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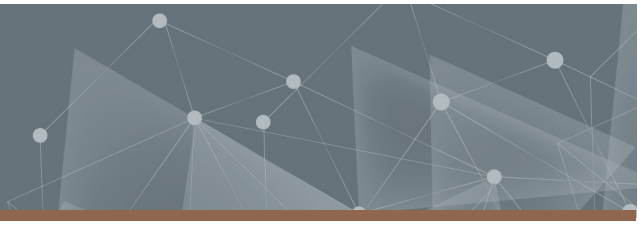

Evaluating Centralisation in Healthcare Supply Chains

A Case Study of Prerequisites and Conditions

Master's thesis in Supply Chain Management

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Abstract

Healthcare supply chains face mounting pressure to deliver high-quality patient care while managing rising costs, workforce shortages, and ageing populations. Fragmented material flows often constrain coordination, visibility, and control, and structural redesigns such as centralisation are commonly considered as a response. Their effectiveness, however, depends on organisational, informational, and governance conditions that are often underdeveloped.

This thesis evaluates how, and under what conditions, different forms of centralisation could improve healthcare supply chain performance, taking a private healthcare provider currently considering such a redesign as the empirical case. The study combines expert interviews with practitioners from comparable healthcare organisations and stakeholder interviews from the case organisation.

The study identifies six prerequisites for centralisation: strategic direction and management commitment, data foundations, IT infrastructure, scale and volume concentration, assortment standardisation and clinical involvement, and change-management capacity. These prerequisites interact sequentially rather than independently. The case organisation presents gaps across all dimensions, with the data foundation representing the most consequential deficiency. Its supply chain operates between the ad hoc and defined stages of maturity, with fragmented delivery flows, person-dependent ordering practices, limited central mandate, and compromised information visibility forming a mutually reinforcing configuration.

The findings suggest that the prior question for the case organisation is not which form of centralisation to adopt, but what preparatory work must precede the choice. Centralisation built on the current foundation is unlikely to deliver its expected benefits, as harmonisation and standardisation of the organisation must precede structural redesign. Under such conditions, centralisation is best understood not as a single structural decision but as a stage in a longer development trajectory in which organisational readiness is established before structural change is pursued.

Keywords: healthcare supply chain, healthcare logistics, supply chain maturity, supply chain governance, supply chain integration, supply chain visibility, supply chain centralisation, centralisation prerequisites, supply chain configuration

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Simon Andersson & Oliver Eliasson, Gothenburg, June 2026

List of Acronyms

Below is the list of acronyms that have been used throughout this thesis listed in alphabetical order:

3PL	Third-Party Logistics
BPO	Business Process Orientation
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
HSC	Healthcare Supply Chain
KPI	Key Performance Indicator
MRI	Magnetic Resonance Imaging
NHS	National Health Service
OTIF	On-Time In-Full
RQ	Research Question
SCC	Supply Chain Coordination
SCI	Supply Chain Integration
SCM	Supply Chain Management
SCOR	Supply Chain Operations Reference
SKU	Stock Keeping Unit
WMS	Warehouse Management System

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1
Introduction

Healthcare systems face increasing pressure to deliver high-quality patient care while simultaneously managing rising costs, workforce shortages, aging population, and ambitious sustainability targets (Hajizadeh et al., 2025; Kallestrup-Lamb et al., 2024; Landry & Philippe, 2004; Pessot & Lolli, 2026). In this context, the efficiency and reliability of supporting functions have become critical enablers of overall healthcare performance. Among these functions, logistics and material supply play a central role in ensuring that healthcare professionals have access to the right materials, at the right place, at the right time (Landry & Philippe, 2004; Volland et al., 2017).

Despite their importance, healthcare material flows are often characterised by fragmented structures and limited coordination across organisational units (de Vries & Huijsman, 2011). In many organisations, procurement and ordering activities are performed locally by individual care units, each interacting directly with multiple suppliers (de Vries & Huijsman, 2011; Landry & Philippe, 2004). While such arrangements provide flexibility and responsiveness to local needs, they also introduce challenges related to coordination, visibility, and control. These challenges may manifest in the form of duplicated efforts, inconsistent purchasing behaviour and increased administrative workload for clinical staff (Cox et al., 2005; de Vries & Huijsman, 2011; Karjalainen et al., 2008; Landry & Philippe, 2004; Rozemeijer, 2000).

Beyond the physical flow of materials, healthcare logistics systems are also shaped by informational and organisational conditions. Limited data visibility, fragmented information systems, and inconsistent data quality can restrict the ability to monitor, analyse, and manage material flows effectively (Barratt & Oke, 2007; Caridi et al., 2010; Wang & Strong, 1996; Zhou & Benton, 2007). Also, governance structures characterised by weak mandate, unclear responsibility distribution, and high levels of local autonomy may reduce compliance with central procurement strategies and limit the effectiveness of coordination mechanisms (Cox et al., 2005; Karjalainen et al., 2008; Karjalainen & van Raaij, 2011; Tassabehji & Moorhouse, 2008).

These challenges are evident in the case organisation studied in this thesis, a private healthcare provider. The current logistics structure is largely decentralised, with materials delivered directly from suppliers to individual care units. Procurement activities are distributed, and the system relies on a combination of central tools and local practices. While this structure provides flexibility, it also creates difficul-

ties in achieving transparency, coordination, and system-wide optimisation.

To address such challenges, organisations often consider structural redesigns of their supply chains, such as centralised warehousing and distribution models. These configurations have the potential to improve coordination, promote standardisation and lower inventory (Pedersen et al., 2012; Pessot & Lolli, 2026). However, research also shows that structural solutions alone are not sufficient. Their effectiveness depends on a range of organisational, technological, and informational prerequisites, including data visibility, system integration, governance mechanisms, and alignment between central and local actors (Davenport, 1998; Fawcett et al., 2007; Pessot & Lolli, 2026; Williams et al., 2013).

Achieving greater supply chain efficiency therefore represents not only a technical redesign of material flows, but also an organisational and operational transformation. Such a change affects roles and responsibilities, information systems, procurement practices, and interactions between central functions and care units. These challenges highlight the need to move beyond viewing logistics design purely as a structural choice, and instead analyse it as a system-level problem shaped by the interaction between material flows, information flows, and organisational control.

Within this context, the case organisation in this study is currently considering centralised supply chain structures as a potential redesign, motivating a closer examination of how such configurations are applied in similar healthcare contexts and under what conditions they perform effectively.

1.1 Purpose

The purpose of this study is to evaluate how, and under what conditions, different forms of centralisation could improve healthcare supply chains, taking a private healthcare provider currently considering such a redesign as the empirical case.

Research suggests that the effectiveness of such a change depends on a range of organisational, technological, and informational conditions, including data visibility, information system capabilities, governance structures, and the alignment between central and local actors. The study therefore does not assume centralisation as an inherently superior solution, but rather assesses the relevance and viability of such configurations in light of the conditions present in the case organisation and the experiences of comparable healthcare providers.

To fulfil this purpose, the study examines both the current state of the case organisation's supply chain structure and how centralised solutions are applied in comparable healthcare contexts. The synthesis of these two strands provides the basis for evaluating whether, and under what conditions, centralisation could meaningfully improve the supply chain in the case organisation.

By combining insights from supply chain theory with empirical findings, the thesis contributes to both practical decision-making and the broader understanding of how healthcare supply chains can be designed and developed under real-world constraints.

1.2 Research questions

To address and fulfil the purpose of the study, two research questions guide the work:

> **RQ1.** How are centralised supply chain solutions applied in healthcare organisations, and what are the prerequisites for such solutions?
>
> **RQ2.** How is the current healthcare supply chain structured, and what key inefficiencies and challenges can be identified in the existing supply chain structure?

1.3 Limitations

To ensure feasibility within the timeframe and scope of a master's thesis, several limitations are applied. The study focuses on inbound material flows to selected healthcare units within the case organisation and does not include outbound patient logistics or clinical process optimisation. Furthermore, pharmaceuticals subject to specialised regulatory handling are excluded from the main analysis where applicable.

The empirical investigation was conducted as a qualitative single-case study. Consequently, the findings are not statistically generalisable to all healthcare organisations, and several observations are likely to be influenced by the specific organisational context, structure, and history of the case organisation. Factors such as governance arrangements, organisational culture, system landscape, and scale may differ substantially across healthcare providers, limiting the direct transferability of specific findings and recommendations. However, the study aims for analytical rather than statistical generalisation. While the empirical manifestations may vary across contexts, the underlying relationships identified between supply chain maturity, governance, information visibility, and centralisation readiness may be relevant to other organisations facing similar challenges.

The study does not aim to develop a fully detailed operational design, such as warehouse layouts, IT system architectures, or routing algorithms. Instead, it focuses on identifying decision-relevant conditions, structural design principles, and key trade-offs that shape the performance of healthcare supply chains. In this context, structural configurations, including centralised models, are evaluated as potential responses contingent on these underlying conditions, rather than as predefined optimal solutions.

2

Theory

The following chapter presents the theoretical foundation of the study. It begins by outlining the structural and contextual characteristics of healthcare supply chains. The chapter then presents dimensions that shape supply chain performance, including integration and coordination, information visibility and system support, governance and control structures, and supply chain maturity. Together, these dimensions describe the organisational and informational conditions that shape how supply chains function in practice. The chapter then turns to change management, which provides the lens for understanding how structural redesigns are enacted within organisations, with particular attention to healthcare-specific transformation conditions. Finally, the chapter examines structural design alternatives, particularly centralised and decentralised logistics configurations.

2.1 Healthcare supply chains

This section introduces the characteristics that affect healthcare supply chains to give a greater understanding of the specific challenges related to healthcare. Factors such as demand uncertainty, service criticality, product variation and regulatory requirements.

2.1.1 Healthcare supply chain characteristics

Healthcare supply chains (HSC) differ fundamentally from industrial supply chains due to the nature of the services provided and the organisational context in which they operate. de Vries and Huijsman (2011) describe hospital logistics systems as closely integrated with care delivery processes and involving multiple organisational and professional actors, which contributes to high system complexity compared to traditional product-based supply chains.

A defining characteristic of HSC is their strong dependence on coordination and integration across organisational boundaries. Healthcare delivery typically involves many stakeholders, including hospitals, suppliers, distributors, and clinical units, which creates interface problems and coordination challenges (de Vries & Huijsman, 2011). These coordination challenges are further reinforced by the need to integrate information flows, planning processes, and operational routines in order to improve performance and avoid fragmented decision-making.

Healthcare logistics activities are also highly resource intensive. Landry and Philippe (2004) estimate that logistics-related activities account for up to 46% of a hospital's total operating budget, including both supplies and labour. Volland et al. (2017), as well as Pedersen et al. (2012) claim that around 30% of hospital costs are linked to logistic activities. A substantial share of this cost is associated with internal distribution and inventory handling, indicating that material flow management is a major operational task within healthcare organisations. Another characteristic is the operational burden placed on clinical staff. Landry and Philippe (2004) report that nursing staff spend approximately 10% of their working time performing logistics-related tasks such as ordering, handling, and searching for supplies, rather than providing direct patient care. This shows how shortcomings in logistics design directly affect clinical productivity and service quality.

HSC are further shaped by external pressures related to demographic and societal trends. Landry and Philippe (2004) and Pessot and Lolli (2026) note that healthcare systems face growing demand due to aging populations, the emergence of new treatments and technologies, and shortages of healthcare professionals. Similarly, both Hajizadeh et al. (2025) and Kallestrup-Lamb et al. (2024) claim that rapidly aging populations will lead to complex public health challenges such as higher costs and difficulties in providing care to everyone. Similarly, Pessot & Lolli (2026) explain how healthcare systems face pressures to maintain high service levels while limiting costs. These pressures increase the importance of efficient logistics structures to ensure material availability while controlling costs.

HSC are also characterised by organisational and cultural constraints. de Vries and Huijsman (2011) highlight that supply chain integration (SCI) in healthcare is often hindered by factors such as lack of strong leadership authority and power relationships between stakeholders. These institutional conditions limit the direct transfer of industrial supply chain practices to healthcare and require adaptations to the healthcare context.

2.1.2 Demand uncertainty

Demand in HSC is characterised by variability and limited predictability due to the nature of patient care and treatment processes. de Vries and Huijsman (2011) describe healthcare services as being subject to fluctuating patient inflows and treatment requirements, which makes planning and forecasting of material demand difficult. The authors further state how, unlike industrial production, where demand can often be smoothed or forecasted based on stable consumption patterns, healthcare demand is driven by medical needs that vary across patients and over time (de Vries & Huijsman, 2011).

This variability directly influences the consumption of medical supplies. Lapierre and Ruiz (2007) show that hospital supply systems must manage irregular consumption patterns and that unusual demand may arise due to changes in medical practices or temporary surges in care needs. They further explain that safety stock

levels in hospital supply systems are determined based on observed variance in daily demand at care units, reflecting the need to buffer against fluctuations in material usage (Lapierre & Ruiz, 2007).

2.1.3 Service criticality

The availability of medical supplies is critical for healthcare operations as material shortages directly affect clinical activities and patient care (Rego & Sousa, 2009). Landry and Beaulieu (2001) argue that logistics in healthcare should be understood as a service function rather than solely a cost function, as its primary role is to improve the productivity of clinical professionals, mainly by ensuring continuous availability of supplies needed for treatment. Similarly, Landry & Philippe (2004) show that a significant share of hospital resources is tied to logistics activities and that inefficiencies in supply processes reduce the time available for patient care.

Böhme et al. (2016) provide further evidence of the critical role of supply availability by showing that stock-outs generate disruptions for medical personnel, who must spend time performing manual stock-takes or and engaging in "unofficial borrowing" between medical care units to compensate for missing supplies, which also increases the risk of a medical mishap.

Patel et al. (2023) support this view by highlighting how failures in material supply can compromise patient safety. This view is also supported by Salsabila et al. (2024), who highlights the importance of healthcare logistics for improving operational efficiency and patient service quality. These findings collectively show how HSC operate under conditions of high service criticality, where the primary performance objective is to ensure uninterrupted access to materials required for patient treatment.

2.1.4 Product variety and heterogeneity

Hospital supply chains are characterised by a high degree of product variety due to the broad range of materials required to support patient care (Rego & Sousa, 2009). Hospital logistics encompasses numerous categories of physical goods, including pharmaceuticals, medical consumables, sterile items, food, laundry, laboratory samples, and waste (Volland et al., 2017). These items differ substantially in terms of storage conditions, handling requirements, shelf life, and criticality for patient treatment. As a result, hospital supply chains must manage heterogeneous material flows rather than standardised product categories. The diversity of products necessitates differentiated inventory management policies and classification systems based on factors such as usage rate, supply characteristics, and treatment criticality, reflecting the complexity associated with managing a wide range of item types in hospital environments (Volland et al., 2017).

2.1.5 Regulatory requirements

HSC operates within a strict regulatory environment that constrains how logistics and distribution activities are designed and managed (Bhakoo & Choi, 2013; Pessot & Lolli, 2026; Rego & Sousa, 2009). Healthcare organisations are required to meet a variety of regulatory requirements aimed at ensuring service quality and patient safety, and these frameworks influence how logistical activities are structured and executed (Dobrzykowski, 2019; Essoussi, 2016; Pessot & Lolli, 2026; World Health Organization, n.d.).

In pharmaceutical logistics, regulatory mandates increasingly demand end-to-end traceability of products to ensure consumer safety and compliance, requiring supply chain actors to implement systems that can track quality and safety information throughout the supply chain lifecycle (Lovis, 2008; Pessot & Lolli, 2026)

More broadly, healthcare policies at national and international levels influence distribution practices, inventory management, temperature and handling requirements, and even demand forecasting and stockpile regulation, all of which contribute to operational constraints in healthcare logistics (European Commission, 2013).

2.2 Supply chain integration and coordination

Supply chain integration and coordination are central concepts in understanding how organisations manage interdependent activities. This section first defines the concepts of integration and coordination, before examining their performance implications, the mechanisms through which they are achieved, and the relational and structural conditions that shape their effectiveness.

2.2.1 Defining supply chain integration and coordination

Supply chain integration (SCI) and supply chain coordination (SCC) are closely related but conceptually distinct concepts in the supply chain management (SCM) literature. Coordination refers to the alignment and synchronisation of interdependent activities to achieve goals and create value, by avoiding sub-optimisation and enabling system-wide performance (Malone, 1987; Malone & Crowston, 1994; Romano, 2003; Simatupang, 2002).

SCI refers to the degree to which a firm links its internal processes with those of its upstream suppliers and downstream customers to manage flows of products, information and finances as a unified system (Frohlich & Westbrook, 2001; Power, 2005). Building on this, Leuschner et al. (2013) defined SCI as "the scope and strength of linkages in supply chain processes across firms". Rather than operating as isolated entities, integrated supply chains function as interconnected systems through improved communication, partnerships and cooperation (Power, 2005; Kumar et al., 2017).

2.2.2 Performance implications of integration and coordination

The importance of coordination and integration lies in their impact on supply chain performance. Prior research demonstrates that higher levels of integration and coordination translate into superior performance. Prajogo and Olhager (2012) show that logistics integration has a direct effect on operational performance, while Leuschner et al. (2013) demonstrate a positive correlation between SCI and firm performance. Similarly, both Kumar et al. (2017) and Yun et al. (2020) link integration to improved production flexibility, inventory turnover, order-fulfilment rate, total logistics costs and operational performance. Simatupang et al. (2002) note that coordination contributes to reduced inventory costs, shorter lead times, lower transportation costs and higher customer service. Conversely, when supply chain actors operate independently, inefficiencies arise in the form of excess inventory, duplicated efforts, and increased costs (Nasiri et al., 2024). Integration therefore enables organisations to move from fragmented decision-making towards system-wide optimisation.

2.2.3 Mechanisms for supply chain coordination

An important aspect of SCC is the set of mechanisms through which it is achieved. One of the most widely recognised mechanisms is information sharing. The exchange of accurate and timely information about demand, inventory and operational data is what allows partners to act on the same picture of reality (Arshinder et al., 2008; Simatupang et al., 2002). Information sharing facilitates alignment by enabling a common understanding of demand, operational conditions, and performance objectives (Li and Lee, 2025). Without this shared visibility, even well-intentioned local decisions tend to amplify variability through the chain, producing higher inventory levels, longer lead times and lower service performance, as local optimisation sacrifices the total profit of the supply chain (Simatupang et al., 2002). Information sharing therefore functions less as a stand-alone activity, and more as the foundation on which other mechanisms operate. Technology enablement is also a recurring mechanism. Prajogo and Olhager (2012) identify information technology and information sharing as fundamentals of integration, while Power (2005) describes shared technology as part of the basis on which integration rests. Related to this, Nasiri et al. (2024) note that information technology, ranging from electronic data interchange (EDI) to enterprise resource planning (ERP) systems, is what makes information sharing scalable across organisational boundaries (Prajogo & Olhager, 2012; Power, 2005; Nasiri et al., 2024).

A second class of mechanisms concerns the alignment of decisions and incentives. Activities have to be planned and rewarded in ways that discourage local optimisation at the expense of system-wide performance (Simatupang et al., 2002). This is typically done through joint planning, joint forecasting and joint decision-making, all practices in which decisions are made collectively so that choices reflect the needs of the chain as a whole (Arshinder et al., 2008; Romano, 2003).

2.2.4 Relational enablers of coordination

Alongside these structural mechanisms, relational factors play an important role in enabling coordination. Trust and collaboration lowers the perceived risk of sharing sensitive information, encourages open communication and supports joint problem-solving (Kocoglu et al., 2021). Where trust is present, collaborative advantage and supply chain agility act as further mediators, suggesting that the relational and capability-based aspects of coordination are mutually reinforcing rather than separate.

2.3 Visibility, data quality and information systems

The integration and coordination mechanisms discussed earlier in this chapter depend on a common precondition: an information infrastructure that allows actors across the supply chain to access, share and act on the same data. In this sense, supply chain visibility and information systems form an important foundation for both operational coordination and strategic supply chain control.

2.3.1 Defining visibility

Visibility can be understood as the extent to which actors in the supply chain have access to information that they consider key or useful to their operations (Barratt & Oke, 2007). The authors distinguish visibility from information sharing, arguing that information sharing is an activity, while visibility is a potential outcome of that activity. Caridi et al. (2010) operationalise supply chain visibility as a measurable property of information exchange between supply chain partners, which considers both the quantity and quality of information shared between actors. Similarly, Somapa et al. (2018) argue that supply chain visibility can be understood through three core dimensions: the accessibility, quality, and usefulness of information.

2.3.2 Why visibility matters

The most compelling argument for visibility is what happens when it is absent. Lee et al. (1997), in their article on the bull-whip effect, show that limited downstream demand information causes upstream partners to amplify variability through over-ordering, longer lead times and inventory build-ups, demonstrating how quickly fragmented information degrades supply chain performance.

Conversely, improved visibility has been associated with several operational benefits. Caridi et al. (2014) demonstrate that increased visibility translates into measurable improvements across operational metrics such as reduced lead times, lower inventory and better service levels. Baah et al. (2022) extend this by showing that visibility has significant positive effects not only on supply chain performance directly, but also on partner collaboration and supply chain agility. Ma and Kang (2025) similarly

find that supply chain visibility significantly improves operational decision-making in a study of Chinese healthcare supply chains.

2.3.3 Why data quality matters

The performance impact of visibility depends not on the volume of information shared but on whether that information is fit for purpose. Barratt and Oke (2007) emphasise that visibility should not be equated with information sharing alone. For shared information to create visibility, it must be accurate, trusted, timely, useful and available in a format that can be acted upon.

Wang and Strong (1996) define data quality as a multidimensional construct encompassing dimensions such as accuracy, completeness, timeliness, consistency and relevance. Zhou and Benton (2007) claim that supply chain practice improves when the shared information is of high quality, while Petersen et al. (2005) extend this argument to collaborative planning, claiming that joint planning effectiveness depends on the level of trust and the quality of the information exchanged between partners.

Information quality therefore becomes the bridge between data availability and decision-support capability. Simply increasing the volume of data does not automatically improve decision-making, since supply chain practice improves when information sharing is effective in its quality dimension as well as its content and supporting technology (Zhou & Benton, 2007). Where quality is lacking, joint planning effectiveness suffers, since collaborative planning depends on the trust and quality of the information shared between partners (Petersen et al., 2005).

2.3.4 Information systems as enablers of visibility

If visibility is the capability, information systems are what make it achievable across organisations. Davenport (1998) explains that enterprise systems are designed to integrate information across functions by replacing fragmented systems with a common database and standardised processes. Related to this, Panko (1998) has documented that informal or end-user-managed tools, most prominently spreadsheets, are associated with substantial error rates with implications for any decision process that depends on them. Gunasekaran and Ngai (2004) describe information technology as a necessary condition for effective SCI, arguing that modern supply chains require integrated information systems to coordinate activities both within and across organisational boundaries.

Although information systems can support visibility, Goswami et al. (2013) highlight that supply chain information systems differ in their ability to do so. The authors claim that relevant, timely and accurate information is required for actors to respond to changing conditions, but poor, delayed or incomplete information remains a common problem across supply networks. Davenport (1998) also warns that such systems impose their own logic on organisations. If the system does not fit the

business context, or if implementation does not consider organisational needs, the intended integration may instead create rigidity, user resistance, or misalignment between the system and actual work practices. Akkermans et al. (2003) similarly find that ERP systems are less effective at supporting inter-firm coordination.

2.3.5 Organisational conditions for visibility

It is important to note that the existence of an information system does not, by itself, produce visibility. Williams et al. (2013) argue that visibility does not automatically lead to improved performance. Instead, its value depends on the extent to which the organisation is internally integrated and able to interpret and act on the information available. Organisations may have access to large amounts of data while still lacking valuable information for decision-making.

Related to this, Fawcett et al. (2007) argue that visibility depends jointly on connectivity (the technical ability to exchange information) and willingness (the organisational disposition to share it), and that the absence of either undermines the value of any information system, however sophisticated. Kalaiarasan et al. (2022) extend this view by showing that visibility is shaped not only by technology but also by organisational, relational and process-related factors. The effects of visibility depend on whether barriers such as poor integration, limited data quality and lack of collaboration are addressed.

2.4 Governance and control

Integration, coordination and visibility mechanisms all presuppose that the actors involved are willing and able to align their decisions with the objectives of the wider supply chain. In practice, however, that alignment cannot be assumed, as each actor has its own goals, incentives and discretion. Governance and control mechanisms address this problem directly, by specifying how authority, monitoring and enforcement are distributed across the supply chain.

2.4.1 Defining supply chain governance

Supply chain governance refers to the set of structures and mechanisms through which activities across organisational units and actors are coordinated and controlled (Bonatto et al., 2022; Pilbeam et al., 2012). Governance determines how decisions are made and authority distributed, how interdependent activities are coordinated, and how local behaviour is aligned with the wider supply chain's objectives across distributed organisational settings (Pilbeam et al., 2012; van Veen-Dirks & Verdaasdonk, 2009).

2.4.2 Centralised and decentralised control structures

A central question in supply chain governance is where decision-making authority resides: how much should be centralised at the corporate level, and how much should

be left to local units? Gereffi et al. (2005) describe several governance structures ranging from loosely coordinated market-based relationships to highly controlled hierarchical systems. These structures differ in terms of how explicitly activities are defined and how strongly behaviour is monitored.

Rozemeijer (2000) argues that decentralised structures preserve responsiveness and local knowledge but risk losing the synergy benefits of consolidated demand, while fully centralised models capture synergy at the cost of local fit. Arnold (1999) similarly identifies the degree of centralisation as a structural choice with measurable consequences for sourcing performance. Karjalainen (2011) argues that centralisation can yield substantial cost savings in the public sector, while Glock and Hochrein (2011) claim that different organisational designs perform better when their structure is properly aligned with the conditions of the environment. This implies that performance depends on the fit between structure and context rather than on any single optimal form.

A response to this trade-off is the hybrid purchasing organisation. Trautmann et al. (2009) describe hybrid structures as integrated network forms that combine corporate-level coordination of strategic categories with decentralised execution at the business-unit level, while Hartmann et al. (2008) show that the effectiveness of such structures depends on the fit between the control mechanisms applied and the firm's specific organisational context.

2.4.3 Mechanisms of control

Mechanisms of control are the means by which governance is enacted. They determine how organisational objectives are translated into operational practices and how compliance with central policies is achieved. Ouchi (1979) distinguishes between three primary forms of control: bureaucratic, market and clan. Bureaucratic control is based on formal rules, procedures, and systems, where behaviour is regulated through standardised processes and administrative structures. Market control relies on economic incentives and performance outcomes, aligning behaviour through cost responsibility and financial evaluation. Clan control is based on shared norms, values, and organisational culture, guiding behaviour through informal expectations rather than formal enforcement. Eisenhardt (1985) extends this view by distinguishing outcome control, which monitors the results of behaviour, from behaviour control, which prescribes the behaviour itself, and shows that the choice between them depends on whether outcomes can be measured and whether the underlying task is well understood.

Pilbeam et al. (2012) distinguish formal governance instruments, such as contracts and pledges, from informal ones, like norms and social mechanisms, while Cao and Lumineau (2015) develop a similar distinction between contractual governance, which relies on formal structure and third party enforcement, and relational governance, which relies on informal structure and self-enforcement.

In supply chain contexts, bureaucratic control is enacted primarily through procurement policies, framework agreements and standardised processes intended to ensure consistent behaviour across organisational units (Kulp et al., 2006; Pilbeam et al., 2012). It is also increasingly embedded directly in information systems (Kulp et al., 2006). In turn, market control is enacted through mechanisms such as competitive sourcing and performance-based supplier evaluation (Ouchi, 1979). Clan control corresponds closely to what Cao and Lumineau (2015) call relational governance, and operates through trust and relational norms rather than through formal authority. Pilbeam et al. (2012) note that informal instruments are particularly common in established relationships, where prior interaction has allowed trust and shared norms to develop.

2.4.4 Mandate, enforcement, and compliance

Tassabehji and Moorhouse (2008) argue that the effectiveness of a procurement function depends on its strategic standing and the level of internal organisational support for the role. Where authority is weak, formal procurement processes may exist but be widely ignored. This phenomenon is called maverick buying: purchasing activity that takes place outside agreed contracts or by people without procurement authority (Karjalainen et al., 2008). Karjalainen et al. (2008) identify a range of contributing factors to this phenomenon, while Karjalainen and van Raaij (2011) link different forms of maverick buying, driven by attempts to obtain better terms and conditions, preference for an existing supplier relationship, and unawareness of frame agreements, to specific individual, task-related and unit-related contingencies.

Cox et al. (2005), in a study of the UK National Health Service, document a number of demand management problems, including fragmentation of spend, interdepartmental power, and maverick buying itself, that arise when procurement is dispersed across internal clients with their own preferences, illustrating how weak procurement mandate combined with strong local autonomy produces predictable dysfunctions. Kulp et al. (2006) show how clear policies, monitored compliance and supporting e-procurement infrastructure can be deployed together to produce enforceable mandate.

2.4.5 Autonomy and decentralised decision-making

A complementary stream considers the value and consequences of autonomy in decentralised decision-making. Decentralisation has advantages worth preserving, namely the effectiveness and efficiency of decentralised purchasing and the local autonomy of business units (Rozemeijer, 2000). However, autonomy is not unconditionally productive. Decentralised decision-making can systematically undermine compliance with corporate-level agreements when local actors are unaware of them, prefer existing supplier relationships, or attempt to obtain better terms and conditions outside the frame agreement (Karjalainen & van Raaij, 2011).

The difficulty of governance also increases with the complexity and decentralisation

of the supply chain. van Veen-Dirks and Verdaasdonk (2009) demonstrate that local management control systems within supply chain partners can call for behaviour that is incongruent with the broader supply chain objective, since local control systems and supply chain governance are intertwined and must be designed together. Autonomy and compliance are therefore best understood not as opposites but as design parameters that must be balanced against each other in any governance structure.

2.5 Supply chain maturity

Integration, visibility, governance, and information-system capabilities do not emerge independently, but tend to develop progressively over time as organisations formalise and coordinate their supply chain processes. The concept of supply chain maturity provides a framework for understanding this progression and for analysing how organisations evolve from fragmented and locally driven structures towards more integrated and coordinated supply chain configurations.

2.5.1 Conceptualising supply chain maturity

In supply chain contexts, maturity refers to the extent to which supply chain processes are explicitly defined, managed, measured and controlled, and to the degree of consistency across the organisation that this produces (Lockamy & McCormack, 2004a). It is commonly conceptualised as a developmental progression in which organisations evolve from fragmented and functionally oriented structures towards more coordinated and integrated configurations (Lockamy & McCormack, 2004a; McCormack et al., 2008). This development is reflected in increasing levels of process standardisation, predictability and cross-functional alignment (Lockamy & McCormack, 2004a) and can be understood across multiple organisational dimensions including strategic alignment, governance, method, information technology, people and culture (de Bruin & Rosemann, 2005).

2.5.2 Maturity as a progression of supply chain development

The supply chain literature characterises maturity as a progression through identifiable stages of development. The supply chain maturity model proposed by Lockamy and McCormack (2004a) builds on the concept of Business Process Orientation (BPO), which frames organisational development in terms of the maturity of cross-functional processes, and is also closely aligned with the Supply Chain Operations Reference (SCOR) framework. In this model, supply chain development is understood as a progression through five stages: ad hoc, defined, linked, integrated and extended. These stages reflect increasing levels of coordination, standardisation and inter-organisational integration, as illustrated in Figure 1.

At the ad hoc stage, supply chain processes are unstructured and ill-defined. Performance depends on individual effort and ad-hoc decisions, there is little visibility

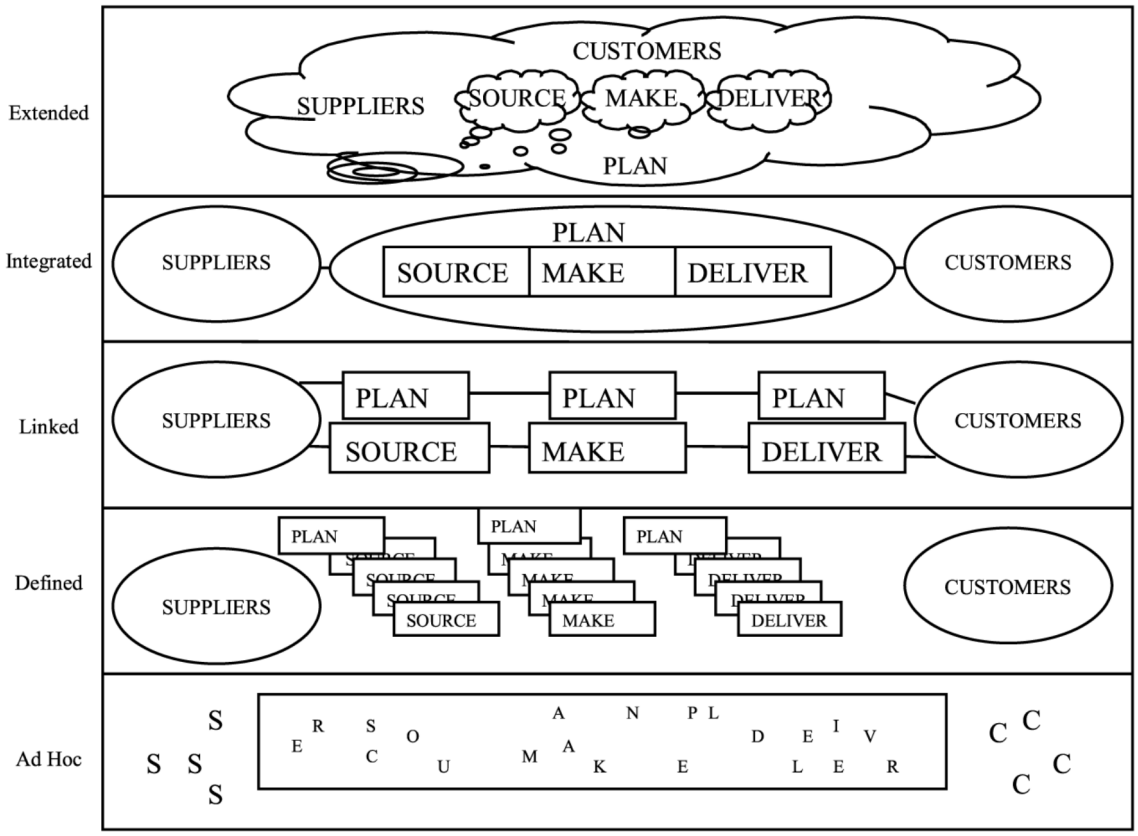

Figure 1: The supply chain management maturity model (Lockamy & McCormack, 2004a)

across functions or partners, and operations rely heavily on manual processes and local workarounds. As a result, performance is often inconsistent and dependent on individual actors rather than organisational systems.

At the defined stage, basic supply chain processes are documented and consistently applied within the firm, but they are still largely managed within functional silos. Coordination across units remains limited, and information sharing is restricted, resulting in only incremental improvements in performance and predictability.

The linked stage represents strategic SCM, in which breakthrough cooperation begins to emerge across functions and with selected key partners, and information sharing becomes more systematic and starts to support coordinated decisions. Although integration is still partial, this stage represents a shift from internal optimisation towards broader SCC.

At the integrated stage, the firm has implemented advanced cooperation, collaborative planning and shared performance measurement with major suppliers and customers, and processes are aligned across organisational boundaries.

At the extended stage, processes are seamlessly integrated across multiple firms in the value chain, with multi-firm collaboration on planning, execution and per-

formance management. At this stage, the supply chain operates as a coordinated network, characterised by shared goals, high levels of transparency, and collaborative decision-making across organisations.

The higher levels of supply chain maturity are also associated with measurable performance gains. McCormack et al. (2008) demonstrate a strong relationship between maturity and supply chain performance, a finding that has been replicated in different contexts, including small- and medium-sized enterprises (Söderberg & Bengtsson, 2010) and in more recent large-scale studies (Pejić Bach et al., 2023).

2.5.3 Maturity and information integration

The progression towards higher levels of supply chain maturity is closely linked to the development of information integration capabilities. Lockamy and McCormack (2004b) identify information sharing and integrated planning among the key SCOR planning practices that drive supply chain performance, and these same practices are characteristic of higher maturity stages in their maturity model. More mature supply chains are characterised by shared planning information, real-time visibility of inventory and orders, and aligned performance measurement across supply chain partners.

As discussed earlier, supply chain visibility depends on the availability, accessibility and quality of information. The development of more integrated and coordinated supply chain processes is therefore closely linked to these conditions, as higher levels of maturity are associated with increased reliance on shared information and system-supported decision-making across organisational boundaries.

2.5.4 Maturity and governance structures

Maturity also depends on the governance structures through which supply chain activities are controlled and coordinated. Schiele (2007) finds that purchasing-management maturity is associated with cost-reduction performance, and introduces the concept of purchasing absorptive capacity, which refers to the firm's ability to absorb and implement best-practice methods and explains why low-maturity organisations may fail to benefit from the introduction of best practices.

Governance structures determine how authority is allocated, how interdependent activities are coordinated, and how compliance with supply chain objectives is achieved. Progression towards higher maturity stages therefore requires governance mechanisms that support coordination across functions and organisational boundaries, including clear procurement mandates (Tassabehji & Moorhouse, 2008), aligned incentives across local control systems (van Veen-Dirks & Verdaasdonk, 2009) and the ability to enforce standardised processes characteristic of higher maturity stages (Lockamy & McCormack, 2004a). Where governance is weak, the maverick-buying literature suggests that local actors will systematically deviate from corporate-level agreements (Karjalainen & van Raaij, 2011), which makes progres-

sion beyond the defined stage of maturity difficult to sustain.

2.6 Change management

The implementation of supply chain redesigns depends not only on the choice of target configuration but also on how change is enacted within the organisation. This is particularly relevant in healthcare contexts, where transformation initiatives have historically achieved limited success. Braithwaite et al. (2020) describe an "implementation problem" in healthcare, with a substantial proportion of change initiatives failing to deliver their intended outcomes. Understanding the conditions under which change can be implemented effectively is therefore essential to evaluating whether structural redesign can deliver its intended benefits. This section reviews relevant change-management literature, with particular attention to its application in healthcare settings.

2.6.1 Models of organisational change

Organisational-change scholarship has produced several established frameworks for guiding transformation initiatives. Lewin's (1947) three-stage model conceptualises change as a process of unfreezing, moving and refreezing, in which existing patterns are first destabilised before new ways of working are introduced and ultimately institutionalised as a new status quo. Kotter (1995) developed an eight-step model centred on creating a sense of urgency, forming a guiding coalition, developing a vision and strategy, communicating the vision, removing barriers to action, generating short-term wins, consolidating gains, and anchoring the change in organisational culture. Kotter's model also emphasises the importance of leadership engagement throughout the change process and the need to build momentum through visible early successes.

A complementary framework is provided by Rogers' (2003) Diffusion of Innovation theory, which describes how change spreads through an organisation. Rogers identifies five stages through which individuals progress in adopting an innovation: knowledge, persuasion, decision, implementation, and confirmation. Furthermore, he categorises adopters by their disposition toward change: innovators, early adopters, early majority, late majority, and laggards. These models are collectively associated with what the broader literature characterises as a planned or diagnostic approach to change (Burnes, 2004; Bushe & Marshak, 2009).

2.6.2 Diagnostic and dialogic change practices

The diagnostic approach has been contrasted with a dialogic approach, which prioritises collaborative emergence over linear planning (Bushe & Marshak, 2009). While the diagnostic method is characterised by top-down execution, where leaders define objectives and direct their implementation, the dialogic approach prioritises collaborative emergence and stakeholder engagement, favoring bottom-up solution

development and heterarchical cooperation.

In a review of 292 transformation cases across ten studies, Hastings (2025) observed that dialogic strategies result in much higher success rates compared to purely diagnostic ones. However, the review also finds that dialogic and diagnostic approaches are not mutually exclusive. Co-application, typically by establishing a diagnostic structure and then iterating dialogically, was associated with the highest success rates.

Hastings (2025) further identifies two leadership capabilities consistently associated with successful transformations. The first is enabling follower contributions. Leaders who incorporate input from stakeholders and adapt plans in response to it, rather than enforcing pre-defined plans, are more likely to deliver successful outcomes. The second is framing change as learning. Successful transformations are characterised by leaders who treat change as a process of learning across the organisation rather than an exercise in reinforcing existing assumptions.

2.6.3 Structural and behavioural dimensions of change

Structural change refers to the formal redesign of organisational configurations, governance arrangements, and information systems, while behavioural change concerns the corresponding shifts in how organisational members act and interact in practice (Aplin, 1978; Beer & Nohria, 2000). The two often diverge in practice as organisations may implement formal redesigns that fail to produce the behavioural alignment they were intended to support (Akkermans et al., 2003; Davenport, 1998). Thus, structural redesign alone is insufficient for sustained transformation (Beer & Nohria, 2000). Behavioural alignment is a separate transformation task that must be planned and managed in its own right, rather than an automatic consequence of structural redesign.

The sequencing of structural and behavioural elements is also significant. Frohlich and Westbrook (2001) argue that internal integration across organisational functions forms the foundation for external integration with partners. Applied to transformation more broadly, the sequencing principle suggests that foundational conditions must be in place before more advanced structural change can be sustained.

2.6.4 Implementation approaches and stakeholder engagement

The literature highlights a fundamental trade-off in the pace of transformation. Faster, more continuous change can enhance adaptability but increases the risk of overload, resistance, and implementation failure, whereas more gradual, spaced change allows for learning and stabilisation but extends the time required to realise benefits (Klarner, 2010). Burnes (2004) frames the choice as context-dependent rather than universally prescriptive, with the appropriate approach depending on organisational and situational factors.

Stakeholder engagement is consistently identified as a critical success factor across both approaches. Drawing on Rogers' adopter categories, change leaders are typically advised to engage innovators and early adopters first, referring to those who are receptive to change and can serve as visible advocates within their units, before extending the change to the early majority and, eventually, to late adopters and laggards (Barrow & Annamaraju, 2022; Rogers, 2003). Hastings (2025) similarly identifies engagement of stakeholders as a leadership capability associated with success, particularly where the representation of different stakeholder groups is balanced.

2.6.5 Healthcare-specific transformation conditions

Healthcare presents specific conditions that shape how change-management principles apply in practice. Kroezen et al. (2022) apply a framework for understanding skill-mix innovation in healthcare settings, which can be applied more broadly to change management in healthcare. In the study, the authors organise influences into five categories: characteristics of the intervention, institutional factors, organisational factors, individual factors, and process factors. Across these categories, the authors identify recurring barriers that are particularly common in healthcare contexts, including lack of time and financial resources, unclear roles and responsibilities, professional territorialism, divergent models of care, and inadequate information transfer. The corresponding facilitators are often the mirror opposite: clear definitions of roles, strong leadership support, good communication, regular meetings, shared organisational goals, and information systems that support collaboration.

2.7 Centralised and decentralised warehousing

While Section 2.4 examined centralisation as a question of decision authority and governance structure, this section addresses centralisation in the distinct sense of physical configuration. The configuration of warehousing and distribution systems constitutes a fundamental strategic decision in SCM (Christopher, 2005), as it directly affects inventory levels, transportation costs, service performance, and risk exposure (Baker, 2007; Das & Tyagi, 1997; Pedersen et al., 2012; Schmitt et al., 2015; Pessot & Lolli, 2026).

A central design question concerns whether inventory and distribution activities should be centralised into one or a few locations or decentralised across multiple local or regional facilities (Pedersen et al., 2012; Pessot & Lolli, 2026; Simões et al., 2018). Pessot & Lolli (2026) emphasises that neither configuration is universally superior. Instead, centralisation and decentralisation represent alternative structural responses to competing performance objectives, with suitability depending on different contextual factors. The two structural configurations are conceptually illustrated in Figure 2.

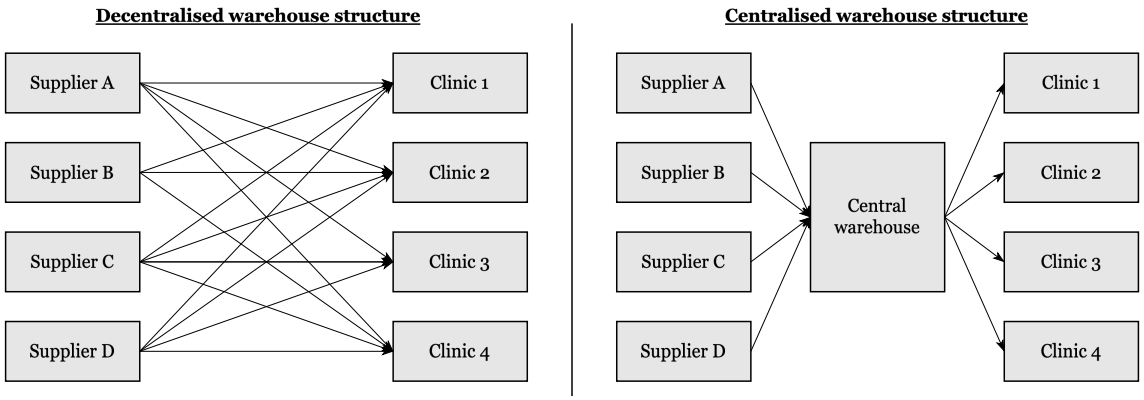

Figure 2: Conceptual illustration of centralised and decentralised warehousing structures.

2.7.1 Centralised warehousing

Centralised warehousing refers to a logistics structure in which inventory is consolidated into a single warehouse or a limited number of hubs that serve multiple demand locations (Pessot & Lolli, 2026; Lee & Jeong, 2009; Schmitt et al., 2015).

One of the primary arguments for centralisation is the potential to reduce total inventory levels through demand aggregation (Abrahamsson, 1993; Chen & Lin, 1989; Croxton & Zinn, 2005; Schmitt et al., 2015). By pooling demand from several locations, the relative variability of demand can be reduced through aggregation effects, resulting in lower safety stock requirements and reduced capital tied up in inventory (Chopra & Meindl, 2016). This effect is often explained through the concept of risk pooling, where centralised inventory lowers expected costs by combining demand uncertainty across multiple locations (Eppen, 1979; Schmitt et al., 2015).

Centralised warehousing can enhance purchasing power and supplier coordination. Consolidated order volumes enable organisations to negotiate more favorable purchasing terms, reduce supplier servicing costs and streamline the supplier base (Abrahamsson, 1993; Das & Tyagi, 1997; Pedersen et al., 2012; Simões et al., 2018). Centralisation can also improve master data quality, standardisation of procedures, and quality control when supported by appropriate governance and information systems (Pedersen et al., 2012).

However, centralisation also introduces risks and drawbacks. Concentrating inventory in a single facility increases exposure to supply disruptions, labour shortages, natural disasters or system failures (Das & Tyagi, 1997; Simões et al., 2018). Although risk pooling reduces expected inventory costs, it does not reduce cost variance under supply disruptions. Schmitt et al. (2015) show that centralised systems may exhibit higher cost variability when disruptions occur, as failures affect all downstream locations simultaneously.

Furthermore, centralisation may increase outbound transportation distances and po-

tentially reduce responsiveness to geographically dispersed demand (Baaijens, 2025; Das & Tyagi, 1997; Pessot & Lolli, 2026). Thus, while centralisation can improve efficiency through scale and coordination, it may reduce flexibility and increase systemic vulnerability.

2.7.2 Decentralised warehousing

Decentralised warehousing involves distributing inventory and logistics activities across multiple local or regional facilities, often located close to points of consumption (Pessot & Lolli, 2026; Schmitt et al., 2015). Advantages of decentralisation include improved responsiveness and shorter lead times, as reduced distances between warehouses and customers enable faster deliveries and improved adaptability to local demand fluctuations (Christopher, 2005; Baaijens, 2025; Pessot & Lolli, 2026; Simões et al., 2018).

From a risk perspective, decentralisation introduces a diversification effect (Schmitt et al., 2015). By spreading inventory across several locations, organisations reduce dependence on a single facility and thereby limit the impact of local disruptions (Das & Tyagi, 1997). Schmitt et al. (2015) demonstrate that decentralised systems may exhibit lower cost variance under supply disruptions compared to centralised systems, particularly when disruptions are frequent or severe.

Despite these advantages, decentralised warehousing is typically associated with higher aggregate inventory levels as safety stock must be maintained at multiple locations which in turn increases capital binding and raises risks of obsolescence and deterioration (Christopher, 2005; Pessot & Lolli, 2026). Furthermore, decentralisation can complicate standardisation, coordination, and data management, as responsibilities are distributed across multiple sites (Pedersen et al., 2012).

Operational complexity and administrative burden also increase as the number of warehouses grows, requiring additional staffing coordination and system integration (Pedersen et al., 2012; Pessot & Lolli, 2026). Consequently, decentralised structures may result in higher fixed and operating costs if not carefully managed (Gerchak & Gupta, 1991).

2.7.3 Centralisation & decentralisation: Trade-offs

Centralised and decentralised warehousing involves a set of trade-offs rather than a universally optimal solution. Centralisation and decentralisation represent alternative structures that prioritise different performance objectives, including cost efficiency, responsiveness, resilience, and governance. (Pedersen et al., 2012; Pessot & Lolli, 2026). As a result, the suitability of each configuration is highly dependent on contextual conditions such as demand characteristics, network structure, technological maturity, and governance capabilities.

To synthesise these trade-offs, Table 1 summarises the principal advantages and dis-

advantages of centralised and decentralised warehousing identified in the literature. Rather than prescribing a single optimal configuration, the trade-offs provide a basis for evaluating logistics design choices in relation to contextual conditions and organisational capabilities.

As shown in Table 1, one of the central trade-offs concerns inventory efficiency versus responsiveness. Centralised configurations benefit from risk pooling and demand aggregation, reducing safety stock and capital binding, as well as leveraging the use of economies of scale (Abrahamsson, 1993; Chen & Lin, 1989; Croxton & Zinn, 2005; Schmitt et al., 2015). In contrast, decentralised configurations prioritise proximity to demand, enabling faster response times and improved local adaptability (Chopra & Meindl, 2016; Pessot & Lolli, 2026; Simões et al., 2018).

Risk exposure further differentiates the two configurations. While centralisation reduces expected inventory costs under demand uncertainty, it increases vulnerability to supply disruptions, as failures at a central warehouse can affect the entire network (Chen & Lin, 1989; Schmitt et al., 2015). Decentralisation mitigates this exposure through risk diversification by spreading inventory across multiple locations, thereby reducing cost variability in disruption-prone environments.

Table 1: Trade-offs between centralised and decentralised warehousing structures

Dimension	Centralised warehousing	Decentralised warehousing	References
Inventory levels & risk pooling	Lower aggregate inventory and safety stock through risk pooling; improved product availability	Higher total inventory due to duplicated safety stock across locations	Abrahamsson (1993); Chen & Lin (1989); Chopra et al. (2016); Christopher (2005); Croxton & Zinn (2005); Eppen (1979); Pessot & Lolli (2026); Schmitt et al. (2015); Teo et al. (2001)
Cost and capital structure	Lower duplicated labour and facility costs; high initial investment; reduced inventory capital binding; facilitates 3PL solutions	Higher infrastructure and labour costs; avoids large central investment; higher capital tied up in distributed inventory	Abrahamsson (1993); Das & Tyagi (1997); Milewski (2020); Pessot & Lolli (2026); Simões et al. (2018); Teo et al. (2001)
Responsiveness & lead times	Slower response to urgent demand; longer lead times due to distance from demand	Faster response and shorter lead times due to proximity to demand	Baaijens (2025); Chopra et al. (2016); Das & Tyagi (1997); Pessot & Lolli (2026); Simões et al. (2018)
Flexibility & local adaptation	Lower flexibility; standardised processes and centralised authority limit local adaptation	Higher flexibility; local autonomy enables adaptation to local conditions	Baaijens (2025); Pessot & Lolli (2026); Simões et al. (2018)
Transportation	Higher outbound transport distances; reduced inbound transport and inter-warehouse flows; increased delivery precision	Reduced transport distances; higher transport complexity	Abrahamsson (1993); Baaijens (2025); Chopra et al. (2016); Das & Tyagi (1997); Pessot & Lolli (2026)

Dimension	Centralised warehousing	Decentralised warehousing	Key references
Risk exposure	Higher dependency on central hubs; disruptions affect large parts of organisation; may lead to higher cost variability	Risk diversification through distributed inventory; failures less likely to propagate; lower system-wide cost volatility	Das & Tyagi (1997); Pessot & Lolli (2026); Schmitt et al. (2015); Simões et al. (2018)
Information integration & control	Improved standardisation, visibility, and data governance; facilitates integrated systems and coordinated decision support	Fragmented data and lower standardisation; limits system-wide coordination and analysis	Abrahamsson (1993); Pedersen et al. (2012); Pessot & Lolli (2026); Simões et al. (2018); Teo et al. (2001)
Purchasing power & supplier negotiation	Increased bargaining power through consolidated demand	Lower bargaining power due to fragmented demand	Abrahamsson (1993); Das & Tyagi (1997); Pedersen et al. (2012); Simões et al. (2018)
Governance & decision structure	Centralised authority; clearer process ownership; faster, more consistent decisions; reduced local autonomy	Greater local autonomy; higher coordination complexity; more context-sensitive decisions	Pessot & Lolli (2026); Simões et al. (2018)
Capability & training requirements	Expertise concentrated centrally; lower local training requirements; stronger role specialisation	Higher training requirements; broader roles and multi-competence requirements	Abrahamsson (1993); Simões et al. (2018)

Transportation and infrastructure considerations also play a decisive role. Centralised warehousing may increase outbound transport distances while reducing inbound transportation and eliminating inter-warehouse transfers (Das & Tyagi, 1997). Decentralised systems, on the other hand, reduce outbound transport distances and improve local responsiveness, but require the operation and coordination of multiple facilities, which can increase infrastructure, staffing, and administrative costs due to duplicated resources and activities (Baaijens, 2025).

Beyond physical flows, organisational and technological factors significantly influence configuration effectiveness. Centralised structures tend to perform more effectively in contexts where integrated information systems are present (Pessot & Lolli, 2026). Jonsson et al. (2013) identify a single planning domain possessing all critical information, standardised working methods, and a dominating organisation with the power and competence to enforce central decisions as prerequisites for centralised supply chain planning to deliver its expected effects. On the other hand, decentralised structures may be preferable where local autonomy, rapid response, and contextual adaptability are prioritised, particularly when central coordination mechanisms are limited or underdeveloped (Baaijens, 2025; Pedersen et al., 2012; Pessot & Lolli, 2026).

2.7.4 Structural design under healthcare-specific conditions

The structural characteristics of HSC have direct implications for the design of warehousing and distribution systems. The factors described in the preceding sections, more specifically demand uncertainty, service criticality, product variety, and regulatory constraints, all influence how centralisation and decentralisation trade-offs should be evaluated in a healthcare context.

Demand uncertainty interacts closely with inventory configuration decisions. In environments where demand fluctuates and forecasting accuracy is limited, centralised inventory structures may offer advantages through demand aggregation and risk pooling, reducing total safety stock requirements while maintaining service levels (Chopra & Meindl, 2016; Eppen, 1979). However, the suitability of such aggregation depends on service requirements and replenishment capabilities, as healthcare organisations cannot tolerate prolonged shortages of critical materials. The benefits of centralised inventory under demand uncertainty are therefore conditional on the ability to maintain short and reliable replenishment cycles between the central facility and the points of consumption.

The high service criticality of HSC shifts the traditional cost-service trade-off. Healthcare logistics prioritise uninterrupted material availability to safeguard patient safety and clinical productivity (Rego & Sousa, 2009). This implies that structural decisions cannot be assessed solely on inventory or transportation cost reductions. Instead, configuration choices must ensure robustness and reliability under variability and disruption.

The large number of stock-keeping units (SKUs) and heterogeneity of healthcare materials complicate inventory management and increase administrative complexity (Volland et al., 2017). Centralised structures may facilitate standardisation and unified master data management, whereas decentralised structures may enable closer adaptation to local consumption patterns. The balance between standardisation and local flexibility therefore becomes central to configuration decisions, particularly in healthcare contexts where clinical requirements often justify variation across units that may appear redundant from a procurement perspective.

Regulatory and traceability requirements impose additional structural constraints on healthcare supply chain design. Centralised warehousing may improve quality control and coordination through standardisation and the use of integrated information systems (Pessot & Lolli, 2026), yet it may increase supply chain vulnerability by concentrating risk in a limited number of facilities (Schmitt et al., 2015).

These healthcare-specific characteristics suggest that the evaluation of centralised and decentralised logistics structures cannot rely solely on generic supply chain efficiency logic. Instead, configuration decisions must be assessed in relation to healthcare's distinctive performance priorities, including service continuity, regulatory compliance, and the reduction of non-clinical workload for healthcare professionals. These contextual conditions form the foundation for the subsequent theoret-

ical discussion of centralisation and decentralisation in warehousing and distribution systems.

3
Methodology

The following chapter outlines the methodological approach used to fulfil the purpose of the study and address the research questions. It begins by presenting the overall research design and the rationale for the selected case-study approach. The chapter then describes the data collection process, including the literature review, interviews, and internal documentation used in the study. Furthermore, the procedures applied for analysing the empirical material are outlined, together with how literature was used to support the interpretation of findings. Finally, the chapter addresses issues related to research quality and ethical considerations in order to ensure transparency and credibility throughout the research process.

3.1 Research design

This study adopts a qualitative case study research design to investigate how, and under what conditions, different forms of centralisation could improve supply chain performance in a healthcare context, with a focus on inbound material flows. A qualitative approach is appropriate because the research seeks to develop an in-depth understanding of organisational structures, operational processes, and decision-making conditions rather than to test predefined hypotheses or quantify causal relationships (Bell et al., 2022). The study is therefore exploratory and analytical in nature, focusing on a complex real-world problem within its practical setting.

Case study research enables an intensive examination of a bounded organisational system while capturing the contextual complexity in which the phenomenon occurs (Yin, 2018). In healthcare supply chains, material flows are influenced by regulatory frameworks, professional practices, and existing organisational routines. As a result, supply chain structures and coordination mechanisms cannot easily be separated from their organisational context. A case study approach therefore allows for a detailed investigation of how logistics processes, governance structures, and operational practices interact within the selected organisational setting (Yin, 2018).

The study is conducted as a single case study, focusing on one organisation to enable a deep and contextually grounded analysis of its supply chain and the potential for centralised solutions (Flyvbjerg, 2006). Rather than aiming for statistical generalisation, the study pursues analytical generalisation, where empirical observations are interpreted in relation to established logistics and supply chain management theory (Yin, 2018). The single-case design is justified by its capacity to produce in-depth,

context-dependent knowledge that broader, statistically representative methods cannot capture (Flyvbjerg, 2006).

To address the research questions, the study is structured in two empirical stages followed by an integrative analysis, as illustrated in Figure 3. First, experiences and examples of centralised supply chain solutions in healthcare are examined through expert interviews to identify common structural characteristics, implementation conditions, and organisational prerequisites associated with such configurations (RQ1). Second, the current supply chain of the selected organisation is mapped and analysed in order to understand how it is structured and where inefficiencies arise (RQ2). The findings are subsequently analysed in relation to literature in order to evaluate how structural design choices interact with organisational, informational, and governance-related conditions within the case organisation.

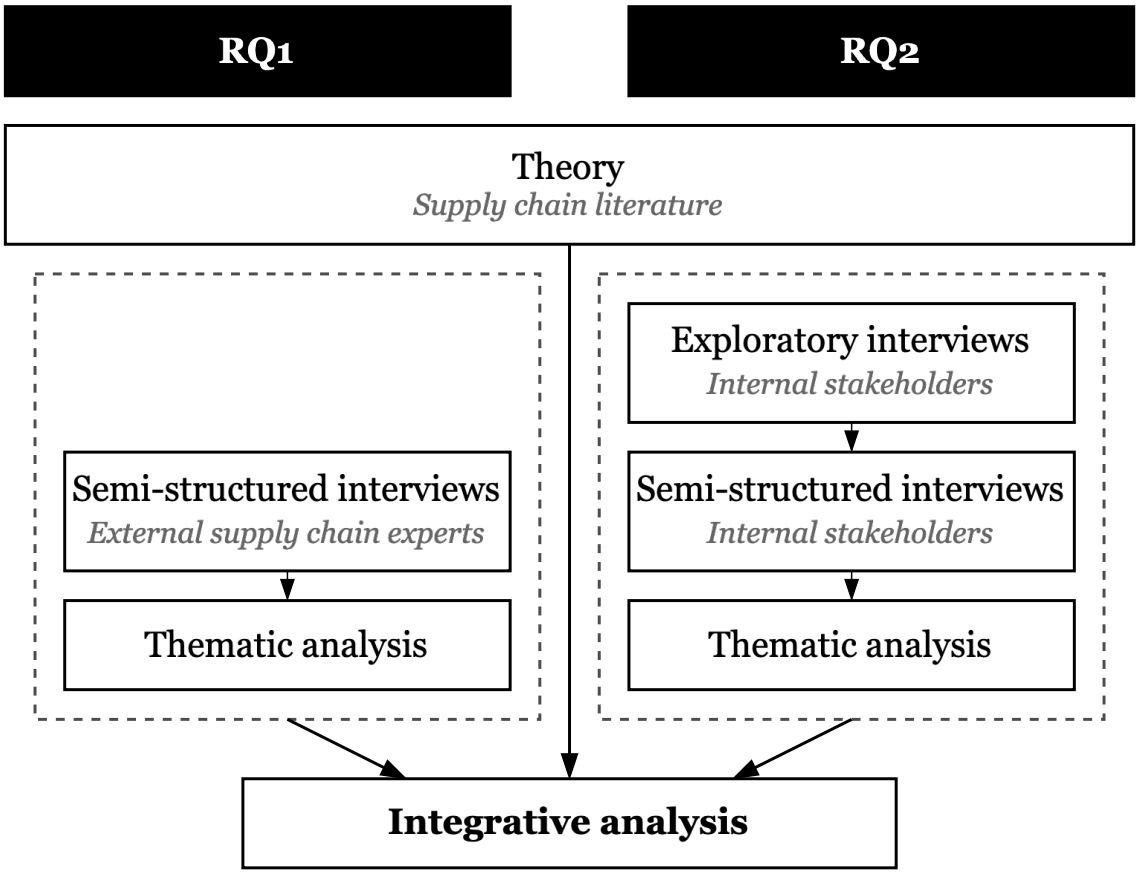

Figure 3: Research Design

3.2 Case selection

The empirical case for this study is Company X, an international healthcare provider operating care units across several countries, mainly in Sweden. The study focuses on Company X's Swedish operations, which serve as the organisational context in

which the research problem is investigated. The research is conducted in relation to an ongoing organisational initiative evaluating alternative supply chain structures.

The study is conducted in an organisational context where healthcare units receive materials directly from suppliers rather than through a centralised warehouse structure. This configuration provides a relevant setting for examining how healthcare supply chains flows are currently structured, and how organisational, technological, and governance-related conditions influence their performance.

The case is centered on the supply chain structure of Company X's inbound material flow, including procurement coordination, ordering practices, and delivery arrangements between suppliers and care units. Focusing on this specific organisational system allows for a detailed examination of how logistics processes are currently structured and coordinated.

Although the findings are context-specific, the case should be considered theoretically informative due to similarities between Company X's challenges and those faced by other healthcare organisations operating under comparable regulatory and operational conditions (Yin, 2018). The insights derived from the case may therefore contribute to broader understanding of supply chain design and structures in healthcare contexts.

3.3 Data collection

To address the research questions, multiple sources of empirical data were collected. The study combines both primary and secondary data. Primary data was gathered through exploratory and semi-structured interviews with stakeholders involved in procurement, logistics coordination, and operational material management. Secondary data consisted of internal documentation and operational data related to inbound material flows.

Interviews provided the primary basis for understanding examples of centralised supply chain solutions in healthcare and how Company X's supply chain is structured and managed in practice, offering insights into organisational perspectives, governance structures, and operational routines. Internal documentation and operational data were used in a complementary capacity to validate and contextualise interview findings rather than as an independent analytical source.

The following sections describe the different data sources and data collection methods used in the study.

3.3.1 Exploratory interviews

Prior to the formal data collection, several exploratory and informal interviews were conducted with representatives from Company X's purchasing organisation. The

purpose of these interviews was to develop an initial understanding of the organisation, its logistics structure, key actors, and perceived operational challenges.

These interviews were open-ended in nature and focused on understanding how ordering processes, supplier coordination, and logistics governance currently function within the organisation. The discussions provided valuable insights and helped identify recurring topics related to governance structures, system usage, operational practices, and coordination challenges.

Insights from the exploratory interviews informed the subsequent design of the semi-structured interview guides and contributed to the identification of analytical themes that later structured the mapping of Company X's current supply chain structure.

3.3.2 Semi-structured interviews

Following the exploratory phase, semi-structured interviews constituted the primary qualitative data collection method. The following sub-sections describe the interview approach and the sampling strategy applied to identify participants.

3.3.2.1 Interview approach

Interviews were conducted with external healthcare logistics experts. The semi-structured format was chosen because it allows for systematic coverage of relevant topics while also providing flexibility for respondents to elaborate on issues that emerge during the conversation, enabling the exploration of emergent themes while maintaining alignment with the study's objectives (Bell et al., 2022). These interviews were relatively open in structure, allowing the interviewees to guide the conversation towards topics they considered particularly relevant based on their professional experience.

A second set of semi-structured interviews was conducted with internal respondents within the case organisation. These interviews followed the same overall approach but were more tightly focused on Company X's current supply chain practices and operational context.

Three separate interview guides were developed based on insights from the exploratory interviews and the theoretical foundation of the study. One guide was designed for external supply chain experts, one for operational respondents at clinics, and one for procurement representatives and senior management. The expert interviews addressed topics related to supply chain maturity, implementation conditions, organisational transformation, and structural differences between healthcare supply chain configurations. The two internal guides covered topics such as ordering practices, coordination, system usage, governance structures, and perceived inefficiencies in Company X's current supply chain setup. While the guides differed in focus depending on the respondent group, common themes, such as coordination and governance, recurred across all three. The complete interview guides are presented in Appendices A-C.

The interview guides were not subjected to a formal pilot test prior to data collection. Instead, they were developed based on insights from the exploratory interviews and refined iteratively as the formal interviews progressed. Minor adjustments were made between interviews to clarify wording, reorder topics, and incorporate emerging themes where these provided richer insights into the research questions. While a formal pilot would have allowed unclear questions to be identified earlier, the iterative approach kept the guide responsive to the empirical context and the evolving analytical focus of the study.

Interviews were conducted on-site at Company X's facilities or digitally via Teams between February and May 2026. In-person interviews were combined with a guided tour of the facility to give further depth to the interview. With participants' consent, the interviews were recorded and subsequently transcribed to facilitate systematic analysis. Most interviews were conducted in Swedish, while a smaller number of interviews with external experts were conducted in English. Transcripts were produced in the original language of each interview. All interviewees were informed about the purpose of the study and the applied confidentiality measures, and responses were anonymised in the reporting.

3.3.2.2 Sampling strategy

The selection of interview participants followed a purposive sampling strategy, where respondents were chosen based on their roles and relevant expertise. Purposive sampling is commonly applied in qualitative case studies when the objective is to obtain detailed insights from individuals who possess relevant knowledge of the phenomenon under investigation (Bell et al., 2022).

For the external expert interviews, participants were selected based on their professional experience with healthcare logistics centralisation and supply chain transformation. The participants were identified through a combination of referral-based and targeted sampling. The majority were reached through referrals from individuals who had previously worked with them on healthcare logistics or supply chain transformation projects, which helped ensure that the experts possessed first-hand experience directly relevant to the study's focus. Two additional experts were contacted by email after being identified through publicly available accounts of comparable centralisation configurations, where their involvement and expertise were documented. Selection prioritised individuals with first-hand experience of the kinds of structural and organisational changes Company X is currently considering, allowing the study to draw on established practice as a reference point.

For the internal interviews, the sampling strategy aimed to capture perspectives from key actors involved in the coordination and execution of supply chain activities within Company X. Interview participants were selected to represent different functional roles within the supply chain system, including procurement personnel responsible for supplier management and assortment management, as well as operational staff at care units involved in ordering and handling materials. Participants

were also selected to represent different geographical locations, to avoid data collection from a single region and provide a more representative result. By including participants from both strategic and operational levels of the organisation, the study captured both the intended design of the supply chain system and how it functions in everyday operations. The selection of internal participants was conducted in collaboration with Company X representatives, who assisted in identifying individuals with relevant responsibilities and experience related to ordering, procurement, and material management. This facilitated access to knowledgeable informants while ensuring that the interview sample reflected the organisational structure of the logistics system.

The total number of interviews was determined by a combination of coverage and saturation considerations. For the external sample, the aim was to achieve breadth across different organisational contexts and types of centralisation transformations, ensuring that the perspectives gathered were not tied to a single setting or transformation pathway. Recruitment continued until additional interviews predominantly reinforced themes already identified in earlier conversations, at which point saturation was considered to have been reached within the practical constraints of expert availability (Guest et al., 2006).

For the internal sample, sampling primarily aimed to achieve breadth across geography, organisational level, professional role, and usage degree of the organisation's ERP system. The latter was included as a sampling dimension because it reflected variation in system engagement and local autonomy within the case organisation. As data collection progressed, recurring themes began to emerge among clinics that expressed alignment with the current procurement structure, indicating thematic saturation in this segment of the sample. Sampling was therefore adjusted toward clinics that expressed dissatisfaction with the existing setup, in order to obtain richer insights into perceived inefficiencies and adaptive behaviours.

Data collection was concluded once additional interviews predominantly reinforced existing patterns, while still ensuring sufficient coverage across the targeted sampling dimensions. In total, 25 interviews were conducted with 24 different interviewees: 5 external supply chain experts and 19 internal Company X respondents across multiple roles and locations. An overview of the conducted interviews is presented in Appendices D and E.

3.3.3 Internal documents and operational data

In addition to interviews, internal documentation and operational order data were used to support the empirical investigation. The data was used in a confirmatory rather than exploratory capacity to triangulate claims emerging from the interviews, particularly regarding ordering patterns, supplier distribution, and delivery frequency. Due to confidentiality constraints and the fragmented structure of the underlying data sources, quantitative findings are not reported. Instead, the data serves to corroborate qualitative observations where interview accounts could be

matched against system records.

3.4 Data analysis

Following the data collection, an analysis of the interview data was conducted using a thematic analysis approach inspired by Braun and Clarke (2006), as seen in Figure 4. This approach was chosen as it enables a systematic identification and interpretation of patterns across qualitative data, while remaining flexible in relation to the study's exploratory and case-based design (Ahmed et al., 2025). The method is particularly suitable for analysing semi-structured interviews in organisational contexts, where the aim is to understand both formal structures and how processes are enacted in practice.

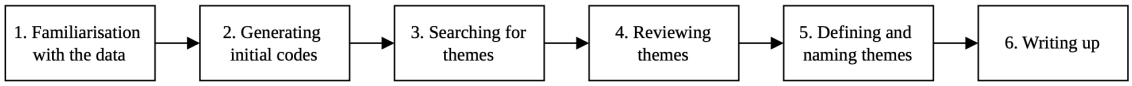

Figure 4: General thematic analysis process, adapted from Braun and Clarke (2006)

The analysis followed an iterative and interpretive process, as described by Braun and Clarke (2006; 2013). First, all interview transcripts were reviewed to achieve familiarisation with the data. During this phase, initial observations regarding recurring patterns, discrepancies, and variations in how respondents described centralisation transformations and the current supply chain system were noted.

Following familiarisation, inductive coding was applied to both sets of transcripts to capture themes that emerged directly from the data without being predefined by the interview themes. This enabled the analysis to remain open to unexpected insights across both sets.

The initial codes were then reviewed and grouped into broader categories based on similarities and relationships between them. Through this process, themes were developed that reflected recurring patterns across the interviews. These themes were then refined in relation to both the empirical material and the study's research questions, and subsequently named. During this iterative stage, themes were continuously reviewed and, where necessary, merged, split or discarded in order to ensure coherence and strong alignment with the empirical material.

The final themes represent patterns identified across both sets of data. The external interview themes describe how comparable centralisation transformations have been undertaken in other organisations, including the conditions and prerequisites that shaped them. The internal interview themes describe how inbound material flows are structured and managed within Company X, as well as the key inefficiencies and challenges associated with the current supply chain setup. To enhance the credibility of the analysis, findings were continuously triangulated against multiple sources. External interview findings were cross-checked across experts to verify recurrence

and consistency, while internal interview findings were compared with Company X's internal documentation and operational data if applicable.

All coding was performed manually using Google Docs and Excel. Google Docs was used to read and annotate transcripts, while Excel was used to organise codes, group them into broader categories, and trace the development of themes across interviews.

Coding was conducted by both researchers. The transcripts were divided between the two, with each taking primary responsibility for coding their assigned set. Following initial coding, the researchers exchanged transcripts and reviewed each other's codes, discussing differences in interpretation and refining codes through discussion until consensus was reached. While this approach does not constitute fully independent double-coding, the peer review process provided a mechanism for cross-checking interpretations, identifying inconsistencies between coders and reducing the risk of individual interpretive bias.

Transcripts were retained in their original language throughout coding and analysis to avoid any loss of nuance during interpretation. Translation into English was applied only at the reporting stage, when quotes were used to illustrate findings in the empirical chapter. Translations were carried out by the authors and prioritised the preservation of meaning over literal phrasing, particularly where idiomatic or context-specific expressions occurred.

3.5 Research quality

This section outlines how research quality was ensured. In line with established practice, quality is assessed through validity and reliability (Bell et al., 2022).

3.5.1 Validity

Validity concerns whether the findings accurately reflect the phenomena under investigation (Kirk & Miller, 1986). In this study, validity was strengthened along four dimensions.

Construct validity concerns whether the study investigates what it claims to investigate (Bell et al., 2022; Farquhar, 2012; Yin, 2018). It was supported through triangulation across data sources by combining semi-structured interviews with internal documentation, but also through informant review of the empirical material to verify factual accuracy and clarify interpretations.

Internal validity concerns the credibility of causal explanations and the extent to which the findings are grounded in a critical examination of the data which is important to demonstrate that interpretations are well founded (Bell et al., 2022; Farquhar, 2012). It was addressed through systematic thematic analysis of interview data, with continuous cross-referencing against internal documentation to allow alternative explanations to be considered, thereby increasing confidence in the study's

interpretations and credibility (Patton, 1999).

External validity refers to the extent to which research findings can be generalised beyond the specific study context (Bell et al., 2022; Farquhar, 2012). In case-study research, this is pursued through analytical generalisation rather than to provide universally generalisable results (Yin, 2009; Flyvbjerg, 2006). By providing a description of the case context, organisational setting and analytical process, readers can assess the applicability of the findings to other healthcare organisations with similar characteristics (Bell et al., 2022).

Ecological validity concerns whether research findings are applicable to real-world settings and everyday organisational practices (Andrade, 2018; Bell et al., 2022; Gehrke, 2018). The study's close engagement with the case organisation, including interviews with practitioners, enhances ecological validity by grounding the findings in actual healthcare logistics processes rather than abstract or artificial research settings.

3.5.2 Reliability

Reliability concerns whether results would be consistent if the research were repeated using the same procedures (Bell et al., 2022; Farquhar, 2012). Full replication is difficult in qualitative research due to context-dependence, but reliability can be supported through systematic and well-documented procedures (Yin, 2018).

In this study, each stage of the research process was documented, including case selection, data collection, and analytical decisions. Interview guides were used as a common framework, with incremental adjustments documented as they occurred. All interviews were recorded and transcribed, and the thematic analysis is documented through coding notes, peer review between researchers, and a research database of transcripts and analytical summaries.

3.6 Ethical considerations

This study was conducted in accordance with established ethical principles for business and management research (Bell et al., 2022). Particular attention was given to informed consent, confidentiality, and the protection of participants. The following subsections describe the ethical considerations relevant to the empirical data collection and analysis, and how these were followed.

3.6.1 Informed consent

Informed consent aims to ensure that participants can make a voluntary and informed decision regarding their participation in a study (Bell et al., 2022). Ethical guidelines emphasise that participants should be informed about the purpose of the study, the nature of their involvement, the voluntary nature of participation, the

handling of collected data, and their right to withdraw at any point without explanation (Brewerton & Millward, 2001; Diener & Crandall, 1978, as cited in Bell et al., 2022; Farquhar, 2012; UK Research & Innovation, 2026).

In line with these principles, informed consent was obtained from all interview participants prior to data collection. Participants were provided with written information describing the purpose of the study, the nature of their involvement, the intended handling of the collected data, and how the findings would be presented and published. Participants were also informed that participation was voluntary, that they could withdraw from the study at any point without explanation, and that interviews would only be recorded with their consent.

3.6.2 Confidentiality, anonymity and data handling

Confidentiality and anonymity concern the protection of participants' identities and the secure handling of research data (Bell et al., 2022; Saunders et al., 2015). In organisational research, complete anonymity can be difficult to guarantee due to the level of contextual detail required, but researchers are expected to take reasonable measures to minimise the risk of identification.

Interview recordings, transcripts, and internal organisational data were stored in secure digital environments accessible only to the research team. Personal identifiers were removed during transcription, pseudonyms were assigned to participants, and role descriptions and organisational references were generalised where necessary to reduce the risk of indirect or deductive disclosure. Findings were reported in anonymised or aggregated form to ensure that neither individuals nor sensitive organisational practices could be identified. Participants were informed about these measures prior to data collection, allowing them to make an informed decision about their participation.

3.6.3 Avoidance of harm

The principle of avoidance of harm requires researchers to minimise the risk that participation in a study may cause physical, psychological, professional, or social harm to participants (Brewerton & Millward, 2001; Diener & Crandall, 1978, as cited in Bell et al., 2022). Researchers also need to respect the privacy of participants by avoiding intrusion into personal or professional domains (Bell et al., 2022; Brewerton & Millward, 2001; British Sociological Association, 2017). Furthermore, harm must be avoided by not misleading participants about the nature, purpose or procedures of a study (Bell et al., 2022; Farquhar, 2012). Earlier guidance from the Social Research Association emphasised that the use of deception risks damaging public trust in research more broadly, which may have negative long-term consequences for the research community (Social Research Association, 2003).

In this study, harm was avoided by limiting data collection to topics relevant to the research objectives and participants' professional roles. Interview questions focused

on processes and structures rather than on individual performance or responsibility, reducing the risk of negative professional consequences. No incentives or pressures were used to encourage involvement, and no form of deception or covert research was applied. All participants were informed about the purpose of the research, the methods of data collection, and how the data would be used.

3.7 Methodological limitations

This study is subject to several methodological limitations that should be considered when interpreting the findings.

The study is based on a single case study, which limits the ability to generalise the findings statistically. While the aim of the study is analytical generalisation rather than statistical generalisation (Yin, 2018), the results are inherently shaped by the organisational context and specific conditions of the chosen case.

Quantitative operational data from internal systems was available but could not be fully exploited due to the fragmented and partially unstructured nature of the underlying records. The data was therefore used to validate and contextualise interview findings rather than to support independent quantitative analysis.

The use of semi-structured interviews allows for a deeper exploration into different topics the researchers might not be aware of. However, it introduces a risk of respondent bias. Participants may unintentionally provide subjective or incomplete accounts about their roles, experiences, or perceptions. To mitigate this risk, multiple interviews with different participants were conducted. These participants differed in roles, responsibilities and geographical location.

Finally, access constraints influenced the study design and data collection process. Limitations in time, availability of respondents, and access to certain organisational information may have affected the comprehensiveness of the empirical material.

4

Empirical Findings

This chapter presents the empirical findings of the study, and is divided into two main parts corresponding to the two research questions.

The first part presents findings from interviews with external supply chain experts and organisations that have implemented centralised or semi-centralised logistics structures. The findings focus on how these supply chain configurations are organised and governed in practice, including the organisational, informational, and operational conditions associated with their implementation and performance.

The second part presents the current state of Company X's supply chain. The findings describe how material flows, governance structures, information systems, and operational practices are organised within the existing supply chain structure, together with challenges and constraints identified across the organisation.

4.1 Expert perspectives on centralisation

This section presents empirical insights from interviews with supply chain experts on how healthcare supply chains are structured before and after centralisation, what conditions shape successful centralisation, and what outcomes have been observed in practice. The thematic analysis of the interviews with healthcare supply chain experts resulted in five themes describing the operational characteristics, structural challenges, and contextual constraints that define the baseline from which centralised solutions emerge. These themes are illustrated in Appendix F, and explained more thoroughly in the following sections.

4.1.1 Empirical context and expert interview basis

Six interviews were conducted with five external experts to develop a broader understanding of healthcare supply chain characteristics, challenges, and prerequisites for centralisation. The findings presented in this section serve as an empirical foundation for the subsequent examination of Company X's current state.

Interviewee A is Head of Unit in a hospital logistics team within a regional health authority in a Nordic country, and was involved in the transformation from a decentralised supply chain to a centralised warehouse solution serving more than one thousand healthcare units across the region.

Interviewee B is a Strategist at a regional health authority in Sweden, with extensive experience in regional healthcare and supply chain efficiency.

Interviewee C is a Senior Manager at a regional health authority, responsible for operations and improvement projects at one of the region's central depots. Although not involved in the original centralisation, which took place several decades ago, the interviewee has led several subsequent transformation initiatives, including the implementation of a new material supply system. Two interviews were conducted with Interviewee C.

Interviewee D is a Healthcare Logistics Director at a private European healthcare provider, coordinating the relationship between a third-party logistics (3PL) provider operating the central warehouse and the healthcare units served, and leading improvement projects.

Interviewee E is a Senior Logistics Director at a global transport and logistics company with extensive experience in supply chain improvement projects in healthcare and other sectors.

4.1.2 Pre-centralisation conditions and constraints

This section presents the interviewees' experiences before undertaking centralisation initiatives and their reflections on the challenges and limitations associated with fragmented and decentralised processes.

4.1.2.1 Historically emergent supply chain structures

A recurring topic across the interviews is that healthcare supply chains tend to develop incrementally alongside organisational growth, with primary focus placed on patients, medical services, and equipment rather than on supply chain design. Logistics structures are therefore described as developed over time, shaped by local optimisations rather than strategic design. Even configurations that appear to follow a deliberate strategy, such as decentralisation, may in practice be fragmented systems with no clear direction.

Interviewee A's illustrates this pattern: before warehouse centralisation, each hospital maintained its own warehouse and stock, with inventory levels and handling routines varying across departments according to local staff practices. Interviewee D describes a similar starting point in the private healthcare context, where purchasing was partly centralised but distribution remained fully decentralised, with each supplier managing deliveries to each facility independently. This resulted in delays, stockouts, and communication failures, with each facility having to resolve supply disruptions in isolation.

Interviewees B and C reinforce this view at the structural level: organisations may appear to follow a coherent strategy, but rapid expansion or acquisitions often leave

behind multiple layers of central warehouses, local warehouses, and direct deliveries that were never designed against a common logic.

4.1.2.2 Limited visibility, weak data foundations and high assortment complexity

The lack of data visibility and system integration emerged as a consistent topic across all interviews, particularly in describing the pre-centralisation state.

Before centralisation, Interviewee A's organisation operated with what was effectively an accounting system: orders could be placed, invoices received and paid, but the system could not verify quantities or quality delivered, and follow-up on deliveries was inconsistent across sites. As Interviewee A summarises, there was "no transparency and no traceability". Off-system ordering, for example via email, compounded the problem: only financial transaction data was captured, while quantities, delivery performance, and return rates remained invisible.

Interviewee D describes a similar situation, explaining that producing precise budgets required close collaboration with the accounting team since no integrated tooling existed to measure cost or quality. Even after centralisation, they still struggle with data collection for off-system orders.

Several interviewees identify data quality as an important but commonly underdeveloped capability. Interviewee C claims that without a sufficient understanding of flows, volumes, and costs, improvement initiatives cannot be evidence-based. Interviewee A adds that even where information is collected, traceability is often scattered across separate systems, for example between patient and logistics systems, and limited integration between these systems makes diagnostics and improvement work difficult.

The data problem is compounded by the complexity of healthcare assortments. All interviewees note that healthcare operations carry tens or even hundreds of thousands of SKUs. Holding this entire range centrally is impractical, so a smaller subset is stocked while many items are delivered directly from suppliers on demand. This produces multiple parallel material flows that are difficult to track or evaluate. Interviewee C notes that the absence of central visibility also drove defensive behaviours, with some healthcare units hoarding supply ahead of anticipated shortages while others ran out.

4.1.2.3 Reactive local operations and logistics as secondary work

Healthcare units are described by both Interviewee A and B as operating independently and reactively, with clinical staff responsible for ordering, receiving, and managing inventory alongside patient care. Interviewee C explains how the focus was on day to day solutions and "firefighting" instead of active supply chain strategy and improvements. Processes were heavily dependent on individual experience and routines, and when staff changed, were absent, or left, performance dropped

accordingly. Interviewee B continues this by stating that operational patterns such as triple-ordering before holidays illustrated the lack of system discipline and the extent to which organisations relied on individual behaviour rather than structured processes.

Interviewee D describes the same dynamic in their private healthcare context. Before centralisation, each facility managed substitutions and product switches independently when stockouts occurred, with no central expertise, no shared communication on availability, and no structured escalation process. The burden of resolving supply problems fell entirely on clinical staff alongside their primary responsibilities.

4.1.3 Centralisation as a spectrum of structural and control models

Building on the description of fragmented starting points, this section presents the centralised configurations the interviewees operate within or have observed, and their views on the broader spectrum of structural models that can serve similar purposes.

4.1.3.1 Different centralisation models

Interviewee A's organisation operates a single central warehouse covering a network of over a thousand clinics and hospitals. Interviewee C describes a hybrid model in which different product categories, such as consumables and pharmaceuticals, are served by dedicated depots. While the delivery structure is decentralised, each category is managed centrally, allowing delivery to each healthcare unit while consolidating volumes. Interviewee C explains that the ability to create customised customer solutions, delivering the right quantities while consolidating and combining shipping is both the economical and operational logic. A defining design principle, according to Interviewee C, is that the logistics solution should be "invisible" to healthcare units, solving problems without the units themselves noticing.

Interviewee C further argues that centralisation need not imply physical consolidation at all. A "control tower" can exercise central coordination over a structurally decentralised flow, functioning as a competence centre that orchestrates the system while allowing some local autonomy where useful. This combines central standardisation with local responsiveness.

Interviewees D and E describe configurations in which a 3PL provider operates the central warehouse. Interviewee E frames the rationale by stating that 3PL allows the organisation to focus on its core operations and capture consolidation benefits without owning warehouse infrastructure, which is particularly relevant if capital investment is constrained. Interviewee D's organisation represents this variant with a nationally scoped central warehouse operated by a specialised pharmaceutical distributor and serving over a hundred healthcare facilities. The platform negotiates prices with suppliers centrally and uses the margin between negotiated and supply

price to fund the logistics operation, without requiring separate logistics budget allocations from each facility. The model operates without exclusivity as facilities can still order directly from suppliers outside the platform, meaning the warehouse competes on service quality rather than mandate.

4.1.3.2 Operational mechanisms: Kanban, replenishment, consolidation, and substitution handling

Interviewee C explains that the purpose with their central depot is to lower the amount of transports to healthcare units, create better working environments, lower transportation costs and create better control. They achieve this by managing pick, consolidation, monitoring, follow up on deliveries, communicating restnotes and shortages, handling sterile goods, stockpiling for crisis and emergency preparedness and supporting their material supply system teams. The material supply system is an initiative to better control the material flow. This was not introduced during the introduction of the central depot, rather a newer initiative to further improve the flow. It is based on Kanban, utilising a signaling system where material supply teams can easily understand what to order, the quantities and where to restock. This system covers today around 60% of the orders, with a goal to increase to 80% over the coming years. It is utilised over hundreds of clinics and many hospitals and has resulted in a greater insight into the flow and a better data visibility. Before, personnel ordered without insight or overview, unsystematically ordering what they needed. With this new standardised ordering system, the ordering costs have decreased and the supply chain is more controlled and robust.

Interviewee A explains their centralised warehouse solution was introduced over ten years ago together with the introduction of a new ERP system, and it is operating with hundreds of trolleys everyday with hospitals ranging from needing ten, twenty to over a hundred trolleys each day. They achieve this by categorising the healthcare units into different categories depending on the need, daily, 2-3x/week or weekly. Furthermore, because of short distances of usually under one hour they can be efficient and reliable in their delivery. The healthcare units ordering depend on a two-bin Kanban system which they implemented together with the new ERP system. They utilise barcodes and handheld scanners to quickly and reliably know what needs to be ordered and the quantity, increasing visibility and lowering the time needed to order. The work has been shifted from healthcare personnel to support staff, drastically reducing labour costs and freeing up clinical time for patient care. Estimations are that around 80-90% of the assortment is handled today through the two-bin system, while a smaller share is still handled directly by clinical staff.

Interviewee D explains how the central platform operates in practice. Facilities place orders through an ERP system, which sends them to their external logistics partner for picking and delivery. The platform separately replenishes its own inventory from pharmaceutical suppliers and maintains a one-month safety stock buffer to absorb upstream disruptions such as system transitions, stockouts, and demand spikes. A key feature of this model is that responsibility for stockout substitutions remains within the healthcare organisation rather than with the logistics provider. When

a supplier reports a stockout, the central team identifies suitable alternatives and either activates an existing equivalent or works with the purchasing function to add a new product to the catalogue before facilities can order it. This ensures that decisions about clinically acceptable substitutions are managed internally. The platform also runs a dormant stock recovery system. Facilities can return unused inventory to the warehouse, receive a financial credit, and have the stock redistributed to other sites where demand exists. This reduces waste and write-offs across the network.

Interview C explains that the flow has historically been cost focused. By studying the flow and the operations you can find savings by removing waste or unnecessary stock. Just-in-time deliveries have been actively pursued by healthcare organisations, putting pressure on suppliers as the organisations want to lower stock and tied-up capital. The focus has been on lowering the supply chain costs, but now the trend has shifted away from cost towards supply chain resilience and robustness. Interview A also emphasises the shift towards a resilience focus, but that it also depends on who you ask in the organisation, and the consensus is still a cost focus.

4.1.4 Prerequisites for centralised solutions

The interviewees consistently identify a set of organisational, informational, and operational conditions on which the effectiveness of centralised solutions depends. This section presents these prerequisites under six headings: strategic direction and management commitment, data foundations, IT infrastructure, scale and assortment prioritisation, assortment standardisation and clinical involvement, and change management. Table 2 summarises these six prerequisites, each of which is examined in turn in the sections that follow.

4.1.4.1 Strategic direction and management commitment

Management commitment is identified across the interviews as the foundational condition without which structural change cannot proceed. Interviewee E states that leadership support is the first and most important factor to create change. Interviewee C reinforces this, noting that investment in centralisation requires resources which in turn require senior backing. They further explain that competent and committed project teams cannot substitute for absent management and financial support.

The interviewees emphasise that management must do more than authorise the project, as it must also define what the supply chain is for and possess the competence to understand why change is needed. Interviewee C states that the management needs to set the ambition and therefore needs the right competence to understand why change is needed. As Interviewee B puts it, the question management must answer is “what is the purpose? Is it about streamlining the logistic network, or about gaining more control, robustness and preparedness?”, and further explains that without an articulated ambition, lower-level efforts cannot align with a coherent direction.

Table 2: The six prerequisites for centralisation identified across the expert interviews.

Prerequisite	**What it concerns**
Strategic direction and management commitment	Whether senior management treats supply chain as a strategic capability and provides the mandate and resources required for change.
Data foundations	The availability and quality of master data, transaction data and performance data on which any centralisation logic depends.
IT infrastructure	Whether the technical systems can support centralised ordering, inventory management and supplier coordination.
Scale and volume concentration	Whether consolidated volumes are sufficient to make the operational and capital costs of a centralised configuration economically viable.
Assortment standardisation and clinical involvement	Whether assortments can be rationalised through standardisation, and whether clinical expertise is available to make those decisions credibly.
Change management	Whether the organisation has the capacity to implement and sustain the structural and behavioural changes that centralisation entails.

Interviewees B and E both argue that where senior management views the supply chain primarily as a support function, the organisation remains in an operative and reactive mode. Interviewee E continues that without mandate, projects will never be able to drive real change, no matter how competent the involved people are. In contrast, where it is instead treated as a strategic and business critical capability, structural change becomes possible, as one can leverage the data collected, control the supply chain, and create control towers to steer the organisation.

Securing this commitment, several interviewees note, typically depends on a quantified business case showcasing the changes and potential savings an initiative will generate. Interviewee E frame the business case as the principal route to executive buy-in. Since management decisions tend to be made on financial logic, transformation initiatives must demonstrate measurable improvements. Interviewee D echoes this, by confirming that their centralisation initiative came from the CEO, but adds that you must prove to the management that the change will deliver improvements in capacity, quality, and financial performance to get them on board. Interviewee A's organisation illustrates this directly. Management support for centralisation followed a consultancy-led report quantifying the potential savings. As Intervie-

wee A notes, supply chain investments compete poorly against more visible clinical investments such as MRI scanners or cancer treatment equipment, and without a clear evidence base, the supporting function tends to lose that competition and be deprioritised.

4.1.4.2 Data foundations

Data is described by Interviewee C as the most fundamental prerequisite for centralisation, on which several other prerequisites depend. Without reliable data on flows, volumes, costs, and performance, the organisation lacks both the basis for improvement initiatives and the evidence required to secure management commitment. This applies not only to obviously valuable information such as procurement spend, but also to seemingly routine data such as addresses.

Data work is often deprioritised because of its scale and visibility. Interviewee C describes such projects as "boring" but foundational, and notes that the issue keeps returning regardless of what else the organisation does. Logistics data, in particular, is typically harder to obtain than financial data but no less essential. Once the data foundation is in place, it becomes the basis on which strategic purchasing, optimisation, control-tower operation, and warehouse management can be built. Interviewee A connects this directly to commercial outcomes, framing data as a source of bargaining strength by stating that "getting more transparency into what we are actually buying makes our contract managers much better equipped to run accurate tenders and negotiate better deals". This is supported by Interviewee D, who views data as a fundamental part of the organisation, especially the financial data as it is a cornerstone for all negotiations with suppliers.

The dependency is explained as reciprocal. The previously discussed business case is used to obtain management commitment depends on data, while data, in turn, depends on management commitment to invest in it. Interviewee E explains that this requires both internal inputs such as transport costs, working hours, deliveries, inventory levels, and supplier performance, and external inputs on suppliers, services, and items that must be obtained through collaboration with other organisations. Internal collection in turn rests on an IT system capable of capturing the right data and making it accessible across the organisation. Without one, information is lost or trapped in local files, and transformation projects become impossible, as transformation projects rest on assumptions rather than evidence.

Interviewee D illustrates the post-centralisation gain. After ERP system implementation and centralisation, the organisation can measure cost and quality by process, model the cost implications of adding new facilities, and set contractual reduction targets with numerical precision. Interviewee D argues that this capability is fundamental for the organisation's success and an important part of developing the healthcare supply chain.

Interviewee C summarises the broader implication that maturity is, in practical terms, a data phenomenon. An organisation's ability, or inability, to produce logis-

tics data easily reveals where it stands on the maturity progression. Furthermore, Interviewee C explains that the consequence of this is most obviously seen in relation to the management, as without data, you can not persuade the management on what needs to change and why.

4.1.4.3 IT infrastructure

IT systems are identified across all interviews as a central prerequisite for transformation, both as the technical foundation for data capture and as the operational backbone of centralised flows.

Interviewees A and B both describe IT systems as essential for control. Fragmented or uncoordinated systems consume resources on local fixes and limit the visibility on which strategic decisions depend. In Interviewee A's case, ERP and centralisation transformations were implemented together, and the organisation has since updated to a newer ERP system. illustrating both the foundational role of IT and the continuous nature of the investment.

Interviewees C and E emphasise the importance of a dedicated logistics system. Interviewee E argues that systems designed for accounting or financial management are insufficient for supply chain operations such as delivery follow-up, inventory tracking, and flow control. Interviewee E continues to explain that Excel-based tracking compounds the problem, producing errors that erode user trust and drive workarounds. A central ordering system used across all clinics is needed to capture order patterns, monitor inventory in real time, and provide central functions with the visibility required to steer the organisation. Interviewee E nuances by explaining that a full system replacement is not always necessary, as a dedicated supplementary system can be integrated alongside existing infrastructure. Interviewee E notes that modern systems are usually advanced enough to handle the cross-system communication this requires.

Interviewee B stated that sufficient IT systems need to be in place before taking future steps in the supply chain development. Interviewee D identifies EDI as a specific IT prerequisite, enabling efficient communication with suppliers and facilities and supporting inventory tracking, order performance evaluation, and flow control. The same interview also illustrates the continuous nature of IT development. Integration between the ERP system and the 3PL's warehouse management system (WMS) remains incomplete, and certain operations such as backorder management and product onboarding are still handled outside the ERP system using Excel and email.

Interviewee C concludes that data must come before IT development, because it determines what the IT system needs to do. Investing in systems before establishing the data foundation risks building tools without a usable basis.

4.1.4.4 Scale and volume concentration

The interviewees agree on the view that scale is necessary for centralisation to be economically viable, but differ on what scale means in practice. Interviewee A emphasises physical proximity, noting that closeness between healthcare units and the central warehouse, typically under an hour, is a key factor for the success of a central warehouse. Interviewees B, D, and E treat distance as less binding, arguing that modern logistics services can cover large geographic areas within a day or two.

The interviewees agree on the importance of consolidated volume rather than geographic compactness. Centralisation depends on aggregating sufficient volume per SKU to justify the operational and capital cost of a central node, and Interviewee A emphasises scale as one of the most important factors for a true centralised solution. Interviewee B states that before designing any centralised solution, the organisation must understand the size of volumes and the number of articles, suppliers, and units involved, and then prioritise high-frequency items.

4.1.4.5 Assortment standardisation and clinical involvement

Standardisation of assortment is described as a prerequisite that operates in close collaboration with scale. Interviewee E explains that without standardisation, the financial logic of centralisation breaks down, since concentrated volumes cannot be achieved if the underlying assortment is fragmented. They continue to explain that most product categories do not require more than one or two variants, and that organisations consistently overestimate the need for assortment breadth.

Several interviewees describe the consequences of failing to standardise. In Interviewee A's organisation, the absence of clear directives allowed the assortment to grow to over two hundred thousand SKUs, with "even basic items like disinfectant having multiple variants in use across sites". Personal clinical preferences compounded this. Interviewee A notes the example of a surgeon who "performed better with the purple scalpel than the pink", making tendering and procurement progressively harder. Interviewee C observes a similar pattern. In the absence of a mandate to enforce assortment decisions, reduction projects yielded only short-term gains, as healthcare units reintroduced different items over time.

Interviewee E argues that making the right standardisation decision is not just based on procurement and logistics competence, but on crucial medical and operational competence. Assessing which product variants are clinically interchangeable is not a question that procurement staff without medical training or operational insight can answer in isolation. Interviewee B illustrates this with an example in which colour-coded binders were replaced with a single universal alternative, only for the team to discover that the colour coding was embedded in clinical workflows, with each colour representing a distinct document category.

4.1.4.6 Change management

Change management is described as essential to both the introduction and the durability of centralisation initiatives. Interviewee B frames it by stating that "without change management it is basically impossible to succeed".

A consistent topic is the need to engage stakeholders, particularly healthcare personnel, early and continuously. Interviewee B explains that excluding clinical staff invites concerns about patient safety that can derail otherwise viable initiatives. At the same time, several interviewees note that engagement does not mean unconditional accommodation. As one hospital manager put it to Interviewee B, "do not ask what we want, give us what we need", the meaning being that the manager wanted assistance in improving the organisation and being challenged in what was possible. Interviewee E adds that stakeholder opinion should inform but not constrain strategically necessary decisions, and that enforcement is sometimes required even though it turns people against you. In contrast, Interviewee D's organisation has never enforced exclusivity regarding their central warehouse. Facilities use the central warehouse because it generally outperforms alternatives, not because they are required to.

The interviewees describe several approaches to sustaining adoption after initial implementation. Interviewee D's organisation monitors facility-level utilisation with a Key Performance Indicator (KPI) that triggers interventions. If utilisation drops, typically reflecting an unfamiliar new employee, central staff are dispatched to coach the user directly through the system. This personal, immediate response is described as effective in maintaining performance. Interviewee A further illustrates how improvements must be sustained over time, explaining that initiatives are not fully realised immediately even after successful implementation. As an example, the interviewee describes how local variants and workarounds persisted after their own rollout, meaning that the transformation effort continued long after the initial implementation phase. Similarly, Interviewee B argues that "it is a marathon, not a sprint", and emphasises that centralisation initiatives should be approached as long-term structural transformations rather than problems solved once at the outset.

Interviewee C cautions against building a "supply chain castle" of promises and structural ambition without underlying substance. Initiatives that raise expectations beyond what the underlying capabilities can deliver erode trust quickly and produce resistance.

Several of the interviewees state that the sequencing principle is important when implementing change. Interviewee C argues that the appropriate sequence is harmonisation, then standardisation, then centralisation. The organisation must first understand how different units operate and what they actually use, before any transformation initiative can be meaningfully enforced. Attempting to enforce change prematurely risks introducing solutions that conflict with how clinical work is performed. Interviewee C further suggests to engage early adopters first, build credibility through delivered results, and then extend the change. Identifying "low-hanging

fruit", i.e. easy problems with visible wins, supports this trajectory by generating acceptance before harder problems are tackled. Interviewee C claims that trust is built alongside delivery rather than in advance of it, and that change management is therefore not a launch event but an ongoing process. Interviewee A gives an example of how a lack of trust can affect the success of transformation initiatives. Their organisation experienced a difficult first year of implementation, partly because the right management was not in place at the outset to guide the project and bring stakeholders along.

Table 3 summarises the positions taken across the expert interviews on each of the six prerequisites discussed above.

4.1.5 Implementation approaches: stepwise transformation and rapid rollout

The interviewees diverge on the question of implementation pace. Interviewee A reflects critically on a rapid rollout, explaining that in retrospect the organisation moved too quickly, leaving ordering responsibility split at the hospital doorstep rather than fully centralised, and producing local workarounds that persisted because units lacked time to adopt the new standardised operations and ERP systems. Interviewee A argues that you should "eat the elephant in small bites", doing a gradual roll out and avoiding a "Big Bang" implementation.

Interviewee C argues that neither approach is superior, and that the "right" approach depends on organisational context, leadership cultures and available resources. What matters is structured progression, such as a sequence of baseline data collection, pilot, test, and iteration. This structured logic is compatible with both gradual and rapid rollouts.

Interviewee D personally favours speed, tying it to quality and decisiveness, but acknowledges that pace depends on stakeholder priorities and capacity, and that compromises are usually the result. Interviewee E emphasises sequence over speed but states the importance of ensuring that the foundational work is done first, regardless of how quickly subsequent steps are executed.

4.1.6 Outcomes, value creation, and remaining limitations

The interviewees describe substantive outcomes from their centralisation and maturity initiatives, while also identifying persistent limitations that illustrate the continuous nature of supply chain development.

The most consistently reported gains are operational and financial. Interviewee C's material supply system now carries over 60% of the material flow, freeing clinical time, reducing purchasing costs, and strengthening supply preparedness. Interviewee A's centralisation has produced higher efficiency, lower costs, and improved

Table 3: Positions taken across the expert interviews on each of the six prerequisites for centralisation.

Prerequisite	Interviewee A	Interviewee B	Interviewee C	Interviewee D	Interviewee E
Strategic direction and management commitment	Support followed a consultancy-led savings report; SC investments compete poorly against clinical investments	Management must set the ambition and treat supply chain as a strategic capability	Management must define the purpose (efficiency vs. control vs. preparedness)	Initiative originated with the CEO; business case required to demonstrate improvement	Leadership support is the first and most important factor; without mandate, no real change
Data foundations	"No transparency, no traceability" before centralisation; data as basis for tender accuracy	"The most essential prerequisite"; maturity is in practice a data phenomenon	Volumes, articles, suppliers and units must be understood before any design	Post-centralisation: modelling of cost implications, contractual targets with numerical precision	Requires internal and external data; internal capture conditional on adequate IT
IT infrastructure	ERP and centralisation implemented together; subsequent ERP update; integration gaps persist	Data must precede IT investment, as it defines what the system needs to do	IT systems must be in place before further development can occur	EDI critical for supplier integration; ERP–WMS integration still incomplete	Accounting-style systems insufficient for SC use; dedicated supplementary system can sit alongside ERP
Scale and volume concentration	Physical proximity (under one hour) and volume are central; scale is a defining condition	Distance is tractable; aggregated volume is the operative question	Must understand size of volumes, articles and units; prioritise high-frequency items	Distance not binding under a 3PL-based model	Modern logistics covers large geographies within one to two days; volume is the question
Assortment standardisation and clinical involvement	Without directives, assortment grew considerably; clinical preferences compounded issue	Without mandate, standardisation efforts yielded only short-term gains	Standardisation without clinical input creates disruption (colour-coded binders example)	—	Standardisation essential for consolidated volumes; requires medical competence
Change management	First year was difficult; transformation continued long after rollout	"Harmonise, standardise, centralise"; engage early adopters; warning for "supply chain castle"	"Without change management impossible to succeed"; "a marathon, not a sprint"	Performance KPIs and on-site coaching to sustain adoption	Stakeholder opinion informs but does not constrain strategically necessary decisions

service quality, and the shift of logistics work from clinical to support staff has reduced personnel costs while returning clinical time to patient care.

Both interviewees identify procurement leverage as one of the most significant financial outcomes. The transparency produced by centralisation and data work has enabled more accurate tenders and stronger supplier negotiations. Interviewee C notes that consolidating data on volumes transported elevated the organisation to a new "level" as a customer, supporting better prices, but cautions that the transformation itself is insufficient as the organisation must also build the competence to leverage the improved visibility. Without translating new data and efficiency into new contracts or strategic decisions, the transformation investment is wasted.

Centralisation has also enabled standardisation of operations and reduction in stocked items. Interviewee A estimates that 20–30% of procured items are discarded due to expiration or misuse, and identifies visibility as the key to addressing this waste. Standardisation has lowered the number of items in routine use and improved efficiency, quality, and consistency in warehouse operations. Interviewee D similarly describes a system for recovering unused stock, where facilities return dormant inventory, receive a financial credit, and have the products redistributed to sites where they are needed.

In Interviewee D's case, the central platform's clearest benefit is service performance measured by On-Time-In-Full (OTIF), where the platform regularly exceeds an internal target of 97.5%, while supplier performance to the platform itself remains well below this level. Other operational benefits include centralised batch recalls, daily backorder reporting and the elimination of minimum order quantities.

By controlling the purchasing through their own channels, Interviewee C's organisation has been able to collect data, which in turn enables forecasting, inventory steering, proactive management, demand optimisation, control towers, and strategic sourcing. Interviewee C further states that the data collection also sheds light on suppliers that are not delivering on the level that are expected, making it easier to choose between suppliers based on performance instead of price.

Despite these outcomes, the interviewees describe IT integration as continuing work rather than a completed task. Interviewee A notes integration problems between the patient journal and ERP systems, and the practical difficulties of tender-driven product changes that propagate through barcode and article number systems. Interviewee D explains that the IT system has resulted in more control and visibility, and time savings, but similarly reports limited integration between the ERP system and the 3PL's WMS. Backorder management, returns, and parts of the ordering process are still handled through Excel and email. New product onboarding is also constrained by system behaviour, where articles cannot be loaded directly into the ERP system without becoming immediately orderable, so new products are first managed in Excel until inventory is in place.

4.2 Current state of Company X's healthcare supply chain

The thematic analysis of the empirical material resulted in three themes describing characteristics and challenges in the supply chain. These themes are illustrated in Appendix G, and are explained more thoroughly in the following sections.

Given the larger respondent sample in this part of the study, the findings are presented by role rather than by individual interviewee. Direct quotations are used throughout to illustrate recurring patterns, and points of divergence within a role group are noted where they emerged in the empirical material.

4.2.1 Intended order-to-receipt structure

The order-to-receipt process within Company X is, in its intended form, a centrally coordinated process, as illustrated in Figure 5. The process is initiated when a need for materials arises at a care unit, typically driven by routine consumption, stock depletion or planned medical procedures.

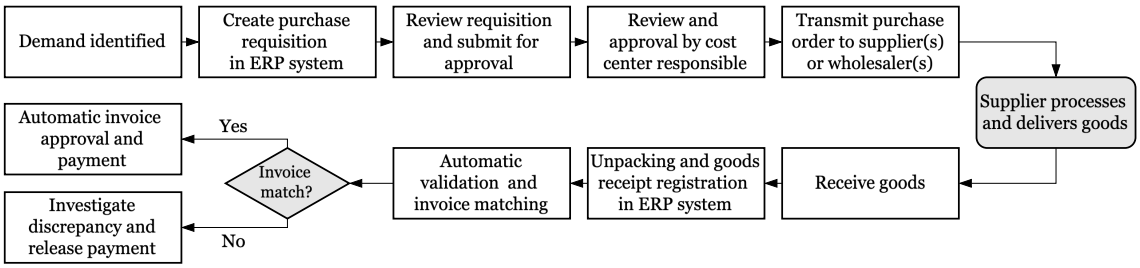

Figure 5: Intended order-to-receipt process

Clinics are expected to place orders through the organisation's ERP system, based on the predefined assortment and contracted suppliers. Orders are transmitted to suppliers, who deliver materials directly to the clinics, where goods are received, stored and used in daily operations. Within this structure, the central procurement function is responsible for supplier contracts, assortment management and overall coordination of procurement activities.

However, the empirical findings indicate that this intended process is not consistently followed in practice. While the organisation's ERP system constitutes the primary procurement channel, clinics frequently use alternative sourcing options, including direct supplier purchases, external platforms and regional procurement channels. Clinical staff describe that these deviations are typically driven by operational considerations such as product availability, delivery conditions and system usability. The use of these alternative channels varies across clinics and across product categories.

4.2.2 Operational practices

This theme captures how ordering, delivery and material handling is conducted at the clinic level in everyday operations. The following sections describe how clinic staff identify material needs, the routines and responsibility structures through which ordering is carried out, how deliveries are structured and arrive at clinics, and the receiving, handling and inventory practices that result.

4.2.2.1 Demand identification

Demand identification at the clinic level is primarily conducted through physical interaction with inventory, where staff perform walkthroughs of storage areas to assess material needs. This is typically complemented by written or verbal input from colleagues, for example through shared lists where staff "write down what is needed" or communicate requests directly. Clinic staff describe these inputs as rarely complete, and report performing additional manual checks to verify needs.

Demand assessment is largely based on the experience of individual staff rather than on system data or formal forecasting. Several clinic staff members describe having "a good sense of how much is actually used". Clinic staff also note that changes in responsible personnel can lead to "very large variations in costs and results".

4.2.2.2 Ordering routines and responsibility

Ordering activities are typically organised around recurring routines, most commonly on a weekly basis. These routines are not strictly fixed and are usually adjusted depending on workload and operational circumstances. In some cases, ordering is carried out continuously throughout the week, particularly in roles where ordering tasks are combined with other responsibilities.

Clinic staff describe ordering as fragmented across the workday, with tasks frequently interrupted by clinical duties. Increased cognitive load and a higher risk of errors, such as forgetting items, is described by clinic staff as a consequence of these interruptions. Ordering, inventory and logistics tasks at the clinic level are performed alongside patient care and administrative responsibilities, and ordering is frequently described as an activity carried out "in between other tasks".

At the same time, many clinics report having designated ordering days or routines, and state a clear preference for simple, reliable, and time-efficient solutions that allow flexibility under fluctuating demand and time availability. Orders are placed primarily through the central procurement system, with clinic staff typically identifying needs before entering them into the system rather than using the system to support demand identification itself.

Responsibility for ordering and material management is, in many cases, concentrated to one or a few individuals at the clinic level. Processes rely on the personal experience, knowledge and routines of these individuals. This concentration is de-

scribed as creating variability in how ordering is carried out across clinics, with risks for continuity particularly in cases of staff absence or turnover.

4.2.2.3 Delivery structure and predictability

Within the current delivery structure, deliveries are supplier-driven rather than centrally coordinated. Although orders are placed through the organisation's ERP system, deliveries are executed independently by each supplier. A single order is therefore often split across multiple deliveries arriving over several days, with clinic staff reporting "5-6 deliveries from the same order". By contrast, deliveries from external procurement channels tend to be more consolidated, often arriving "in one delivery" due to the broader assortments offered by wholesalers.

Deliveries also occur continuously throughout the week rather than at fixed times. As clinic staff describe, "it feels like deliveries arrive almost every day", often consisting of small and sporadic shipments. The fragmented delivery pattern is one of the most frequently raised concerns, with multiple clinic staff members stating that "it's almost the worst part".

Backordered items also occur frequently, in some cases in "more than every second delivery", and are typically delivered separately at a later stage. Combined with unreliable delivery information, this is described by clinic staff as requiring them to manage uncertainty reactively, often waiting to see whether items will arrive before taking action.

Predictability is also raised as an issue. While some suppliers follow general delivery patterns, exact timing is rarely known to clinics. A majority of clinic staff state that they "never know exactly which day the deliveries will come", with deliveries arriving "quite randomly during the day". This is described as limiting their ability to plan and coordinate material flows. Deliveries through external channels are described as often more predictable.

4.2.2.4 Receiving, handling and inventory consequences

The frequency of deliveries is reported as adding to handling requirements at the clinic level. Inventory management at the clinic level involves receiving, unpacking, verifying and distributing materials across storage locations, with clinic staff estimating that delivery-related activities can take "half a day a week" to "1-2 people full day a week", depending on clinic size and delivery patterns. Storage is described as taking place across several locations within the clinic.

Fragmented delivery patterns are also described as causing repeated interruptions in daily work, and large delivery formats, such as pallets, are noted as creating handling and space-related challenges.

Several clinic staff also note that packing slips do not always accompany deliveries, and that verification of received goods often occurs late in the process, for example

during invoice approval. This is described as delaying the identification of discrepancies and complicating follow-up, while also limiting the ability to assess supplier delivery performance.

The use of buffer stock varies across clinics. Some maintain minimal or no formal buffer, while others describe a shift towards holding additional stock to increase resilience. A majority of clinics express a preference for small and rolling inventory levels. Clinic staff describe reluctance to hold large stocks, emphasising that "large inventories lead to inefficiency". Clinic staff connect this preference to efforts to minimise waste, particularly for items with low usage frequency or limited shelf life. Overall waste levels are reported as low, although expired products still occur, mainly in connection with low-demand items or large minimum order quantities. As one clinic staff member notes, "minimum order quantity can be 100 pieces, even though I only need 1 piece", resulting in surplus inventory that cannot be used before expiration. To mitigate this, some clinics describe informal coordination across units, sharing materials between clinics to reduce overstocking and waste.

Clinics describe regularly facing situations where required materials are not available. In these cases, clinic staff describe needing to make immediate and reactive adjustments to maintain operational continuity. Local responses to such situations include emergency orders and borrowing materials from other units. In more severe cases, shortages affect clinical activities, requiring workflow adjustments or, in rare instances, the redirection of patients.

4.2.3 Visibility, data quality and information systems

This theme captures the information environment in which clinics and the procurement function operate, and how it supports operational and analytical decisions. The following sections describe how clinic staff experience the central procurement system in daily ordering, the product information and decision support available to them, the visibility they have into order and delivery status, and the data and analytical capability available to the procurement function.

4.2.3.1 ERP system usability and ordering experience

The system is widely described as difficult to use, unintuitive and poorly structured. Clinic staff report challenges in navigating the interface, locating products and performing basic procurement tasks.

Search functionality is one of the most frequently raised issues. Finding the correct products is described as difficult, with search results often requiring exact phrasing or returning irrelevant items. One clinic staff member notes that when "searching for milk, then oil shows up", while another explains that one must "write 'gloves' instead of 'glove"' to retrieve results. In other cases, search queries fail to produce results despite precise input. This lack of flexibility is described as reducing efficiency, particularly when searching for unfamiliar products.

System navigation is also described as complex, requiring multiple steps and correct interface positioning to access relevant functions. While some clinic staff acknowledge that the system provides a general overview of products and prices, these benefits are described as outweighed by the effort required to use it. As one clinic staff member explains, “even though the price may be a little lower in the system sometimes, it’s still too much extra work. My time is valuable and also a type of cost”.

Adaptation over time to the system is mentioned by some clinic staff, but is described as due to familiarity rather than usability. Frustration is frequently expressed in the interviews, with the system described as “making people go crazy”. Several clinic staff voice a need for substantial improvements, with some suggesting that “replacing the ERP system” would be the most important change to the procurement process.

The system also requires multiple process steps for ordering, which is described as adding to the time spent on ordering. The system is described by clinic staff as needing to support clinical work alongside administrative or financial control, and not being a source of friction. In some cases, bypassing the system is described as easier than completing the full procedure. As one clinic staff member explains, “the system must match the quality of how we work, just having a better price is not enough”. Orders require managerial approval, which several clinic staff describe as a source of delay and an unnecessary step. A majority of the clinical staff note that approvals are typically routine and add limited value, as “the manager always approves the orders anyway”. In cases where managers are unavailable, ordering is described as further delayed.

Technical reliability issues are also described, including session timeouts, disappearing orders and inconsistent system behaviour. As one clinic staff member states, “orders just disappear within the system”. This unpredictability is described as creating hesitation in system use. Some clinic staff describe being reluctant to interact with the system due to concerns about errors, stating that “you barely dare to touch anything”. Precautionary behaviours such as double-checking information, manually tracking orders and placing duplicate orders are also described.

A range of informal practices result from these limitations, including relying on memory, sourcing product information externally, contacting suppliers directly and conducting price comparisons outside the system. The central system is described as being used alongside other tools rather than on its own.

Procurement representatives describe similar usability difficulties, noting that “the ERP system is not the easiest system” and acknowledging it as inadequate for daily clinical use. As one procurement representative summarises, “I have not had a single unit say that it is a good system”. Despite this, procurement representatives describe continuing to promote the use of the central system by emphasising its administrative advantages.

4.2.3.2 Product information and decision support

Clinic staff describe missing images, inconsistent product descriptions and non-functional documentation links. As one clinic staff member explains, “sometimes there are no pictures [...] then it is difficult to order”, while another notes that it is “hard to even see what article it is”.

Inconsistencies in product information are also reported. One clinic staff member describes how “some articles have pictures, some don’t”, while others mention cases where information is incorrect, for example when “the picture shows a needle with a needle guard, but the text says without”. Access to product documentation is also described as unreliable, with links often not functioning.

These information issues are described as affecting ordering accuracy. Several clinic staff report cases of incorrect purchases, stating that “it has happened that I have ordered the wrong item because there is no picture or incorrect product information”. Difficulty distinguishing between similar products is also raised, particularly among non-medical staff.

A lack of decision-support functionality is also raised. There are no integrated recommendations for substitute products or cost-efficient alternatives, and limited guidance is reported when items are unavailable. As one clinic staff member notes, “a clear replacement product is never automatically suggested”, with alternatives needing to be searched for manually.

Limitations in decision support for logistics-related considerations are also raised by procurement representatives, such as shipping cost optimisation. As one explains, there is “no clear overview or warning if you fall below minimum order value”, which can result in situations where “an order of 30 SEK generates a shipping cost of 400 SEK”. Procurement representatives also describe being unable to effectively propose replacement products, and limited ability to guide clinics in purchasing decisions within the system itself.

4.2.3.3 Order, stock and delivery visibility

Clinic staff describe limited access to real-time information regarding stock availability, delivery status and order progress. The system is reported as not consistently showing whether items are in stock, backordered or discontinued at the time of ordering. One clinic staff member refers to it as a “black hole where items disappear and are not delivered”.

Backordered items are often not communicated at the time of ordering. Issues are typically identified later, for example “when the delivery note arrives”. Clinic staff describe this as limiting their ability to act earlier, noting that “we would have liked to have known that earlier so that we could have ordered from another supplier”. Inconsistencies are also described where items are listed as unavailable but still arrive.

Compared to external supplier platforms, the central system is described as offering less visibility. External systems are reported to provide immediate and reliable information, where "you see immediately if something is backordered at the time of ordering".

Difficulties determining whether orders have been processed, delivered or delayed are also raised. Delivery documentation is described as often incomplete or unclear, with clinic staff noting that "you don't get a clear delivery note" and that "delivery notes don't always arrive". Responsibility for tracking orders is described as resting largely with clinic staff themselves. As one explains, "it's up to me to keep track of it myself", and another notes that "I have to call and check". In some cases, this involves memory-based tracking, where "a lot of it is kept in your head".

Clinic staff describe placing duplicate orders when uncertain about order status or stock availability. In some cases this produces over-delivery once items are restocked, with one clinic staff member describing how "a mountain of articles arrives".

4.2.3.4 Procurement data and analytical capability

Procurement data is distributed across multiple systems, supplier platforms and manual processes. While the central ERP system serves as the primary ordering system, procurement representatives describe it as not capturing the full scope of procurement activities, particularly as a significant share of purchasing occurs outside the system.

Data from external suppliers is not automatically integrated and must be collected and consolidated manually. Procurement representatives describe being "dependent on suppliers sending statistics", often in inconsistent formats that "must first be merged and restructured" before analysis. Technical limitations are also described, with procurement representatives noting that the system "cannot read individual order lines in PDF invoices".

The level of detail available in procurement data is described as limited. Visibility is described as concentrated at an aggregated level, where procurement monitors spend primarily at the supplier level rather than at the level of individual products or transactions. As one procurement representative notes, procurement may "see turnover per supplier" but still have "no idea exactly what is being purchased". For purchases made outside the central system, procurement representatives describe little or no visibility into product-level data, which is described as making it difficult to analyse demand, identify inefficiencies or support standardisation efforts.

Within the system, procurement representatives describe difficulties in linking orders, deliveries and invoices into a coherent dataset. As one notes, "you can see what has been ordered, but not what has been delivered".

Procurement work is described by procurement representatives as heavily reliant on

manual data handling, with Excel playing a central role in organising, processing and analysing procurement information. As one notes, “everything is manual”, with significant time spent managing “price files and procurement cases” in Excel-based workflows. Procurement representatives describe Excel as flexible but also as introducing risks related to data quality. As one explains, “if you type in the wrong cell, everything becomes wrong” and the lack of version control means “it is not possible to see who has done what”. Manual processes also affect data timeliness and reliability, with delays in updating product availability sometimes resulting in orders being placed for unavailable items.

The handling of stockout and assortment data illustrates these limitations. Procurement receives Excel files from suppliers with detailed data on backordered items, but as this information is not integrated into the central system, it is processed manually, with procurement representatives needing to “search for every article individually” to update product status. System transparency is also limited: one procurement representative gives an example of how “all comments on articles disappeared” during a system update, requiring manual reconstruction from older files, while in another case “all rows were shifted one cell down”, resulting in discontinued products becoming orderable in the system and vice versa. Procurement representatives describe such incidents as infrequent but highly sensitive and consequential.

Procurement representatives describe an ambition to analyse detailed data, while describing the current data environment as limiting the extent to which such analyses can be performed consistently. Analysis is described as often restricted to areas where data is available, particularly supplier-level spend and high-volume categories. Significant effort is described as required to prepare data before analysis, with analytical work described as often focused on specific issues rather than continuous monitoring.

4.2.4 Governance and integration

This theme captures how authority and responsibility are distributed between the central procurement function and the clinics, and how the two interact in practice. The following sections describe the mandate of the procurement function and the decentralised decision-making that characterises clinic-level procurement, the misalignment of priorities between the two, the communication and collaboration gaps that arise, and the limitations in clinical product knowledge within the procurement function.

4.2.4.1 Mandate and decision authority

The mandate of the procurement function is described as limited. Procurement representatives describe an inability to enforce compliance with contracts, product selections or system usage across clinics. As one notes, procurement has “not really been given the mandate to do so”. Several procurement representatives also highlight that effective change “needs to be a mandate from higher up” and requires

"support from management" to be implemented.

Responsibility for procurement decisions is described as unclear in several areas. Ownership of product assortment, in particular, is described by procurement representatives as ambiguous, with one stating that "no one really owns the responsibility". Clinic staff also describe a need for clearer accountability and greater central responsibility for logistics-related issues. However, several procurement representatives describe that they are not positioned to assume this role, due to limited system support and fragmented information flows.

Procurement representatives and clinic staff also describe the limited clinical product knowledge within the procurement function as affecting how procurement-led decisions are received at the clinic level, particularly in matters involving product selection, supplier consolidation, and assortment changes.

Decision-making authority for procurement is largely decentralised at the clinic level. Clinics have significant freedom to select products, choose suppliers and determine how procurement is carried out in practice. Clinic staff emphasise the importance of being able to "decide ourselves", particularly in product selection, where functionality, usability and staff preferences are often given priority over standardised guidelines. Procurement representatives describe Company X as an "autonomous" organisation, where historically independent units are accustomed to managing their own operations.

Established routines and habits also shape procurement practices at the clinic level. Clinic staff describe a preference for continuing to "do what they have always done", with existing practices embedded in daily operations.

A substantial share of procurement is also reported as occurring outside central systems and contracts. While the central system is used for the majority of purchases, clinics describe relying on external supplier platforms or other channels when products are unavailable, when better prices are identified or when the central system is perceived as inefficient to use. Procurement representatives describe this as limiting their ability to enforce compliance with central agreements, noting that procurement "cannot ensure ethical compliance for external suppliers". Off-system purchasing is also described by procurement representatives as adding to administrative work. As one procurement representative explains, "the invoice ends up outside the flow" and requires local handling of pricing and verification.

4.2.4.2 Misalignment of priorities and incentives

Different priorities are described between procurement and clinics: procurement emphasises cost efficiency and compliance, while clinics prioritise functionality, availability and ease of use. As one procurement representative notes, "it is not really decided what weighs the most".

Procurement representatives and clinic staff also describe a difference in how cost

savings from external purchasing are evaluated. From the procurement perspective, clinic perceptions of cost savings may overlook administrative and coordination costs. Clinic staff describe the main driver for external purchases as reduced workload and labour costs rather than lower product prices.

4.2.4.3 Communication and collaboration gaps

Day-to-day interaction between clinics and the central procurement function is described as relatively limited. Clinic staff describe a lack of familiarity with procurement, with one stating that they have "no idea who they [procurement] are". Several clinics report delays in responses and difficulties in receiving support from procurement, with statements such as "there is a lot of delay when contacting procurement" and "I still haven't received a response to an email I sent them". Other clinics describe the response as adequate and note that they are able to receive support within a relatively short timeframe. Clinics describe uncertainty about who to contact within procurement, with the absence of a designated contact person described as reducing relationship quality.

From the procurement perspective, difficulties in disseminating information across the organisation are described. As one procurement representative notes, "the information gets stuck somewhere". Existing channels, including intranet communication, newsletters and emails, are also described as ineffective, with one procurement representative explaining that "[clinics] don't read it". Difficulties in obtaining feedback from clinical units are also described by procurement representatives. Clinics are described as often resolving supplier-related problems independently without informing procurement.

4.2.4.4 Clinical knowledge asymmetry

A recurring theme across the empirical material concerns the clinical product knowledge available within the procurement function. Clinic staff describe procurement as lacking the clinical understanding required to evaluate medical products, assess functional equivalence between alternatives, or anticipate the operational implications of product decisions. As one clinic staff member notes, "they have no idea what we do here at the clinics".

Clinic staff describe this as influencing how they respond to procurement-led initiatives. Several note that they place greater weight on their own assessments of products than on assortment decisions made centrally, particularly where these decisions concern functional equivalence between alternative products.

Procurement representatives themselves describe limitations in their clinical product knowledge. They describe difficulties in assessing whether proposed substitutes are clinically suitable, and in evaluating product attributes that are relevant in clinical practice but not visible in supplier data.

Procurement representatives describe these limitations as affecting their ability to

propose alternatives that clinics will accept, and as requiring additional clinical input before product-related decisions can be made. Clinic staff similarly describe procurement decisions as more readily accepted when accompanied by clinical input or when concerning non-clinical product attributes.

4.2.4.5 Assortment complexity and standardisation challenges

The product assortment varies significantly across clinics and is described by procurement representatives as having expanded over time through continuous additions, often initiated by local preferences or requests from clinical staff. Procurement representatives describe limited authority to reject these requests.

Duplication within the assortment is also described by procurement representatives, with the exact same articles offered by multiple suppliers. The number of available products is described as adding to the time required to identify appropriate items.

Product selection at clinics is described as driven primarily by clinical requirements. Clinic staff emphasise that decisions must prioritise "medical needs, efficiency and patient benefit" rather than cost considerations. Different units describe needing different products depending on clinical context, and full standardisation across units is described as difficult to achieve.

Procurement representatives describe how their limited clinical product knowledge, as discussed in the last section, affects their ability to identify functionally equivalent products and to propose substitutions that clinics will accept. Clinic staff similarly describe assortment changes as more readily accepted when accompanied by clinical input. Similarly, procurement representatives explain that the limited clinical knowledge contributes to their restricted authority to reject product proposals from clinics.

Clinic staff describe standardisation as needing to be balanced with flexibility. Several note that overly restrictive assortments can lead to workarounds, where clinics bypass the central system to access required products.

Table 4 summarises the three themes and the key sub-findings within each.

Table 4: Themes and sub-findings on the current state of Company X's supply chain.

Theme	Key sub-findings
Operational practices	• Demand identified through manual walkthroughs and individual experience. • Ordering interrupted by clinical duties and concentrated on one or a few individuals per clinic. • Multiple supplier-driven deliveries per order with low predictability. • Receiving and handling consume significant amount of time every week. • Inter-unit borrowing and emergency orders used as informal contingency.
Visibility, data quality and information systems	• ERP described as difficult to use, with poor search functionality and missing or inconsistent product information. • Limited real-time visibility of stock, backorders and delivery status. • Procurement data fragmented across systems and supplier platforms. • Heavy Excel reliance with documented data-quality incidents. • No decision support for substitutes, minimum-order checks or assortment guidance.
Governance and integration	• Procurement holds limited mandate to enforce contracts, product selection or system usage. • Assortment ownership ambiguous, with continuous additions and duplication across suppliers. • Clinics retain high autonomy over product, supplier and system choices. • Misalignment of priorities (procurement: cost and compliance; clinics: functionality, availability and ease of use). • Communication gaps, absent designated contacts and limited feedback flow. • Procurement's limited clinical product knowledge constrains credibility in product-related decisions.

5

Analysis

This chapter analyses the empirical findings in relation to the theory presented in Chapter 2, structured around the principle that the appropriate structural configuration cannot be determined without first understanding the conditions in which it would operate. Section 5.1 diagnoses Company X's current supply chain along three dimensions: maturity, governance, and information visibility. Section 5.2 evaluates what centralisation could and could not address given those conditions. Section 5.3 assesses Company X against the prerequisites for centralisation. Section 5.4 synthesises the analysis to consider which configuration is consistent with current conditions, and how this shifts as those conditions develop.

5.1 Diagnosing Company X through a theoretical lens

Before evaluating whether centralisation is suitable for Company X, the current state of the supply chain must be characterised in theoretical terms. The empirical findings describe what is happening, while this section interprets those findings in relation to the supply chain literature reviewed in Chapter 2, focusing on three interrelated dimensions: maturity, governance, and information visibility.

5.1.1 Supply chain maturity

Locating Company X on the maturity progression proposed by Lockamy and McCormack (2004a) requires balancing competing signals. On the surface, the organisation displays several characteristics of the defined stage: a centrally administered ERP system is in place, framework agreements with several suppliers have been negotiated, and basic procurement processes are documented. These elements distinguish Company X from purely ad hoc configurations in which processes are unstructured and rely entirely on individual judgement (Lockamy & McCormack, 2004a).

However, the empirical findings suggest that these defined elements coexist with substantial ad hoc characteristics. Demand identification at the clinic level is performed through manual walkthroughs and personal experience rather than system-supported forecasting. Ordering responsibility is concentrated in one or a few individuals at each clinic, and procedures vary across units depending on staff preferences. Clinic staff describe relying on memory to track orders, placing duplicate orders to compensate for system uncertainty, and developing informal contingency

practices such as inter-unit borrowing. These patterns correspond closely to the ad hoc stage, where performance depends on individual effort and operations rely heavily on manual processes and local workarounds (Lockamy & McCormack, 2004a).

Critically, Company X has not reached the linked stage. Lockamy and McCormack (2004a) characterise this stage by breakthrough cooperation across functions and systematic information sharing supporting coordinated decisions. The findings indicate the opposite as clinics and the central procurement function operate with limited mutual awareness, lack designated points of contact, and rarely collaborate on decisions. Information sharing remains restricted, and procurement representatives describe their work as predominantly reactive. The progression from defined to linked, which McCormack et al. (2008) associate with measurable performance gains, has not occurred at Company X.

This positioning has analytical consequences. Schiele (2007) introduces the concept of purchasing absorptive capacity, arguing that low-maturity organisations may fail to benefit from the introduction of best practices because they lack the underlying capability to absorb them. The implication is that any structural intervention at Company X, including centralisation, must account for the maturity stage from which the organisation is operating. Imposing structurally advanced solutions on a defined-stage supply chain risks either outright failure or, more commonly, structural change without corresponding behavioural change.

The absorptive capacity argument applies in both directions at Company X: the function's ability to absorb best practices is constrained by maturity, and its ability to absorb clinical knowledge from its internal customers is constrained by limited clinical presence within procurement itself. Both limitations bear on whether structural change can be expected to translate into operational improvement.

5.1.2 Governance, control and integration

The governance pattern at Company X corresponds closely to a configuration well documented in the procurement literature: weak central mandate combined with high local autonomy. Tassabehji and Moorhouse (2008) argue that procurement effectiveness depends on strategic standing and internal organisational support, and that where authority is weak, formal procurement processes may exist but be widely ignored. The empirical findings provide direct evidence of this dynamic. Procurement representatives describe themselves as having "not really been given the mandate" to enforce contract compliance, product selection, or system usage, and ownership of central elements such as the product assortment is described as ambiguous. Procurement representatives further describe the function as insufficiently prioritised within the organisation, and identify executive-level backing as a precondition for any substantive change in procurement behaviour. The empirical material therefore indicates that the standing problem involves both elements of Tassabehji and Moorhouse's (2008) framework: positional authority within the procurement function itself and recognised support from senior management.

A further element of the governance problem concerns the absence of clearly defined strategic priorities for the procurement function. Procurement representatives describe the function as operating without explicit guidance on how to balance competing objectives in day-to-day decision-making. As one procurement representative notes, "it is not really decided what weighs the most". This strategic ambiguity has consequences for both governance design and operational behaviour. Eisenhardt's (1985) distinction between outcome and behaviour control depends on the task being sufficiently well understood that meaningful targets or procedures can be defined. Where competing objectives are not prioritised at the strategic level, neither form of control can be applied consistently. Simatupang et al. (2002) make a complementary point about coordination: activities must be planned and rewarded in ways that discourage local optimisation at the expense of system-wide performance, which presupposes that the criteria for system-wide optimisation are themselves defined. The absence of explicit strategic priorities at Company X therefore weakens governance not only at the level of authority and credibility, but also at the level of the substantive objective that authority is intended to advance.

Cox et al. (2005), in their study of the UK National Health Service, identify a recurring set of demand-management dysfunctions arising in this configuration: fragmentation of spend, inter-departmental power dynamics, and maverick buying. All three are visible in Company X. Spend is fragmented across the central ERP system, external supplier platforms, regional channels, and direct purchases. Power dynamics between clinical staff and procurement constrain assortment decisions, with procurement representatives describing limited authority to reject locally driven product additions. Maverick buying, purchasing that takes place outside agreed contracts (Karjalainen et al., 2008), is widely documented across the empirical material. Karjalainen and van Raaij (2011) distinguish between forms of maverick buying driven by attempts to obtain better terms, preference for existing suppliers, and unawareness of frame agreements. Clinic-level empirical findings at Company X identifies all three drivers, particularly the first two. However, it should be noted that the "better terms" category requires careful interpretation: clinic staff describe time efficiency and operational convenience rather than price advantages as the primary reasons for using external channels.

The findings add a further dimension to this diagnosis. Tassabehji and Moorhouse (2008) frame procurement's strategic standing primarily in terms of positional authority and internal organisational support, but their argument implicitly assumes a level of professional credibility in the relevant decision domain. The empirical material indicates that procurement at Company X faces credibility constraints in addition to authority constraints: clinical staff describe procurement decisions as carrying limited weight in clinical product matters, and procurement representatives describe needing clinical input to act effectively in this space. This adds a substantive dimension to the mandate problem alongside the formal dimension already identified, and helps account for the persistence of maverick buying observed in the case. Where local actors do not believe that central decisions are informed

by adequate domain knowledge, the incentive to substitute their own judgement is reinforced, providing an additional driver alongside those identified by Karjalainen and van Raaij (2011).

The mechanisms of control available to procurement reinforce this diagnosis. In Ouchi's (1979) framework, bureaucratic control operates through formal rules and standardised processes. Company X has the formal architecture for bureaucratic control, such as an ERP system, framework agreements, predefined assortments, but the system's usability problems and the absence of enforcement mechanisms render this control largely ineffective. Market control, which relies on financial incentives and outcome evaluation, is similarly compromised. Procurement and clinics evaluate cost differently, and there is no shared accountability structure for coordination outcomes. Clan control, which Cao and Lumineau (2015) link to relational governance based on trust and shared norms, has not filled the gap, because the relational foundation between clinics and procurement is itself weak.

The depth of this relational deficit is visible in the empirical material. Clinic staff describe a lack of familiarity with procurement representatives and the absence of a designated point of contact, while procurement representatives describe difficulty obtaining feedback from clinics, who tend to resolve supplier-related problems independently rather than escalating them. Kocoglu et al. (2022) argue that trust and collaboration are what enable open communication and joint problem-solving across organisational interfaces. Neither mechanism is operating at Company X: communication between clinics and procurement is reactive and intermittent, and problem-solving occurs independently at the clinic level rather than jointly with procurement. The consequence is that the gap left by ineffective bureaucratic and market control cannot be closed through relational governance either, because the relational substrate on which Cao and Lumineau's (2015) clan/relational mechanism depends has not been built.

A further dimension of the governance problem appears in the way procurement positions itself in relation to the central system. Procurement representatives continue to promote the system to clinics while acknowledging that it is inadequate for daily clinical use. This creates a credibility paradox where procurement advocates for a system it simultaneously recognises as insufficient. It also creates a perception among clinics that system users recognise its limitations more clearly than those responsible for managing it, which further weakens the function's standing as a coordinating actor. Tassabehji and Moorhouse's (2008) argument about strategic standing is again relevant: standing depends not only on positional authority and domain credibility, but also on the perceived alignment between the function's recommendations and the operational reality of those it serves.

The empirical findings also indicate a divergence between procurement's and clinics' accounts of why the central system is bypassed. Procurement representatives describe clinic deviation primarily in terms of perceived price advantages from external suppliers and a limited appreciation of administrative costs. Clinic staff de-

scribe deviation differently, citing system usability constraints and the operational convenience of supplier packaging arrangements as the primary drivers, with price playing a secondary role. This divergence corresponds to what Frohlich and Westbrook (2001) identify as a precondition for integration: a shared understanding across functions of how and why current practices occur. Its absence constrains the effectiveness of governance interventions, since interventions designed against one diagnosis cannot address conditions described in another.

The result is a structural mismatch. The formal governance architecture suggests a centralised model, while operational behaviour displays decentralised dynamics. This corresponds to the situation that van Veen-Dirks and Verdaasdonk (2009) describe as local control systems calling for behaviour incongruent with the broader supply chain objective. Without aligned governance design, structural redesign alone is unlikely to alter operational behaviour.

5.1.3 Visibility, data quality and information systems

The information environment at Company X displays the conditions under which Barratt and Oke (2007) argue that visibility cannot be assumed even when information sharing is technically possible. The authors emphasise that, for shared information to constitute visibility, it must be accurate, trusted, timely, useful, and available in a format that can be acted upon. The empirical findings identify deficiencies along each of these dimensions. Product information is incomplete or inconsistent, delivery and stock status are not communicated reliably, and a substantial share of procurement activity occurs outside the central system entirely, leaving little to no trace in central data. Wang and Strong's (1996) multidimensional construction of data quality, which encompasses accuracy, completeness, timeliness, consistency, and relevance, is compromised on every dimension.

These limitations are amplified by the heavy reliance on manual processes. Procurement representatives describe price files, supplier statistics, and assortment data as being managed primarily in spreadsheets, with limited integration into central systems. Panko (1998) documents that informal end-user-managed tools are associated with substantial error rates with implications for any decision process that depends on them. The empirical findings include direct evidence of such errors at Company X, including documented cases of misaligned cells leading to discontinued products becoming orderable. Davenport (1998) warns that ERP systems impose their own logic on organisations, and that misalignment between system logic and operational practice can produce rigidity and user resistance rather than integration. Both phenomena are visible: the ERP system is described by procurement representatives themselves as inadequate for daily clinical use, and clinic-level workarounds proliferate as a response.

The framework proposed by Fawcett et al. (2007) is particularly useful here. The authors argue that visibility depends jointly on connectivity (the technical ability to exchange information) and willingness (the organisational disposition to share

it) and that the absence of either undermines the value of any information system. Company X has nominal connectivity through the ERP system, but experiences quality problems that compromise its usefulness, and the empirical findings document a parallel willingness deficit. Clinics frequently bypass the system in favour of external platforms perceived as more reliable, while difficulties in obtaining feedback from clinics constrain procurement's ability to act on issues. Williams et al. (2013) extend this argument by showing that visibility does not automatically translate into improved performance. Its value depends on the extent to which the organisation is internally integrated and able to interpret and act on the information available. By this standard, even improving the ERP system would not by itself deliver visibility benefits without addressing the broader integration deficit.

Beyond the static characterisation of visibility deficits, the empirical material indicates that system quality, system usage, and data quality at Company X interact in a self-reinforcing pattern. The usability problems increase the time cost of system use, which clinic staff describe as making external channels more attractive in time-constrained settings. Reduced central system use limits the data captured centrally, which constrains the procurement function's ability to maintain accurate information and respond proactively. This in turn produces inconsistencies between system information and clinic reality, which clinic staff describe as further reducing their trust in the system. The pattern corresponds to what Davenport (1998) warns of when ERP systems are introduced without alignment to operational practice, and implies that data quality and visibility at Company X cannot be improved through technical change alone, as the behavioural conditions sustaining the loop must also be addressed.

5.1.4 An internally consistent configuration

The three diagnostic dimensions describe an internally consistent configuration rather than a set of independent problems. Low-to-moderate process maturity, weak central mandate combined with strong local autonomy, and compromised information visibility are mutually reinforcing conditions. Weak governance reduces compliance with central systems, which limits the data captured centrally, which constrains visibility, which weakens the analytical and decision-support capability of central functions, which in turn further reduces their authority over local actors. The limited clinical knowledge within the procurement function reinforces the same loop from a different direction, by constraining procurement's credibility in product-related decisions and providing local actors with an additional reason to act outside central agreements. The pattern corresponds closely to what Frohlich and Westbrook (2001) describe as a configuration in which internal integration is underdeveloped and external integration with suppliers cannot meaningfully advance until internal integration is addressed.

At the same time, the widespread use of local workarounds indicates a degree of adaptive capacity within the organisation, as actors actively compensate for system limitations. However, these practices also imply that the functioning of the sys-

tem relies on continuous local adjustment, rather than on stable and well-integrated processes. In line with Lockamy and McCormack's framework, this dependence on informal corrective practices is characteristic of lower maturity stages, where process execution is sustained through local intervention rather than systemic coordination.

This diagnosis has direct implications for how the question of centralisation should be framed. Rather than evaluating centralisation as a structural choice in isolation, the analysis must consider whether and how a structural redesign would interact with the maturity, governance, and information conditions identified here, both as constraints on what centralisation can achieve, and as preconditions that may need to be developed alongside, or before, structural change.

5.2 What centralisation could address and what it cannot

The diagnosis above describes an internally consistent configuration in which limited maturity, weak governance, and compromised information visibility reinforce each other. The analysis now turns to whether, and to what extent, centralisation addresses the problems identified. Applying the trade-offs synthesised in Chapter 2 to the conditions of Company X distinguishes problems for which centralisation provides a direct structural response from problems where its contribution is conditional, and from problems that centralisation does not address or actively makes more difficult to manage.

5.2.1 Problems centralisation can structurally address

The empirical material documents a delivery pattern in which orders placed through the central ERP system are executed independently by individual suppliers, producing small and uncoordinated shipments arriving throughout the week. Clinic staff describe receiving up to six deliveries from a single order, with handling activities consuming several days of staff time per week. This is precisely the structural condition that centralisation is theorised to address. Consolidation of inbound and outbound flows is a primary mechanical effect of centralisation (Pedersen et al., 2012; Schmitt et al., 2015), and demand aggregation reduces both the number and the variance of delivery events (Abrahamsson, 1993; Croxton & Zinn, 2005). The variance-reduction effect is particularly relevant in healthcare, where consumption is patient-driven, irregular, and difficult to forecast from historical patterns alone (de Vries & Huijsman, 2011; Lapierre & Ruiz, 2007), which is precisely the condition under which risk pooling delivers its largest benefits. The interview material reinforces this: Interviewee C describes the purpose of a central depot as being to "lower the number of transports to healthcare units" and to "create better control". Delivery fragmentation at Company X is therefore a problem for which centralisation is, in structural terms, a direct response.

The empirical material shows ordering practices that are heavily person-dependent

and manual. Clinic staff describe identifying demand through visual walkthroughs and memory, placing duplicate orders to compensate for system uncertainty, and resolving stockouts through reactive inter-unit borrowing. These practices are a recurring source of waste, error, and clinical workload, and they persist because the central system does not provide the decisional support that would replace them. Centralisation addresses this problem through the structured replenishment apparatus that a centralised flow makes operationally coherent and cost-justified. The interview material is consistent on this. Interviewee A's two-bin Kanban system, introduced together with the central warehouse and a new ERP system, handles approximately 80–90 per cent of the assortment and has shifted ordering work from clinical to support staff. Interviewee C's material supply system, also signal-based, covers around 60 per cent of the flow with a stated target of 80 per cent and is described as producing measurable gains in cost, visibility, and supply preparedness. The benefit attributed to centralisation here is not the warehouse itself, but the structured ordering layer that becomes economically and organisationally viable once flows are consolidated. Without that layer, the manual ordering practices persist regardless of where inventory sits.

The governance pattern of weak central mandate combined with strong local autonomy, producing maverick buying and ambiguous assortment ownership is, in part, a structural condition. Clinic staff describe external purchasing as driven primarily by usability and operational convenience rather than price. The route by which centralisation could reduce maverick buying is therefore competitive rather than authoritative. It can absorb the volume that currently flows outside the system only to the extent that the central channel is in fact superior to existing alternatives on the dimensions clinics value. Interviewee D's model is explicit on this point, operating without exclusivity and competing on service quality and convenience rather than mandate. A modest structural effect remains, in that a single well-integrated channel makes off-system purchasing administratively costlier even without enforcement. Thus, whether maverick buying declines under centralisation depends primarily on whether the central channel is built to outperform the alternatives, and secondarily on whether the autonomy culture is allowed to coexist with the new configuration or is actively contested by management.

Regarding limited data visibility and fragmented master data, centralisation contributes to addressing this in two complementary ways. By consolidating transactions through a single channel, it widens the share of activity captured centrally and reduces the volume of purchasing that leaves little or no trace in central data. And, as Pessot and Lolli (2026) argue, centralised structures perform more effectively in contexts with standardised processes and integrated information systems precisely because they create the structural impetus for unified master data. The interview material supports this causal direction. Interviewee A reports that, following centralisation, "getting more transparency into what we are actually buying makes our contract managers much better equipped to run accurate tenders and negotiate better deals", and Interviewee D describes being able to model the cost implications of adding a new facility and to set contractual reduction targets with numerical

precision only after centralisation and ERP system implementation. Centralisation creates the conditions under which unified master data becomes operationally valuable, but does not, in itself, produce that master data. As argued earlier through Barratt and Oke (2007) and Williams et al. (2013), connectivity alone is insufficient for visibility, and Company X's existing connectivity already operates under documented quality and willingness deficits. Centralisation in this context provides the structural conditions for visibility, but presupposes deliberate development of the data foundation underneath it.

5.2.2 Problems centralisation does not solve, or even aggravates

The dominant performance objective in healthcare supply chains is uninterrupted material availability, with stock-outs producing not merely administrative cost but operational and clinical risk (Böhme et al., 2016; Patel et al., 2023). This characteristic alters the standard trade-off identified in Chapter 2 in a way that constrains how far centralisation can be taken. Schmitt et al. (2015) show that while centralisation reduces expected inventory cost through risk pooling, it increases cost variance under supply disruption, because a single facility constitutes a concentrated failure mode whose loss affects all downstream locations simultaneously. Furthermore, in healthcare, where demand variability further complicates the sizing of buffer stock against disruption (de Vries & Huijsman, 2011; Lapierre & Ruiz, 2007), this concentration risk might be harder to absorb than one might suggest. In Company X this argument requires a particular reading as the current configuration is not meaningfully decentralised in the warehousing sense. Company X holds no regional stock points of its own, but consists of supplier-direct flows into clinic-level inventory. The diversification that exists is therefore distributed across the supplier base rather than across the company's own facilities, and a supplier-level failure typically affects a product category rather than all flows simultaneously. Introducing a central warehouse adds a new node between suppliers and clinics. Whether this improves or worsens resilience is not unconditional: a central buffer can shield clinics from upstream disruption but the warehouse can also become a new chokepoint whose failure would affect all clinics across all categories at once. The trade-off in this case is therefore not whether to give up diversification, but which kind of concentration is preferable.

Schiele (2007) argues that low-maturity organisations may fail to benefit from the introduction of best practices because they lack the underlying capability to absorb them. Centralisation is, in maturity terms, a structurally advanced configuration whose benefits depend on the master data discipline, process standardisation, and cross-functional coordination characteristic of the linked stage and beyond. Applied to centralisation, this implies that imposing it on an organisation that has not yet reached the relevant maturity stage risks producing structural change without corresponding behavioural change: the warehouse and the ERP exist, but ordering practices, governance norms, and information sharing do not adjust to fit them. The clinic-procurement integration documented in Section 4.2.4 is part of this absorp-

tive constraint, since the relational coordination required for a centralised function to operate effectively is itself underdeveloped. The interview material is alert to the risk. Interviewee C's caution against building a "supply chain castle" of promises and structures without underlying substance describes precisely this failure mode, and Interviewee A's account of local workarounds proliferating during the first year after centralisation illustrates that the absorptive constraint operates even where the structural change is otherwise well-supported. The implication for the analysis here is that centralisation does not bypass the maturity question. If anything, it raises the stakes of it, because the cost of structural change without behavioural follow-through exceeds the cost of remaining in the current configuration.

The assortment complexity documented in Company X follows from the limited mandate and clinical product knowledge within the procurement function. Product selection is described by clinic staff as needing to prioritise "medical needs, efficiency and patient benefit" rather than cost considerations, and assortment changes are described as more readily accepted when accompanied by clinical input. Centralisation does not address this constraint. It alters where decisions are taken, but the underlying requirement for clinical input does not diminish. If anything, centralised assortment decisions amplify the consequences of inadequate clinical knowledge by applying them across a wider footprint. Improving clinical credibility within procurement is therefore a parallel requirement that operates independently of structural redesign.

A centralised configuration is more dependent on integrated information systems than the current configuration, not less. Centralised ordering, warehouse management, inventory visibility, and supplier coordination all run through the same system infrastructure, and the absence of any of those capabilities concentrates rather than disperses the resulting dysfunction. The system landscape documented in the empirical findings is inadequate on precisely these dimensions. The ERP system is described by procurement representatives themselves as not fit for daily clinical use, key procurement processes are conducted in Excel with documented error consequences, and integration between the central system and supplier or logistics partner systems is limited. The interview material is consistent on the implication. Interviewees A, C, D, and E identify fit-for-purpose IT, including ERP system, warehouse management, and EDI capabilities, as a precondition for centralisation rather than an outcome of it, and Interviewee D's continued reliance on Excel for backorder management several years after centralisation illustrates how an inadequate system base persists into the new configuration. Centralisation built on the current IT base at Company X would therefore inherit and amplify the existing dysfunction rather than resolve it. This is not a constraint that structural redesign can address, but instead requires investment in the system layer on which the structure depends.

5.2.3 Implications for the structural choice

The analysis developed in the preceding subsections supports the following synthesis: Centralisation provides a structurally appropriate response to the delivery frag-

mentation, ordering, and information conditions diagnosed earlier, and a conditional response to maverick buying through channel competition rather than through mandate. Its limits are substantive and accumulate. The underlying mandate deficit, including the strategic ambiguity over what procurement is to optimise for, is organisational and cultural rather than structural, and is not removed by redesign. The IT infrastructure on which a centralised configuration depends is currently inadequate and would constrain or amplify the dysfunction unless developed in parallel. The maturity gap means that structural change risks running ahead of the absorptive capacity needed to convert it into behavioural change. Service criticality can bound how far inventory consolidation can be taken. In Company X's case the relevant question is not whether diversification is given up but what redundancies are built in around the new central node. And the clinical-credibility component of the governance problem is not addressable through structural means at all.

A further implication follows from the configuration identified in Section 5.1.4. Because maturity, governance, and information operate as a mutually reinforcing system in the case organisation, single-axis intervention, including structural intervention, is unlikely to break the loop on its own. Centralisation can change the structural axis, but unless governance commitment, IT capability, and process maturity are developed alongside it, the behavioural patterns that currently sustain the configuration will reassert themselves around the new structure. The analytical question is therefore not whether centralisation resolves the problems diagnosed, but which combination of structural and parallel interventions, and in which sequence, would be required to produce a durable change. The analysis turns next to the prerequisites that determine whether that combination is feasible at Company X.

5.3 Prerequisites for centralisation at Company X

The expert interviews identify six categories of prerequisites for centralisation: strategic and management commitment, data foundations, IT infrastructure, operational scale, assortment standardisation and clinical involvement, and change-management capacity. This section assesses Company X against each prerequisite in turn, drawing on the empirical findings and the diagnosis developed, and then considers how the prerequisites interact.

5.3.1 Strategic direction and management commitment

Across the interviews, executive commitment is described as the precondition without which other prerequisites cannot be developed. Interviewee C argues that change requires investment and that investment requires management to set "the ambition", while Interviewee E frames management buy-in as the first and most important factor and identifies a quantified business case as the typical instrument for securing it. Interviewee D's account, where the transformation originated with the CEO, illustrates the same point from the implementation side. This expectation of sus-

tained rather than authorising leadership corresponds closely to Kotter's (1995) argument that change processes depend on continuous leadership engagement rather than initial endorsement. Interviewee C further distinguishes between management treating the supply chain as a support function and management treating it as a strategic capability, arguing that only the latter view enables structural change. This distinction relates directly to the maturity progression set out by Lockamy and McCormack (2004a), where movement beyond the defined stage depends on supply chain processes being recognised and resourced as a strategic capability rather than as a support function.

The empirical material on Company X does not record the position taken by senior management directly, but it records consistent signals from the procurement function that such backing is currently absent. Procurement representatives describe themselves as having "not really been given the mandate" to enforce contract compliance, product selection, or system usage, and identify executive-level support as a precondition for substantive change. The strategic ambiguity where "it is not really decided what weighs the most" between cost, availability, and ease of use, points to the same gap from a different angle. The ambition that Interviewee C describes as a management responsibility has not been articulated in a form that can guide trade-offs at the operational level. The problem in which procurement lacks both positional authority and recognised senior support in the sense of Tassabehji and Moorhouse (2008), is therefore not merely an outcome of weak governance but also evidence that the strategic prerequisite is unmet. These consequences are significant, as Eisenhardt's (1985) argument that meaningful outcome or behaviour control presupposes a clearly defined task means that, without explicit strategic priorities, neither form of control can be applied consistently at the operational level. A further complication is that the route to management commitment described by Interviewees D and E runs through a business case, and a credible business case in turn depends on data. The data gap discussed in the next section therefore constrains not only operational analysis but the very mechanism through which strategic commitment is typically obtained.

5.3.2 Data foundations

Interviewee C identifies master data and data quality as "the most essential prerequisites for any type of centralisation solution", arguing that without data no improvement is possible and that maturity is, in practical terms, a data phenomenon. Interviewees A, D, and E reach similar conclusions from different starting points: data is the basis for better tendering, for measuring cost and quality by process, and for the business case that secures management commitment.

By this standard, Company X displays the most pronounced prerequisite gap. The empirical findings show that procurement data is distributed across multiple systems, supplier platforms, and manual processes. The ERP system captures only part of procurement activity, as a substantial share occurs through external channels. Visibility is concentrated at the supplier level and lacks product-level granu-

larity, while orders, deliveries, and invoices cannot be linked into a coherent dataset. Procurement work also depends heavily on Excel-based handling, with documented data-quality incidents. These limitations matches closely with the pre-centralisation states described by Interviewees A and D. Interviewee A's "no transparency and no traceability" condition, in which the accountant-style system captured invoices but not delivered quantities or quality, and Interviewee D's account of being unable to produce precise budgets without working directly with the accounting team because no integrated tools to measure cost or quality existed.

The diagnosis shows that every dimension of Wang and Strong's (1996) data-quality construct is compromised and that nominal connectivity through the ERP system coexists with a willingness deficit in the sense of Fawcett et al. (2007). The conditions Interviewee C describes as preconditions for centralisation, the ability to produce logistics data easily and to base contractual and operational decisions on it, are not in place.

This gap is decisive for two reasons. First, it bears directly on the operational logic of any centralised configuration. A central warehouse depends on accurate consumption and inventory data to plan replenishment, and a control-tower model depends on visibility into flows across units to coordinate them. Centralising material flows without first establishing the data foundation would correspond closely to what Interviewee C labels a "supply chain castle": a structure built on insufficient substance, raising expectations that the underlying capabilities cannot meet. Second, the data gap propagates backwards into the strategic prerequisite. Without reliable cost, volume, and performance data, the business case that Interviewees D and E identify as the route to executive commitment cannot be constructed with the numerical precision they describe, leaving any case for change resting on inference rather than evidence.

5.3.3 IT infrastructure

The interviews establish that a dedicated and functioning IT system for logistics is a foundational prerequisite for supply chain transformation. Interviewee A describes the IT landscape as integral to gaining control and structure, while Interviewee C explains that without centralised systems, organisations are forced to manage many small, uncoordinated systems that drain resources and reduce visibility. Both Interviewees C and D identify IT capability as an essential step before further supply chain development can take place. Interviewee E adds that a full system replacement is not always necessary, as a supplementary system dedicated to logistics can serve the same purpose, but is clear that a system designed for accounting or financial practices is insufficient for supply chain tasks and that reliance on Excel-based processes leads to loss of trust and system circumvention.

Company X's current IT position presents a clear gap. The ERP system captures only part of procurement activity, with a large share conducted through external channels. Orders, deliveries, and invoices cannot be linked into a coherent dataset,

and visibility is concentrated at the supplier level. Procurement work depends heavily on Excel-based handling, with documented incidents affecting both ordering and data collection. Manual processes also create operational inefficiencies, where personnel are required to update restnotes by hand, creating windows in which out-of-stock items remain orderable. The ERP system was originally designed as an accounting system and has been reconfigured for logistics use, resulting in limitations including missing product information, poor search functionality, unsaved progress, and no decision support. These shortcomings have lowered trust both in the system and in the procurement function that represents it, driving widespread circumvention. The system also provides no visibility into inventory levels, backorders, or delivery status.

The IT and data gaps are closely intertwined. Interviewee C argues that master data must precede IT acquisition, as it determines what the system needs to do, but a functional IT system is also the basis on which data can be collected, meaning the two gaps reinforce each other. Davenport (1998) warns that systems impose their own logic on organisations, and that a poor contextual fit produces resistance and misalignment rather than integration. Resolving the IT gap therefore requires sufficient data maturity to understand what the organisation needs, while meaningful data improvement in turn requires better systems to capture it.

The distance between Company X's current IT capabilities and the prerequisite the interviews describe is considerable. The ERP system directly contradicts Interviewee E's position that a logistics system cannot be built on an accounting platform. Rather than generating control or structure, it creates friction for both clinical and procurement staff. Circumvention reduces data collection and introduces additional administrative costs, and as both Interviewee E and Panko (1998) note, Excel-based processes are error-prone and erode trust, a pattern clearly evident at Company X. The state Company X are currently in is similar to Interviewee A's pre-centralisation state, where an accountant-style system extended into procurement use, manual processes filling the gaps left by the system, and a fragmented data trail in which a substantial share of activity bypassed central capture entirely.

5.3.4 Scale and volume concentration

The scale prerequisite is described in the interviews in two ways. Interviewee A treats physical scale, both volume and geographic proximity to a central warehouse, as the central condition for a true centralisation. Interviewees B, D, and E view distance as largely tractable with modern logistics services and instead highlight aggregate consolidated volume as the operative scale question. Interviewee B emphasises that any solution must be designed against a prior understanding of volumes, articles, suppliers, and units. The common thread is that the relevant scale question is not "is the organisation large?" in absolute terms but "is there sufficient consolidated volume on a defined assortment to make a centralised configuration economically viable?". This is consistent with the literature on risk pooling and demand aggregation (Pedersen et al., 2012; Schmitt et al., 2015) that motivates centralisation in

the first place, the benefits of which depend on volume being concentrated at the level on which the configuration operates.

Company X is a private healthcare provider operating at a substantially smaller scale than the regional authorities represented by Interviewees A, B, and C. The empirical material does not provide the figures required to settle the scale question definitively, but it does establish two relevant points. First, as section 5.3.5 sets out, this assortment breadth means that whatever the aggregate volume across Company X, it is currently dispersed across more SKUs than necessary, and any scale assessment is therefore conditional on the assortment work discussed there being undertaken first. Second, the spectrum of centralisation models includes configurations less dependent on physical scale than a single central warehouse. Interviewee C's control-tower model, in which central coordination is exercised over a structurally distributed flow, is one such option, and Interviewee D's 3PL-based model, which competes on service rather than mandate, is another. The variation across these configurations supports the contingency position taken by Glock and Hochrein (2011), that the appropriate structural response depends on the fit between configuration and context rather than on any optimal form, and implies that the scale prerequisite cannot be assessed in the isolation but only against a specific configuration. For Company X, the operational and scale prerequisite is therefore better read as conditional than as a simple pass or fail. A full physical central warehouse along the lines of Interviewee A's solution is unlikely to be supported by current volumes, while lighter-weight centralisation models may be viable provided that assortment consolidation reduces the SKU base on which they would operate.

5.3.5 Assortment standardisation and clinical involvement

The interviews present standardisation of item assortment as a prerequisite that must be in place before centralisation can become economically viable. Interviewee E argues that standardising items and removing duplicates is essential to generate the consolidated volumes on which bulk purchasing and bargaining power depend, and that a broad assortment directly counteracts this logic by fragmenting volume across too many SKUs. This corresponds closely to the SKU heterogeneity that Volland et al. (2017) identify as a defining complication of healthcare materials management, where the large and varied item base both complicates inventory work and constrains the scope for unified master data management. A further dimension raised by Interviewee E is that making the right assortment decisions in a healthcare setting requires medical and clinical competence, not only logistics or procurement expertise, because the question of which product variants are clinically interchangeable is one that generalist procurement staff cannot settle alone.

Company X displays the conditions the interviews associate with an absence of standardisation work. The empirical material shows an assortment that has expanded through continuous additions over time, with duplication in which identical articles are available through multiple suppliers and procurement reporting limited authority to reject new requests. Clinical preferences currently drive purchasing decisions,

and units operate with a degree of autonomy that has historically placed assortment decisions with those closest to clinical practice rather than with a central function capable of evaluating them across the whole organisation. This pattern reproduces the maverick-buying dynamic that Karjalainen and van Raaij (2011) attribute to weak procurement authority and local preferences for established supplier relationships, and corresponds to the demand-management dysfunctions that Cox et al. (2005) document in the UK NHS, where dispersed procurement combined with strong local autonomy produced predictable fragmentation of spend.

There is little indication in the empirical material that standardisation work has been systematically undertaken, that the operations and material flows of individual units have been mapped, or that the sequencing principle Interviewee C describes, beginning with articles that are clearly standardisable before addressing clinically contested ones, has been applied in any structured way. The assortment position at Company X therefore reflects the same dynamic that Interviewee A describes in their pre-centralisation state, where the absence of clear directives allowed local preferences to continuously expand the item base, eventually producing an assortment too broad to support the consolidation logic on which centralisation depends.

The standardisation prerequisite connects directly to the scale assessment in Section 5.3.4. The current assortment breadth disperses volume across too many SKUs, undermining scale economies regardless of aggregate size. Whether any centralised configuration is viable at Company X therefore cannot be determined until the assortment is better understood and rationalised.

A final point concerns clinical involvement. This is distinct from the change management considerations handled later in Section 5.3.6, as the issue is not only how staff are brought along through a transition but whether the right expertise is present to make sound assortment decisions at all. Without clinical input, decisions will either be clinically inappropriate or lack the credibility required for clinics to accept them. Given the weak integration between procurement and clinical staff already identified at Company X, building these mechanisms is part of the substantive preparation that would need to precede any centralisation initiative, not a consequence of it.

5.3.6 Change management

Interviewee B states that “without change management it is basically impossible to succeed” and describes the work as “a marathon, not a sprint”, signalling that change management is not a single launch event but a sustained process. Interviewee C sets out two sequencing principles for this work. The first is substantive: harmonisation of operations and flows must come first, then standardisation, and only then centralisation, since attempting to centralise without first understanding and aligning how different units operate risks imposing a standardised logic onto conditions that will resist it. Interviewee B illustrates the same point from the standardisation side, noting that efforts imposed without sufficient understanding of operational reality create disruption rather than efficiency. This sequencing logic corresponds to

Schiele's (2007) absorptive capacity argument, that the value of advanced practices depends on the foundational capabilities already present in the organisation, with each stage building the capacity on which the next can be effectively absorbed. The second is procedural: starting with early adopters, building credibility through delivered results, and applying enforcement only at the end, which restates Rogers' (2003) Diffusion of Innovation logic and presupposes that the organisation has time, attention, and a credible delivery record to invest in this work. This is also consistent with Kotter's (1995) emphasis on visible early successes as a mechanism for building momentum and trust during transformation, suggesting that the sequencing principle Interviewee C describes reflects a wider change-management logic. Read against the diagnostic and dialogic distinction in the change-management literature, these two sequencing principles correspond to what Hastings (2025) describes as the most consistently successful transformation pattern of a diagnostic structure that defines direction and stages, combined with dialogic iteration that adapts to stakeholder input as the change unfolds. The substantive sequence Interviewee C describes provides the diagnostic spine, while the procedural sequence of early adopters and delivered results provides the dialogic mechanism by which the spine is adjusted in contact with local conditions. Bushe and Marshak's (2009) argument that purely diagnostic approaches under-perform when applied to organisations whose stakeholders need to be brought along through the change applies directly here, and supports the reading that the sequencing principle Interviewee C describes is not a single interviewee's preference but a recognised mode of transformation work.

Interviewee A's account of a Kanban and ERP system rollout across all healthcare units bears the broader point out: even where standardisation was successfully introduced, local variants and workarounds persisted because of the speed of the rollout, and the standardisation work continued long after the initial transformation. Interviewee D's account of using performance monitoring and on-site coaching to embed and retain change after implementation makes the same point from the implementation side. The contrast between Interviewee A's rapid rollout and Interviewee D's incremental adoption corresponds to the pace trade-off that Klarner (2010) identifies: faster change can enhance adaptability but raises the risk of overload, resistance, and implementation failure, whereas more gradual, spaced change allows for learning and stabilisation but extends the time to realise benefits. The persistence of workarounds in Interviewee A's organisation, even where the structural change itself succeeded, illustrates the overload failure mode Klarner describes, and reinforces Burnes' (2004) point that the appropriate pace is context-dependent rather than universally prescriptive.

Company X presents two features that make this prerequisite particularly demanding. The first is the autonomy culture in which clinics value being able to "decide ourselves" and procurement representatives describe Company X as an "autonomous" organisation, with established routines reflected in a preference for continuing to "do what they have always done". The second is the prevalence of well-developed workarounds: direct supplier orders when the central system is inefficient to use, inter-unit borrowing when stock is unavailable, emergency procedures when delivery

information is unreliable. Both features map onto the institutional and individual barriers that Kroezen et al. (2022) identify as recurrent in healthcare change settings, including professional territorialism, unclear roles, and divergent models of care. The workarounds are not simply cultural artefacts, but also functional substitutes that clinic staff currently rely on to maintain operational continuity in the face of the deficiencies of the current system. Centralisation that constrained these practices without first offering reliable alternatives would predictably trigger the loss of trust that Interviewee C associates with the "supply chain castle" pattern, and could intensify the already weak clinic–procurement integration. Interviewee A's account of the first year after centralisation illustrates this risk concretely: a rapid implementation that did not adequately support healthcare units' adoption of the new standardised operations and ERP system produced exactly the proliferation of local workarounds that the section here identifies as the predictable consequence of removing established practices before substitutes are in place, and many of those workarounds persist in their organisation today.

The picture is not uniformly negative. The workarounds are also evidence of an adaptive capacity, where clinic staff actively compensate for system limitations rather than allowing operations to fail. This suggests that staff will adopt new practices when those practices reliably solve problems they recognise, which is the condition Interviewee D describes operating under in their own facilities. The implication for sequencing is that visible operational reliability needs to precede, not follow, the consolidation of authority that a centralised configuration would imply. This is consistent with Beer and Nohria's (2000) point that structural redesign does not in itself generate the behavioural alignment it is intended to support, so behavioural work has to be planned as a task in its own right rather than as a by-product of structural change. Beginning with units willing to engage, in the manner Interviewee C recommends, would also test this dynamic at limited scale before broader rollout. The credibility constraint identified in Company X, where procurement decisions carry limited weight on clinical product matters, further reinforces that change management at Company X cannot rely on formal authority alone and would need to combine delivered improvements with the clinical input mechanisms which are currently absent.

5.3.7 Reading across the six prerequisites

Assessed individually, each of the six prerequisites is currently unmet at Company X, though to different degrees and for different reasons. Strategic commitment is not visibly in place, the data foundation is the most severe and consequential gap,IT systems cannot handle a structural transformation, operational scale is conditional rather than ruled out depending on the configuration considered and on prior assortment work, standardisation is lacking both in assortment and processes and change-management requirements are demanding given the autonomy culture and entrenched workarounds.

Read across the six, the prerequisites form a sequence rather than a checklist. This

sequencing reflects the developmental logic of the maturity literature, in which capabilities at each stage build on those established at the preceding one (Lockamy & McCormack, 2004a), and is consistent with Schiele's (2007) earlier mentioned argument that the value of advanced practices depends on the absorptive capacity already present in the organisation. The data gap is foundational as it constrains the operational analysis on which any sensible scale and configuration choice would rest, the business case through which strategic commitment is typically obtained, and the demonstrable improvements through which change management builds credibility. The IT gap is directly intertwined with this, as inadequate IT systems both cause and are caused by the data deficit, creating the destructive feedback loop identified in section 5.3.5. Strategic commitment is in turn the precondition for the investment required to address both gaps, producing the chicken-and-egg dynamic that Interviewee C associates with low-maturity organisations. Standardisation depends on the data and IT foundations being sufficiently developed to understand the assortment and map how units operate, meaning it cannot be meaningfully pursued until those foundations are addressed. The scale question can only be answered once standardisation work has begun to rationalise the assortment, and the change-management approach can only be designed once the configuration is known. The "supply chain castle" warning is therefore particularly apposite at Company X. Presenting centralisation as a near-term structural choice would raise expectations that none of the underlying prerequisites can currently support. What the prerequisite analysis suggests instead is that the prior question for Company X is not which form of centralisation to adopt, but which preparatory work, beginning with master data, the closely related IT deficiencies, and the governance structures needed to sustain standardisation efforts, would need to be undertaken before that choice could be made on an informed basis.

Table 5 summarises the assessment of Company X against each of the six prerequisites.

5.4 Centralisation configurations for Company X

The previous sections together imply that the question facing Company X is not whether to centralise in some general sense, but which configuration along the spectrum is consistent with the conditions actually present. This section synthesises the empirical and theoretical material into a configuration that links different forms of centralisation to the conditions on which their effectiveness depends, identifies which configuration most closely fits Company X at its current maturity, and sets out how the situation changes if prerequisites develop differently from how they currently stand.

5.4.1 Configuration as contingency

The reviewed literature rejects the idea that any single configuration is universally superior. Glock and Hochrein (2011) argue that organisational designs perform better when properly aligned with the conditions of their environment, so that per-

Table 5: Assessment of Company X against the six prerequisites for centralisation.

Prerequisite	**Status**	**Key evidence**
Strategic direction and management commitment	Not in place	• Procurement describes a lack of mandate from senior management. • Strategic ambiguity over what to optimise for ("not really decided what weighs the most"). • No empirical signal of executive-level backing.
Data foundations	Severe gap	• Visibility concentrated at supplier level rather than product or transaction level. • Orders, deliveries and invoices cannot be linked into a coherent dataset. • Excel-based handling with documented data-quality incidents. • Substantial procurement activity occurs outside the central ERP.
IT infrastructure	Not in place	• ERP originally designed as an accounting system; lacks usable search, decision support and operational visibility. • Key processes (backorder, returns, product onboarding) handled in Excel and email. • Manual updates create windows in which discontinued items remain orderable.
Scale and volume concentration	Conditional	• Aggregate volumes not established empirically. • Volumes currently dispersed across an unrationalised assortment. • Viability depends on prior standardisation work and on the configuration chosen.
Assortment standardisation and clinical involvement	Not in place	• Assortment expanded through continuous local additions with duplication across suppliers. • Procurement lacks authority to reject requests. • No systematic standardisation work documented. • Clinical-input mechanisms underdeveloped.
Change management capacity	Demanding	• Strong autonomy culture in which clinics value being able to decide for themselves. • Entrenched workarounds (direct supplier orders, inter-unit borrowing, emergency procedures) function as substitutes for system deficiencies. • Adaptive capacity present but not yet channelled into structured change.

formance depends on the fit between structure and context rather than on any optimal form. Pessot and Lolli (2026) develop the same position for healthcare supply chains, treating centralisation and decentralisation as alternative responses to competing performance objectives whose suitability depends on contextual factors. This view is reinforced by the hybrid purchasing literature by Trautmann et al. (2009), who describe hybrid structures as network forms that combine central coordination with decentralised execution, treating centralisation not as a binary choice. Hartmann et al. (2008) extend this by showing that the effectiveness of such structures depends on the fit between the control mechanisms applied and the organisational context, making hybrid forms inherently conditional on the environment in which they are deployed.

This view is consistent with the empirical findings. The interviewees describe different configurations not as competing answers to a common question, but as responses tailored to different combinations of scale, data, governance, and organisational readiness. Interviewee A operates a single central warehouse serving a network of over a thousand units in close geographic proximity. Interviewee C describes a hybrid with category-specific depots and a control-tower coordinating layer. Interviewees D and E describe 3PL-based models that achieve consolidation without ownership of warehouse infrastructure. Each interviewee identifies a different combination of prerequisites as decisive for their own configuration. The contingency principle is therefore both a theoretical position and an empirical observation. The question is which configuration matches Company X's conditions, not which configuration is best in the abstract.

5.4.2 What each configuration on the spectrum demands

The different configurations on the spectrum can be ordered by the demands they place on the six prerequisites identified in the expert interviews. A physical central warehouse of the kind described by Interviewee A makes the heaviest demands. It requires sufficient consolidated volume to be financially viable, mature master data to plan replenishment and inventory levels, a clear central mandate over assortment and ordering, and substantial change-management capacity. Interviewee A states that scale, both volume and geographic proximity, is the central condition for this configuration, and the role of the new ERP system introduced alongside the warehouse indicates that the data and integration prerequisites are equally demanding.

A 3PL-based central warehouse of the kind described by Interviewees D and E reduces some of these demands. The logistics partner provides physical infrastructure, lowering the capital and operational scale required from the focal organisation itself. Master data and integration requirements remain substantial, however, because the platform's value rests on visibility into flows and on the ability to coordinate substitutions and assortment changes across facilities. Interviewee D's account makes clear that integration between the ERP system and the logistics partner's warehouse-management system, master data on new products, and central handling of stockout substitutions are critical operational dependencies even when the warehouse is oper-

ated externally. The model competes on service rather than mandate, which reduces the change-management demand somewhat, but it does not remove the requirement for a credible data foundation.

A control-tower configuration, in Interviewee C's formulation, is the lightest in physical-scale terms. It exercises central coordination over a structurally decentralised flow rather than consolidating that flow into a single facility. The control-tower model thereby relaxes the physical-scale prerequisite that Interviewee A treats as central, and reduces the up-front change-management burden because it does not require relocating ordering and inventory work away from clinic staff. It does not, however, escape the data and IT prerequisites. A control tower without visibility into the flows it is meant to coordinate is, in Interviewee C's terms, exactly the "supply chain castle" that the imagery is intended to caution against. The control-tower configuration therefore shifts the focus of the prerequisites from physical scale toward information capability and governance, but does not eliminate the data requirement.

Across the spectrum, information integration, standardised working methods, and the authority to enforce central decisions are common prerequisites; the configurations differ primarily in the scale of physical investment they require and in the speed and depth of behavioural change at the clinic level. This pattern is consistent with the literature. Pessot and Lolli (2026) identify integrated information systems as a condition for effective centralisation, and Jonsson et al. (2013) specify a single planning domain possessing all critical information, standardised working methods, and a dominating organisation with the power and competence to enforce central decisions as prerequisites for centralised supply chain planning to deliver its expected effects.

5.4.3 The configuration closest to Company X's current conditions

When the different configurations are evaluated against the prerequisite assessment, the implications for Company X are reasonably clear. A full physical central warehouse would require a combination of scale, data, IT, mandate, and change-management capacity that Company X does not currently have and could not develop on a short horizon. The volumes and geographic structure of the case organisation, the data and IT gaps, the weak central mandate, and the depth of clinic-level workarounds together place this configuration well beyond what current conditions support. Imposing it would, in Pessot and Lolli's (2026) terms, place a structurally advanced configuration in a context lacking the supporting environment that the configuration presupposes. Along the lines of Schiele (2007), it would expose the absorptive-capacity limits that currently exist in the organisation.

A 3PL-based model is somewhat less demanding in physical and capital terms, and Interviewee D's account demonstrates that such a model can operate without requiring significant volumes. Its master data, IT and integration requirements, however, are not materially lower than those of a directly operated central warehouse, and

the analysis indicates that these are precisely where Company X is weakest. A 3PL solution would also still relocate substantial work and authority away from clinics, requiring the kind of change-management investment that the autonomy culture and workaround patterns make particularly demanding. The configuration is conceivable as a medium-term option, but it does not relieve Company X of the prerequisite work, it rather re-channels it.

On the analysis developed here, a control-tower-led hybrid configuration is the option that aligns most closely with Company X's current conditions. This configuration corresponds directly to the hybrid form Trautmann et al. (2009) describe, in which a central function takes on the coordinating role over strategic categories, master data, supplier relationships and substitution handling, while execution of ordering and material handling remains at the clinic level within a coordinated framework. It captures the coordination benefits that motivate the centralisation question, standardisation of assortment, visibility into flows and central handling of stockouts and substitutions, while preserving the structurally distributed delivery flow that Company X already operates. Hartmann et al.'s (2008) point that the effectiveness of such structures depends on the fit between control mechanisms and organisational context applies here directly. The configuration's appropriateness for Company X follows precisely from the diagnosis developed in Section 5.1, where high local autonomy and weak central mandate combine in a way that a hybrid distribution of responsibilities is better positioned to address than a fully centralised one. It works with rather than against the adaptive capacity of Company X, since it does not require clinic staff to abandon the practices on which they currently depend. Instead, it provides the coordinating layer that those practices are currently compensating for. It also makes more modest demands on physical scale, which is the prerequisite where the empirical material gives least confidence. The configuration still requires investment in master data, IT, integration, and governance, none of which is in place, but these are investments that would be required for any configuration further along the spectrum and that have intrinsic value in addressing the inefficiencies identified in Company X, even if the structural step is not ultimately taken.

This argument should not be read as a recommendation that Company X adopt a control-tower configuration in its current state. It is rather that, among the configurations on the spectrum, the control-tower-led hybrid is the one whose prerequisites are closest to those that Company X possibly could develop. Whether that configuration is appropriate at all depends on whether the underlying data and governance prerequisites can be developed, which is the question addressed next.

5.4.4 Harmonise before standardise before centralise

Interviewee C summarises the sequencing principle as "harmonise first, then standardise, then centralise", and the surrounding interview material treats it as a general feature of supply chain maturity development rather than a context-specific rule. The principle is consistent with the maturity literature: Lockamy and McCormack (2004a) describe progression as a movement from ad hoc through defined and

linked stages toward integrated operation, with each stage building on capabilities developed in the preceding one. Schiele (2007) makes the similar argument that the introduction of best practices yields performance benefits only when an organisation has the absorptive capacity to use them, which is itself a function of maturity.

For Company X, the sequencing principle means that the immediate prior work is not configuration choice but the development of the conditions that make any configuration choice meaningful. Harmonisation in this sense involves bringing master data, procurement information flows, and assortment management into a consistent form across clinics, addressing the current inefficiencies of the organisation. Standardisation involves reducing the assortment duplication, defining product categories and approved alternatives in ways that procurement and clinical staff can both work from, and building the clinical-input mechanisms whose absence is documented in the findings. Centralisation, in whichever form is eventually appropriate, is the structural step that can be taken once harmonisation and standardisation have produced the data, the consolidated volumes, and the governance basis on which centralisation depends. Interviewee C's example of the material supply system, developed over five years in a stepwise fashion, illustrates that this sequencing is consistent with substantive and lasting change rather than a counsel of indefinite delay.

The implication for the topic of this section, i.e. which form under which conditions, is that it should be read as a trajectory rather than a snapshot. The configuration appropriate for Company X today is shaped by current conditions, but the configurations that may become appropriate as conditions develop are equally part of the question. Decisions in the near term, particularly around data and governance, determine which parts of the spectrum become reachable later.

5.4.5 Reading across alternatives

By considering how the appropriate configuration changes as conditions develop differently, three trajectories are worth distinguishing.

If the data and governance prerequisites can be developed alongside genuine senior commitment and IT system investments, the spectrum opens up. A control-tower-led configuration could be implemented in a relatively near term as the structural complement to the harmonisation and standardisation work, and movement further along the spectrum, toward a 3PL-based central warehouse or a hybrid depot structure of the kind Interviewee C describes, becomes a plausible medium-term option.

If senior commitment is secured but data and integration remain underdeveloped, the framework cautions against moving directly to a physical configuration. The "supply chain castle" risk in this scenario is high. Structural change without the underlying data foundation would raise expectations that the configuration cannot meet, eroding the trust on which subsequent change management depends. In this case the appropriate immediate step is the prerequisite work itself, packaged as an

investment in supply chain maturity rather than as a centralisation initiative; the configuration choice is deferred until the prerequisites support it.

If neither senior commitment nor prerequisite investment materialises, the configuration question effectively answers itself in the negative. Continuation of the present configuration is not a neutral outcome but the configuration that already exists: low-to-moderate maturity, weak mandate combined with high autonomy, and compromised information visibility, sustained through clinic-level workarounds. As previously mentioned, these dimensions are mutually reinforcing, and the prerequisite assessment implies that no part of the spectrum can be entered without addressing them. In the absence of prerequisite development, the structural choice is not between centralisation and decentralisation but between an actively managed maturity programme and the continuation of the dysfunctions already diagnosed.

The analysis yields no single recommendation independent of conditions, in line with the contingency principle. Instead, it provides a structured basis for relating Company X's current state to the configurations on the spectrum. On this basis, the control-tower-led hybrid emerges as the configuration closest to current conditions, while also indicating a sequencing logic in which harmonisation and standardisation precede any structural step. It further makes explicit how the appropriate configuration shifts as underlying prerequisites develop. Under this interpretation, the configuration question for Company X is less about selecting a structural form and more about determining which prerequisites the organisation is prepared to develop, and in what sequence. The structural choice then follows from these decisions, rather than preceding them.

6

Conclusion

The purpose of this thesis was to evaluate how, and under what conditions, different forms of centralisation could improve healthcare supply chains, taking a private healthcare provider currently considering such a redesign as the empirical case. The study examined how centralised solutions are applied in comparable healthcare contexts and how the case organisation's supply chain currently operates, drawing on supply chain theory together with insights from expert practitioners with direct experience of healthcare centralisation and from stakeholder interviews and internal data at the case organisation.

The first research question asked *how centralised supply chain solutions are applied in healthcare organisations, and what the prerequisites for such solutions are.* The expert interview material identifies six categories of prerequisites: strategic and management commitment, data foundations, IT infrastructure, scale and volume concentration, assortment standardisation and clinical involvement, and change-management capacity. At Company X, all six prerequisites are currently unmet to varying degrees, with the data foundation representing the most severe and consequential deficiency. The expert material further shows that these prerequisites interact sequentially rather than independently, and that attempting structural change before foundational conditions are in place risks producing what one interviewee describes as a supply chain castle: a structure that raises expectations the underlying capabilities cannot meet.

The second research question asked *how the current healthcare supply chain at Company X is structured, and what key inefficiencies and challenges can be identified in the existing supply chain structure.* The empirical findings describe a system characterised by fragmented delivery flows, person-dependent and manual ordering processes, limited central mandate, compromised data visibility and low supply chain maturity. Analysed through the theoretical framework, these conditions form an internally consistent configuration rather than a set of independent problems: limited process maturity, weak governance, and inadequate information visibility reinforce each other, producing a system in which operational continuity depends on informal workarounds rather than stable, integrated and standardised processes. The evidence locates Company X between the ad hoc and defined stages of supply chain maturity, with the progression towards more developed configurations not yet achieved.

Taken together, the findings suggest that the question for Company X is not which

form of centralisation to adopt, but which preparatory work must precede the choice. A supply chain maturity foundation needs to be present before any type of supply chain solution can be pursued. Centralisation can be a solution to many of the problems Company X is facing, including fragmented deliveries, manual ordering processes, and poor data visibility. However, a centralisation solution built on the current data and governance environment at Company X is unlikely to generate the benefits attributed to centralised configurations in the literature.

The study contributes to the healthcare supply chain literature by demonstrating the analytical value of treating maturity, governance, and information visibility as a jointly diagnostic framework for evaluating centralisation readiness, rather than assessing each dimension independently or treating centralisation as an inherently superior structural choice. The findings support and extend the argument that structural interventions in healthcare logistics depend on organisational and informational prerequisites that are often underdeveloped, and that the effectiveness of centralisation is contingent rather than universal. For practitioners, the thesis offers a structured basis for sequencing supply chain development decisions, and illustrates the risks of advancing structural redesign ahead of the foundational conditions on which it depends.

The study is subject to several limitations noted at the outset. The empirical investigation is conducted as a single qualitative case study, which supports analytical generalisation but does not permit statistical inference to broader populations of healthcare providers. The scope is limited to inbound material flows and does not address outbound patient logistics, pharmaceuticals subject to specialised regulatory handling, or the detailed operational design of any specific configuration. The findings reflect conditions at the time of data collection and may not capture subsequent organisational developments.

Future research could extend the analysis by examining how comparable private healthcare providers at a similar scale have navigated the transition from fragmented to more coordinated supply chain structures, providing a basis for cross-case comparison. A longitudinal study revisiting Company X as preparatory work progresses would also offer valuable insight into how the prerequisites identified here develop in practice, and whether the sequencing logic proposed in the recommendations holds under real organisational conditions.

Bibliography

Abrahamsson, M. (1993). Time-based distribution. *The International Journal of Logistics Management, 4*(2), 75-83. https://doi.org/10.1108/09574099310805000

Ahmed, S. K., Mohammed, R. A., Nashwan, A. J., Ibrahim, R. H., Abdalla, A. Q., M. Ameen, B. M., & Khdhir, R. M. (2025). Using thematic analysis in qualitative research. *Journal of Medicine, Surgery, and Public Health, 6*, 100198. https://doi.org/10.1016/j.glmedi.2025.100198

Akkermans, H. A., Bogerd, P., Yücesan, E., & van Wassenhove, L. N. (2003). The impact of ERP on supply chain management: Exploratory findings from a European Delphi study. *European Journal of Operational Research, 146*(2), 284–301. https://doi.org/10.1016/S0377-2217(02)00550-7

Andrade C. (2018). Internal, External, and Ecological Validity in Research Design, Conduct, and Evaluation. *Indian journal of psychological medicine, 40*(5), 498–499. https://doi.org/10.4103/IJPSYM.IJPSYM_334_18

Aplin, J.C. (1978). Structural Change vs. Behavioral Change. *The Personnel and Guidance Journal, 56*, 68-72. https://doi.org/10.1002/j.2164-4918.1978.tb04672.x

Arnold, U. (1999). Organization of global sourcing: Ways towards an optimal degree of centralization. *European Journal of Purchasing and Supply Management, 5*, 167–174. https://doi.org/10.1016/S0969-7012(99)00023-4

Arshinder, Kanda, A., & Deshmukh, S. G. (2008). Supply chain coordination: Perspectives, empirical studies and research directions. *International Journal of Production Economics, 115*(2), 316–335. https://doi.org/10.1016/j.ijpe.2008.05.011

Baah, C., Agyeman, D. O., Acquah, I. S. K., Agyabeng-Mensah, Y., Afum, E., Issau, K., Ofori, D., & Faibil, D. (2022). Effect of information sharing in supply chains: Understanding the roles of supply chain visibility, agility, collaboration on supply chain performance. *Benchmarking: An International Journal, 29*(2), 434–455. https://doi.org/10.1108/BIJ-08-2020-0453

Baaijens, N. (2025). *Decentralized vs. centralized warehousing: Managing seasonal demand and sustainability* [Master's thesis, Tilburg School of Economics and Management]. https://arno.uvt.nl/show.cgi?fid=190264.

Baker, P. (2007). An exploratory framework of the role of inventory and warehousing in international supply chains. *The International Journal of Logistics Management, 18*, 64–80. https://doi.org/10.1108/09574090710748171

Barrett, M. (1995). Practical and ethical issues in planning research. In G.M. Breakwell, S. Hammond and C. Fife-Schaw (Eds.), *Research Methods in Psychology*. London, UK: Sage Publications

Beer, M., & Nohria, N. (2000). Cracking the code of change. *Harvard Business Review, 78*(3), 133–141

Bell, E., Bryman, A., Reck, J., & Fields, J. (2022). *Social research methods* (6th ed.). New York, NY: Oxford University Press.

Bhakoo, V., & Choi, T. (2013). The iron cage exposed: Institutional pressures and heterogeneity across the healthcare supply chain. *Journal of Operations Management, 31*, 432–449. https://doi.org/10.1016/j.jom.2013.07.016

Bonatto, F., Resende, L. M. M. de, & Pontes, J. (2022). Supply chain governance: a conceptual model. *Journal of Business and Industrial Marketing, 37*, 309–325. https://doi.org/10.1108/JBIM-09-2019-0418

Braithwaite, J., Glasziou, P., & Westbrook, J. (2020). The three numbers you need to know about healthcare: The 60-30-10 Challenge. *BMC Medicine, 18*(1), 102. https://doi.org/10.1186/s12916-020-01563-4

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2013). *Successful qualitative research*. London, England: SAGE Publications.

Brewerton, P. M., & Millward, L. J. (2001). *Organizational research methods*. SAGE Publications, Ltd, https://doi.org/10.4135/9781849209533

British Sociological Association. (2017). *Statement of ethical practice*. British Sociological Association

de Bruin, T., & Rosemann, M. (2005). Towards a business process management maturity model. *Proceedings of the 13th European Conference on Information*

Systems. 521–532

Burnes, B. (2004). Emergent change and planned change – competitors or allies?: The case of XYZ construction. *International Journal of Operations & Production Management, 24*(9), 886–902. https://doi.org/10.1108/01443570410552108

Bushe, G. R., & Marshak, R. J. (2009). Revisioning organization development: Diagnostic and dialogic premises and patterns of practice. *Journal of Applied Behavioral Science, 45*(3), 348–368. https://doi.org/10.1177/0021886309335070

Böhme, T., Williams, S. J., Childerhouse, P., Deakins, E., & Towill, D. (2016). Causes, effects and mitigation of unreliable healthcare supplies. *Production Planning & Control, 27*(4), 249–262. https://doi.org/10.1080/09537287.2015.1105396

Cao, Z. & Lumineau, F. (2015). Revisiting the interplay between contractual and relational governance: A qualitative and meta-analytic investigation. *Journal of Operations Management, 33-34*, 15-42. https://doi.org/10.1016/j.jom.2014.09.009

Caridi, M., Crippa, L., Perego, A., Sianesi, A., & Tumino, A. (2010). Measuring visibility to improve supply chain performance: A quantitative approach. *Benchmarking: An International Journal, 17*(4), 593–615. https://doi.org/10.1108/14635771011060602

Caridi, M., Moretto, A., Perego, A., & Tumino, A. (2014). The benefits of supply chain visibility: A value assessment model. *International Journal of Production Economics, 151*, 1–19. https://doi.org/10.1016/j.ijpe.2013.12.025

Chen, M. S., & Lin, C. T. (1989). Effects of centralization on expected costs in a multi-location newsboy problem. *Journal of the Operational Research Society, 40*, 597–602. https://doi.org/10.1057/jors.1989.97

Chopra, S., Meindl, P., & Kalra, D. V. (2016). *Supply chain management*. Delhi, India: Pearson Education.

Christopher, M. (2005). *Logistics and Supply Chain Management* (4th ed.). Pearson Education.

Cox, A., Chicksand, D. & Ireland, P. (2005). Overcoming demand management problems: The scope for improving reactive and proactive supply management in the uk health service. *Journal of Public Procurement, 5*(1), 1–22. https://doi.org/10.1108/JOPP-05-01-2005-B001

Croxton, K. L., & Zinn, W. (2005). Inventory considerations in network design. *Journal of Business Logistics, 26*, 149–168. https://doi.org/10.1002/j.

2158-1592.2005.tb00197.x

Das, C., & Tyagi, R. (1997). Role of inventory and transportation costs in determining the optimal degree of centralization. *Transportation Research Part E: Logistics and Transportation Review, 33*, 171–179. https://doi.org/10.1016/S1366-5545(97)00019-7

Davenport, T. H. (1998). Putting the enterprise into the enterprise system. *Harvard Business Review, 76*(4), 121–131.

de Vries, J., & Huijsman, R. (2011). Supply chain management in health services: An overview. *Supply Chain Management: An International Journal, 16*, 159–165. https://doi.org/10.1108/13598541111127146

Dobrzykowski, D. (2019). Understanding the Downstream Healthcare Supply Chain: Unpacking Regulatory and Industry Characteristics. *Journal of Supply Chain Management, 55*, 26–46. https://doi.org/10.1111/jscm.12195

Eisenhardt, K. M. (1985). Control: Organizational and Economic Approaches. *Management Science, 31*(2), 134–149. http://www.jstor.org/stable/2631511

Eppen, G. D. (1979). Note—Effects of Centralization on Expected Costs in a Multi-Location Newsboy Problem. *Management Science, 25*, 498–501. https://doi.org/10.1287/mnsc.25.5.498

Essoussi, I. E. (2016). A performance evaluation of some collaborative inventory management practices in the healthcare supply chain. *Proceedings of 2015 International Conference on Industrial Engineering and Systems Management*, IEEE IESM 2015, 277–284. https://doi.org/10.1109/IESM.2015.7380171

European Commission. (2013). *Guidelines on good distribution practice of medicinal products for human use (2013/C 343/01).* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52013XC1123(01)

Farquhar, J. D. (2012). *Case study research for business*. SAGE Publications Ltd. https://doi.org/10.4135/9781446287910

Fawcett, S. E., Osterhaus, P., Magnan, G. M., Brau, J. C., & McCarter, M. W. (2007). Information sharing and supply chain performance: The role of connectivity and willingness. *Supply Chain Management: An International Journal, 12*(5), 358–368. https://doi.org/10.1108/13598540710776935

Flyvbjerg, B. (2006). Five Misunderstandings About Case-Study Research. *Qualitative Inquiry, 12*(2), 219-245. https://doi.org/10.1177/1077800405284363

Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of Operations Management, 19*(2), 185–200. https://doi.org/10.1016/s0272-6963(00)00055-3

Gehrke, P. (2018). Ecological validity. In *The SAGE encyclopedia of educational research, measurement, and evaluation* (Vol. 4, pp. 564-565). SAGE Publications, Inc. https://doi.org/10.4135/9781506326139.n219

Gerchak, Y., & Gupta, D. (1991). On apportioning costs to customers in centralized continuous review inventory systems. *Journal of Operations Management, 10*, 546–551. https://doi.org/10.1016/0272-6963(91)90010-U

Gereffi, G., Humphrey, J., & Sturgeon, T. (2005). The governance of global value chains. *Review of International Political Economy, 12*, 78–104. https://doi.org/10.1080/09692290500049805

Glock, C. H., & Hochrein, S. (2011). Purchasing Organization and Design: A Literature Review. *Business Research, 4*, 149–191. https://doi.org/10.1007/BF03342754

Goswami, S., Engel, T., & Krcmar, H. (2013). A comparative analysis of information visibility in two supply chain management information systems. *Journal of Enterprise Information Management, 26*(3), 276–294. https://doi.org/10.1108/17410391311325234

Guest, G., Bunce, A., & Johnson, L. (2006). How Many Interviews Are Enough?: An Experiment with Data Saturation and Variability. *Field Methods, 18*(1), 59–82. https://doi.org/10.1177/1525822X05279903

Gunasekaran, A., & Ngai, E. W. T. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research, 159*(2), 269–295. https://doi.org/10.1016/j.ejor.2003.08.016

Hajizadeh, A., Hafezi, R., Torabi, F., Akbari Sari, A., & Tajvar, M. (2025). Consequences of Population Ageing on Health Systems: A Conceptual Framework for Policy and Practice. *Ethiopian Journal of Health Sciences, 35*, 51–62. https://doi.org/10.4314/ejhs.v35i1.8

Hartmann, E., Trautmann, G., & Jahns, C. (2008). Organisational design implications of global sourcing: A multiple case study analysis on the application of control mechanisms. *Journal of Purchasing and Supply Management, 14*(1), 28–42. https://doi.org/10.1016/j.pursup.2008.01.003

Hastings, B. J. (2025). Guidance for successful healthcare transformation: A systematic review of change management practices and outcomes. *Australian Journal of Management, 50*(3), 985–1005. https:

//doi.org/10.1177/03128962241307347

Jonsson, P., Rudberg, M., & Holmberg, S. (2013). Centralised supply chain planning at IKEA. *Supply Chain Management, 18*, 337–350. https://doi.org/10.1108/SCM-05-2012-0158

Kalaiarasan, R., Olhager, J., Agrawal, T.K., & Wiktorsson, M. (2022). The ABCDE of supply chain visibility: A systematic literature review and framework. *International Journal of Production Economics, 248*, Article 108464. https://doi.org/10.1016/j.ijpe.2022.108464

Kallestrup-Lamb, M., Marin, A. O. K., Menon, S., & Søgaard, J. (2024). Aging populations and expenditures on health. *Journal of the Economics of Ageing, 29*. https://doi.org/10.1016/j.jeoa.2024.100518

Karjalainen, K., Kemppainen, K., & van Raaij, E.M. (2008). Non-Compliant Work Behaviour in Purchasing: An Exploration of Reasons Behind Maverick Buying. *Journal of Business Ethics, 85*(2), 245–261. https://doi.org/10.1007/s10551-008-9768-2

Karjalainen, K. (2011). Estimating the cost effects of purchasing centralization-Empirical evidence from framework agreements in the public sector. *Journal of Purchasing and Supply Management, 17*, 87–97. https://doi.org/10.1016/j.pursup.2010.09.001

Karjalainen, K., & van Raaij, E. M. (2011). An empirical test of contributing factors to different forms of maverick buying. *Journal of Purchasing and Supply Management, 17*(3), 185–197. https://doi.org/10.1016/j.pursup.2011.05.001

Kirk, J., & Miller, M. L. (1986). *Reliability and validity in qualitative research*. SAGE Publications, Inc. https://doi.org/10.4135/9781412985659

Klarner, P. (2010). Managing the Pace of Strategic Change: The Rhythm of Change as a Means of Balancing. In: *More than Bricks in the Wall: Organizational Perspectives for Sustainable Success*. Gabler. https://doi.org/10.1007/978-3-8349-8945-1_5

Kocoglu, I., Keskin, H., Cemberci, M., & Civelek, M. E. (2021). Effect of Supply Chain Coordination on Performance. *International Journal of Information Systems and Supply Chain Management, 15*(1), 1–15. https://doi.org/10.4018/ijisscm.287130

Kotter, J. P. (1995). Leading change: Why transformation efforts fail. *Harvard Business Review, 73*(2), 59–67.

Kroezen, M., Kuhlmann, E., Gericke, C., & Dussault, G. (2022). Change management in health care settings: organizational strategies to foster skill-mix changes. In C. B. Maier, M. Kroezen, R. Busse, & M. Wismar (Eds.), *Skill-mix Innovation, Effectiveness and Implementation: Improving Primary and Chronic Care* (pp. 345–372). Cambridge: Cambridge University Press. https://doi.org/10.1017/9781009031929.012

Kulp, S. L., Randall, T., Brandyberry, G., & Potts, K. (2006). Using Organizational Control Mechanisms to Enhance Procurement Efficiency: How GlaxoSmithKline Improved the Effectiveness of E-Procurement. *Interfaces, 36*(3), 209–219. https://doi.org/10.1287/inte.1060.0209

Kumar, V., Chibuzo, E. N., Garza-Reyes, J. A., Kumari, A., Rocha-Lona, L., & Lopez-Torres, G. C. (2017). The Impact of Supply Chain Integration on Performance: Evidence from the UK Food Sector. *Procedia Manufacturing, 11*, 814–821. https://doi.org/10.1016/j.promfg.2017.07.183

Landry, S., & Beaulieu, M. (2001). La logistique hospitalière: un remède aux maux du secteur de la santé? *Gestion, 26*, 34–41. https://doi.org/10.3917/riges.264.0034

Landry, S., & Philippe, R. (2004). How Logistics Can Service Healthcare. *Supply Chain Forum: An International Journal, 5*(2), 24–30. https://doi.org/10.1080/16258312.2004.11517130

Lapierre, S. D., & Ruiz, A. B. (2007). Scheduling logistic activities to improve hospital supply systems. *Computers and Operations Research, 34*, 624–641. https://doi.org/10.1016/j.cor.2005.03.017

Lee, D. J., & Jeong, I. J. (2009). Regression approximation for a partially centralized inventory system considering transportation costs. *Computers and Industrial Engineering, 56*, 1169–1176. https://doi.org/10.1016/j.cie.2008.06.005

Lee, H. L., Padmanabhan, V., & Whang, S. (1997). Information distortion in a supply chain: The bullwhip effect. *Management Science, 43*(4), 546–558. https://doi.org/10.1287/mnsc.43.4.546

Leuschner, R., Rogers, D. S., & Charvet, F. F. (2013). A Meta-Analysis of Supply Chain Integration and Firm Performance. *Journal of Supply Chain Management, 49*(2), 34–57. https://doi.org/10.1111/jscm.12013

Lewin, K. (1947). Frontiers in group dynamics: Concept, method and reality in social science; social equilibria and social change. *Human Relations, 1*(1), 5–41. https://doi.org/10.1177/001872674700100103

Li, M., & Lee, G. (2025). Supply Chain Management: The Impact of Shared Meaning, Inter-Organization Coordination, and Leadership. *SAGE Open, 15*(3). https://doi.org/10.1177/21582440251363827

Lockamy, A., & McCormack, K. (2004a). The development of a supply chain management process maturity model using the concepts of business process orientation. *Supply Chain Management: An International Journal, 9*(4), 272–278. https://doi.org/10.1108/13598540410550019

Lockamy, A., & McCormack, K. (2004b). Linking SCOR planning practices to supply chain performance. *International Journal of Operations & Production Management, 24*(12), 1192–1218. https://doi.org/10.1108/01443570410569010

Lovis, C. (2008). Traceability in healthcare: crossing boundaries. In *Yearbook of medical informatics, 17(01)*, 105–113. https://doi.org/10.1055/s-0038-1638590

Ma, J.-Y., & Kang, T.-W. (2025). The impact of digital technology characteristics on operational decision optimization: The mediating role of information system agility in healthcare supply chains. *Sustainability, 17*(18), Article 8471. https://doi.org/10.3390/su17188471

Malone, T. W. (1987). Modeling Coordination in Organizations and Markets. *Management Science, 33*(10), 1317–1332. http://www.jstor.org/stable/2632219

Malone, T. W., & Crowston, K. (1994). The interdisciplinary study of coordination. *ACM Computing Surveys, 26*(1), 87–119. https://doi.org/10.1145/174666.174668

McCormack, K., Bronzo Ladeira, M., & Paulo Valadares de Oliveira, M. (2008). Supply chain maturity and performance in Brazil. *Supply Chain Management: An International Journal, 13*(4), 272–282. https://doi.org/10.1108/13598540810882161

Milewski, D. (2020). Total costs of centralized and decentralized inventory strategies — including external costs. *Sustainability (Switzerland), 12*, 1–16. https://doi.org/10.3390/su12229346

Nasiri, G. R., Moradi, M., & Khodayari, N. (2024). Supply Chain Integration and Coordination Applying SAP-ERP: A Case Study in the Fast-moving Consumer Goods Industry. *Engineering Management Journal, 37*(3), 324–340. https://doi.org/10.1080/10429247.2024.2412415

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

Panko, R. R. (1998). What we know about spreadsheet errors. *Journal of Organizational and End User Computing (JOEUC), 10*(2), 15-21. https://doi.org/10.4018/joeuc.1998040102

Patel, V., Cieslak, K., & Hertig, J. (2023). Improving Safety by Evaluating the Impact of the Supply Chain and Drug Shortages on Health-Systems. *Hospital Pharmacy, 58*, 120–124. https://doi.org/10.1177/00185787221126338

Patton M. Q. (1999). Enhancing the quality and credibility of qualitative analysis. *Health services research, 34*(5 Pt 2), 1189–1208.

Pedersen, S. G., Zachariassen, F., & Arlbjorn, S. J. (2012). Centralization vs. De-Centralization of Warehousing: A Small and Medium-Sized Enterprise Perspective. *Journal of Small Business and Enterprise Development, 19*(2): 352–369, http://dx.doi.org/10.1108/14626001211223946

Pejić Bach, M., Klinčar, A., Aleksić, A., Rašić Jelavić, S., & Zeqiri, J. (2023). Supply Chain Management Maturity and Business Performance: The Balanced Scorecard Perspective. *Applied Sciences, 13*(4), 2065. https://doi.org/10.3390/app13042065

Pessot, E., & Lolli, J. (2026). Centralised or Decentralised? Decision Factors for Healthcare Supply Chain Configurations. In Camarinha-Matos, L.M., Ortiz, A., Boucher, X., Lucas Soares, A. (Eds.), *Hybrid Human-AI Collaborative Networks*. PRO-VE 2025. IFIP Advances in Information and Communication Technology, vol 770. Springer, Cham. https://doi.org/10.1007/978-3-032-05673-3_20

Petersen, K. J., Ragatz, G. L., & Monczka, R. M. (2005). An examination of collaborative planning effectiveness and supply chain performance. *The Journal of Supply Chain Management, 41*(2), 14–25. https://doi.org/10.1111/j.1055-6001.2005.04102002.x

Pilbeam, C., Alvarez, G., Wilson, H. & (2012). The governance of supply networks: A systematic literature review. *Supply Chain Management: An International Journal, 17*, 358–376. https://doi.org/10.1108/13598541211246512

Power, D. (2005). Supply chain management integration and implementation: a literature review. *Supply Chain Management: An International Journal, 10*(4), 252–263. https://doi.org/10.1108/13598540510612721

Prajogo, D., & Olhager, J. (2012). Supply chain integration and performance: The effects of long-term relationships, information technology and sharing, and logistics integration. *International Journal of Production Economics, 135*(1),

514–522. https://doi.org/10.1016/j.ijpe.2011.09.001

Qu, Z., Raff, H., & Schmitt, N. (2015). Inventory Control and Intermediation in Global Supply Chains. *CESifo Working Paper Series, 5269*. http://dx.doi.org/10.2139/ssrn.2592353

Rego, N., & Sousa, J. P. (2009). Supply chain coordination in hospitals. *IFIP Advances in Information and Communication Technology, 307*, 117–127. https://doi.org/10.1007/978-3-642-04568-4_13

Rogers, E. M. (2003). *Diffusion of Innovations* (5th ed.). New York, NY: Free Press.

Romano, P. (2003). Co-ordination and integration mechanisms to manage logistics processes across supply networks. *Journal of Purchasing and Supply Management, 9*(3), 119–134. https://doi.org/10.1016/s1478-4092(03)00008-6

Rozemeijer, F. (2000). How to manage corporate purchasing synergy in a decentralised company? Towards design rules for managing and organising purchasing synergy in decentralised companies. *European Journal of Purchasing and Supply Management, 6*, 5–12. https://doi.org/10.1016/S0969-7012(99)00034-9

Salsabila, L. N., Gurning, F. P., & Wasiyem, W. (2024). Analysis of The Quality of Inpatient Services at Hospital X Binjai Using The Customer Satisfaction Index (CSI) Method. *Contagion: Scientific Periodical Journal of Public Health and Coastal Health, 6*, 853. https://doi.org/10.30829/contagion.v6i2.21190

Saunders, B., Kitzinger, J., & Kitzinger, C. (2015). Anonymising interview data: challenges and compromise in practice. *Qualitative research : QR, 15*(5), 616–632. https://doi.org/10.1177/1468794114550439

Schiele, H. (2007). Supply-management maturity, cost savings and purchasing absorptive capacity: Testing the procurement–performance link. *Journal of Purchasing and Supply Management, 13*(4), 274–293. https://doi.org/10.1016/j.pursup.2007.10.002

Schmitt, A.J., Sun, S.A., Snyder, L., & Shen, Z.J.M. (2015). Centralization versus decentralization: Risk pooling, risk diversification, and supply chain disruptions. *Omega, 52*, 201–212. https://doi.org/10.1016/j.omega.2014.06.002

Simatupang, T.M., Wright, A.C., & Sridharan, R. (2002). The knowledge of coordination for supply chain integration. *Business Process Management Journal, 8*(3), 289–308. https://doi.org/10.1108/14637150210428989

Simões, J., Cartaxo, J., Loureiro, R., Santos, B., & Silva, S. (2018). Advantages and Disadvantages of Warehouse Centralization - Hospital Case. *Preprints.*

https://doi.org/10.20944/preprints201808.0422.v1

Social Research Association. (2003). *Ethics guidelines*. Social Research Association

Somapa, S., Cools, M., & Dullaert, W. (2018). Characterizing supply chain visibility – A literature review. *The International Journal of Logistics Management, 29*(1), 308–339. https://doi.org/10.1108/IJLM-06-2016-0150

Söderberg, L., & Bengtsson, L. (2010). Supply chain management maturity and performance in SMEs. *Operations Management Research, 3*(1–2), 90–97. https://doi.org/10.1007/s12063-010-0030-6

Tassabehji, R., & Moorhouse, A. (2008). The changing role of procurement: Developing professional effectiveness. *Journal of Purchasing and Supply Management, 14*(1), 55–68. https://doi.org/10.1016/j.pursup.2008.01.005

Teo, C. P., Ou, J., & Goh, M. (2001). Impact on inventory costs with consolidation of distribution centers. *IIE Transactions (Institute of Industrial Engineers), 33*, 99–110. https://doi.org/10.1023/A:1007646817627

Trautmann, G., Bals, L., & Hartmann, E. (2009). Global sourcing in integrated network structures: The case of hybrid purchasing organizations. *Journal of International Management, 15*, 194–208. https://doi.org/10.1016/j.intman.2008.09.001

UK Research and Innovation. (2026, January 26). *Consent – ESRC research ethics guidance*. UK Research and Innovation. https://www.ukri.org/councils/esrc/guidance-for-applicants/research-ethics-guidance/consent/

van Veen-Dirks, P. M. G., & Verdaasdonk, P. J. A. (2009). The dynamic relation between management control and governance structure in a supply chain context. *Supply Chain Management, 14*, 466–478. https://doi.org/10.1108/13598540910995237

Volland, J., Fügener, A., Schoenfelder, J., & Brunner, J. O. (2017). Material logistics in hospitals: A literature review. *Omega, 69*, 82–101. https://doi.org/10.1016/j.omega.2016.08.004

Wang, R. Y., & Strong, D. M. (1996). Beyond accuracy: What data quality means to data consumers. *Journal of Management Information Systems, 12*(4), 5–33. https://doi.org/10.1080/07421222.1996.11518099

Williams, B.D., Roh, J., Tokar, T., & Swink, M. (2013). Leveraging supply chain visibility for responsiveness: The moderating role of internal integration. *Journal of Operations Management, 31*(7–8), 543–554.

https://doi.org/10.1016/j.jom.2013.09.003

World Health Organization. (n.d.). *Regulating medical products.* https://www.who.int/europe/activities/regulating-medical-products

Yin, R. K. (2018). *Case study research and applications* (6th ed.). Thousand Oaks, CA: SAGE Publications.

Yun, Y., Kurniawan, A., & Romi, M. (2020). Supply Chain Coordination and Integration on Supply Chain Performance in Food Business. *Proceedings of The International Conference on Environmental and Technology of Law, Business and Education on Post Covid 19, ICETLAWBE 2020*, 26 September 2020, Bandar Lampung, Indonesia. https://doi.org/10.4108/eai.26-9-2020.2302726

Zhou, H., & Benton, W. C., Jr. (2007). Supply chain practice and information sharing. *Journal of Operations Management, 25*(6), 1348–1365. https://doi.org/10.1016/j.jom.2007.01.009

A

Interview Guide: Supply Chain Experts

Introduction

- Begin by thanking the respondent for their time and valuable insight.
- Explain the project and who we are
- Explain the interview structure and that there are no right or wrong answers

Confidentiality and Consent

- We will only use the information given for a scientific purpose for our Master thesis.
- Company X will, as all other interested, have access to the thesis, but not individual interviews or material.
- All interviews are anonymous, which means no names, dates or other indicators will be public.
- Ask for consent to record and transcribe the interview. Clarify that it is only to make it easier for us to ensure that all information from the interviews is collected and that the recording will be deleted after a transcript has been made

Part 1: Background and Experience

- Could you briefly describe your role and experience within healthcare logistics or supply chains?

Part 2: Centralised and Decentralised Structures in Practice

- In your experience, how are logistics and purchasing typically structured in healthcare organisations?
- In what types of situations do organisations tend to move towards more centralised solutions?
- Can you explain how centralized your organization is today?
  - How was the supply chain organised before centralisation?
- Do you have any other examples of centralised or semi-centralised solutions you have encountered?
  - How was the supply chain organised before centralisation?
  - How were these solutions designed in practice?

Part 3: Conditions for Success

- What do you think are the most important prerequisites for overall supply chain performance?
- What do you think are the most important prerequisites for successful centralisation?

Part 4: Challenges and Limitations

- What are common challenges when implementing or operating centralised logistics solutions?
- Are there any current challenges or limitations in your supply chain structure?
- Have you experienced cases where centralisation created new problems?

Part 5: Role of Systems, Data and Visibility

- What role do systems and data play in enabling centralised solutions?
- What level of visibility or integration is typically required?
- What are common limitations?

Part 6: Implementation and Change

- What are the main challenges when implementing changes?
- What typically creates resistance?
- What distinguishes successful implementations from unsuccessful ones?
- If you compare different organisations, what distinguishes those where centralisation works well from those where it does not?

Part 7: Closing Questions

- Based on your experience, when would you recommend a more centralised approach?
- If you could re-design your entire supply chain, how would you do it?
- Is there anything important we have not discussed?

B

Interview Guide: Clinics

Introduction

- Begin by thanking the respondent for their time and valuable insight.
- Explain the project and who we are
- Explain the interview structure and that there are no right or wrong answers

Confidentiality and Consent

- We will only use the information given for a scientific purpose for our Master thesis.
- Company X will, as all other interested, have access to the thesis, but not individual interviews or material.
- All interviews are anonymous, which means no names, dates or other indicators will be public.
- Ask for consent to record and transcribe the interview. Clarify that it is only to make it easier for us to ensure that all information from the interviews is collected and that the recording will be deleted after a transcript has been made

Part 1: Background and Role

1. Could you briefly describe your role and responsibilities?
2. How long have you been in your current position?
3. How would you describe this clinic (size, specialties, etc.)?

Part 2: Organisation, Responsibilities and Governance

1. How is purchasing organised at the clinic?
2. How would you describe your interaction with the purchasing department?
3. How do their guidelines influence your work?

Part 3: Ordering Process and Daily Practice

1. Can you describe a typical ordering process?
2. What usually triggers an order?
3. How are ordering routines structured (frequency, fixed ordering days or internal coordination, etc.)?
4. What works well in the process?
5. What feels complicated or unnecessary?

Part 4: Systems and Information

1. What systems or tools do you use for ordering?

2. How do you experience their usability?
3. How well does the system support:
   (a) Product information?
   (b) Availability and substitutes?
   (c) Order and delivery visibility?
   (d) Stock overview?
4. Are there situations where information is unclear or unreliable?

Part 5: Deviations and Workarounds

1. Are there situations where the standard process is not followed?
2. Can you describe how such situations are handled in practice?
3. Do you rely on any informal routines or local solutions (e.g. Excel lists, direct supplier contact, stock practices)?

Part 6: Assortment

1. How do you experience the current assortment?
2. Does it meet your needs?
3. Have you experienced changes in the assortment and how did they affect you?

Part 7: Deliveries, Storage, and Handling

1. How do deliveries typically work in practice?
2. How do they affect daily work?
3. How are materials stored and managed locally?
4. Do you experience challenges related to storage, expiration, or stock levels?

Part 8: Administrative Work and Operational Impact

1. What administrative work is involved in purchasing and material handling?
2. Approximately how much time is spent on these activities?
3. Does this work affect clinical operations or patient care?

Part 9. Overall Performance and Challenges

1. What works well in the current setup?
2. What are the main challenges or inefficiencies?

Part 10: Future Scenario – Centralisation

1. What is your spontaneous reaction to a more centralised supply chain setup?
2. What advantages or concerns do you see?
3. How would such a change affect your daily work?
4. How might it influence the relationship with the purchasing department?
5. What challenges or resistance would you expect?

Part 11: Closing Questions

1. If you could redesign the supply chain setup from scratch, what would you change?
2. Is there anything important we have not discussed?

C

Interview Guide: Purchasing & Senior Management

Introduction

- Begin by thanking the respondent for their time and valuable insight.
- Explain the project and who we are
- Explain the interview structure and that there are no right or wrong answers

Confidentiality and Consent

- We will only use the information given for a scientific purpose for our Master thesis.
- Company X will, as all other interested, have access to the thesis, but not individual interviews or material.
- All interviews are anonymous, which means no names, dates or other indicators will be public.
- Ask for consent to record and transcribe the interview. Clarify that it is only to make it easier for us to ensure that all information from the interviews is collected and that the recording will be deleted after a transcript has been made

Part 1: Background and Role

- Could you briefly describe your role and responsibilities?
- How would you describe the role of central purchasing within Company X?

Part 2: Purchasing Structure and Governance

- How is purchasing governance structured today?
- How are responsibilities and decision rights distributed between central purchasing and the clinics?
- How would you describe the interaction between central purchasing and the clinics?
- To what extent are purchasing guidelines enforced or encouraged?
- Do you experience any ambiguity in responsibilities or mandate?

Part 3: Intended Process

- How is the purchasing, ordering and replenishment process intended to function?

Part 4: Systems, Information and Data Visibility

- What systems are used in the purchasing organisation, and what roles do they serve?
- How well do the current systems support purchasing work?
- How is article and master data managed?
- How reliable would you say the current data is?
- What types of analyses or insights can you extract from the system today?
- Are there insights you would like to have but currently cannot obtain?
- How much visibility do you have into (and what are the consequences of this):
  - Ordering patterns?
  - Consumption?
  - Off-contract purchases?
  - Off-system purchases?
  - Supplier delivery performance?

Part 5: Deviations and Informal Practices

- To what extent is the intended purchasing process followed in practice?
- Where do deviations typically occur?
- What usually drives these deviations?
- What are the consequences of off-system or off-contract purchasing?
- How are these situations handled today?

Part 6: Assortment and Standardisation

- How would you describe the current assortment?
- Are products actively reviewed or removed from the assortment?
- How is clinical autonomy balanced with purchasing efficiency?
- Have there been previous standardisation or improvement initiatives?

Part 7: Delivery Structure

- How would you describe the current inbound delivery structure?
- Do you see any structural inefficiencies in transport or delivery?

Part 8: Administrative and Organizational Load

- What tasks take up most of your time in daily work?
- Where do you see the biggest inefficiencies?

Part 9: Structural Tensions and Trade-offs

- Do you see any tensions between central control and local flexibility?
- How important is decentralisation to Company X's way of working?
- Is decentralisation mainly a strategic choice, necessity, or legacy?

Part 10: Future Scenario – Centralisation

- What is your spontaneous reaction to a more centralised logistics setup?
- What potential advantages do you see?
- What risks or concerns do you have?
- How would such a change affect daily work?
- How might it affect the relationship with clinics?

- What challenges or resistance would you expect?

Part 11: Closing Questions

- If you could redesign the supply chain setup from scratch, what would you change?
- Is there anything important we have not discussed?

D

Overview of Interviews for RQ1

Table 6: Overview of Interviews for RQ1

ID	Date	Workplace	Role
A	2026-03-24	Regional Health Authority	Head of Unit, Hospital Logistics
B	2026-03-25	Regional Health Authority	Strategist
C	2026-03-30	Regional Health Authority	Senior Management
C	2026-04-24	Regional Health Authority	Senior Management
D	2026-05-06	International Healthcare Provider	Healthcare Logistics Director
E	2026-05-08	Global Transport & Logistics Company	Senior Logistics Director

E

Overview of Interviews for RQ2

Table 7: Overview of Interviews for RQ2

ID	Date	Workplace	Role
1	2026-02-23	Hospital	Senior Management
2	2026-02-23	Hospital	Senior Management
3	2026-03-10	Clinic	Middle Management
4	2026-03-10	Clinic	Clinical staff
5	2026-03-17	Procurement Office	Procurement Staff
6	2026-03-24	Clinic	Senior Management
7	2026-03-24	Clinic	Clinical Staff
8	2026-03-26	Clinic	Clinical Staff
9	2026-03-26	Clinic	Clinical Staff
10	2026-03-27	Hospital	Clinical Staff
11	2026-04-08	Hospital	Procurement Officer
12	2026-04-09	Clinic	Clinical Staff
13	2026-04-09	Clinic	Administrative Staff
14	2026-04-13	Clinic	Support Service Staff
15	2026-04-13	Clinic	Clinical Staff
16	2026-04-20	Procurement Office	Procurement Staff
17	2026-04-21	Procurement Office	Procurement Staff
18	2026-04-23	Clinic	Support Service Staff
19	2026-04-23	Clinic	Support Service Staff

F

Derived themes for RQ1

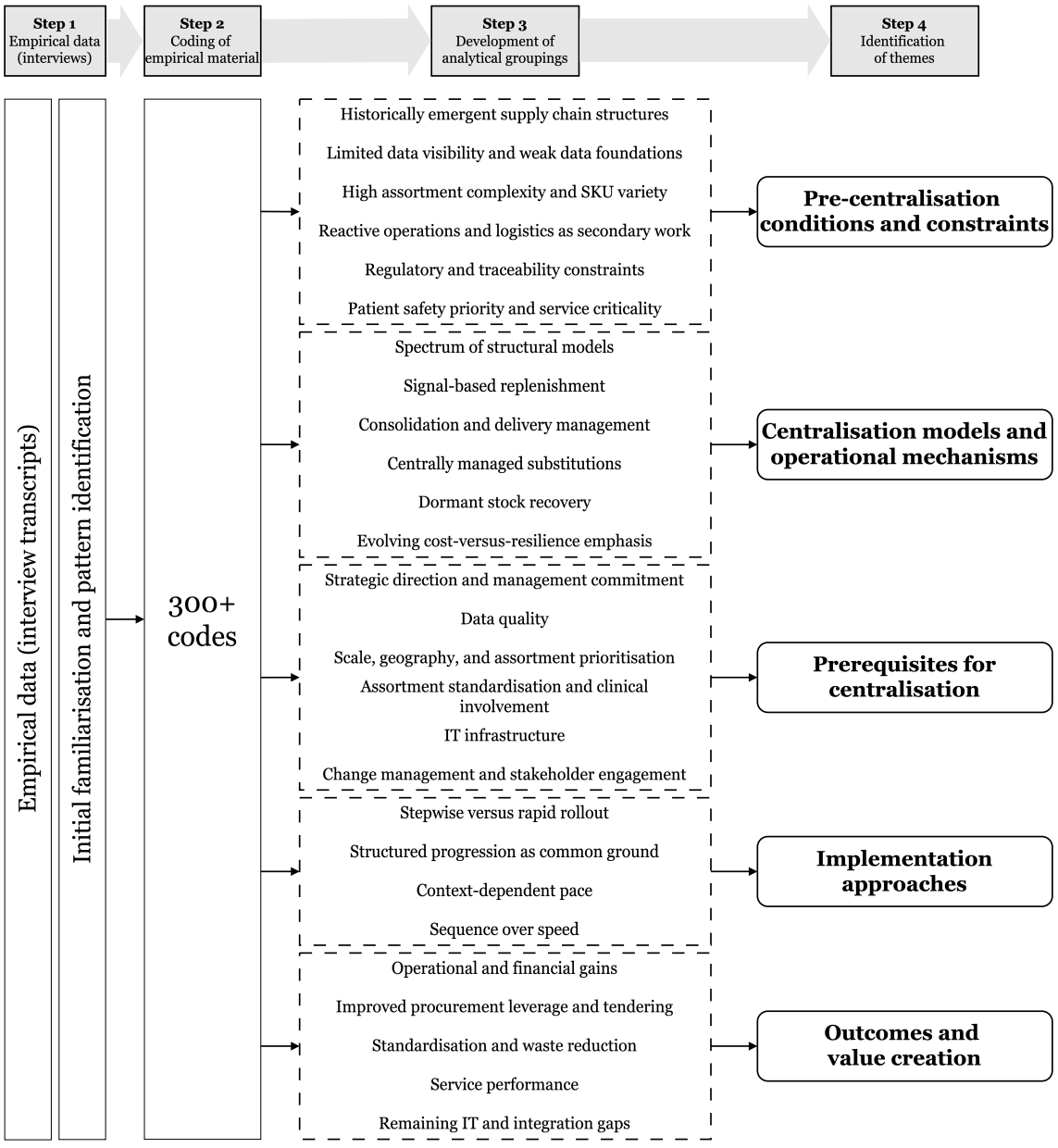

Figure 6: Overview of thematic analysis for RQ1

G

Derived themes for RQ2

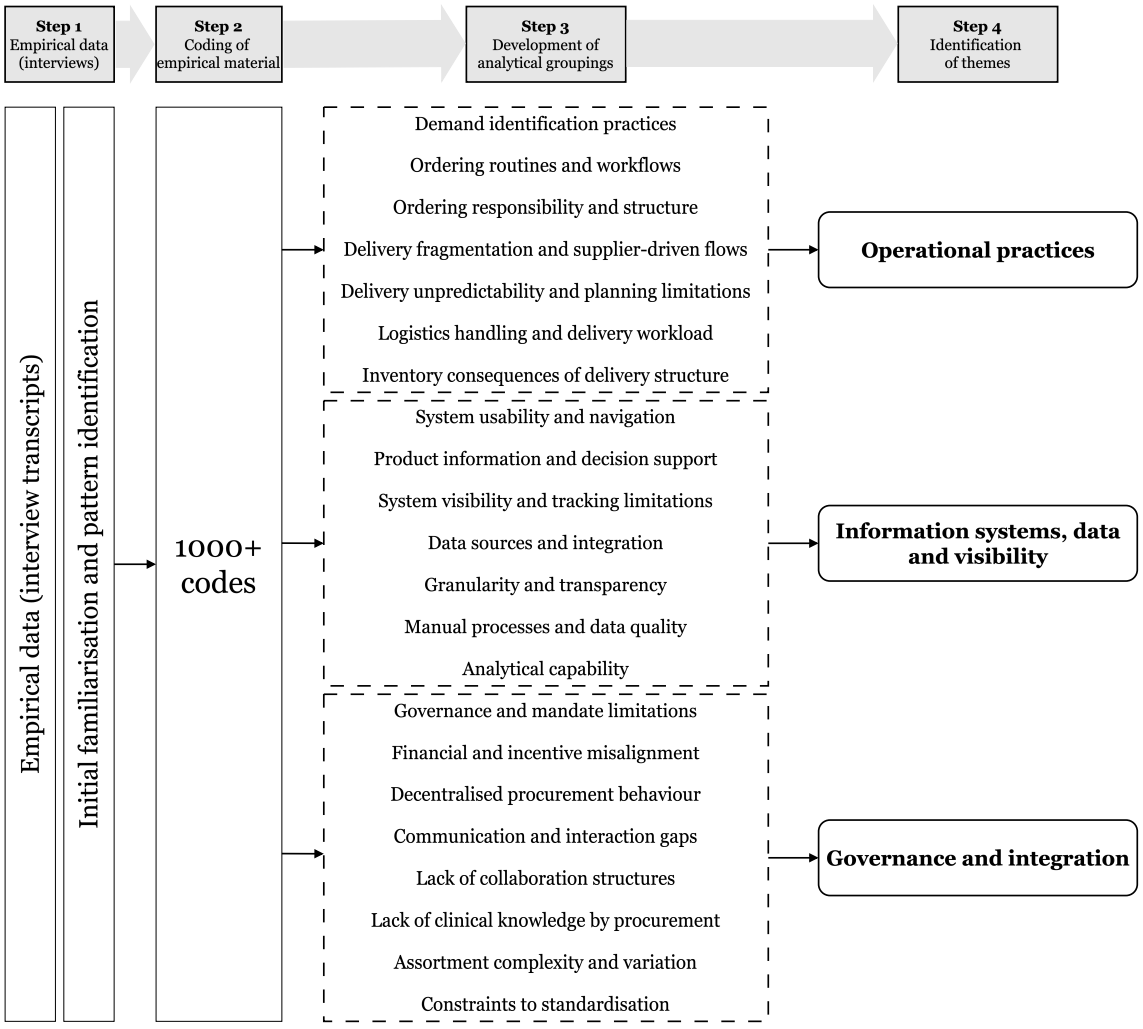

Figure 7: Overview of thematic analysis for RQ2.

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