. These findings demonstrate that GR issues are a complex interplay of process design, system data, communication, and accountability. Based on these findings, the recommendations focus on improving automated GR triggers and post-GR invoicing, formalising cross-functional communication protocols and establishing clearer consequence governance and escalation procedures.

7.2 Managerial implications

The findings of this study could offer multifaceted insights for managers in procurement, accounts payable, process development, and outsourced service management. Generally, the study suggests that organisational governance needs to shift from standardised technical monitoring to a more data-driven, context-aware, and people-centred model. Firstly, reliable data-driven automation needs to be developed, as generic reminders and standard system checks are not always sufficient to identify urgent or high-risk GR cases. Specifically, managers could utilise information such as delivery status, invoice status, payment urgency, and unresolved matching exceptions to trigger more targeted follow-up actions, helping organisations shift from reactive problem-solving to proactive process control. Secondly, managers need to more clearly incorporate actual operational needs from the user end into process and system design. Research findings indicate that the person who actually possesses the goods receipt information may not be the one the system identifies. Thirdly, automation needs to be more user-centric and

consequence-driven. Notifying users of a missing GR is not enough; system alerts should explain why GR action is required and the potential consequences of delays to encourage relevant personnel to act. Finally, the OSP operates as an intermediary between internal users and external suppliers but lacks comprehensive visibility. To reduce the coordination gaps, managers could establish clearer communication protocols and escalation paths.

7.3 Academic and Practical Contribution

The study's contributions to academic literature are primarily reflected in three areas. First, by focusing on GR, a relatively overlooked control point in the 3WM process, the study links the fields of outsourcing, automation, indirect procurement, and P2P processes, thereby bridging distinct areas of organisational control, transaction cost economics, agency theory, and technology-driven research. Second, the role misalignment observed between design and practice supports agency theory. System flaws and the corresponding user behaviours demonstrate the shaping effect of electronic systems on human behaviour, thereby extending the technology acceptance model from the perspective of organisational control theory. Furthermore, the increased coordination costs resulting from outsourcing corroborate the core principles of TCE.

The practical contribution of this study lies in its in-depth, process-oriented understanding of the root causes of GR and 3WM issues, as well as methods for improvement. The study identifies key root causes that could help managers move beyond a reactive approach to invoice troubleshooting and address the underlying causes of invoice discrepancies at the source. Also, this study offers practical recommendations for enhancing controls and efficiency. These recommendations aim to improve GR performance by shifting from generic technical monitoring to a more data-driven, context-aware, and people-centred approach to process governance. For practitioners, this study is notable for identifying GR as a critical control and coordination point and proposing best practices for GR management to improve invoice STP rates.

7.4 Limitations and Future Research

There are two obvious limitations to this thesis. Firstly, the results may have limited generalizability because they are based on a single company case. Secondly, the study does not strictly distinguish between physical goods and services, nor does it conduct an in-depth analysis of service products. Future studies could employ quantitative process data to evaluate the effects of GR changes on 3WM performance, compare GR and 3WM processes across multiple cases, or even industries, and develop a quantitative model incorporating variables related to PO, invoice, and GR actions. Furthermore, it could be explored how emerging technologies such as blockchain and advanced AI can further automate GR in 3WM.

References

- Aberdeen Group. (2001). E-Procurement: Finally Ready for Prime Time. *Aberdeen Group, Research Report*, 14(2), 1-12.
- Allerson. J (2025, December 28). *Goods received note (GRN): Meaning, template and process*. Retrieved April 15, 2026, from <https://invoicefly.com/academy/goods-received-note/>
- Barthélémy, J. (2001). The hidden costs of IT outsourcing. *MIT Sloan Management Review*, 42(3), 60–69.
- Bichachi, R. (2022, May 6). *What is three-way matching and why is it important?* Retrieved April 17, 2026, from <https://www.netsuite.com/portal/resource/articles/accounting/three-way-matching.shtml>
- Bals, L., & Turkulainen, V. (2017). Achieving efficiency and effectiveness in purchasing and supply management: Organization design and outsourcing. *Journal of Purchasing and Supply Management*, 23(4), 256–267. <https://doi.org/10.1016/j.pur-sup.2017.06.003>
- Cflow. (2026). *Goods received note (GRN): What it is and why it is important in procurement*. Retrieved April 15, 2026, from <https://www.cflowapps.com/goods-received-note-grn/>
- CIPS (n.d.). *Procure to pay process*. Retrieved November 11, 2025, from <https://www.cips.org/intelligence-hub/procurement-technology/procure-to-pay-process>
- Committee of Sponsoring Organizations of the Treadway Commission (COSO). (2013). *Internal Control—Integrated Framework: Illustrative Tools for Assessing Effectiveness of a System of Internal Control*.
- Cox, A., Chicksand, D., Ireland, P., & Davies, T. (2005). Sourcing indirect spend: a survey of current internal and external strategies for non - revenue - generating goods and services. *Journal of Supply Chain Management*, 41(2), 39–51. <https://doi.org/10.1111/j.1055-6001.2005.04102004.x>

- Dakshnamurthy, S (2026, March 16). *Goods received note (GRN): Meaning, process, and its role in modern procurement*. Retrieved April 14, 2026, from <https://www.zoho.com/procurement/academy/procurement/what-is-goods-received-note-in-procurement-process-explained.html>
- Davenport, T. H. (1998). Putting the enterprise into the enterprise system. *PubMed*, 76(4), 121–131. <https://pubmed.ncbi.nlm.nih.gov/10181586>
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319–340. <https://doi.org/10.2307/249008>
- Eisenhardt, K. M. (1985). Control: organizational and economic approaches. *Management Science*, 31(2), 134–149. <https://doi.org/10.1287/mnsc.31.2.134>
- Flanagan, O. (2024). *Invoice Verification and the GR/IR in SAP S/4HANA*(first edition). Espresso Tutorials GmbH.
- GEP. (2026, January 22). *Procure to pay systems implementation: Challenges and best practices*. Retrieved April 13, 2025, from <https://www.gep.com/blog/strategy/procure-to-pay-systems-implementation-challenges-best-practices-to-overcome-them>
- Grover, V., Cheon, M. J., & Teng, J. T. (1994). A descriptive study on the outsourcing of information systems functions. *Information & Management*, 27(1), 33–44. [https://doi.org/10.1016/0378-7206\(94\)90100-7](https://doi.org/10.1016/0378-7206(94)90100-7)
- Hoing, J. (2025, July 30). *3-way invoice matching in accounts payable*. Retrieved April 15, 2026, from <https://start.docuware.com/blog/document-management/3-way-invoice-matching>
- IBM. (n.d.). Procure to pay automation. Retrieved April 12, 2026, from <https://www.ibm.com/think/topics/procure-to-pay-automation>
- Israel, D., & Curkovic, S. (2020). Indirect procurement: A literature review and study of trends. *American Journal of Industrial and Business Management*, 10(04), 775-792. <https://doi.org/10.4236/ajibm.2020.104052>

- Jayaram, J., & Curkovic, S. (2018). The right way to procure indirect materials & service: a new IP standard offers a framework to get the most from your indirect spend. *Supply Chain Management Review*.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3(4), 305–360. [https://doi.org/10.1016/0304-405x\(76\)90026-x](https://doi.org/10.1016/0304-405x(76)90026-x)
- Khayyat, N., & Haddud, A. (2025). Digital Transformation in Procurement: The Adoption of Artificial Intelligence and Blockchain Technologies. *International Journal of Innovation and Technology Management (IJITM)*, 22(05n06), 1-30. <https://doi.org/10.1142/S021987702550018X>
- Kher, A. A., & Hira, S. (2020). An Approach to Identify Product Purchase Processing Time by Applying Business Intelligence in Steel Coated Production. *Bioscience Biotechnology Research Communications*, 13(14), 28-31. <https://doi.org/10.21786/bbrc/13.14/7>
- Kirsch, L. J. (1996). The management of complex tasks in organizations: Controlling the systems development process. *Organization Science*, 7(1), 1–21. <https://doi.org/10.1287/orsc.7.1.1>
- Lahiri, S., Kedia, B. L., & Mukherjee, D. (2011). The impact of management capability on the resource–performance linkage: Examining Indian outsourcing providers. *Journal of World Business*, 47(1), 145–155. <https://doi.org/10.1016/j.jwb.2011.02.001>
- Li, M., & Edmunds, T. (2024). Digital Procurement Survey 5th Edition. PWCHK. Retrieved April 12, 2026, from <https://www.pwchk.com/en/consulting/digital-procurement-survey-apr2024.pdf>
- O’Neill, L. (n.d.). *Mastering invoice matching: Three-way, line item and PO matching explained*. Retrieved April 15, 2026, from <https://kefron.com/2025/06/three-way-matching-po-matching-line-item-invoice/>
- Ouchi, W. G. (1979). A conceptual framework for the design of organizational control mechanisms. *Management Science*, 25(9), 833–848. <https://doi.org/10.1287/mnsc.25.9.833>

- Rillion. (n.d.). *What is 3-way matching? Definition and how to automate with control*. Retrieved April 19, 2026, from <https://www.rillion.com/learn-ap/3-way-matching/>
- Saunders, N. K., Lewis, P., and Thornhill, A. (2019). *Research Methods for Business Students*, 8th Edn. London: Pearson Education.
- S Shah, P., Kirche, E., & Davison, T. J. (2025). *Supply Chain Management-An Integrated Approach*. Retrieved Jan 16, 2026, from <https://pressbooks.pub/supplychainmanagement3005/>
- Simanjuntak, S., & Devano, A. (2025). Optimizing Supply Chain Performance: A Performance Prism Analysis of Goods Receipt in Semiconductor Manufacturing. *Journal of Applied Business Administration*. <https://doi.org/10.30871/jaba.8341>.
- Syafira, R., Rizqi, M., & Rumiasih, N. (2024). Analisis Implementasi Three Way Matching Dalam Meningkatkan Kualitas Sistem Informasi Akuntansi (Pada CV Migaspro Energia). *Jurnal Ekonomika Dan Bisnis (JEBS)*. <https://doi.org/10.47233/jeps.v4i5.2065>.
- Themistocleous, M., Irani, Z., & Love, P. E. (2004). Evaluating the integration of supply chain information systems: A case study. *European Journal of Operational Research*, 159(2), 393–405. <https://doi.org/10.1016/j.ejor.2003.08.023>
- Van Der Aalst, W. M. P., Bichler, M., & Heinzl, A. (2018). Robotic Process Automation. *Business & Information Systems Engineering*, 60(4), 269–272. <https://doi.org/10.1007/s12599-018-0542-4>
- Van Weele, A. (2018). *Purchasing and supply chain management*. (seventh edition). Cengage.
- Williamson, O. E. (1989). Transaction cost economics. In R. Schmalensee & R. D. Willig (Eds.), *Handbook of industrial organization* (Vol. 1, pp. 135–182). Elsevier.
- Xideas, E., & Moschuris, S. (1998). The influence of product type on the purchasing structure. *European Journal of Marketing*, 32 (11/12), 974-992. <https://doi.org/10.1108/03090569810243587>
- Yin, R. K. (2018). *Case study research and applications* (Vol. 6). Thousand Oaks, CA: Sage.
- ZYCUS. (2024). *Top 4 procure-to-pay trends in 2024 and beyond*. Retrieved April 13, 2026, from <https://www.zycus.com/blog/procure-to-pay/p2p-transformation-procure-to-pay-trends>

Appendices

Appendix 1. Interview Guide for Purchasing Managers

First interview

Do you think GR is the most common issue in 3WM?

What do you think of the current GR performance, and do you find any gap between designed GR and current GR?

What do you think of the reasons that some GR did not been done properly?

How would you describe the current GR automation?

How does purchasing outsourcing influence the current process?

Second Interview

Do you agree with the identified root causes of GR issues?

Are the proposed recommendations practical and feasible?

What should be added or changed in the recommendations?

Appendix 2. Interview Guide for Internal Purchasers

What is your role in relation to GR?

How does the process work in practice compared with formal instructions?

Who is usually responsible for completing GR in practice?

What kind of GR errors have you encountered? What are the reasons?

What do you think of the current GR automation process?

What are the implications of outsourcing on GR and 3WM?

What changes would help improve GR to support 3WM?

Appendix 3. Interview Guide for Outsourced Purchasers

How would you describe your role in relation to GR process?

Who is usually responsible for completing GR in practice?

What kind of GR errors have you encountered? What are the reasons?

Do you have any difficulty during GR coordination?

What do you think of the current GR automation process supporting your work?

How does the AI assistant work? Do you find it helpful?

How do GR-related problems affect downstream 3WM process performance?

What changes would help improve GR to support 3WM?

Appendix 4. Interview Guide for End Users

Have you ever placed indirect PO?

Do you know who is responsible to complete GR?

Do you know how to do GR?

Do you know the difference between ordinary PO and FO?

Have you read the GR instructions? Do you find it useful?

Do you process the GR right after receiving the ordered items? Why?

Have you ever encountered a GR error? How did you solve it?

Did you know that category items have automagical GR functions? Did you find it helpful?

Have you ever received emails reminding you to do GR? Did you find it helpful?

How do you think of the current GR process? Any recommendations?

Appendix 5. Interview Guide for AP Personnel

Do you think GR is the most common issue in 3WM?

How important is GR information for your work in 3WM?

Do you feel 3WM efficiency improvement after IP GR related RPAs used?

Do you think outsourcing have any influence on GR and 3WM?

To support 3WM, do you have any suggestions on GR process?

Appendix 6. Document Review Table (coded)

ID	Document name	Relevant content	Theme	Category	Interpretation
D1	IP Operating Model Summary	PPIs include effectiveness, quality and efficiency, and 3WM-related indicators include % of manual invoices, % of blocked invoices, and % of spot buys automated via digital solution. KPIs include business benefits, % of sourcing events, % of PRs, Customer Satisfaction Score, and OP/SP escalation Rate.	Performance measurement	Suggestion	PPI & KPIs could be used as measurement dimensions for GR performance, which helps in formulating recommendations.
		Regional management is used.	Responsibility	Reason	Different regions may have different practices.
		IP operational work is outsourced; the outsourced service provider is responsible for PO approval and invoice support.	Responsibility	Reason	The outsourcing partner should be the main coordinator in the 3WM process.
		TWO platforms are used for PO, including GR; invoices and 3WM are recorded on another platform, and GR can also be done there.	System	Reason	There might be gaps between the two systems
		An AI-enabled tool developed by the outsourcing partner is used to track processes.	Automation	Reason	Need more explanation of this tool
D2	IP handbook	PO requestors do the GR in platform one; after that, the invoice can be paid to the supplier	responsibility	Reason	GR requisitioners are responsible for doing GR
D3	Instructions for the IP platforms	Creating & voiding GR instruction for platform one; GR instruction for platform two, including mobile devices.	System	Reason	GR can be done on different platforms. GR on platform two from different devices.

D4	IP categories	The product range is extensive and, in some regions, includes parts available for direct purchase. These PO are placed on platform two.	Responsibility	Reason	In some areas, part of direct purchasing is covered.
D5	IP end-user responsibility	Everyone originates PR is the end user.	Responsibility	Reason	PR requisitioners are end users.
		Creating a framework when a PO is required for long-term purchasing, and when many invoices will be received for the same purchase.	Process	Reason	Confirmation of invoice is needed for services POs; it is like GR to some extent.
D6	Invoice processing guide	Purchasers are responsible for checking blocked invoices at least twice a week and providing invoicing support and coordination among stakeholders	Responsibility	Reason	Purchasers are coordinators, and a timely process is required
		Invoice to pay process flow	Process	Reason	If GR is missing, invoices are posted but still blocked.
		Digital invoices would be automatically validated	Automation	Reason	Digital invoices trigger an automation process
		Each invoice step must be completed within 2 days, and payments are made regularly but not every day.	Timelessness of 3WM	Reason	3WM requires a timely process
		GR is done by the requisitioner in platform 1 and logistics or another responsible organisation in platform 2	responsibility	Issue	The responsible personnel at GR may differ across platforms.
D7	Supplier guidelines	Digital invoices are preferred	Automation	Issue	Digital invoices need collaboration from suppliers
		An agent is used for non-strategic, low-value purchases	Responsibility	Issue	The agent could provide designed support, like digital invoices
		Invoice requirements including content, bank information, and additional information (language, way of sending, with PO number, etc.)	System	Issue & Suggestion	For automation, besides the mandatory information, more information would be very helpful

Appendix 7. Observation Table (coded)

ID.	Observation focus	Observation notes	Theme	Category	Interpretation
O1	Process	The majority of 3WM errors are caused by quantity mismatch, and most of them can be solved by sending GR reminders	GR timeliness problems	Issue	Delaying GR is the most common issue.
		Most of the delaying GRs were done after 3 or more auto reminders were sent.	GR timeliness problems	Issue	There is a timing gap between the physical receipt and the system confirmation.
		The PO is automatically generated once the PR review is complete.	PO process	Reason	PR determines PO
O2	Role execution	When a user is out of the office, the GR status cannot be updated, and their colleagues or line managers cannot assist if they are not aware of the situation.	GR timeliness problems	Reason	Lack of transparency and tracking information
		The leave of internal purchasers has necessitated additional verification of GR for many POs.	GR timeliness problems	Reason	Lack of transparency regarding the actual delivery status
		Some end users had left the company before marking GR on the platform for their POs.	GR timeliness problems	Reason	Lack of transparency regarding the actual delivery status
		Some PO requisitioners help colleagues order items with only the actual user's name on the recipient's part.	Responsibility	Reason	Barrier to information sharing

		Order approval and invoice support are handled by different purchasers.	Responsibility	Reason	The division of responsibilities requires more communication and cooperation. Otherwise, a lack of rigour upstream will lead to operational difficulties downstream.
O3	System use	GR was done on platform one, but did not integrate with platform two, because PO had an integration error, and the GR had been done before the PO was integrated.	System	Reason	Challenges in Cross-Platform Integration
		The 3WM happens on platform two, and the operating system for end users is platform one, so many end users do not have access to check GR and invoice posting status.	system	Reason	Challenges in Cross-Platform Integration
O4	RPA use	For invoices pending with GR, an RPA sent reminders with GR instructions and an easy click link to do GR.	Automation	Reason	Considerations for end-user convenience
		There was a certain robot doing automated GR for certain items with a certain range.	Automation	Reason	Considerations for end-user convenience
		The outsourcing partner has an AI-powered tool to help.	Automation	Reason	The function of the AI-powered tool needs to be clarified
O5	Communication	Purchasers would send reminders to end users if invoices were blocked due to the GR not matching for about one week.	communication	Reason	Proactively communicate with users
		If the user does not respond, the reminder will be forwarded to their line manager.	communication	Reason	Proactively communicate with users
		Some purchasers' reminders did not get a response or GR action.	communication	Reason	GR missing

		Upstream and downstream purchasers usually communicate in the PO comments area	communication	Reason	Communication transparency
O6	Framework orders (FO)	Framework orders did not require GR, but the invoices need approval from the end user and purchasers before posting.	PO type	Reason	The purchasers handling the PO approval process need to guide the requisitioners to choose the PO type correctly.
		FO approval needs an account on Platform Two. To avoid the approval process, some users make many item lines for each invoice, and keep the order as an ordinary PO, which needs to be GR.	PO type	Reason	Account issues influence the choice of FO and ordinary PO.
		The FO also show GR functions on platform one, though it did not really help with the approval of the invoice posting directly. Some users did not know, and they still do GR, and purchasers could help them approve the invoice, noticing the GR had been done.	PO type	Reason	There is a knowledge gap that leads to more ordinary PO and fewer FO.
O7	Downstream effect	A PO has multiple invoices; the second and following invoices were booked as sub-debit, and they were paid without a GR being done.	Batch invoices	Reason	Choice of PO type leading to problems with invoice booking and payment.
		Without GR, the invoice could not be paid; some suppliers keep sending reminders, some ask for penalties, and some stop providing goods or services.	Result of late payment	Reason	GR problems have a big impact on payment.

Appendix 8. Interview Table (coded)

ID	Participant group	Origin notes	Theme	Category	Interpretation
I1	IP Manager	The reason of most blocked invoices is GR problem, like late GR, GR missing or GR mismatch.	GR issues	Issue	There are several types of GR issues.
		We have sufficient training and materials for end users.	Training	Reason	Training is not a reason for the GR issue.
		End users cannot sit in front of computers every day, and they cannot do GR right after receiving the goods.	Late GR	Reason	Accessibility of the platform and the convenience of GR are important.
		The invoices of indirect PO usually come with items, instead of after items received.	GR issues	Reason	The early issuing of the invoice makes the GR look late.
		We have RPA send reminders and doing auto GR for catalogue items. The robot has improved GR efficiency sufficiently.	Automation	Suggestions	RPA is a useful tool in GR, reminding and auto GR. If more items are catalogue items, less manual work in GR is required.
		We had many training sessions of the outsourcing service provider.	Training	Reason	Knowledge Transfer in Outsourcing is sufficient.
		It takes time for the outsourced partner to get familiar to everything, but they are handling better and better.	Outsourcing	Issue	The transition to outsourcing will take some time, but it is feasible.
I2	Internal Purchaser	It is end user's responsibility to do GR, but sometimes I help users to do if they confirm they have received the items.	Responsibility	Reason	Responsibility is clear, and purchasers' help is still needed.

	The automation works well but GR reminding emails sent by the RPA could be overlooked, and manual reminders are still necessary.	Automation	Reason	Manual reminders may be more effective at getting people's attention than automated ones.
	Requisitioner often use default UoM, and it causes problems when need to do batch GR.	GR issues	Issue, Reason	Batch GR requires the correct UoM.
	Most GR issues are caused by delays in processing, but some require coordination from purchasers, such as quality issues or errors in the quantity posted on invoices.	GR issues	Issue, Reason	Delayed GR is most common, and GR quantity mismatch can be caused by quality problems and invoice errors.
	When reminding users to do GR, I usually send them both the link and the delivery instructions at the same time for their convenience and get positive feedback from users.	Communication	Suggestions	User-friendly thinking is helpful to get GR done.
	I often reach out to users via messaging, sometimes calling, which allows me to get feedback more quickly.	Communication	Suggestions	The direct way of communication gets faster feedback
	The outsourcing provider separates the responsibilities for PO approval and invoice processing. While this clear division of labour has its benefits, it can also lead to coordination issues.	Responsibility	Reason	Communication and coordination between purchasers also need to be prioritised.
	The outsourcing company's buyers are not based locally, which may create a distance between them and the end users and potentially hinder communication.	Communication	Reason	Closer physical proximity may facilitate communication.

		Some small sized vendors have difficulty issue tickets that fully comply with our standard, for example, shipping in batches but issue invoice in single, reluctance to void and reissue an invoice when there is a minor error. Also, some very big companies requires us to follow their procedure to download invoices, instead of sending them to us. And for late payment, penalty invoices are sent without negotiation.	Supplier cooperation	Reason	A supplier's level of cooperation is not directly proportional to its size.
		Urgent payment usually needs the purchaser to be involved. It might work better if the RPAs could work based on the payment terms.	Automation	Issue & Suggestion	Automation needs to be more flexible.
		I had a case where I could not reach out to the requisitioner at all. At last, I got it from another colleague that the user was a driver usually on the way, and the front desk staff was helping him make POs and GRs.	Responsibility	Reason	The requisitioner might not be the person making GR.
13	Out-sourced Purchaser	There is a case where the item had a quality problem, and the item was sent back to the supplier to fix. I need to follow the case until it is solved. It takes several months. The invoice should be sent back for reissuing, but the suppliers did not do it, as there are no payment terms shown on the invoice.	Supplier cooperation	Reason	The discrepancy between the supplier's invoice and the company's requirements requires manual work.
		Some POs have multiple invoices, and multiple item lines are set for invoices, but the GR might be done to other lines.	Standardization	Reason	The number of item lines should not be excessive.

	A situation that is not very common but does occur is when the delivery date for some international shipments is later than the invoice due date. The payment terms should be changed.	Communication	Reason	Downstream teams need to provide timely feedback to upstream teams to prevent errors from recurring.
	Some requisitioners are not easy to get in touch with. Some requisitioners are not the end users	Communication	Reason	The actual recipient may not be the requisitioner. There is difficulty in finding the right person.
	The GR on platform one sometimes did not integrate with platform two, and we need to reverse it and do it again. And sometimes, we reverse and immediately do GR again, which also causes errors; we need to wait a while.	System	Reason	Cross-platform integration needs to be improved.
	Some GRs can't be done until long after the invoice is received, so it would be best if the system could flag them accordingly.	System	Suggestion	It is recommended that GR be done before invoice posting.
	It would be more efficient if the GR of rents could be done by auto GR	Automation	Suggestion	PO of the catalogue item requires less manual intervention than FO.
	It is common for existing invoices to have a GR to match them. However, some invoices have been posted for a long time, and errors are only discovered during the 3WM process, after which they must be resolved one by one. This is not very efficient.	Process	Reason	GR before invoice could find invoice problems early.
	The GR reminder list can be sent to responsible purchasers to avoid repetitive work.	Automation	Suggestion	Purchasers need a report of RPA work
	Some customers who have placed orders don't receive their items and I can't get in	Communication	Suggestion	Tracking information is needed.

		touch with the supplier; it becomes very difficult to resolve the issue.			
		When integration issues arise between two platforms, they can be very difficult to resolve.	System	Reason	Cross-platform integration needs to be improved.
		User information needs to be better maintained to enhance automation. For example, the backup person of users leaving the company, user information on platform which only available on platform one.	System	Suggestion	User information integration is helpful for automation.
		The system can be enhanced to include function of automatic reminding of GR.	System	Reason	Some of the outsourced purchasers may not be very familiar with in-use RPAs.
		When receiving inquiries from users, the AI tool will assign them to a specific person for resolution.	Automation	Reason	The AI-powered tool is mainly helpful to find a responsible person; manual intervention is still needed.
14	End User	I often work in a factory and rarely have time to sit in the office, so I cannot make GR right after receiving the goods. Sometimes I ask purchasers for help.	Process	Reason	The accessibility of GR impacts whether users do GR promptly or not
		Automatic GR notifications are very helpful, but they can also be annoying, because if I don't mark GR, I'll keep getting reminders and can't turn them off.	Automation/customer satisfaction	Reason	Some GRs cannot be done immediately, and flexibility is needed on the GR reminder
		I haven't made any PO, though I have worked here for two years. I just tell my line manager what I need, and he will help with the process.	Responsibility	Reason	The requisitioner and the person doing GR might be the same, but the end user might be another one.
		I do GR immediately after I receive the items, then I don't need to keep it in mind	Process	Reason	Users who take GR seriously will process the GR promptly.

		If payments aren't made on time, the supplier I usually use will suspend their services, so I make sure to process GRs as promptly as possible. But still, there could be late payments because no invoice was posted, so I asked the purchaser for a payment schedule for some important payments. The supplier requires us to download invoices from their website, and I am pretty sure I have downloaded and sent the invoices to the correct email address.	GR issues	Reason	GR has been done, but the invoice is missing. This kind of issue would delay payment and result in more human intervention.
		When the item arrived, I received an email with a link to complete the GR. I find this very helpful.	Communication/automation	Reason	The direct link to do GR is very helpful.
		I don't know 3WM. But I think that to get people to do GR, the main point is helping users understand the importance of GR.	Process	Suggestion	It might be helpful to let users know the results of doing GR.
		If we can do GR in the reception place, that would be very convenient. Then we don't need to carry all the stuff to the office to open the laptop.	System	Suggestion	The convenience of doing GR is important for users,
		I have heard of FO, but I don't know exactly how it works.	Communication	Reason	The recruiter needs help to choose
15	AP personnel	It's best to process the GR before the invoice arrives. Some POs contain many items, and if the GR isn't processed, we'll have to manually match them one by one.	Process	Suggestion	It is recommended to have GR before the invoice is posted.

	There was a case with a supplier and an end user using different units. For example, the user placed an order with a pack, but the supplier used pieces. What's more, the invoice was issued partially. It took a lot of time for the purchaser and me to figure things out, but actually, the problem could have been avoided.	Process	Suggestion	Using the same unit could avoid a mismatch.
	When the contractor just took over, I didn't know who to contact, but things have gradually improved.	Outsourcing	Reason	It would be helpful to have a consolidated list of internal and external contacts.
	I don't feel a difference after outsourcing	Outsourcing	Reason	Outsourcing doesn't change the situation with AP personnel

Appendix 9. Supplementary data summary table

Supplementary activity	Focus	Purpose	Outcome
Focused observation	The coordination between upstream and downstream purchasers	To find the root reasons for choosing the correct PO type.	The communication was transparent, but the communication about the PO type choice was not noticed.
	Outsourced purchasers' application of auto GR and auto GR reminder	To find the root reasons why they are unfamiliar with the RPAs	Training sessions have been given. Some purchasers come after training.
Follow-up Clarification	Platform retention functions	To identify the reason for the GR missing issue with the reason for retention.	Platform two supports, but platform one does not.
	The possibility of doing GR on mobile devices	To check if it is convenient to do GR.	Platform two supports, but platform one does not.