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Assessing Strategic Sourcing Capabilities for Long-term Global Manufacturing Operations Planning

A Case Study from an Industrial Manufacturing Company

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Abstract

This study examines how strategic sourcing capabilities support industrial firms' long-term global manufacturing operations planning (GMOP) under conditions of supply risk. Drawing on dynamic capability theory, strategic sourcing literature, supply chain resilience research, supply risk management, and global manufacturing management literature, the study develops and applies a conceptual framework consisting of five interrelated sourcing capability dimensions: sensing, seizing, reconfiguring, relational, and governance & integration capabilities.

The research adopts a qualitative single-case study design within a division of a global industrial manufacturing company. Empirical data were collected through twelve semi-structured interviews with professionals from sourcing, supply chain, sales and operations planning, and sustainability-related functions, supplemented by internal documents. This approach enabled an in-depth examination of how sourcing capabilities are enacted in practice and how they contribute to long-term manufacturing planning under uncertainty.

The findings show that sourcing capabilities support long-term manufacturing planning by improving supply visibility, enabling timely sourcing responses, supporting supplier network adaptation, strengthening supplier collaboration, and enhancing cross-functional alignment between sourcing and manufacturing planning. At the same time, the study identifies several capability gaps, including limited multi-tier supplier visibility, reactive sourcing responses, technical constraints in supplier switching, and incomplete integration between sourcing, engineering, and planning functions.

The study contributes to existing literature by conceptualising sourcing capability as a multidimensional dynamic capability supporting resilient and adaptive global manufacturing planning under uncertainty. From a managerial perspective, the findings emphasize the need to develop coordinated, flexible, and learning-oriented sourcing capabilities to enhance the resilience and robustness of long-term GMOP.

Keywords sourcing capabilities, dynamic capabilities, supply chain resilience, global manufacturing planning

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Abbreviations

GMOP	Global Manufacturing Operations Planning
R&D	Research & Development
S&OP	Sales and Operations Planning
SCRM	Supply Chain Risk Management

1 Introduction

1.1 Background and Motivation

Global manufacturing has been radically transformed in recent decades, evolving from predominantly local production systems into geographically dispersed manufacturing and supply networks. Firms now configure production and sourcing across multiple countries to gain cost advantages, specialized competencies, technological capabilities, and proximity to international markets (Ferdows, 1997; Kotabe & Murray, 2017). Empirical evidence shows that companies benefit from shifting away from decentralized "local-for-local" operations toward integrated network-level management, where coordination and capability development across sites play a central role (Schellmann & Köbke, 2021). As a result, manufacturing performance is no longer determined solely at the individual plant level; instead, it increasingly depends on effective coordination and integration across globally distributed production facilities and supplier networks (Friedli et al., 2014; Shi & Gregory, 1998).

However, the globalization of manufacturing has also greatly intensified the complexity of managing operations across these interconnected supply networks. International manufacturing firms face a broad array of uncertainties, including geopolitical tensions, shifting trade policies (e.g., tariffs), supply shortages, regulatory pressures, and disruptions propagating across multi-tier supply chains (Chopra & Sodhi, 2004; Ivanov et al., 2016). Recent major disruptions—including the COVID-19 pandemic, international trade conflicts, and shortages of critical materials—have underscored the vulnerability of globally dispersed supply networks to shocks, with severe impacts on manufacturing continuity and operational performance (Pellegrino, 2024; Ahmed et al., 2025). In turn, firms are under mounting pressure not only to maintain cost efficiency but also to strengthen supply chain resilience, flexibility, and adaptability amid volatile global conditions (Gunasekaran et al., 2015).

In this environment, long-term global manufacturing operations planning (GMOP) has become increasingly important as a strategic function. In this study, GMOP is understood as the high-level planning and coordination of manufacturing activities across internationally dispersed production sites and supply networks, drawing on literature on global manufacturing networks and long-term capacity planning (Ferdows, 1997; Olhager et al., 2001). GMOP entails critical decisions about manufacturing footprint design, production and capacity allocation, network-wide coordination, and the integration of manufacturing plans across global facilities over extended planning horizons. These long-term decisions significantly affect a firm's operational efficiency, responsiveness, and competitiveness. Moreover, global

manufacturing planning has become ever more intertwined with supplier networks, given that suppliers provide essential materials, technologies, and capabilities that have direct consequences for manufacturing performance and flexibility (Monczka et al., 2015; Squire et al., 2009).

Concurrently, the role of sourcing has evolved from a narrow, transactional procurement function toward a broader strategic organizational capability. Traditional purchasing was largely focused on price negotiation and cost reduction, whereas modern strategic sourcing emphasizes long-term value through supplier collaboration, proactive risk management, market intelligence, integrated information systems, and cross-functional coordination (Axelsson et al., 2005; Handfield et al., 2015). Strong sourcing capabilities are increasingly associated with greater supply chain agility, adaptability, and resilience, especially in dynamic and uncertain environments (Pillania & Khan, 2008; Aslam et al., 2018; Frederico, 2023). In the context of global manufacturing networks, advanced sourcing capabilities can influence not only procurement costs and efficiency but also broader strategic outcomes such as manufacturing continuity, supply flexibility, and the ability to respond effectively to disruptions.

Notably, the value of robust sourcing capabilities is most clearly evident under conditions of supply risk. When operating in globally dispersed supply networks, firms require heightened flexibility and resilience to cope with disruptions and market volatility (Colicchia et al., 2010; Ivanov, 2022). Various sourcing strategies have been proposed to mitigate supply-side risks and bolster operational resilience—these include multi-sourcing, diversifying the supplier base, developing collaborative supplier partnerships, and maintaining backup supply arrangements (Sawik, 2014; Namdar et al., 2018; Mahapatra et al., 2022). However, the effectiveness of such strategies depends fundamentally on a firm's underlying sourcing capabilities—specifically, its ability to assess and monitor supply risks, coordinate among multiple suppliers, integrate information flows, and dynamically adapt sourcing arrangements as conditions change. These considerations suggest that strengthening sourcing capabilities may be key to supporting GMOP in uncertain supply environments.

Despite the importance of sourcing in global manufacturing, existing research has provided limited integrated explanation of how sourcing capabilities directly support long-term GMOP under supply risks. The literature on global manufacturing networks and operations planning has typically emphasized manufacturing system configuration, production allocation, and optimization-based planning methods (Ferdows, 1997; Jung & Sim, 2015). Meanwhile, supply management and sourcing research has focused on areas such as supplier relationship management, procurement strategies, and risk mitigation in relative isolation from long-term manufacturing planning processes (Kraljic, 1983; Axelsson et al., 2005). In other words, although both streams recognize the importance of suppliers and global networks, they

provide limited insight into how specific sourcing capabilities can inform or enhance strategic manufacturing planning decisions across distributed production systems. This shortcoming in the literature provides the motivation for an integrated investigation of sourcing capabilities and GMOP under uncertainty, as described below.

1.2 Research Gap, Question, and Objectives

A review of prior research reveals that separate streams have examined the two major facets of this topic—supply risk management and global manufacturing planning—but without integrating these perspectives. On one hand, extensive work in supply chain risk management (SCRM) has explored strategies for coping with supply disruptions, including multi-sourcing, supplier diversification, supplier development, inventory buffering, and resilient sourcing practices (Tang, 2006; Sawik, 2014; Namdar et al., 2018; Cui et al., 2025). On the other hand, research on global manufacturing operations planning has focused on issues like manufacturing network configuration, production and capacity planning, and coordination of manufacturing activities across international plants (Ferdows, 1997; Friedli et al., 2014; Jung & Sim, 2015). However, these bodies of literature remain largely fragmented. The manufacturing operations planning literature emphasizes structural and optimization-driven approaches, whereas the sourcing and procurement literature concentrates on supplier management and sourcing strategies. Consequently, little attention has been paid to how organizational sourcing capabilities might contribute to long-term manufacturing planning and decision-making, particularly under conditions of supply uncertainty.

There is insufficient understanding of what organizational capabilities are required to support long-term manufacturing operations planning in volatile and uncertain supply environments. Some studies acknowledge the need for flexible supplier networks and adaptive sourcing practices (e.g., Handfield et al., 2015; Frederico, 2023), but few have examined how specific sourcing capabilities—such as supplier collaboration, risk assessment, information integration, sourcing flexibility, and cross-functional coordination—enable or enhance strategic manufacturing planning in global networks. This limitation is increasingly significant as firms face intensifying external pressures (e.g., new regulations, geopolitical disruptions, and global supply dependencies) that demand not only optimized manufacturing networks but also organizational capabilities fostering adaptability and resilience across both sourcing and manufacturing functions (Ivanov, 2022; Statsenko et al., 2024). Yet the integration of a sourcing-capability perspective into long-term GMOP remains underexplored in the existing literature.

Based on the identified research gap, the primary research question guiding this study is:

How do strategic sourcing capabilities support industrial firms' long-term global manufacturing operations planning under supply risks?

To address this research question, the study pursues the following objectives:

- Objective 1: Identify and conceptualize key sourcing capabilities discussed in existing literature in relation to supply uncertainty, resilience, and global manufacturing environments.
- Objective 2: Examine how sourcing capabilities support long-term manufacturing operations planning decisions, including manufacturing network coordination, sourcing structures, supplier management, and operational flexibility under supply risk.
- Objective 3: Develop a conceptual framework linking sourcing capabilities to long-term global manufacturing operations planning under uncertain supply conditions.
- Objective 4: Apply and refine the conceptual framework through an empirical single case study within a global manufacturing company.

By addressing these objectives, the study seeks to contribute to both theory and practice through a more integrated understanding of sourcing capability and global manufacturing operations planning under supply uncertainty.

1.3 Scope of the Study

This research is narrowly focused on long-term GMOP within international manufacturing networks that are subject to supply-side risks. To be specific, the study examines sourcing-related capabilities and how these capabilities support long-term manufacturing planning under uncertain supply conditions. The scope of inquiry is limited to upstream supply-side risks while excludes demand-side risks, downstream distribution issues, and routine short-term operational scheduling, which lie outside the study's primary focus.

Empirically, the thesis adopts a qualitative single-case study methodology. The research is conducted within one industrial manufacturing company operating in a complex global supply network. The unit of analysis is the organization's sourcing function and its interaction with long-term manufacturing operations planning processes in this case firm. The study does not develop formal quantitative optimization models or detailed mathematical planning algorithms; instead, it focuses on understanding organizational and managerial capabilities that support strategic manufacturing planning under uncertain supply conditions.

Given its reliance on a single case organization, the research findings are inherently context-specific and not intended to be statistically generalizable to all manufacturing firms. Nevertheless, the in-depth case study approach provides rich qualitative insights into managerial processes and decision-making, and the research design follows established case study principles to ensure rigor, transparency, and consistency in data collection and analysis. Furthermore, although manufacturing planning is influenced by multiple functional areas, this study centres chiefly on sourcing-related activities as they relate to manufacturing planning. Other functions are considered only insofar as they intersect with sourcing's role in long-term planning. Similarly, sustainability considerations are acknowledged as part of the external pressures on sourcing and manufacturing decisions, but a detailed assessment of sustainability performance is beyond this study's scope.

1.4 Structure of the Thesis

This thesis is organized into six chapters. Chapter 1 presents the introduction, encompassing the research background and motivation, the research problem and gap, the research question and objectives, and the scope of the study. Chapter 2 provides a comprehensive literature review, covering global manufacturing operations planning under uncertainty, supply risks and supply chain resilience, strategic sourcing and sourcing capabilities, and sourcing strategies for uncertain supply environments; the chapter also develops the conceptual framework guiding the research. Chapter 3 describes the research methodology, including the rationale for adopting a qualitative single-case study design, the data collection procedures, and the approach to analysing the data. Chapter 4 details the empirical findings from the case study, focusing on the sourcing capabilities identified and how they relate to long-term manufacturing planning in the case company. Chapter 5 discusses the findings in the context of extant literature and the initial conceptual framework. Finally, Chapter 6 concludes the thesis by summarizing the key findings, drawing out theoretical contributions and managerial implications, acknowledging the study's limitations, and suggesting directions for future research.

2 Literature Review

This chapter reviews existing literature to establish the theoretical foundation for the study. The review is structured into four sections where section 2.1 discusses GMOP under uncertainty. Section 2.2 examines supply risks and supply chain resilience. Section 2.3 reviews strategic sourcing and sourcing capability literature from a dynamic capability perspective. Finally, Section 2.4 develops the conceptual framework.

2.1 GMOP under Uncertainty

2.1.1 Planning Complexity of GMOP

Manufacturing firms have increasingly transformed their operations from localized production into global manufacturing networks, distributing production across multiple countries and regions to capitalize on cost advantages, local expertise, and access to international markets (Kotabe & Murray, 2017; Ferdows, 1997; Shi & Gregory, 1998). Global manufacturing networks are broadly defined as interconnected systems of geographically dispersed manufacturing facilities, managed as an integrated whole to optimize production and supply chain performance on a global scale (Friedli et al., 2014; Ivanov et al., 2016). Early contributions like Ferdows (1997) highlight how plants within a network assume differentiated strategic roles (e.g., source, lead, contributor factories) which must align with corporate strategy. In parallel, scholars have emphasized that the complexity of global networks far exceeds traditional single-facility operations, requiring multi-layered coordination and structural planning. For instance, Feldmann and Olhager (2019) provide a taxonomy of global manufacturing networks that reveals how sites can be coordinated and optimized across different dimensions, including their strategic roles, product focus, and capabilities. These perspectives converge on the point that long-term operations planning in a global context goes far beyond optimizing individual factories, extending to decisions about the optimal global footprint (number, location, and roles of plants) and the coordination of material flows, capacities, and information across the entire network (Abele, 2008; Friedli et al., 2014). This requires balancing cost efficiency with global integration which is voiced earlier by Kotabe & Murray (2017) and reinforced by current studies on network configuration and performance (Cheng et al., 2019; Friedli et al., 2021).

GMOP refers to the strategic and tactical coordination of manufacturing activities across geographically dispersed production and supply networks (Ferdows, 1997; Olhager et al., 2001). GMOP encompasses decisions concerning manufacturing footprint configuration, production allocation, capacity planning, inventory positioning, sourcing coordination, and coordination

between manufacturing facilities and suppliers (Friedli et al., 2014). Such decisions typically extend across long-term planning horizons and significantly influence firms' operational flexibility, responsiveness, and competitiveness within global manufacturing environments.

Long-term GMOP is increasingly understood as a strategic planning activity aimed at aligning manufacturing capacity, resources, and operational decisions with organizational objectives, future demand, and product lifecycle requirements over extended planning horizons (CSCMP et al., 2013; Lakhdar et al., 2007; Georgiadis et al., 2006). Existing literature further emphasizes that long-term GMOP within global manufacturing networks involves the strategic integration of network design, capacity planning, risk management, and coordination across complex interdependencies both within and between firms. In this regard, GMOP requires balancing strategic alignment, operational coordination, demand–supply integration, technological support, and sustainability considerations to respond to changing market dynamics and increasing product customization requirements (Cheng et al., 2019; Friedli et al., 2014; de Matta & Miller, 2018; Mourtzis, 2016).

2.1.2 Sources of Uncertainty in GMOP

Global manufacturing planning is complicated by a broad spectrum of uncertainties and risks inherent to international operations. External strategic uncertainties include geopolitical tensions, volatile trade policies, tariffs, exchange-rate fluctuations, and regulatory shifts that can rapidly alter the cost-benefit calculus of plant locations or sourcing choices (Chopra & Sodhi, 2004; Baldwin & Freeman, 2022; Dong & Kouvelis, 2020). For example, a sudden increase in tariffs or export restrictions may force a firm to reconfigure its global production network or procure critical materials from alternative regions (Dong & Kouvelis, 2020). Operational uncertainties emerge from multi-tier supplier networks and complex logistics: as global networks rely on far-flung suppliers and just-in-time flows, they become more exposed to disruptions like natural disasters, port strikes, pandemics, or quality failures which can cascade across countries (Chopra & Sodhi, 2004; Ivanov, 2020; Ahmed et al., 2025). Indeed, the COVID-19 crisis and semiconductor shortages starkly illustrated how localized disruptions can ripple globally, halting production lines in multiple regions (Pellegrino, 2024; Li et al., 2025; Habibi et al., 2026). Demand-side volatility also introduces planning uncertainty, as firms face increasingly fragmented global markets and shorter product life cycles (Mourtzis, 2016; Can Saglam et al., 2021). Collectively, these uncertainties create a challenging environment for GMOP, demanding far more robust and flexible planning processes.

Scholars have sought to categorize these uncertainties and risks to better inform planning. For instance, Chopra and Sodhi (2004) classify supply chain risks into categories like disruptions, delays, and capacity constraints,

highlighting how lean global networks minimize slack but heighten vulnerability. Tang (2006) similarly outlines major supply risk drivers and potential mitigation strategies, underscoring that managers must proactively plan for a range of disruption scenarios if they are to preserve manufacturing continuity. Meanwhile, Christopher and Peck (2004) differentiate between internal and external sources of risk in the supply chain and promote building resilience through flexibility and collaboration. These perspectives show a consensus that uncertainty is now a permanent fixture in global operations and ignoring it in long-term planning is perilous (Trkman & McCormack, 2009; Jüttner & Maklan, 2011). At the same time, some researchers frame the problem as one of risk identification and categorization (Chopra & Sodhi, 2004; Wiedenmann & Größler, 2021), while others stress capability development for resilience (Christopher & Peck, 2004; Jüttner & Maklan, 2011; Gruchmann et al., 2024). Both streams inform the modern understanding that GMOP cannot treat uncertainty as a negligible factor, it must be systematically addressed in planning models and management practices alike.

2.1.3 From Efficiency to Resilience

Given the volatile environment, the paradigm of long-term manufacturing planning has been evolving, which shifts from traditional, efficiency-centric practices toward more adaptive and resilient approaches. Classical GMOP models prioritized efficiency, often employing deterministic, optimization-based methods under assumptions of stable markets and reliable suppliers (Kotabe & Murray, 2017; Olhager et al., 2001; Lanza & Moser, 2014). These approaches yielded finely tuned global production footprints and lean supply networks to minimize costs. However, research has documented that strategies such as single-sourcing and minimal safety stocks – ideal for efficiency – amplify risk exposure (Trkman & McCormack, 2009; Ivanov, 2022). For example, Park et al. (2001) note that while transaction cost economics might favour narrowing the supplier base for efficiency, such consolidation can also increase vulnerability to supplier failures under uncertain conditions. In the 21st century, global manufacturers experienced dramatic shocks that revealed the limitations of static planning. As Jung and Sim (2015) and Heckmann et al. (2015) observe, traditional long-term planning approaches are inadequate when confronted with unpredictable supply disruptions and multi-dimensional risks.

An emerging planning paradigm emphasizes building flexibility and redundancy into manufacturing networks to withstand shocks, even at the expense of some efficiency (Tang, 2006; Tukamuhabwa et al., 2017; Namdar et al., 2018). This adaptive approach involves incorporating scenario planning, simulation of disruptions, and contingency planning into GMOP (Ivanov, 2020; de Matta & Miller, 2018; Tsai, 2016). For instance, Tsai (2016) demonstrates how including probabilistic supply disruption scenarios in a dual

sourcing strategy can lead to more robust production plans. A key debate in the literature revolves around the efficiency–resilience trade-off: some researchers argue that firms can achieve both high efficiency and resilience by carefully designing flexible networks (Gunasekaran et al., 2015; Raj Sinha et al., 2004), while others contend that building resilience inherently entails costs or redundancies that may reduce short-term efficiency (Chopra & Sodhi, 2004; Khan, 2022). The consensus, however, is that in today's environment, neglecting resilience in long-term planning introduces unacceptable strategic risk (Christopher & Peck, 2004; Kraljic, 1983; Namdar et al., 2018).

In practice, leading manufacturers are adjusting their planning processes to incorporate uncertainty more systematically. Global S&OP is increasingly used to address multi-site constraints, demand–supply coordination challenges, and unforeseen disruptions (Seeling et al., 2021; Oliva & Watson, 2011). This shift from cost-driven optimization toward resilience-oriented planning reflects a broader trend in supply chain and operations management (Christopher & Peck, 2004; Gunasekaran et al., 2015).

2.1.4 Coordination and Capabilities for GMOP

Managing a global manufacturing network under uncertainty increasingly relies on organizational capabilities that support integration and agility. With dispersed factories and suppliers, information systems and cross-functional coordination mechanisms become crucial to unify planning efforts (Da Silveira & Cagliano, 2006; Dreyer et al., 2009). Companies invest in advanced planning systems and digital platforms to achieve multi-site visibility and synchronize capacity, inventory, and procurement decisions across regions. Enhanced data sharing and collaboration help reduce reaction time to disruptions (Huang & Handfield, 2015) and facilitate transnational S&OP processes linking individual plants' production plans into a cohesive whole (Cheng et al., 2019; Seeling et al., 2021). Such coordination additionally enables firms to compare subsidiary performance, identify operational synergies, support benchmarking activities, and realize network-level benefits beyond localized manufacturing optimization (Seeling et al., 2021). The literature highlights that firms can better reconcile global efficiency with local responsiveness by cultivating stronger dynamic capabilities (Aslam et al., 2018).

2.2 Supply Risks and Supply Chain Resilience

2.2.1 Supply risks

Within the context of global manufacturing networks, supply risks are recognized as a principal source of uncertainty, threatening the continuity and performance of manufacturing operations. Supply risk is generally defined as

the probability and impact of adverse events that disrupt the flow of materials, components, or services from suppliers to a manufacturer (Zsidisin, 2003). This definition emphasizes both the likelihood and severity of potential disruptions in inbound supply. Early purchasing and supply research (e.g., Kraljic, 1983) highlighted supply risk as a key dimension of strategic procurement, emphasizing that sourcing decisions should consider the vulnerability of supply and not just cost. More recent work continues to refine the concept, for example, Ho et al. (2015) characterize supply risk as one of the core risk categories in supply chain risk research, focusing on threats emerging from upstream supply operations (e.g., supply delays, quality issues, capacity shortfalls, etc.). Taken together, these studies depict supply risk as an ever-present concern in global operations, intimately tied to the reliability of external partners and the steadiness of supply flows.

Scholars have identified multiple, interrelated sources of supply risk that can jeopardize global manufacturing. Supplier-related disruptions directly threaten the supply of critical inputs, such as bankruptcy, labour strikes, or quality failures at a key supplier (Zsidisin, 2003; Wagner & Bode, 2006). Operational failures at supplier facilities or logistics hubs can similarly halt the flow of materials (Craighead et al., 2007). While Chopra and Sodhi (2004) delineate supply chain risks into categories including disruptions (e.g., natural disasters, accidents), delays (transportation or process lags), systems failures, forecast inaccuracies, intellectual property breaches, and more. Their taxonomy highlights that supply risk is multifaceted, encompassing everything from sudden cataclysms like earthquakes to chronic issues like capacity constraints or poor supplier quality. Other researchers echo and expand these typologies. For example, Wagner and Bode (2006) identify sources like supplier defaults and inbound logistics breakdowns, while Tang and Tomlin (2008) emphasize differentiating high-impact, low-probability disruptions from more routine variability. Despite varying emphases, the literature concurs that supply risks stem from multiple interconnected sources – spanning supplier capabilities, transportation networks, market dynamics, and macro-level factors (Chopra & Sodhi, 2004; Ho et al., 2015; Wiedenmann & Größler, 2021). This interconnectedness can create risk propagation in upstream networks, where a single trigger can generate cascading effects across a manufacturer's supply base.

Supply risks can have severe consequences on manufacturing operations, making them a focal point in GMOP under uncertainty. Disruptions in supply can directly halt production lines, leading to missed customer deliveries, revenue losses, or idle capacity, such as the unavailability of a key component (Tang, 2006; Namdar et al., 2018). Tang (2006), surveying supply chain risk scenarios, noted that supplier failures and logistics breakdowns universally result in negative performance outcomes, such as production stoppages, inventory shortages, and cost escalations. The ripple effect of supply disruptions has been documented across various industries. For example,

Craighead et al. (2007) found that supply chain complexity exacerbates the spread of disruptions: the more globally dispersed and tightly coupled a network, the larger the footprint of a single disruption (i.e., affecting multiple plants or product lines). Namdar et al. (2018) explicitly compare single vs. multiple sourcing under disruption risk and show that having only one source magnifies vulnerability, whereas multi-sourcing can dampen the impact of any one supplier's failure. Similarly, Sawik (2014) demonstrates through optimization models that multi-sourcing strategies can reduce expected losses under supplier failure scenarios, albeit at a potential cost of higher procurement complexity. These studies underscore that the propagation of supply risk is a systemic threat: due to global interdependencies, a local disruption (e.g., a Tier-2 supplier's shutdown) can propagate upstream and downstream, causing widespread instability in a manufacturer's operations (Ivanov, 2022; Craighead et al., 2007; Wagner & Bode, 2006).

In response to these threats, companies engage in supply risk management, a subset of the broader SCRM discipline that focuses explicitly on upstream (supplier-related) risks (Zsidisin, 2003; Gurtu & Johny, 2021). Supply risk management is typically framed as a structured, cyclical process encompassing risk identification, assessment, mitigation (or treatment), and monitoring. For example, Fan and Stevenson (2018) emphasize a process-oriented view where firms proactively scan for potential supply disruptions, evaluate their probability and severity, implement mitigation measures (such as safety stocks, multi-sourcing, or closer supplier collaboration), and continuously monitor changes in risk exposure. This proactive, iterative approach contrasts with older reactive strategies that addressed disruptions only after they occurred. Researchers like Zsidisin et al. (2004) document how purchasing organizations can employ risk assessment techniques (such as supplier audits, supplier development initiatives, and contingency planning) to uncover vulnerabilities in supplier operations and thereby reduce outcome uncertainty in inbound supply. By gathering better information on supplier performance and aligning goals with suppliers, buyers can mitigate potential quality or delivery problems before they escalate.

However, despite advances in supply risk management practices, limitations persist. One challenge is the inherent unpredictability of certain extreme events – so-called "black swan" events (Taleb, 2010) – that defy easy quantification and can overwhelm even well-prepared supply chains (Baryannis et al., 2019). Another is the cost and complexity of mitigation, multi-sourcing or holding strategic safety stocks can cushion against disruptions but may raise costs and require managerial bandwidth (Chopra & Sodhi, 2004; Tang, 2006). Moreover, Kamalahmadi and Parast (2017) note that companies often struggle to choose among mitigation strategies (e.g., redundancy vs. flexibility vs. collaboration), each with its own trade-offs, and many firms remain reluctant to invest heavily in risk mitigation until after a crisis underscores its necessity. This indicates that beyond technical tools, a

cultural shift and capability development may be needed to fully integrate supply risk considerations into strategic planning.

2.2.2 Supply chain resilience

In response to escalating supply uncertainties and disruption risks, supply chain resilience has emerged as a pivotal concept in both academic and practitioner discourse (Christopher & Peck, 2004; Jüttner & Maklan, 2011). There is broad consensus that supply chain resilience denotes the ability or capability of a supply chain to prepare for, respond to, recover from, and adapt to unexpected disruptions while maintaining its core functions or performance (Ponomarov & Holcomb, 2009; Eggert & Hartmann, 2023). This definition underscores resilience as a dynamic capability – an organizational capacity to withstand shocks and swiftly reestablish or even improve its operational equilibrium post-disruption. The concept of resilience initially drew on foundations in engineering (ability to return to stable equilibrium after a disturbance) and ecology (ability to adapt to new conditions or equilibriums post-disturbance) (Holling, 1973; Fiksel, 2006). In the supply chain domain, Ponomarov and Holcomb (2009) framed resilience as a dynamic capability enabling supply chains to handle disruptions while sustaining performance. Over time, research has further enriched this definition. Hosseini et al. (2019) capture resilience as a multi-stage process involving absorption, adaptation, and recovery, integrating both preventive and reactive elements. Adobor and McMullen (2018) advanced this understanding by distinguishing among engineering resilience (bouncing back to pre-disruption performance), ecological resilience (adapting to a new equilibrium post-disruption), and evolutionary resilience (transformative learning and growth through disruptions). These convergent perspectives indicate that resilience is not simply an outcome (e.g., returning to normal) but a set of capabilities encompassing anticipation, absorption, recuperation, and adaptation.

A key distinction in the resilience literature lies between proactive (preventive) and reactive (response and recovery) capabilities. Proactive resilience emphasizes preparedness and robustness, for example, building redundant capacity or maintaining safety stocks, dual sourcing, and rigorous supplier vetting to reduce vulnerability before disruptions occur (Sheffi & Rice, 2005; Cheng & Kam, 2008). It aligns with the notion of inherently robust supply chain design, where supply networks configured to resist disruptions through buffers and diversification (Chopra & Sodhi, 2004; Kamalahmadi & Parast, 2017). Reactive resilience, meanwhile, focuses on responsive and adaptive actions during and after an event to contain impacts and recover quickly, such as rapid decision-making, dynamic rerouting of supplies, or flexible production scheduling (Sheffi & Rice, 2005; Wieland & Wallenburg, 2013). Both aspects are necessary, as resilience requires both ex-ante measures to limit the initial impact of disruptions and ex-post capabilities to

ensure rapid recovery and learning (Christopher & Peck, 2004; Pettit et al., 2010). The ability to reconfigure supply chains on the fly, for instance by activating alternative suppliers or shifting production across plants, exemplifies reactive resilience (Ivanov, 2022; Tukamuhabwa et al., 2017). Researchers often frame these dual facets in terms of resistance vs. recovery (Hosseini et al., 2019) or vulnerability vs. adaptive capacity (Pettit et al., 2010). The consensus is that supply chain resilience encompasses a portfolio of strategies and actions spanning both the proactive and reactive dimensions, and that a deficit in either can undermine overall resilience (Kamalahmadi & Parast, 2017; Tukamuhabwa et al., 2017).

Literature on supply chain resilience has identified a range of organizational, structural, and relational enablers of resilience, particularly in global contexts. Redundancy and flexibility are frequently highlighted structural enablers that can help absorb shocks, such as maintaining multiple suppliers (multi-sourcing), excess inventory, or spare capacity (Sheffi & Rice, 2005; Sawik, 2014; Namdar et al., 2018). These deliberate redundancies act as shock absorbers at the cost of additional overhead, reflecting a direct trade-off with efficiency (Chopra & Sodhi, 2004). On the other hand, flexibility – be it in sourcing (switching suppliers quickly), routing (alternate logistics paths), or manufacturing (adaptable production lines) – is seen as a more agile resilience strategy that minimizes the need for heavy buffers (Stevenson & Spring, 2009). Additionally, close supplier relationships and information sharing can help firms sense disruptions earlier and coordinate joint responses (Christopher and Peck, 2004; Ambulkar et al., 2016; Mena et al., 2014). Additionally, an organizational culture that values risk management and flexibility is often cited as an intangible driver of resilience (Christopher & Peck, 2004; Wieland & Wallenburg, 2013). Moreover, Jüttner and Maklan (2011) identify factors such as visibility, velocity, and collaboration as critical to resilience, indicating that companies must cultivate both structural agility (fast re-routing, response speed) and deep relationships (trust, coordination) to effectively manage disruptions. Recent empirical studies (e.g., Gruchmann et al., 2024) corroborate that resilience arises from a mix of these factors, combining operational redundancies (safety stock, backup suppliers) with strategic agility (rapid decision-making, flexible contracts) and network-oriented capabilities (partnerships, information sharing).

A resilient supply chain is increasingly seen as a source of competitive advantage and a crucial component of strategic manufacturing planning. The capability to remain operational and meet customer needs in the face of disruptions can directly protect revenue streams and market share (Sheffi & Rice, 2005; Wieland & Wallenburg, 2013). Empirical evidence generally shows a positive link between supply chain resilience and performance. For instance, Wieland and Wallenburg (2013) found that firms with a higher degree of both agility (fast responsiveness) and robustness (buffered capacity) reported better customer service and financial performance in the face of

disruptions. However, this robust performance often requires investment in resilience-building measures, which can raise costs or reduce short-term efficiency (Kamalahmadi & Parast, 2017; Ivanov, 2022; Khan, 2022). The trade-off between efficiency and resilience is a recurring theme in the literature, encapsulated by the phrase "just-in-time versus just-in-case". For example, hyper-lean supply strategies minimize cost but leave little margin for error, whereas resilient strategies add slack and redundancy to hedge against risk (Chopra & Sodhi, 2004; Sheffi & Rice, 2005). Managing this trade-off is a strategic decision that sits squarely within the purview of long-term GMOP (Tang, 2006; Um & Han, 2021). Many have advocated that resilience be institutionalized into the strategic planning process, for instance, through scenario planning, risk-adjusted performance metrics, and sourcing strategies that explicitly account for risk (Namdar et al., 2018; Pettit et al., 2010; Khan, 2022). Ultimately, by embedding resilience thinking into GMOP, firms strive to cushion themselves against future supply disruptions, thereby safeguarding their global manufacturing strategies.

Importantly, achieving resilience is not only about discrete strategies (like inventory or multi-sourcing) but about cultivating resilience as a supply chain capability. Leading firms treat resilience as a continuous improvement journey, building advanced capabilities in risk sensing, rapid response, and network reconfiguration (Ivanov, 2020; Pettit et al., 2010; Ponomarov & Holcomb, 2009). The supply chain resilience literature therefore highlights the importance of organizational capabilities supporting adaptation, coordination, and responsiveness under uncertain supply conditions. These insights provide an important theoretical foundation for examining sourcing capability within long-term GMOP in contexts characterized by supply risks and uncertainty.

2.3 Strategic Sourcing and Sourcing Capability

As industrial manufacturing firms globalized their operations, the role of purchasing evolved from a transactional cost-centre into a strategic function integral to competitive advantage. Strategic sourcing is defined as the systematic and long-term management of a firm's procurement activities to align with business strategy and optimize value, rather than focusing solely on unit price (Kotabe & Murray, 2017; Monczka et al., 2015). This entails globally integrating purchasing decisions with product design, manufacturing plans, and market strategies (Kotabe & Murray, 2017; Jin, 2004). Global sourcing, as described by Trent and Monczka (2003), involves leveraging worldwide supplier capabilities to achieve cost, quality, and innovation benefits beyond what domestic sourcing alone can provide. Over the past decades, research has chronicled the increasing strategic scope of sourcing from a narrow focus on cost efficiency to broader objectives including quality, innovation, and supply continuity (Anderson & Katz, 1998; Axelsson et al.,

2005). For example, Anderson and Katz (1998) argued that strategic sourcing integrates purchasing decisions with overall supply chain strategy, meaning choices about how and where to source are made in conjunction with manufacturing network configuration and long-term capacity planning. In practice, strategic sourcing today influences global manufacturing footprint decisions (e.g., which regions to source from), shapes supplier development programs, and directly supports operational goals like reduced lead times and improved product reliability (Monczka et al., 2015; Gualandris et al., 2014).

2.3.1 Strategic Sourcing under Supply Risk

In an era of heightened volatility and complex supply networks, strategic sourcing must explicitly incorporate supply risk management to safeguard manufacturing continuity. Traditionally, firms shielded themselves from external supply risks through tactical buffers, such as holding safety stock, qualifying multiple suppliers per item, or building slack capacity (Guo et al., 2025; Lücker et al., 2025). While such approaches provide temporary insulation, they are costly and fail to address the root causes of disruptions or deliver long-term solutions to evolving supply chain uncertainties. As a result, companies are moving beyond these static buffers and embedding risk considerations into their strategic sourcing strategies from the outset (Kraljic, 1983; Jüttner & Maklan, 2011). For example, Kraljic (1983) emphasized the importance of differentiating sourcing tactics based on supply risk: for high-risk, high-impact purchases, firms should develop supplier diversification, collaborative partnerships, and other risk-reducing strategies rather than relying on lowest-cost single sourcing. Two decades later, as supply chains grew more global and leaner, Christopher & Peck (2004) argued that supply networks must be designed and managed for resilience, not just efficiency, with strategic sourcing decisions (such as supply base design and supplier relationships) at the heart of building resilience in the face of vulnerability.

A consensus has emerged that strategic sourcing can act as a primary lever for robust supply chain design in uncertain environments. By proactively incorporating risk criteria into decisions about supplier selection, geographic sourcing mix, and contract structure, firms can bolster their supply chain resilience (Chopra & Sodhi, 2004; Zsidisin et al., 2004; Wagner & Bode, 2006). For instance, Chopra and Sodhi (2004) highlight how careful supplier segmentation and sourcing from multiple suppliers can mitigate the risk of a single point of failure.While Zsidisin et al. (2024) suggest that many established strategic sourcing tools can also support supply risk management and supply chain resilience. In practice, these approaches include qualifying alternate suppliers, developing supplier contingency plans, maintaining strategic stock, and securing flexible contract terms, all of which are decisions

rooted in strategic sourcing (Kamalahmadi & Parast, 2017; Namdar et al., 2018). Each of these practices is essentially a manifestation of long-standing strategic sourcing principles adapted for risk contexts, allowing firms to continue operations when disruptions strike (Tang, 2006).

Importantly, strategic sourcing under supply risk is not only about preventing disruptions, but also about enabling agility and recovery, thereby directly supporting long-term GMOP. For example, multi-sourcing and geographically diversified supply bases can localize or limit the impact of regional disruptions, allowing global manufacturing plans to continue largely uninterrupted (Sawik, 2014; Namdar et al., 2018). By building redundancy and flexibility into the supply network through strategic sourcing decisions, companies create the conditions for quicker re-routing of materials and faster scaling of alternate sources when needed. This is a core principle of supply chain resilience (Christopher & Peck, 2004; Tukamuhabwa et al., 2017), and strategic sourcing provides the means to realize it. The Ever-Given blockage of the Suez Canal in 2021 famously underscored this point, it revealed "the vulnerability of international supply chains and the need to optimize them not only in consideration of costs, but also of risks" (Zsidisin et al., 2024). In response, many firms revisited their sourcing strategies, balancing just-in-time efficiencies with "just-in-case" resilience measures (Yu et al., 2024; Khan, 2022). Recent literature suggests that long-range supply chain planning increasingly needs to balance efficiency-oriented and resilience-oriented objectives (Ivanov, 2022; Um & Han, 2021). In short, strategic sourcing under supply risk represents a paradigm shift, from pursuing lowest-cost supplies in stable conditions to managing a robust, flexible supply base that can sustain the firm's manufacturing objectives in uncertain, turbulent conditions. This shift directly feeds into the development of higher-order sourcing capabilities, which allow firms to repeatedly and reliably achieve these risk-adjusted sourcing outcomes over time.

2.3.2 From Strategic Sourcing to Sourcing Capability

While strategic sourcing describes the deliberate strategies and practices a firm uses to procure goods and services, sourcing capability refers to the underlying organizational ability to execute and continuously adapt those strategies over time in a dynamic environment. Strategic sourcing emphasizes the systematic and long-term management of sourcing decisions aligned with organizational objectives, supplier relationships, and operational requirements (Anderson & Katz, 1998; Gottfredson & Phillips, 2005; Monczka et al., 2015). As sourcing increasingly influences manufacturing continuity, operational flexibility, and supply chain performance, firms require organizational competences that extend beyond transactional procurement activities (Axelsson et al., 2005; Handfield et al., 2015). Researchers therefore conceptualize sourcing capability as a higher-order organizational capability that

encompasses the skills, routines, and structures enabling firms to effectively manage supplier relationships, sourcing decisions, and supply networks in support of long-term operational and strategic objectives (Shook et al., 2009; Su & Gargeya, 2012; Handfield et al., 2015).

Crucially, sourcing capability is intangible and internally developed. Rather than representing a tool or discrete sourcing practice, it emerges through organizational learning, accumulated experience, managerial routines, and cross-functional coordination. Consistent with the dynamic capability perspective, sourcing capability can be understood as an organizational ability embedded within recurring processes that enable firms to modify and improve sourcing activities under changing environmental conditions. Dynamic capabilities are defined as organizational activities embedded within repetitive processes that support adaptation and the modification of operational routines over time (Zollo & Winter, 2002; Teece, 2007). Similarly, sourcing capability develops through established but evolving routines related to supplier management, sourcing coordination, market intelligence, and organizational integration (Brandon-Jones & Knoppen, 2018; Handfield et al., 2015; Huang & Handfield, 2015).

This perspective distinguishes sourcing capability from individual sourcing practices. The existence of specific sourcing arrangements, such as supplier diversification, dual sourcing, or contractual governance mechanisms, does not in itself constitute sourcing capability. Rather, sourcing capability reflects the organizational capacity to develop, coordinate, and adapt such practices as environmental conditions change (Aslam et al., 2018; Handfield et al., 2015). For instance, a firm might have a dual-sourcing policy in place, but without a strong sourcing capability (e.g., insufficient supplier development processes or poor cross-functional communication), that policy may not translate into actual resilience or cost advantage. In this sense, sourcing capability integrates multiple organizational competences, including supply market intelligence, supplier evaluation, sourcing flexibility, risk management, supplier relationship management, and cross-functional coordination (Monczka et al., 2015; Handfield et al., 2015; Axelsson et al., 2005; Gualandris et al., 2014).

Based on the strategic sourcing literature, sourcing capability is therefore defined in this study as the organization's collective ability to plan, execute, coordinate, and adapt sourcing strategies in support of long-term manufacturing or business objectives under changing environmental conditions. It represents an enduring organizational capacity, grounded in knowledge, routines, and managerial processes, that enables firms to maintain sourcing effectiveness, operational continuity, and responsiveness in dynamic supply environments (Teece, 2007; Su & Gargeya, 2012; Handfield et al., 2015).

2.3.3 Sourcing Capability as a Dynamic Capability

The increasing uncertainty and complexity of global supply environments have led sourcing capability to be viewed through the lens of dynamic capabilities theory. Dynamic capabilities refer to a firm's ability to sense environmental changes, seize opportunities, and reconfigure resources and organizational routines in response to changing conditions (Teece, 2007). Unlike static operational competences, dynamic capabilities emphasize adaptation under uncertainty. As Winter (2003) puts it, ordinary (or "zero-level") capabilities let a firm "make a living" in the short term, whereas dynamic capabilities operate to extend, modify or create those ordinary capabilities to cope with evolving conditions.

Applying these ideas to sourcing, sourcing capability qualifies as a dynamic capability because it equips the firm to repeatedly re-align and renew its sourcing processes (ordinary procurement routines) in response to shifting supply conditions (Aslam et al., 2018; Handfield et al., 2015). For instance, a robust sourcing capability enables a firm to continuously update its supplier portfolio and procurement strategies as technologies evolve, new suppliers emerge, or risk profiles change (Monczka et al., 2015; Handfield et al., 2015). Without such dynamic adaptation, static procurement practices can quickly become misaligned with current market realities, jeopardizing manufacturing plans (Teece, 2007; Ivanov et al., 2016). Thus, sourcing capability is the enduring capacity to reconfigure the supply base and sourcing routines to ensure ongoing alignment with strategic objectives under changing conditions, as distinct from a one-time sourcing strategy (Aslam et al., 2018; Teece, 2007). This aligns with Winter's (2003) characterization of dynamic capabilities as "higher order" routines that require deliberate investment and development, beyond ad hoc problem-solving.

Moreover, because dynamic capabilities are embedded in routines and learned patterns of behaviour, sourcing capability is inherently a function of an organization's accumulated experience and knowledge in managing suppliers over time (Zollo & Winter, 2002; Schilke et al., 2018). It entails institutionalized processes for scanning supply markets (sensing), making agile sourcing decisions (seizing), and restructuring supplier relationships or contracts (reconfiguring) as needed to meet long-term business needs (Teece, 2007; Kotula & Ho, 2014; Huma et al., 2020). In this way, sourcing capability acts as the dynamic engine behind strategic sourcing, ensuring that strategic sourcing does not remain a static plan but continuously evolves and improves under changing supply conditions (Monczka et al., 2015; Handfield et al., 2015). A firm with strong sourcing capability can, for example, detect early signals of a supplier's financial distress (sensing), quickly shift volumes to an alternate pre-qualified supplier (seizing), and reconfigure its contracts and operations to integrate the new supplier (reconfiguring) (Kotula & Ho, 2014; Sawik, 2014; Huma et al., 2020). Such actions result from ingrained capabilities rather than improvised reactions, illustrating why sourcing capability is

a dynamic capability that confers longevity and adaptability to a firm's global operations planning (Teece, 2007; Aslam et al., 2018).

Under the lens of dynamic capability, sourcing capability is not static domain expertise, but an agile, learning-oriented process of adapting sourcing practices to maintain alignment with an evolving environment (Teece, 2007; Handfield et al., 2015). For instance, Aslam et al. (2018) find that superior market sensing and adaptability in supply management enable "supply chain ambidexterity," the dual attainment of efficiency and flexibility in volatile contexts. Likewise, Ambulkar et al. (2016) show that managers' risk mitigation competencies improve supply risk responsiveness, especially when such skills are institutionalized across the organization. Thus, by viewing sourcing capability as a dynamic capability, we emphasize its micro foundations, the individual and organizational routines, such as supplier risk monitoring, cross-functional coordination, supplier relationship management, and flexible sourcing practices, that collectively allow firms to continually refresh and realign sourcing strategies as conditions change (Barney, 1991; Teece, 2007; Handfield et al., 2015).

2.4 Conceptual Framework

A conceptual framework provides the theoretical and analytical structure that guides a research study by identifying key concepts, clarifying their relationships, and explaining the logic underlying empirical investigation (Green, 2014). For this thesis, a conceptual framework is necessary because the relationship between sourcing capabilities and long-term GMOP under supply risks is multidimensional and insufficiently integrated within existing literature. Unlike a single established theory, a conceptual framework is developed by the researcher through integrating and synthesizing relevant theories, empirical literature, and key concepts to provide a coherent analytical lens for addressing the research problem (Maxwell, 2013; Ravitch & Riggan, 2016). Accordingly, the conceptual framework developed in this study integrates insights from dynamic capabilities theory and the strategic sourcing literature to explain how sourcing capabilities support long-term GMOP under supply uncertainty. While supply risk and GMOP provide the contextual motivation and practical relevance for the study, sourcing capabilities constitute the primary analytical construct of the framework.

As shown in the Figure 1, the supply risk environment provides the external context in which sourcing capabilities are developed and deployed, whereas long-term GMOP outcomes represents the operational domain in which these capabilities create value. The framework therefore serves primarily as an analytical lens for examining how sourcing capabilities are enacted in practice.

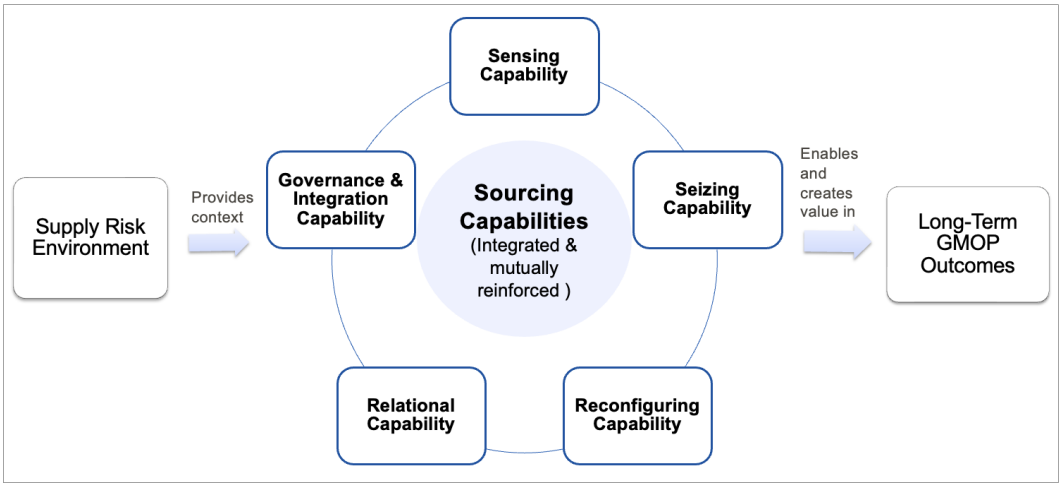


Figure 1 Conceptual Framework

The conceptual framework is situated within an increasingly uncertain supply environment. As elaborated in Section 2.1 and Section 2.2, supply risks arise from supplier-related disruptions, logistics and transportation problems, external environmental changes, and increasing regulatory and sustainability requirements that may affect supply continuity and manufacturing operations (Zsidisin, 2003; Chopra & Sodhi, 2004; Tang, 2006; Ivanov, 2022).

The centrepiece of the framework is sourcing capability. Dynamic Capabilities Theory provides the overarching theoretical perspective by explaining how organizations adapt to changing environments through sensing, seizing, and reconfiguring capabilities (Teece, 2007). However, supply chain resilience and strategic sourcing literature suggest that effective sourcing in global manufacturing also depends on organizational capabilities that extend beyond these three processes, particularly supplier relationship management, cross-functional coordination, and governance mechanisms (Axelsson et al., 2005; Handfield et al., 2015; Monczka et al., 2015). Integrating these complementary perspectives, this study conceptualizes sourcing capability as a multidimensional organizational capability consisting of five interrelated dimensions that together support long-term GMOP under supply uncertainty.

Based on the conceptualization, sourcing capability comprises five interrelated dimensions: sensing capability, seizing capability, reconfiguring capability, relational capability, and governance and integration capability. These dimensions are not intended as independent capabilities but as complementary organizational capabilities that collectively enable firms to adapt sourcing strategies and supplier networks under changing supply conditions.

- **Sensing capability** refers to the ability to identify, monitor, and interpret changes in the supply environment that may affect sourcing and manufacturing operations (Teece, 2007). In sourcing

contexts, this includes supply market intelligence, supplier monitoring, risk identification, and supply visibility mechanisms that enable firms to anticipate emerging disruptions and supply constraints (Aslam et al., 2018; Ivanov, 2020; Huang & Handfield, 2015).

- **Seizing capability** refers to the ability to translate identified risks and opportunities into sourcing decisions and coordinated actions (Teece, 2007). In sourcing environments, this includes contingency planning, sourcing prioritization, supplier engagement, and coordinated sourcing responses that support supply continuity under uncertain conditions (Frederico, 2023; Namdar et al., 2018; Handfield et al., 2015)
- **Reconfiguring capability** refers to the ability to modify sourcing structures, supplier networks, and sourcing allocations in response to changing supply conditions (Teece, 2007; Eisenhardt & Martin, 2000). This capability enables firms to adapt sourcing arrangements, redesign supplier networks, and increase sourcing flexibility to maintain operational continuity and resilience under supply uncertainty (Sawik, 2014; Guo et al., 2024).
- **Relational capability** refers to the ability to establish and leverage collaborative supplier relationships that support information sharing, coordination, responsiveness, and joint problem-solving (Handfield et al., 2015; Jean et al., 2014). Strong supplier relationships facilitate collaboration and improve firms' ability to respond to disruptions and changing operational requirements (Oh & Rhee, 2008; Squire et al., 2009; Zhou et al., 2024).
- **Governance and integration capability** refers to the ability to coordinate sourcing activities across organizational functions and integrate sourcing decisions into broader manufacturing planning processes; a concept rooted in the supply management alignment framework established by Handfield et al. (2015). This capability supports cross-functional alignment, information sharing, and coordinated decision-making between sourcing, operations, engineering, and planning functions (Axelsson et al., 2005; Kocabasoglu & Suresh, 2006; Handfield et al., 2015).

These five dimensions of sourcing capability are interconnected and mutually reinforcing. Together, they allow a firm to monitor the supply environment, coordinate sourcing responses, restructure supply networks, manage supplier relationships, and integrate supply considerations into manufacturing plans. Crucially, sourcing capability operates continuously and proactively, injecting resilience into planning before, during, and after potential supply disruptions.

In addition, previous research suggests that organizations possessing stronger dynamic capabilities are better able to maintain manufacturing

continuity, improve manufacturing flexibility, enhance planning robustness, and adapt operations under changing supply conditions (Ferdows, 1997; Olhager et al., 2001; Dreyer et al., 2009; Ivanov et al., 2016). The framework posits that sourcing capability drives these GMOP outcomes by embedding risk mitigation and adaptability into the planning process: with advanced sensing, firms anticipate and prevent many surprises; with seizing and relational capabilities, they coordinate swift interventions during disruptions; with reconfiguring and integration capabilities, they evolve their supply base and plans to match new realities, often with minimal impact on production schedules or customer deliveries (Teece, 2007; Dreyer et al., 2009; Ivanov et al., 2016).

3 Research Methodology

This chapter presents the methodological approach adopted to investigate how sourcing capabilities support firms' long-term GMOP under supply risks. It explains the research design, data collection procedures, and analytical approach used to address the research question. The chapter is structured to show how the study moves from the research question and conceptual framework to empirical evidence, and from evidence to interpretation and conclusions.

3.1 Research Design

This study employs a theory-informed qualitative case study to investigate how sourcing capabilities support firms' long-term GMOP under supply risks. Case study research is appropriate when the aim is to understand a contemporary phenomenon in depth within its real-life organisational context, especially when the boundaries between the phenomenon and its context are not clear (Yin, 2018). The present study examines sourcing capability enactment and its contribution to long-term planning in practice—an organisational phenomenon that is shaped by cross-functional coordination, supplier relationships, governance arrangements, and uncertainty conditions embedded in the operating environment. For this reason, an in-depth case study strategy provides a suitable methodological basis for answering the study's process-oriented "how" question (Yin, 2018).

Within this strategy, the study adopts a single-case embedded design. The single case enables an in-depth investigation of sourcing capability enactment within a bounded organisational setting, while the embedded design supports structured examination of multiple sub-units through which the phenomenon is enacted (Yin, 2018). While multiple case studies may enhance comparative breadth, a single case approach allows deeper contextual understanding of organizational processes and capability enactment within one setting (Eisenhardt, 1989). This design is appropriate because sourcing capabilities are not enacted as a single uniform practice; rather, they are manifested through multiple organisational interfaces and routines. The embedded design therefore strengthens within-case analytical depth by enabling comparison and synthesis across embedded units while maintaining the coherence of a single case (Yin, 2018).

In this study, the conceptual framework operationalises the theoretical propositions guiding the case study. Conceptual frameworks provide a structured and theory-informed lens that supports research design, empirical inquiry, data analysis, and interpretation of findings (Green, 2014). Rather than functioning as a hypothesis-testing model, the framework defines the study's analytical focus and maintains coherence between theoretical

foundations and empirical investigation (Green, 2014; Yin, 2018). The framework integrates literature on global manufacturing operations planning under uncertainty, supply risks and supply chain resilience, strategic sourcing, and dynamic capability theory. The framework proposes that supply risk conditions shape the need for sourcing capabilities, while sourcing capabilities influence the effectiveness of long-term manufacturing planning outcomes.

The case is defined at the divisional level within a large global manufacturing company. This division constitutes the focal organisational setting in which sourcing practices and long-term GMOP related planning interfaces are examined. Defining the case at the divisional level provides a bounded yet contextually meaningful setting for analysing how sourcing capabilities is enacted and integrated into long-term planning activities (Yin, 2018).

To maintain analytical focus, the study establishes clear case boundaries (Yin, 2018). First, the temporal boundary centres on long-term GMOP activities associated with a three- to five-year planning horizon. Second, the organisational boundary focuses on sourcing and procurement activities and their interfaces with supply chain management and long-term manufacturing planning functions. Third, the process boundary encompasses the practices and mechanisms through which sourcing capabilities support long-term GMOP under supply risks. Finally, the evidence boundary consists primarily of semi-structured interviews supplemented by internal documents.

The overarching unit of analysis is the divisional-level organisational processes through which sourcing capabilities are enacted and integrated into long-term GMOP under supply risks. Consistent with the embedded design, the study examines several embedded units of analysis representing key organisational arenas of capability enactment, including: (1) supply risk sensing and information routines, (2) sourcing response and decision-making practices, (3) supplier relationship and governance mechanisms, and (4) cross-functional integration between sourcing and long-term planning processes. Examining these embedded units enables a more nuanced understanding of how sourcing capabilities support long-term planning across different organisational interfaces while remaining anchored within the same case context (Yin, 2018).

3.2 Research Process Overview

The research process of this study follows a sequential, theory-informed case study approach, moving systematically from theoretical framing to empirical investigation and analytical interpretation. As shown in the Figure 2, the process was designed to ensure coherence between the research question, conceptual framework, data collection, and analysis, consistent with Yin's (2018) case study design logic.

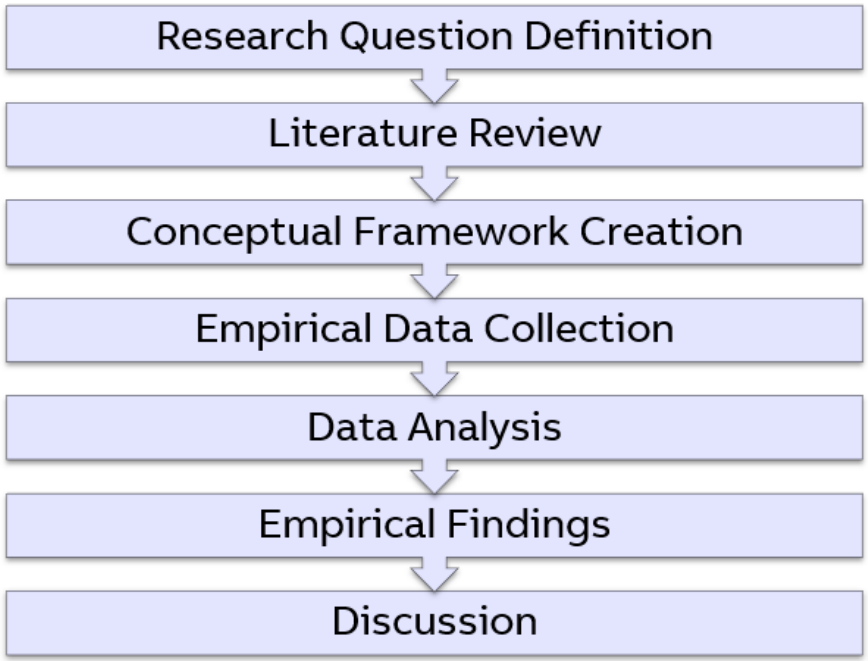


Figure 2 Research Process

First, the study begins with the development of the research question, derived from the identified research gap concerning the role of sourcing capabilities in supporting long-term GMOP under supply risks. This is followed by a literature review, which establishes the theoretical foundation and highlights the limitations of existing research in explaining the process-level linkage between sourcing capability and long-term planning.

Based on this theoretical grounding, a conceptual framework was developed to guide empirical inquiry. The framework operationalises key sourcing capability dimensions and functions as the study's theoretical propositions, directing both data collection and analysis. In line with Yin (2018), such theoretically informed propositions provide focus for identifying relevant evidence and interpreting findings.

Empirical data were then collected through semi-structured interviews as the primary source of evidence, supplemented by organisational documents. The use of multiple sources of evidence supports triangulation and improves the robustness of case study findings (Yin, 2018).

The analysis follows a structured data analysis approach. Empirical data are coded and organised in relation to the conceptual framework, enabling identification of patterns and relationships across embedded units of analysis.

The linking logic of the study is based on thematic coding and pattern matching, where observed organisational practices and mechanisms are compared with the capability dimensions proposed in the conceptual framework. This enables the study to explain how sourcing capabilities are enacted and how they contribute to long-term GMOP under supply risks.

Finally, findings are interpreted based on the extent to which convergent evidence across multiple sources and embedded units supports coherent explanations, consistent with Yin's emphasis on maintaining a transparent chain of evidence. The study aims for analytical generalisation, whereby findings are used to refine and extend theoretical understanding rather than to achieve statistical generalisation.

3.3 Data Collection

3.3.1 Semi-Structured Interviews

Semi-structured interviews constituted the primary source of empirical data in this study. Interviews were selected because the research seeks to understand how sourcing capabilities are developed, enacted, and integrated into long-term global manufacturing operations planning (GMOP) under supply risks within a real organisational setting. As sourcing capability involves managerial practices, decision-making processes, cross-functional coordination, supplier relationships, and responses to uncertainty, interviews provide access to participants' experiences, interpretations, and practical knowledge that may not be observable through documentary evidence alone (Yin, 2018).

In qualitative case study research, interviews are regarded as an important source of evidence because they enable researchers to investigate organisational processes, perceptions, and experiences related to a phenomenon of interest (Green, 2014; Yin, 2018). Semi-structured interviews are particularly appropriate when research is informed by theoretical concepts while remaining open to contextual and emergent insights (Eriksson and Kovalainen, 2008). Unlike structured interviews, semi-structured interviews provide flexibility in questioning while maintaining consistency through common thematic areas (Yin, 2018).

The use of semi-structured interviews was considered appropriate because sourcing capabilities are often embedded in tacit organisational knowledge, informal routines, and cross-functional interactions. Processes such as supplier risk sensing, sourcing strategy development, supplier collaboration, planning integration, and supply continuity management frequently rely on practical experience and organisational interpretation rather than formal documentation alone (Axelsson et al., 2005; Handfield et al., 2015). Accordingly, interviews enabled detailed exploration of how sourcing-related practices are enacted and perceived within the organisational context.

The interview approach was informed by the conceptual framework developed from the literature review. Interview themes reflected sourcing capability dimensions identified in the framework, including sensing capability, seizing capability, reconfiguring capability, relational capability, and governance and integration capability, while maintaining flexibility to explore context-specific practices and emergent issues raised by respondents (Teece,

2007; Green, 2014). This ensured alignment between theory and empirical inquiry while preserving openness to organisational complexity.

As qualitative case study research seeks contextual understanding rather than statistical representativeness, interviews were designed to generate rich and information-intensive insights into sourcing practices and long-term manufacturing planning processes (Eriksson & Kovalainen, 2008). Interview evidence therefore served as the principal basis for subsequent thematic coding, interpretation, and analytical discussion.

3.3.2 Sample Selection

Respondents were selected through purposive sampling, whereby participants were intentionally chosen based on their functional relevance, organisational role, and expected ability to contribute meaningful insights regarding sourcing capabilities, supply risks, and long-term manufacturing operations planning (GMOP). In qualitative case study research, purposive sampling is appropriate when the objective is to obtain rich and contextually relevant information from individuals directly involved in the phenomenon under investigation rather than to achieve statistical representativeness (Eriksson & Kovalainen, 2008; Yin, 2018).

The sampling logic was guided by the research question and conceptual framework. Since the study investigates how sourcing capabilities support long-term GMOP under supply risks, respondents were selected from organisational functions involved in sourcing, supply chain management, sustainability, and planning-related coordination. This enabled the study to capture multiple organisational perspectives relevant to sourcing capability enactment and planning integration.

A total of twelve respondents participated in the study. Participants represented several functions associated with sourcing and operational planning, including supply chain managers, global category managers, S&OP specialists, and sustainability and compliance professionals. Some respondents also had prior experience in R&D or production-related roles, providing broader perspectives on engineering requirements, manufacturing constraints, sourcing decisions, and operational coordination.

The inclusion of respondents from multiple functional backgrounds supported a cross-functional understanding of sourcing capability and long-term manufacturing planning. Existing literature suggests that sourcing decisions are increasingly interconnected with engineering, operations, sustainability requirements, and manufacturing strategy, particularly in globally dispersed production systems characterised by supply uncertainty (Axelsson et al., 2005; Handfield et al., 2015; Colicchia et al., 2010). Consequently, relying solely on procurement personnel could have provided only a partial understanding of sourcing capability and its role in manufacturing planning.

Participant selection also reflected the analytical dimensions of the conceptual framework, including supplier risk identification and monitoring (sensing capability), sourcing decision responses (seizing capability), supply base adaptation (reconfiguring capability), supplier collaboration and governance (relational capability), and cross-functional planning coordination (governance and integration capability). This alignment strengthened coherence between the theoretical framework, empirical inquiry, and subsequent analysis (Green, 2014).

The final number of interviews was considered sufficient to provide information-rich and contextually grounded insights while remaining manageable within the scope of the thesis study. In qualitative case study research, emphasis is placed on analytical depth and contextual understanding rather than large sample size (Yin, 2018).

3.3.3 Interview Protocol Development

The interview protocol was developed based on the study's conceptual framework and relevant literature on sourcing capabilities, supply risks, supply chain resilience, and global manufacturing operations planning (GMOP). In qualitative case study research, interview protocols support consistency across interviews while maintaining flexibility to explore context-specific experiences and emergent organisational practices (Yin, 2018). The protocol therefore functioned as a theory-informed guide rather than a rigid questionnaire.

The conceptual framework played a central role in protocol design. Interview questions were organised around sourcing capability dimensions relevant to supporting long-term GMOP under supply risks, including sensing capability, seizing capability, reconfiguring capability, relational capability, and governance and integration capability. Accordingly, interview themes explored how respondents identify and monitor supply-related risks, respond to uncertainty through sourcing decisions and supplier actions, adapt sourcing structures and supply networks, collaborate with suppliers, and coordinate sourcing activities with planning and other organisational functions.

In line with recommendations for semi-structured interviewing, open-ended questions were prioritised to encourage participants to elaborate on practical experiences, organisational challenges, and managerial decision-making processes (Yin, 2018). Follow-up questions and probing were used when clarification or deeper contextual understanding was required, enabling consistency across interviews while allowing respondents to discuss issues relevant to their responsibilities and expertise (Green, 2014).

The interview protocol consisted of thematic question groups covering sourcing processes, sourcing capability dimensions, supply risks, and

implications for long-term GMOP. The full interview protocol is presented in Appendix A.

3.3.4 Conducting Interviews

Data collection consisted of a single round of twelve semi-structured interviews conducted with employees of the case company. Interviews were carried out online via Microsoft Teams and lasted approximately sixty minutes on average. Online interviewing was selected due to practical considerations relating to participant accessibility, availability, and organisational working arrangements.

All interviews were audio recorded with participant consent to ensure accurate capture of respondent perspectives and reduce risks of incomplete documentation. Audio recording is recommended in qualitative research because it improves reliability of data capture and supports detailed analysis beyond field notes alone (Yin, 2018). Recordings were subsequently transcribed to facilitate systematic coding and analysis.

Interviews followed a consistent thematic structure informed by the conceptual framework while maintaining flexibility for respondents to elaborate on issues relevant to their organisational roles. Discussions therefore combined theory-informed questions with adaptive probing and clarification to improve contextual understanding of sourcing practices, supplier interactions, planning processes, organisational coordination, and responses to supply uncertainty (Green, 2014; Yin, 2018).

The interview setting aimed to encourage open reflection on sourcing practices and organisational challenges while maintaining a professionally structured discussion. As sourcing capabilities and supply risk management are often embedded in organisational routines and practical experience, reflective discussion was important for generating rich qualitative evidence (Eriksson & Kovalainen, 2008).

The final sample of twelve interviews was considered sufficient to provide information-rich insights across relevant sourcing capability dimensions while remaining manageable within the scope of a master's thesis. In qualitative case study research, emphasis is placed on analytical depth and contextual understanding rather than sample size (Yin, 2018).

All interviews were conducted under informed participation and confidentiality arrangements. Recordings and transcripts were anonymised and securely stored, with detailed ethical and confidentiality procedures presented in Section 3.5.

3.3.5 Supplementary Data Collection

Although semi-structured interviews served as the primary source of empirical evidence, supplementary documentary evidence was collected to

strengthen contextual understanding and support triangulation. In qualitative case study research, the use of multiple sources of evidence is recommended because it enables richer understanding of a phenomenon and strengthens construct validity through corroboration across evidence sources (Yin, 2018). In this study, documentary evidence was used to contextualise, validate, and complement interview findings rather than function as an independent source of analysis.

The supplementary data collection strategy was guided by the research question and conceptual framework concerning how sourcing capabilities support long-term global manufacturing operations planning (GMOP) under supply risks. Documentary materials were collected to provide contextual understanding of sourcing activities, manufacturing planning processes, governance structures, supplier relationships, and supply-related decision-making within the case company.

The documentary materials included two internal planning reports, three strategic sourcing related reports, and two documents about sustainable supply chain. These materials provided organisational context regarding sourcing governance, planning assumptions, supplier management approaches, and long-term manufacturing planning mechanisms. Sustainability and compliance documentation additionally supported understanding of sourcing-related environmental, regulatory, and supplier governance requirements influencing sourcing decisions and supplier relationships (Gualandris et al., 2014; Statsenko et al., 2024).

The documentary materials were not analysed independently as isolated artefacts but served a supporting role in interpreting interview findings and improving contextual understanding of organisational sourcing and planning practices. Documentary evidence therefore functioned primarily as triangulation material to strengthen the credibility and internal consistency of interpretations derived from interviews (Yin, 2018). Access to documentary materials was governed by confidentiality requirements, and sensitive identifiers were removed or generalised during reporting (see Section 3.5).

3.4 Data Analysis

This study employed a theory-informed qualitative analysis approach guided by Yin's five-phased process of qualitative data analysis, comprising: (1) compiling, (2) disassembling, (3) reassembling, (4) interpreting, and (5) concluding (Yin, 2015). Semi-structured interview data constituted the primary analytical material, while internal documents served as supplementary evidence for contextualisation and triangulation.

Since the study aims to examine how sourcing capabilities support long-term GMOP under supply risks, data analysis was informed by a conceptual framework derived from literature on global manufacturing management, strategic sourcing, supply risk management, supply chain resilience, and

dynamic capabilities. Consequently, the analysis adopted a theoretically informed thematic analysis approach, in which sourcing capability dimensions derived from the conceptual framework guided initial coding while remaining open to emergent empirical themes and contextual explanations (King & Brooks, 2018; Miles et al., 2014).

In line with case study logic, empirical findings were subsequently interpreted through pattern matching by comparing observed organisational practices and sourcing capability mechanisms with theoretically expected relationships embedded in the conceptual framework (Yin, 2018). Data were analysed and reported in accordance with the anonymisation, secure storage, and non-disclosure procedures described in Section 3.5.

Step 1 – Data Compiling:

The first stage involved compiling and organising empirical material into a structured analytical dataset to facilitate systematic analysis and maintain a transparent chain of evidence (Yin, 2015; Yin, 2018). Semi-structured interviews were audio-recorded, transcribed, and systematically anonymised prior to analysis. Personal identifiers, department names, supplier names, and commercially sensitive references were removed or generalised to ensure confidentiality and comply with organisational ethical requirements. Supplementary materials were compiled and organised to support contextual understanding of interview findings. All collected material was securely stored and reviewed exclusively for academic purposes in accordance with confidentiality agreements and research ethics principles.

Step 2 – Data Disassembling:

The second analytical stage involved data disassembling, whereby empirical data was broken into smaller analytical units through systematic coding (Yin, 2015). Interview transcripts constituted the primary source of coding.

Following a theoretically informed thematic analysis approach, sourcing capability dimensions derived from the conceptual framework served as first-order analytical categories (King & Brooks, 2018). These dimensions included:

- sensing capability
- seizing capability
- reconfiguring capability
- relational capability
- governance and integration capability

Within each capability dimension, interview material was coded to identify recurring organisational practices, managerial perceptions, supply risk-related mechanisms, and sourcing activities relevant to long-term manufacturing planning. For example, statements regarding supplier visibility, risk monitoring, and disruption awareness were coded under sensing capability, whereas evidence concerning supplier diversification, sourcing flexibility, and regional sourcing adjustments was coded under reconfiguring capability.

Although the analysis followed a primarily deductive structure, inductive sensitivity was maintained to allow emergent themes, contextual explanations, and interdependencies across sourcing capabilities to surface from empirical observations (King & Brooks, 2018; Miles et al., 2014).

Step 3 – Data Reassembling:

The third stage involved data reassembling, whereby coded fragments were reorganised into broader thematic patterns and relationships relevant to the conceptual framework (Yin, 2015). During this stage, coded interview evidence was grouped and categorised to identify how sourcing capabilities contributed to long-term GMOP under supply risks, while supplementary documentary evidence was used to contextualise and triangulate interview findings. (King & Brooks, 2018).

The analysis focused on identifying relationships between sourcing capability dimensions and planning-related outcomes, including manufacturing flexibility, capacity assurance, supplier optionality, sourcing resilience, and long-term planning robustness. In addition, cross-cutting empirical themes spanning multiple sourcing capability dimensions were identified to explain organisational mechanisms not fully captured by individual capability categories.

Step 4 – Data Interpreting:

The fourth stage involved interpretation of reorganised evidence to explain how sourcing capabilities supported long-term GMOP under supply risks (Yin, 2015). Pattern matching was applied by comparing empirical findings with theoretical expectations derived from literature reviews. Attention was paid to identifying consistencies, differences, and contextual explanations between theoretical expectations and organisational realities. Through this process, empirically identified thematic patterns were interpreted in relation to the conceptual framework to explain how sourcing-related organisational practices influenced manufacturing planning under uncertain supply conditions.

Step 5 – Concluding:

The final stage involved synthesising findings and drawing conclusions regarding the role of sourcing capabilities in supporting long-term GMOP under supply risks (Yin, 2015). Findings were synthesised across sourcing capability dimensions and interpreted in relation to manufacturing planning outcomes.

Conclusions were derived through iterative comparison between interview evidence, documentary materials, and theoretical propositions established in the conceptual framework (Yin, 2018). This enabled the study to generate a contextually grounded understanding of how sourcing capabilities contribute to strategic manufacturing planning in uncertain supply environments.

3.5 Ethical Considerations and Confidentiality

Ethical considerations and confidentiality requirements were prioritised throughout the research process due to the corporate setting and the use of potentially commercially sensitive information. In qualitative case study research, protecting participants and safeguarding organisational interests are important for ensuring informed participation, maintaining trust, and supporting responsible handling of evidence (Yin, 2018; Eriksson & Kovalainen, 2008).

Participation in the study was voluntary. Prior to interviews, participants were informed of the purpose of the study, the academic nature of the research, the intended use of findings in a master's thesis, and the approximate interview duration. Participants were informed that they could decline to answer any question and withdraw from the study at any time without consequences. Interviews were audio recorded only with explicit consent to support accurate transcription and analysis (Eriksson & Kovalainen, 2008; Yin, 2018).

To protect organisational confidentiality, the identity of the case company is not disclosed, and potentially sensitive organisational information is reported at an aggregated or generalised level. Commercially sensitive details, such as supplier identities, procurement information, or internal planning assumptions, are not reported in identifiable form. Where necessary, descriptions are presented using generalised terms to preserve confidentiality while maintaining analytical meaning (Yin, 2018).

Participant anonymity was ensured through transcript anonymisation. Personally identifiable information and sensitive contextual details were removed, generalised, or pseudonymised prior to analysis. Participants are referred to using non-identifying labels (e.g., Interviewee 1, Interviewee 2) or broad functional descriptions where appropriate. Quotations included in the findings were reviewed to remove identifying information without altering substantive meaning (Yin, 2018; Eriksson & Kovalainen, 2008).

Research materials, including recordings, transcripts, and documentary evidence, were stored securely and accessed only for academic purposes. During analysis and reporting, findings were interpreted across multiple participant perspectives and supported by documentary evidence to reduce reliance on individual accounts and avoid selective interpretation. Findings are reported at an aggregated level to preserve confidentiality while maintaining transparency between empirical observations and theoretical interpretation (Yin, 2018).

3.6 Research trustworthiness

To ensure the rigour and credibility of the study, the quality of the research design and execution was assessed in accordance with established case study

criteria, including construct validity, internal validity, external validity, and reliability (Yin, 2018).

Construct validity refers to the extent to which the study accurately captures the concepts it intends to examine. In this study, construct validity was enhanced by multiple sources of evidence, including semi-structured interviews and organisational documents. Triangulation across these data sources enabled cross-verification of findings and reduced the risk of relying on a single source of information. In addition, the conceptual framework guided data collection and coding, ensuring alignment between theoretical constructs and empirical observations (Yin, 2018).

Internal validity concerns the logical consistency and explanatory strength of the findings. Although internal validity is primarily relevant for explanatory studies, it is addressed here through pattern matching and explanation building. Empirical findings were systematically compared with propositions embedded in the conceptual framework to identify consistencies and discrepancies. Attention was also given to alternative explanations during analysis, strengthening the robustness of the interpretation (Yin, 2018).

External validity refers to the generalisability of findings. In case study research, generalisation is achieved through analytical generalisation, whereby findings are extended to theoretical constructs rather than to populations. This study contributes to external validity by linking empirical results to the conceptual framework and to existing literature on sourcing capabilities, dynamic capabilities, and supply risk management, thereby enabling theoretical insights that may be transferable to similar organisational contexts (Yin, 2018).

Reliability addresses the consistency and transparency of the research procedures. Reliability in this study was supported by establishing a clear case study protocol, including structured interview guidelines, systematic data collection procedures, and a transparent analytical process. Interview data were recorded, transcribed, and coded consistently, and the use of a structured analytical approach improved the traceability of findings (Yin, 2018).

Overall, the study ensures research trustworthiness by combining multiple data sources, theoretically guided analysis, and transparent procedures, thereby enhancing the credibility and robustness of the findings.

4 Empirical Findings

The empirical findings presented in this chapter are structured around the five strategic sourcing capability dimensions derived from the conceptual framework: sensing, seizing, reconfiguring, relational, and governance & integration capabilities. For each capability dimension, evidence from the semi-structured interviews is synthesized and supplemented with insights from internal documents. Within each capability section, the chapter provides a narrative synthesis of the interview data, highlighting key themes that emerged, supported by both examples of effective practices and reported limitations or challenges. To maintain transparency and give voice to participants, verbatim quotations from interviewees are included (anonymised as Interviewee 1, Interviewee 2, etc.), grouped by sub-themes. Finally, the chapter concludes with a cross-capability synthesis summarizing patterns that cut across multiple capability domains, and a brief empirical summary linking the findings to long-term GMOP outcomes.

4.1 Case Company Background

The case company examined in this study is a large multinational industrial manufacturing organization, operating through multiple business divisions. The empirical research is conducted at the level of one specific division within the case company, hereafter referred to as the focal division, rather than at the corporate level. Within the organization, the focal division belongs to a broader business area and focuses on products and solutions characterized by high technical intensity and global operational coordination. All empirical data for this study were collected within the scope of the Global Operations team of the focal division, which plays a central role in coordinating manufacturing and sourcing activities across regions.

4.1.1 Division Role and Organizational Context

The focal division is responsible for the development, manufacturing, and delivery of large-scale, power-intensive industrial systems and subsystems used in critical industrial applications. The division's activities span product development, manufacturing, sourcing, and delivery, with division-level governance structures guiding strategic decisions related to operations and supply networks.

The division operates in an environment characterized by high product variety, long product lifecycles, and stringent performance requirements. Products are frequently customized to customer or project specifications, which increases design complexity and places strong interdependencies between engineering, manufacturing, and sourcing decisions. As a result, long-

term GMOP involves not only internal capacity and footprint considerations, but also early and sustained alignment with supplier capabilities and sourcing strategies.

4.1.2 Manufacturing and Global Operations

Manufacturing operations within the focal division are globally distributed, with multiple production sites located across different countries and regions. These sites perform specialized manufacturing, assembly, and testing activities and are coordinated through a division-level Global Operations organization. Many products follow engineer-to-order or configure-to-order logics, rather than standardized mass production.

The Global Operations team is responsible for coordinating manufacturing activities across sites and over multiple planning horizons. Its remit includes global capacity planning, manufacturing footprint coordination, and cross-site production alignment, as well as ensuring consistency between long-term business plans and operational capabilities. The Global Operations team also acts as an integrative function, linking manufacturing, sourcing, and planning activities across regions, and providing a centralized perspective on operational risks and constraints.

4.1.3 Organization of the Sourcing Function

Sourcing within the focal division is organized through a hybrid global–local structure. Strategic sourcing responsibilities are primarily held at the division level, while operational procurement and execution are managed locally at manufacturing sites.

The sourcing organization follows a category-based management model, in which category managers are responsible for developing sourcing strategies for key material and component categories across all sites. These roles coordinate supplier selection, contracting, and performance management at a global level. In parallel, local sourcing and supply chain teams at plant level are responsible for operational purchasing, supplier communication, and material availability for day-to-day production. Project- or product-specific sourcing roles are also used for complex delivery programs, requiring close interaction with engineering, manufacturing, and project management functions.

This organizational arrangement reflects the need to balance global coordination and standardization with local responsiveness and operational execution, especially in a context where products are complex and supplier capabilities vary across regions.

4.1.4 Manufacturing Planning and Sourcing Interface

The focal division operates formal planning processes at two distinct but linked horizons. First, the division uses a S&OP process that typically covers the next 12 to 24 months. S&OP is driven by demand forecasts and focuses on balancing near-term supply with expected demand. This process yields a production plan and material requirements plan that are considered relatively robust due to the shorter horizon and known demand cues (including customer orders or high-confidence forecasts).

In addition to S&OP, the division engages in long-term GMOP, which extends the planning horizon to roughly 3 to 5 years. The long-term GMOP layer is more strategic and top-down. To be specific, it incorporates business objectives, anticipated market trends, and structural considerations. Because demand forecasts beyond two years carry greater uncertainty, the GMOP planning emphasizes directional goals and scenarios. For example, it might set targets for capacity expansion to be achieved over the next five years, guided by corporate strategy.

These two planning layers are linked. For example, decisions made in the GMOP horizon eventually inform and shape future S&OP cycles. The Global Operations team ensures coordination between these layers by facilitating cross-functional forums that include representatives from manufacturing, sourcing, supply chain, and business units. Through this structure, near-term plans are aligned with long-term strategic intent, and sourcing considerations (such as supplier capacity and risk factors) are incorporated into planning horizons.

The Global Operations team plays a coordinating role in these processes, consolidating inputs from manufacturing sites and interfacing with sourcing functions. Sourcing representatives and category managers participate in planning forums to provide input on supplier capacity, lead times, and potential supply risks that may affect manufacturing plans. Formal cross-functional interfaces are used to ensure that sourcing constraints and supply uncertainties are reflected in long-term manufacturing plans, such as forecast reviews and demand–supply reconciliation meetings.

4.1.5 Relevance of the Focal Division for the Study

The focal division provides a relevant and appropriate empirical context for examining how strategic sourcing capabilities support long-term GMOP under supply risk. The division's global manufacturing footprint, reliance on specialized suppliers, complex product structures, and long planning horizons create a setting in which sourcing decisions have significant and lasting implications for manufacturing continuity and flexibility.

By focusing on the Global Operations team within this division, the study captures a division-level perspective that bridges strategic planning and operational execution. This perspective enables a detailed examination of how sourcing capabilities are enacted, coordinated, and integrated into long-term

manufacturing planning processes under uncertain supply environments. The background presented here establishes the organizational and operational context for the empirical findings that follow, without disclosing sensitive or commercially confidential information.

4.2 Sourcing Capability Dimensions

4.2.1 Sensing Capability

The interview findings suggest that sensing capability in the case company operates through a combination of formal monitoring systems, supplier interaction, market intelligence, internal communication, and visibility-building practices across supply networks. Interviewees consistently described supplier performance monitoring, structured supplier risk assessments, recurring supplier discussions, cross-regional information exchange, and market observation as mechanisms used to identify emerging risks and improve sourcing preparedness. Participants also emphasized the importance of supplier communication and planning visibility in strengthening awareness of future developments.

The findings further indicate that sensing practices occur at both operational and strategic levels. On an operational level, sensing activities were commonly associated with supplier monitoring, issue escalation, and visibility into supplier performance and material availability. At a more strategic level, interviewees described efforts to strengthen future visibility through long-term demand communication, market intelligence gathering, and planning discussions with suppliers to anticipate capacity constraints and supply risks before they materialize. However, participants also highlighted important limitations, regarding material-level long-term forecasting and visibility beyond first-tier suppliers. These limitations suggest variation in the depth and time horizon of sensing capability across sourcing activities and supplier relationships.

Market Monitoring and Early Risk Detection

Many interviewees described actively monitoring suppliers and market conditions for early warning signs of disruptions. Participants emphasized staying attentive to supplier lead-time developments, supplier capacity utilization, financial stability, and broader market developments affecting availability and continuity of supply. Information gathering was reported to occur through both formal organizational systems and informal information channels.

Several interviewees described the use of formal supplier performance monitoring and risk-management mechanisms to improve visibility of supplier-related risks. Participants referred to supplier performance

management systems and procurement platforms, including supplier management tools and performance dashboards, to monitor delivery reliability, supplier performance trends, and operational disruptions. Some interviewees also mentioned the use of market intelligence tools and supplier-related reporting systems to identify emerging supply concerns and monitor supplier risk indicators. In addition, the supply chain sustainability team was described as sensing sustainability and regulatory risks through regulatory horizon scanning, which enabled the company to identify emerging environmental regulations, due diligence requirements, and carbon emission standards that could affect supplier compliance and component availability. One noted, "*We are anticipating some new EU rules that mean we might have to stop using particular suppliers or components if they don't meet the new sustainability criteria in time*". Some organisational market intelligence reports further show how the case company actively seize the supply risks under dynamic market conditions. For instance, in one region the sourcing team noticed small but consistent slips in a crucial supplier's delivery performance and proactively engaged the supplier's management, discovering that industry-wide demand for that component had spiked. This early detection helped them expedite some orders and seek interim alternatives.

Interviewee 2 highlighted the role of digital dashboards and regular reviews in enabling early detection of problems. They explained that *"weekly scorecards monitor each supplier's on-time delivery, lead times, and defect rates, which alerts us to any downward trends"*. While Interviewee 5 emphasized the importance of continuous supplier performance monitoring, which allows the team to identify potential production bottlenecks or emerging issues before they escalate:

> *"We track supplier delivery performance and quality metrics all the time, so if a supplier's quality falls or shipments slow, we catch it early"*.

In some cases, interviewees reported identifying gradual warning signs of disruption through supplier monitoring and follow-up discussions. One participant described how extended lead times eventually revealed an underlying supplier capacity shortage:

> *"They used to have lead times of three to four months, which was okay. Then suddenly they doubled the lead time to six months… then to 12 months. Now we have lead times of 400 days. It turned out their factories are full; they don't have capacity to support everybody. We get late deliveries – it's an annoying situation." (Interviewee 1)*

Interviewees also explained that sourcing teams use structured supplier evaluation processes when identifying and onboarding new suppliers. Several participants referred to an internal stage-gate model, which includes risk

analysis activities intended to assess supplier suitability, sourcing feasibility, and potential exposure to supply risks before supplier selection decisions are finalized. Interviewees described this process as a mechanism for proactively identifying risks during supplier selection and qualification.

In addition to formal systems, regular discussions with suppliers were described as an important sensing mechanism. Participants explained that sourcing personnel maintain recurring communication with key suppliers to discuss operational developments, market conditions, capacity developments, and potential uncertainties affecting future supply continuity. These interactions were described as creating visibility beyond what internal systems alone can provide. Some interviewees emphasized that suppliers themselves often contribute to risk identification by sharing early information regarding disruptions identified through their own operational analysis or market monitoring. Participants reported situations where suppliers informed sourcing teams about emerging raw material shortages, capacity pressures, logistics disruptions, or regional developments that could later affect delivery performance, allowing sourcing personnel to prepare in advance.

Interviewee 6 described how a supplier warned them of upcoming transportation challenges: "*Our supplier told us two months ahead that a port closure was likely, so we were able to expedite shipments before it hit*". This proactive communication gave the team time to arrange alternate routes. At same time, Interviewee 4 noted that strong supplier relationships can yield early warnings: "*Good suppliers will give us a heads-up if a raw material is getting scarce or if there's a strike brewing in their region*". These alerts about emerging market or delivery risks help the company prepare contingency plans earlier.

Interviewees additionally described informal information-sharing practices as an important complement to formal monitoring systems. Participants referred to regular communication with sourcing colleagues across regions, supplier contacts, and professional networks to exchange observations about supplier behaviour, market shortages, labour disruptions, and regional developments affecting supply continuity. These informal exchanges were described as useful for identifying weak signals that may not yet be visible through formal systems.

For example, one interviewee described regularly holding monthly calls with colleagues in other regions to compare notes on supplier behaviours or foresee if a local issue might spread globally.

> *"I often talk to colleagues in different regions and to a couple of suppliers informally – just to get a heads-up if something is brewing. If one supplier is running out of raw materials or facing strikes, we want to know before they tell all their customers." (Interviewee 2)*

Interviewees also described challenges in sensing risks beyond direct suppliers, particularly regarding visibility into lower-tier supply networks. Several participants indicated that sourcing teams generally possess stronger visibility over first-tier suppliers, while transparency regarding second-tier suppliers and upstream material dependencies remains more limited. According to interviewees, first-tier suppliers do not typically disclose detailed information regarding their own supplier base, constraining the organization's ability to fully monitor upstream sourcing risks. Nevertheless, participants explained that some visibility into upstream exposure is developed through supplier discussions, market knowledge, and accumulated sourcing experience. While detailed supplier identities are not always known, interviewees reported having awareness of the geographical origins of certain critical materials or components, particularly when supply dependencies are concentrated within specific regions or countries.

Interviewee 9 described the difficulty of obtaining visibility beyond first-tier suppliers:

> *"We generally only see our direct suppliers. For anything beyond first-tier, information gets vague or unavailable".*

Interviewee 6 echoed this challenge:

> *"We try to map critical sub-suppliers, but beyond tier 1, it's quite difficult. We don't always know who our suppliers' suppliers are".*

Despite this limited transparency, interviewees explained that sourcing teams attempt to identify potential concentration risks by examining whether multiple first-tier suppliers rely on upstream supply from the same geographical region or country. In such situations, sourcing personnel described monitoring whether several suppliers may ultimately depend on the same upstream source, thereby increasing the risk of supply disruption if regional instability, geopolitical developments, or material shortages occur.

Interviewee 9 further explained:

> *"Even though we can't see every tier, we do know several of our critical parts ultimately come from the same region, which is a worry if that region has a problem".*

Interviewee 1 also recognized this "*geographic concentration risk*", noting that

> *"Even if we don't have full tier-2 data, we have informal knowledge that, for instance, a lot of our critical parts are made in one region – so we're aware that any disruption there could hit multiple suppliers at once".*

Despite the presence of both formal systems and informal monitoring practices, several interviewees acknowledged that not all disruptions are identified early. In some cases, supplier constraints or disruptions became fully visible only after operational impacts had already emerged. For example, a critical component supplier's capacity shortage was only fully appreciated when lead times had already doubled and deliveries were delayed. Participants described situations where stronger supplier visibility or earlier market intelligence could potentially have improved preparedness.

Demand Forecasting & Visibility

Sensing also encompasses the ability to understand and forecast internal demand, thereby giving suppliers adequate visibility of future needs. Interviewees indicated that short-term forecasting is reasonably well communicated to key suppliers, but long-term demand visibility remains limited. Several participants mentioned that forecast horizons typically extend 18–24 months at most, leaving a gap in proactive capacity planning for periods beyond that. This was seen as a constraint, without a clear view of long-term production demand, sourcing cannot fully anticipate future supply needs or potential mismatches in capacity.

Beyond monitoring external supply markets, interviewees described sensing as also dependent on visibility into future manufacturing demand and sourcing requirements. Participants indicated that sourcing decisions are informed by internal planning processes linked to business objectives and future manufacturing expectations. Several interviewees referred to the internal long-term planning report as a planning mechanism providing long-term product-level demand expectations and directional visibility regarding future manufacturing priorities.

Interviewees generally indicated that short-term and mid-term demand visibility is comparatively more established. Rolling forecasts are communicated to key suppliers to support production planning and capacity preparation, enabling suppliers to anticipate expected demand changes and reduce short-term uncertainty.

As one interviewee explained:

> *"We need visibility. Our category managers need to see what our demand is, both short term and long term. We have to constantly communicate that to suppliers – show them if our demand is going up or down so they can plan."(Interviewee 3)*

At the same time, several interviewees referred to limitations in translating long-term business planning into detailed sourcing visibility. Although long-term planning mechanisms exist at the product level, participants

frequently noted challenges in converting long-term product expectations into sufficiently detailed material-level forecasts for sourcing purposes, particularly beyond approximately two years.

One interviewee described the uncertainty associated with longer-term planning horizons:

> *"Beyond two years, it's kind of blind for us. We might suspect demand will grow, but we don't have firm figures. It makes it hard to go to a supplier and say, 'we'll need double capacity in 4 years' when even we aren't sure." (Interviewee 3)*

At the same time, interview evidence suggested that long-term planning information is increasingly incorporated into supplier discussions. Multiple interviewees either explicitly or implicitly referred to discussions with suppliers regarding future demand developments and preparedness for potential volume changes, which helps the company gauge suppliers' readiness under various future conditions. One participant described actively using the long-term planning report in discussions with key suppliers to increase long-term visibility and facilitate future-oriented dialogue regarding supplier readiness and uncertainty.

Interviewee 2 described conducting scenario planning sessions with key suppliers:

> *"We share our long-term volume forecasts with them and ask, 'what if demand doubles, or a certain country supply is cut off?' They run through those scenarios with us".*

Interviewee 7 noted actively involving suppliers in "what-if" planning using multi-year demand projections, adding:

> *"We say, imagine we have a big jump in orders next year – can you handle it? We try to game out different situations together".*

Although interviewees described varying levels of maturity and detail across sourcing categories, several participants indicated that maintaining visibility regarding future business direction and communicating expected developments to suppliers' forms part of ongoing sourcing discussions.

4.2.2 Seizing Capability

The interview findings suggest that seizing capability in the case company involves both proactive sourcing actions and reactive responses to emerging supply disruptions. Interviewees frequently described supplier localization, contingency sourcing, backup suppliers, sourcing volume adjustments, and

cross-functional coordination as mechanisms used to maintain supply continuity and improve preparedness. Participants explained that sourcing teams increasingly attempt to anticipate supply constraints by introducing preventive measures, such as identifying secondary suppliers, localizing supply where feasible, or coordinating with internal stakeholders to secure sourcing alternatives before disruptions escalate.

At the same time, interviewees consistently emphasized that the effectiveness and speed of sourcing responses are shaped by significant organizational and technical constraints. Participants highlighted lengthy supplier qualification procedures, dependence on engineering approval, cross-functional decision-making requirements, and technical product dependencies as factors that often slow implementation and limit sourcing responsiveness. Several interviewees also acknowledged a tendency for sourcing adjustments to occur after disruptions have materialized rather than entirely in anticipation of them, suggesting that although proactive sourcing actions are increasingly emphasized, elements of reactive adaptation remain present. Consequently, seizing capability emerged as both an operational and organizational challenge, requiring not only sourcing interventions but also sufficient organizational alignment to enable timely execution.

Proactive Sourcing Actions and Opportunity Capture

Several interviewees shared instances of proactive measures taken in anticipation of or immediately after sensing a change. For example, one sourcing manager described how, noticing rising freight costs and potential trade restrictions, his team initiated a project to localize sourcing for certain heavy components. They identified a capable local supplier and started the qualification process, aiming to reduce dependency on distant overseas suppliers before a crisis forced their hand. Another interviewee spoke about a cost-saving opportunity they seized: upon sensing that a global supplier was introducing a new technology, the team quickly engaged that supplier to incorporate the innovation into the company's designs, which eventually lowered unit costs and improved lead times. These examples show that when conditions allow, the organization can act decisively to improve its supply setup.

For example, one interviewee described how anticipated logistics disruptions and rising freight costs led sourcing teams to initiate a localization effort before severe operational impacts materialized:

> *"When we saw shipping delays and costs skyrocketing, we reached out to a local supplier here to see if they could make one of our parts. We got approval and started trials. It wasn't planned initially, but we moved fast and it paid off – now we have a local option with a six-week lead time instead of 16." (Interviewee 5)*

Rapid Response to Supply Disruptions

In addition to proactive sourcing actions, interviewees described several situations where sourcing teams responded quickly to supply disruptions. Participants referred to emergency sourcing adjustments, temporary supplier switching, expedited logistics decisions, and escalation processes used to maintain continuity during disruption events.

One interviewee described how sourcing personnel coordinated across functions to switch suppliers after an operational disruption at a supplier facility:

> *"When our main supplier couldn't deliver due to a flood at their plant, we scrambled to switch to another supplier we had kept as a backup. There was a lot of back-and-forth with quality and engineering, but we managed to get it done before our stock ran out." (Interviewee 6)*

Similarly, interviewees referred to situations where sourcing teams escalated disruptions to leadership teams to secure approval for expedited transportation or alternative sourcing arrangements when deliveries became delayed due to logistics bottlenecks. These accounts illustrate efforts to maintain production continuity through rapid sourcing responses under time pressure.

Agility Through Preparedness and Cross-Functional Coordination

Interviewees generally described improvements in sourcing agility following recent global supply disruptions, including the pandemic, semiconductor shortages, and logistics disturbances. Several participants explained that such disruptions increased attention toward contingency planning, sourcing flexibility, and preparedness measures intended to reduce future vulnerability.

For example, interviewees referred to greater emphasis on maintaining backup suppliers, improving sourcing flexibility, and preparing alternatives before disruptions occur. An interviewee summarized a mindset: *"We learned to prepare Plan B's in advance, not just when Plan A fails."*. At the same time, participants frequently emphasized that effective sourcing responses depend on coordination across functions, particularly with engineering, quality, and operational teams. Several interviewees explained that supplier switching, qualification activities, or sourcing changes often require cross-functional alignment to ensure continuity and technical feasibility.

Organizational Constraints and Reactive Tendencies

Despite examples of agility, several sourcing personnel interviewed admitted encountering internal hurdles that impede rapid or proactive action. A prominent barrier is the lengthy and complex process required to qualify new suppliers or to implement sourcing changes. For instance, even if a category manager senses an opportunity to add a second source or to lock in capacity early, they must navigate internal procedures such as approval workflows, supplier qualification testing, and alignment with engineering. Many described this process as slow and resource intensive. Several interviewees specifically pointed out dependence on the engineering department as a bottleneck: *"If R&D is not on board or too busy with other projects, adding a new supplier can take forever,"* one said. Another internal challenge raised was risk aversion at higher management levels, in some cases, decision-makers hesitate to commit to new suppliers or inventory buffers because of short-term cost concerns, even if it could yield resilience benefits, thereby delaying action.

One interviewee described how procedural requirements may delay sourcing changes intended to improve resilience:

> *"We might identify a great second supplier to reduce risk, but the process to get them approved is long. You need signoffs, testing, maybe new tooling. By the time we're done, we might have already suffered a disruption that we were trying to avoid." (Interviewee 2)*

In addition, interviewees acknowledged that sourcing responses are sometimes implemented after disruption events rather than beforehand. Participants reflected on how painful supply shortages have frequently triggered sourcing improvements, such as multi-sourcing or contingency planning, only after operational disruption has already occurred, rather than anticipation. This suggests that although the organization has improved its seizing capability in handling acute problems, fully institutionalizing a proactive approach remains a work in progress.

> *"Honestly, we tend to make changes after we feel some pain. We say, 'we should have dual-sourced this!' only after a shortage hits. We're getting better now at planning ahead, but we have a history of reacting more than anticipating." (Interviewee 7)*

4.2.3 Reconfiguring Capability

The interview findings suggest that reconfiguring capability in the case company is characterized by ongoing efforts to redesign the supply network through multiple sourcing initiatives, region-to-region sourcing strategies, supplier base optimization, and sourcing adjustments linked to product and manufacturing changes. Interviewees frequently described actions aimed at

introducing alternative suppliers, increasing geographical diversification, reducing dependency on concentrated sourcing structures, and streamlining supplier portfolios to balance supply continuity, resilience, and sourcing efficiency. In several cases, participants explained that sourcing teams were attempting to improve flexibility by building additional supply options or reallocating sourcing volumes to reduce exposure to disruptions.

At the same time, interviewees consistently emphasized that supply network reconfiguration is neither rapid nor straightforward. Rather, reconfiguration was described as a gradual and highly cross-functional process constrained by engineering specifications, supplier qualification requirements, technical dependencies, and product design choices. Participants repeatedly noted that introducing new suppliers, redesigning sourcing arrangements, or modifying supply configurations often requires engineering involvement, qualification procedures, and significant coordination across functions, making adaptation slower than desired despite growing organizational awareness of the need for greater flexibility and resilience.

Multiple Sourcing for Supply Flexibility

A recurring theme across interviews concerned efforts to reduce dependency on single-sourced suppliers by introducing multiple sourcing arrangements for critical materials and components. Many interviewees explained that a large proportion of components had historically been sourced from a single supplier due to legacy sourcing decisions, technical specifications, supplier capability constraints, or limited supplier availability. Participants described increasing organizational attention toward introducing second or additional qualified suppliers to improve sourcing flexibility and continuity.

Several interviewees explained that category managers increasingly review sourcing portfolios to identify single-source exposure and assess where alternative suppliers could be introduced to reduce vulnerability to disruption. Rather than relying exclusively on one supplier for strategically important items, sourcing teams described efforts to establish second or, in some cases, third sourcing alternatives to strengthen sourcing resilience and maintain continuity during disruptions.

Some interviewees described dual-sourcing or multi-sourcing as an expected sourcing practice across categories:

> *"For each critical part, the category leads have a shortlist of potential alternate suppliers we can quickly pivot to if our main supplier runs into trouble". (Interviewee 9)*

> *"Especially after the pandemic, we're pushing to have multiple sources for everything critical. It's a kind of insurance against supply interruptions". (Interviewee 7)*

Similarly, other participants described how repeated supply concerns prompted a structured effort to reduce historical single sourcing within a sourcing category. This proactive review is aimed at ensuring that no critical item relies on only one source, reducing vulnerability:

> *"When I took over the category, everything was single-sourced. We had some close calls with supply. So we made a plan: identify at least one alternate for each critical part. It's been two years and now most parts have a backup supplier – not all fully ramped up, but at least qualified." (Interviewee 8)*

> *"Every quarter we go through our categories to identify single-source cases and see how we can introduce second suppliers", said one interviewee. (Interviewee 5)*

Interviewees generally described multiple sourcing as a gradual and planned process requiring supplier identification, qualification, and internal coordination before alternative suppliers could be fully utilized. Participants noted that implementation maturity varies across sourcing categories, although reducing single-source dependency was widely described as an increasingly important sourcing objective.

Region-to-Region Sourcing and Geographic Diversification

A prominent theme across interviews concerned efforts to geographically diversify sourcing arrangements through region-to-region sourcing strategies. Nearly all interviewees referred to ongoing initiatives aimed at reducing dependence on concentrated sourcing regions and increasing sourcing resilience through greater geographical distribution of suppliers.

Participants explained that recent geopolitical disruptions, logistics bottlenecks, trade restrictions, and regional supply interruptions have increased attention toward regional sourcing exposure. Rather than relying heavily on suppliers concentrated in one geographical area, sourcing teams described efforts to redesign supply arrangements so that sourcing alternatives exist across regions where feasible.

Several interviewees explained that sourcing strategies increasingly consider whether key materials or components are overly dependent on suppliers operating in the same region or exposed to similar geopolitical or logistics risks. In such cases, sourcing personnel described efforts to diversify sourcing locations, establish regional alternatives, or localize sourcing to improve continuity and reduce vulnerability to regional disruption.

Some interviewees emphasized the regional diversification to avoid single-sourcing exposure:

> *"We make sure to have suppliers from different regions so that one event doesn't stop all deliveries". (Interviewee 4)*

> *"We've moved some sourcing out of Asia to Eastern Europe recently. That way, not everything is in one basket if something happens, like a pandemic wave or political instability in Asia". (Interviewee 6)*

While couple participants highlighted the shifting from cost-focused sourcing to include geographic dependency:

> *"We used to look mainly at cost per unit… now we also weigh heavily where those suppliers are located and if we're overly dependent on a single geography". (Interviewee 8)*

> *"I'd say in the past it was all about costs, but now nearly every sourcing decision involves a talk about diversification. We actively consider if a supplier's location could pose a dependency risk". (Interviewee 1)*

Interviewees generally described region-to-region sourcing as a longer-term effort requiring supplier qualification, cross-functional coordination, and gradual redesign of sourcing arrangements. Participants also noted that feasibility varies depending on component complexity, supplier availability, and engineering requirements.

Supplier Base Optimization and Redundancy Reduction

Alongside efforts to introduce multiple sourcing and geographical diversification, interviewees also described ongoing attempts to optimize the supplier base by reducing unnecessary supplier redundancy and improving sourcing efficiency. Several participants explained that sourcing teams seek to balance resilience objectives with supplier base complexity, particularly where overlapping suppliers, duplicated sourcing arrangements, or fragmented purchasing structures exist across divisions.

Interviewees noted that, in some cases, the company maintains relationships with the same suppliers across multiple divisions, creating opportunities to consolidate sourcing volumes, simplify supplier management, and improve coordination. Rather than maintaining excessive supplier overlap, sourcing personnel described efforts to streamline supplier portfolios while preserving sufficient flexibility and continuity.

One interviewee described supplier redundancy reduction as an expected sourcing practice across categories:

> *"All my category managers, when they start, look at who are my suppliers, who are my preferred suppliers, give more business to them, make sure we have second sources. You don't need 7 suppliers for 10 parts – two suppliers are enough for resilience." (Interviewee 1)*

Interview insights also reveal that volume consolidation is used as a means to achieve greater bargaining power and cost efficiency in sourcing:

> *"If we consolidate volumes, we can leverage our spend to negotiate better pricing or priority with those suppliers". (Interviewee 2)*

> *"It has to be balanced with risk – if we put all volume to one supplier to get a discount, we could expose ourselves if they have issues. So, we use this tactic mostly where risk is low or we still have backups". (Interviewee 4)*

Participants described supplier base optimization as an effort to balance resilience, efficiency, and manageability. While multiple sourcing remains important for reducing disruption exposure, interviewees indicated that excessive supplier fragmentation may dilute purchasing leverage, increase coordination complexity, and create inefficiencies in supplier management. Consequently, sourcing teams described selectively consolidating suppliers while maintaining appropriate sourcing flexibility for critical materials and components.

Switching Constraints and Technical Lock-In

Despite clear efforts to expand sourcing flexibility, interviewees consistently highlighted that reconfiguring suppliers is often a technically complex and time-consuming process. Participants referred to engineering specifications, supplier-specific tooling, qualification requirements, and limited market alternatives as important constraints affecting sourcing flexibility.

Technical constraints, primarily arising from product design specifications and qualification requirements, were cited as a primary reason. If a component has been designed for a specific supplier's product or if a supplier's tooling is unique, then finding another supplier who can meet the exact specifications or quality levels can be extremely difficult. *"We're sometimes locked in by engineering decisions,"* said one manager, referring to designs that only one supplier can make. Participants further explained that customized parts and supplier-specific technical know-how often increase the time and cost required to qualify alternatives, making supply reconfiguration a gradual and long-term effort rather than a rapid operational adjustment.

One interviewee described the challenge as follows:

> *"Switching a supplier takes time. Sometimes the market doesn't have many options due to our engineering design, so finding new ones is hard. We're stuck with what we have, unless R&D changes something." (Interviewee 5)*

These accounts suggest that although sourcing teams seek to improve supply flexibility, technical and qualification-related dependencies frequently limit the speed and scope of supplier reconfiguration.

Adaptation to Product and Manufacturing Footprint Changes

Reconfiguring capability also emerged in relation to product lifecycle transitions, new product introductions, and manufacturing footprint changes. Several interviewees described sourcing as needing to continuously realign suppliers in response to changes in product portfolios and production requirements.

Participants explained that ramping down legacy products while simultaneously ramping up new products creates sourcing complexity, requiring careful planning regarding which suppliers remain strategically relevant, which new suppliers need to be introduced, and how supply continuity should be maintained during transition periods.

One interviewee described this challenge:

> *"We're in a complex situation – ramping down one product but still needing availability and ramping up new products. We need to understand who are the suppliers that will be long-term suppliers, and which are going away when we ramp down [the old product]." (Interviewee 1)*

Interviewees described these transitions as requiring extensive coordination across sourcing, engineering, operations, and suppliers to ensure continuity during product changeovers and avoid disruption during production transitions.

4.2.4 Relational Capability

The interview findings indicate that the company's relational capability exists on a spectrum ranging from highly collaborative supplier partnerships to more transactional relationships shaped by structural and organizational constraints. Strong relational capability was most evident among strategically prioritized suppliers, especially those associated with high-volume or high-value components identified through the company's ABC sourcing principles. In these relationships, trust-based collaboration was reinforced through frequent communication, proactive information sharing, early supplier involvement, and participation in long-term planning discussions.

Suppliers were not only informed about future demand expectations but, in some cases, involved in meetings concerning production outlooks and capacity planning, enabling greater alignment and preparedness on both sides. Interviewees generally associated such partnership-oriented relationships with improved supply reliability, responsiveness, and resilience through stronger coordination, mutual visibility, and joint problem-solving.

At the same time, participants emphasized that this level of relational depth was not feasible across the entire supplier base. Purchasing leverage, supplier prioritization, organizational focus, and resource availability significantly influenced the extent to which collaborative relationships could be developed. Consequently, many lower-priority or lower-volume suppliers continued to be managed through more transactional interactions centred on purchasing execution rather than long-term strategic engagement. These findings suggest that relational capability is shaped not only by relationship-building efforts but also by organizational structures and economic realities that determine where deeper supplier collaboration is feasible.

Strategic Supplier Partnership, Trust, and Information Sharing

Many interviewees emphasized the importance of strong partnerships with strategically important suppliers, particularly those supplying high-volume or high-value components. This emphasis aligns with the company's internal strategic sourcing documentation, which follows an ABC sourcing principle to differentiate supplier importance and prioritize relationship management efforts. Interviewees described these supplier relationships as more tightly integrated into operational activities. In these relationships, communication is frequent and forward-looking: suppliers are kept abreast of future demand plans, and in turn, they share their own capacity outlook and even participate in solving problems jointly. One interviewee noted a scenario in which a strategic supplier, aware of the company's growth plans, invested in additional capacity proactively to ensure they could meet future orders, which is a move enabled by the trust and transparency between the two firms. These close partnerships are credited with yielding benefits such as more reliable supply, preferential allocation during shortages, better alignment on quality, and collaborative cost reductions over time.

Several interviewees described how strategic supplier relationships extend beyond routine purchasing interactions into forms of collaborative planning and joint problem-solving. One interviewee explained that even in single-sourcing situations, strong relational management mechanisms were deliberately maintained through continuous engagement:

> *"Some locations have strategic partnerships with suppliers to maintain the relationship. Even if it's single sourcing, they have regular talks, open discussion, regular monitoring… so they know which suppliers are doing*

> *well and can maintain capacity for us, even when the market becomes very competitive." (Interviewee 6)*

This quotation illustrates how relational capability is operationalized through regular communication, monitoring, and mutual understanding. Rather than relying solely on contractual arrangements, supplier commitment appears to be reinforced through sustained interaction and transparency. Such relationships were considered particularly valuable during periods of market tightness, where trusted suppliers were perceived as more willing to prioritize the company's demand.

The interviews further suggest that high relational capability enables proactive information sharing and early problem visibility. Several managers explained that trusted suppliers were willing to disclose emerging risks or constraints in advance, enabling the company to prepare mitigating actions. For example, one interviewee noted that a supplier proactively warned the company about an anticipated raw material shortage, allowing procurement teams to secure orders earlier than competitors. Such information-sharing behaviour was described as a product of mutual trust, where suppliers felt sufficiently secure in the relationship to reveal vulnerabilities without fearing commercial disadvantage.

Some interviewees further emphasized that strategic supplier relationships were characterized by early supplier involvement in planning activities. Rather than limiting interactions to operational purchasing processes, suppliers were brought into meetings and discussion sessions concerning future production outlooks and long-term capacity requirements. Interviewees described how selected suppliers participated in forward-looking planning discussions, enabling earlier visibility into future demand and allowing suppliers to prepare production capacity accordingly. Such practices suggest a more collaborative and partnership-oriented relationship, where suppliers are engaged not merely as vendors but as contributors to long-term supply continuity and planning.

In some cases, supplier relationships were described as approaching operational integration. One interviewee characterized a key supplier as functioning almost as an extension of the internal team:

> *"One of my suppliers is basically an extension of our team now. We share production plans with them months ahead, and they tell us if they foresee any issues. It's a two-way dialogue, not just issuing POs." (Interviewee 9)*

At the same time, relational capability was also reinforced through structured engagement practices such as regular supplier performance reviews, joint workshops, continuous dialogue, and recognition of supplier contributions. These mechanisms appeared to strengthen trust while creating feedback loops for operational improvements.

Transactional Relationships and Structural Constraints

Although interviewees recognized the value of strategic supplier partnerships, they consistently emphasized that such relationships are not feasible across the entire supplier base. Many supplier interactions remain transactional, with collaboration constrained by purchasing leverage, business volume, and resource availability.

Business volume emerged as one of the most significant limiting factors. Several interviewees noted that when the company represents only a small share of a supplier's business, opportunities for deeper collaboration become restricted. One interviewee explained how differences in purchasing scale across company locations shaped supplier attention and prioritization:

> *"Our spend is less than 10% compared to [another plant]. So, we're a very small customer for most of our suppliers, which means the supplier is not that interested in doing business with us beyond the basics." (Interviewee 1)*

This observation highlights an important boundary condition of relational capability: strong supplier relationships cannot be developed solely through managerial intent but are also influenced by structural factors such as purchasing power and customer attractiveness. Smaller plants or lower-volume sites were often perceived as receiving less supplier attention than larger internal locations, resulting in more transactional exchanges centred on delivery and pricing rather than long-term collaboration.

Similarly, another interviewee contrasted strategic partnerships with more conventional purchasing arrangements:

> *"For some of our suppliers, it's more like a regular purchasing relationship – we send purchase orders, they send parts. There's not much in terms of joint planning or special treatment because our volumes aren't big enough. But we still try to keep a good rapport, because sometimes even a little goodwill can help in a pinch." (Interviewee 10)*

This quotation reflects a more limited form of relational capability, where collaboration remains constrained but interpersonal goodwill and communication are still considered valuable. Even when deeper supplier integration is not economically feasible, interviewees suggested that maintaining positive rapport could improve responsiveness during supply disruptions or urgent situations.

In addition to purchasing leverage, interviewees identified organizational resource limitations as another factor shaping relational capability. Historically, supplier relationship management efforts had been concentrated on the company's largest and most strategically important suppliers, while a

long tail of smaller suppliers received limited relational investment. Although the introduction of category managers was viewed as improving supplier engagement coverage, many participants acknowledged that interactions with numerous suppliers remain primarily transactional. Consequently, information flows from these suppliers are weaker, and the company's ability to influence supplier responsiveness during periods of disruption remains relatively limited.

4.2.5 Governance & Integration Capability

The interview findings suggest that Governance and Integration capability is currently in a state of ongoing development. Participants consistently emphasized that stronger integration between sourcing, engineering, and long-term production planning remains necessary, particularly given historical challenges associated with sole-source designs, limited sourcing flexibility, and misalignment between sourcing realities and manufacturing ambitions. At the same time, interviewees described several ongoing improvements aimed at strengthening organizational alignment, including earlier procurement involvement in development processes, stronger sourcing participation in production planning discussions, and the implementation of more formal governance structures and routines.

From a governance perspective, interviewees highlighted the increasing role of global category management structures, standardized sourcing policies, supplier evaluation frameworks, and recurring coordination mechanisms in improving consistency and strategic alignment across organizational units. However, participants also suggested that sourcing considerations are not yet fully embedded in all cross-functional decision-making processes, meaning that gaps in organizational integration continue to constrain sourcing effectiveness. Consequently, Governance and Integration capability emerged as an enabling mechanism that connects and supports other sourcing capabilities, with several limitations identified in sensing, seizing, relational, and reconfiguration capabilities tracing back to incomplete cross-functional coordination and governance alignment.

Integration with Engineering and Production Design

Most interviewees emphasized the interface between sourcing and engineering as one of the most critical cross-functional integration points. Participants repeatedly highlighted that historical engineering and design decisions often failed to sufficiently consider sourcing implications, contributing to sourcing vulnerabilities such as sole-sourced components, supplier lock-in, and dependence on difficult-to-source materials.

Several sourcing managers explained that engineering decisions significantly shape sourcing flexibility because supplier qualification, component

specifications, and design choices ultimately determine the sourcing options available later in the product lifecycle. One interviewee summarized this interdependence directly:

> *"Sourcing cannot do anything without engineering support. Engineering should also be interested in multiple sourcing, cost saving, supply chain resilience – not just performance. If they qualify only one supplier, our hands are tied later." (Interviewee 2)*

This quotation illustrates how sourcing resilience is heavily dependent on cross-functional ownership rather than sourcing activities alone. Interviewees consistently stressed that sourcing flexibility, supplier diversification, and resilience considerations need to be embedded during product design rather than addressed reactively once products are already industrialized.

At the same time, participants also described growing organizational awareness of this integration challenge and early efforts to improve sourcing–engineering collaboration. Several interviewees noted that procurement is increasingly being involved earlier in product development processes, enabling sourcing concerns to be addressed before design decisions become fixed. As one interviewee explained:

> *"We're trying something new where procurement is involved earlier in product development. It's still early days, but the hope is we can catch those decisions that cause trouble later – like a sole-source design – and propose alternatives." (Interviewee 7)*

Rather than treating procurement as an operational function engaged only after technical decisions are finalized, these emerging practices suggest a shift toward stronger governance routines involving earlier cross-functional participation. Interviewees described such changes as attempts to improve visibility, challenge sole-source decisions, and introduce sourcing perspectives earlier in development processes. Nevertheless, most participants acknowledged that sourcing–engineering integration remains an area requiring further development, indicating that formal governance mechanisms such as structured design reviews, early supplier involvement, and cross-functional decision forums still have room for maturation.

Integration with Manufacturing and Long-term Planning

Interviewees also identified integration between sourcing and manufacturing planning as another important capability area. Participants—especially those closer to operational planning—observed that sourcing considerations had historically been insufficiently incorporated into long-term production

planning and, conversely, sourcing teams often lacked adequate visibility into strategic manufacturing decisions.

This disconnect was described as problematic when production expansion decisions or manufacturing changes occurred without a parallel assessment of supplier readiness or supply chain constraints. As one interviewee noted, operational planning improvements have increasingly been supported through formal coordination mechanisms:

> *"We started a monthly meeting between sourcing and production planning. We go over the forecast, any changes, any supplier issues. Before this, plans were made in silos sometimes. Now at least we catch if a production plan might be unrealistic due to supply limits." (Interviewee 11)*

This quotation illustrates how governance routines, such as recurring cross-functional meetings, can function as integration mechanisms that improve information flow and planning alignment. Interviewees generally perceived these routines as helping reduce siloed decision-making by creating opportunities for sourcing and production planning to jointly assess risks, supplier limitations, and forecast implications.

Participants further emphasized the reciprocal dependency between sourcing and manufacturing planning. Production schedules were viewed as highly vulnerable to sourcing disruptions, while sourcing effectiveness depended on receiving timely visibility into future volume requirements. One interviewee described this growing recognition of interdependence:

> *"Production schedules can be thrown off if sourcing can't deliver. So, we are trying to link our planning systems – basically making sure procurement knows of any big changes in volume well in advance, and we also need to know their constraints when we commit to a plan." (Interviewee 4)*

Operational alignment between sourcing and manufacturing has improved through participation in planning forums such as S&OP and long-range planning discussions, strategic integration remains an evolving capability. Interviewees indicated that sourcing representatives are increasingly included in planning discussions to assess whether anticipated production growth or strategic manufacturing changes can realistically be supported by suppliers and supply networks.

Global-local Coordination, Governance Structure, and Decision-making

Governance capability also emerged through discussions of the company's internal sourcing structures, decision-making routines, and role coordination mechanisms. Some interviewees described the implementation of a

global category management structure in which global category leads coordinate sourcing strategies while local buyers execute regionally. Participants generally viewed this governance arrangement positively, emphasizing that it improved strategic alignment, supplier consistency, and organizational leverage.

As one interviewee explained:

> *"We've set up a global category management structure; now our local buyers don't act in isolation. They coordinate with a global category lead, sharing strategies and aligning on supplier selection and negotiations. This governance has improved our leverage and consistency." (Interviewee 12)*

The quotation highlights how governance structures were intended to reduce fragmentation by ensuring alignment between local sourcing actions and broader strategic objectives. Interviewees described regular coordination routines as mechanisms through which sourcing knowledge and priorities were shared across organizational levels, including monthly meetings, strategy rollouts, and category discussions.

Formal sourcing policies and governance routines also appeared increasingly important in supporting consistency and discipline in sourcing decisions. Participants referred to standardized supplier evaluation criteria, supplier risk reviews, and internal sourcing guidelines that shape decisions regarding supplier qualification and relationship management. One interviewee explained:

> *"We have certain corporate guidelines – like for every critical part, we should aim for two suppliers, or if a supplier is high-risk, we must do quarterly risk reviews. Those are relatively new, but they help enforce some discipline in how we manage things." (Interviewee 3)*

This quotation demonstrates how governance capability extends beyond organizational structure to include formalized routines and policies designed to institutionalize sourcing practices and reduce inconsistencies across business units.

In addition, several interviewees highlighted role clarity and decision-making authority as important governance considerations. Clear responsibilities regarding sourcing changes, supplier approvals, and escalation processes were perceived to improve decision-making speed, whereas ambiguity sometimes delayed sourcing adaptations due to excessive approvals or unclear ownership. Within defined governance boundaries, greater empowerment of category managers could improve responsiveness while still maintaining alignment with broader sourcing strategy.

4.2.6 Cross-capability Patterns and Shared Constraints

While the empirical findings were analysed according to five sourcing capability dimensions derived from the conceptual framework, interview evidence revealed several recurring themes that cut across multiple capability areas. The following themes therefore summarize shared patterns observed across the interviews.

Single-Sourcing Dependency

Multiple interviewees identified single sourcing of critical components as a key source of supply vulnerability. This issue emerged across several capability dimensions, including sensing, where single-sourced items require heightened monitoring, and reconfiguring, where supplier diversification was viewed as a priority risk mitigation strategy. Several respondents also linked the persistence of single sourcing to historical decisions and insufficient cross-functional integration, particularly between sourcing and engineering. As noted by Interviewee 2, engineering had qualified only one supplier for a critical component for more than a decade, leaving sourcing without viable alternatives. While the company is actively pursuing multi-sourcing initiatives, single sourcing remains a structural weakness that continues to expose certain supply categories to elevated risk.

Reactive Posture & Short-Term Focus

Across the capability dimensions, interviewees consistently acknowledged that many improvement initiatives were reactive rather than proactively planned. Respondents noted that organisational attention tends to focus on immediate and medium-term issues, limiting the ability to anticipate and prepare for longer-term supply risks. This short-term orientation was evident in sensing capability through limited forecasting horizons, in seizing capability through actions often triggered by disruptions, and in governance and integration capability through insufficient long-range planning alignment. Although interviewees indicated that the company is increasingly seeking to adopt a more forward-looking approach, the transition toward proactive long-term risk management remains an evolving capability.

Integration Gaps as Root Causes

Many challenges identified within individual capability dimensions were ultimately linked to shortcomings in governance and cross-functional integration. For example, difficulties in adding alternative suppliers, associated with seizing and reconfiguring capabilities, were often attributed to limited engineering involvement in supplier qualification processes. Likewise, constraints in sensing long-term demand were connected to insufficient

coordination between sourcing and planning functions. Interviewees repeatedly emphasised that organisational silos amplified supply-related challenges and that stronger cross-functional governance, especially between sourcing, engineering, and planning, is essential for enhancing overall capability effectiveness.

Supply Risk Awareness

Supply risk emerged as a pervasive theme across all interviews rather than as a distinct capability dimension. Respondents consistently recognised that both external disruptions and internal vulnerabilities, such as single sourcing, create a highly uncertain supply environment. Regardless of role, interviewees emphasised the need to strengthen organisational capabilities to manage this uncertainty. This shared awareness created a common sense of urgency. Risk managers highlighted the importance of risk identification and monitoring, while category managers focused on supplier diversification and contingency measures. Collectively, the interviews suggest that unexpected disruptions are increasingly viewed as a normal feature of the operating environment.

Sustainability and Regulatory Pressures

Although sustainability and compliance were primarily discussed as external risk factors, they also appeared across several capability dimensions. In sensing capability, interviewees referred to monitoring regulatory changes. In reconfiguring capability, respondents described redesigning products or identifying new suppliers to meet environmental requirements. In governance and integration capability, participants highlighted sourcing policies introduced to support sustainability objectives. These findings suggest that sustainability and compliance considerations are increasingly embedded in sourcing practices, although their integration remains uneven across the organisation.

4.3 Link Sourcing Capabilities to Long-Term GMOP

The empirical findings suggest that sourcing capabilities support long-term GMOP primarily by improving planning visibility, enhancing manufacturing continuity, and strengthening cross-functional alignment between sourcing and operations. Rather than operating independently, sensing, seizing, reconfiguring, relational, and governance capabilities appear closely interconnected in shaping how sourcing considerations are incorporated into long-term manufacturing planning under supply uncertainty.

Sourcing capabilities enhance planning visibility and preparedness. Interviewees described supplier monitoring, market intelligence, supplier

dialogues, and internal planning routines as important sources of information on supplier capacity, lead times, material availability, and emerging supply risks. Through demand communication and planning discussions with suppliers, sourcing teams contribute supply-related knowledge to long-term manufacturing planning. However, participants also highlighted limitations in material-level forecasting, visibility beyond first-tier suppliers, and planning reliability beyond approximately two years.

Sourcing capabilities also support manufacturing continuity and operational flexibility. Interviewees identified multi-sourcing, supplier localisation, regional diversification, and contingency sourcing as key mechanisms for reducing supply dependency and improving disruption preparedness. Strong supplier relationships further supported continuity through information sharing and collaborative problem-solving during supply shortages. Nevertheless, sourcing adaptation was often constrained by engineering specifications, supplier qualification requirements, supplier-specific tooling, and lengthy approval processes, limiting the speed of supply-base adjustments.

The findings further indicate that the effectiveness of sourcing capabilities depends heavily on governance and cross-functional integration. Interviewees reported increasing efforts to improve coordination between sourcing, engineering, and manufacturing planning through recurring planning forums, sourcing participation in production discussions, and earlier procurement involvement in development activities. These mechanisms helped align manufacturing ambitions with sourcing realities by improving visibility into supplier readiness, sourcing risks, and operational constraints. Despite these improvements, participants noted that sourcing considerations are not yet fully embedded in all strategic planning and development decisions. As a result, organisational silos and incomplete integration continue to constrain sourcing effectiveness in supporting long-term GMOP.

5 Discussion

This chapter interprets the empirical findings in relation to the conceptual framework and literature review, following a pattern-matching approach (Yin, 2018). Each subsection examines a specific sourcing capability and evaluates how the empirical evidence aligns with or diverges from theoretical expectations. The discussion emphasizes the implications of these capabilities for long-term GMOP under supply risks and identifies gaps between theory and practice. Finally, the chapter assesses the conceptual framework's validity in the case context and proposes refinements to better capture the interplay and evolution of sourcing capabilities for strategic planning.

5.1 Sourcing Capabilities

5.1.1 Sensing Capability

Sensing capability is the firm's capability to scan the environment, gather intelligence, and detect early signals of supply risks and opportunities (Teece, 2007; Aslam et al., 2018). The conceptual framework posits that effective sensing is critical for maintaining planning reliability and robustness, as it enables the firm to anticipate disruptions and incorporate that knowledge into long-term plans. Literature highlights proactive risk sensing through supplier performance monitoring, supply market analysis, and predictive analytics (Zsidisin et al., 2004; Wiedenmann & Größler, 2021).

The case provides evidence of a moderately strong sensing capability. Sourcing managers described routine supplier monitoring processes, including tracking delivery performance, lead times, and capacity utilization, using internal dashboards and supplier scorecards. The company also conducts periodic risk review meetings to discuss emerging supplier issues and supply market trends (e.g., raw material price volatility, potential supplier financial difficulties). These practices echo recommended approaches in the literature for early risk identification (Ho et al., 2015) and confirm that the firm actively seeks to enhance supply visibility.

These empirical practices align with theoretical expectations by improving the reliability of long-term planning. For example, early detection of a supplier's capacity bottleneck allowed the planning team to adjust production schedules and evaluate alternate sourcing scenarios, which in turns maintained manufacturing continuity. This illustrates how sensing capability feeds risk knowledge into GMOP, thereby bolstering planning robustness. It echoes Ivanov et al. (2016) and Frederico (2023), who argue that timely risk information is vital for resilient operations planning.

The empirical findings also show that the company's sensing is not fully predictive or comprehensive, highlighting a gap with the idealized view of an

all-knowing sensing capability. Interviewees noted difficulties in obtaining multi-tier supply chain visibility and anticipating far-future risks beyond the typical two-years planning horizon. Some disruptions (such as an abrupt geopolitical event or an upstream sub-supplier failure) were only recognized when their impact materialized in delayed deliveries. This indicates that the sensing capability, while beneficial, operates with incomplete information and occasional lag in risk detection. The literature on supply chain risk posits the use of advanced analytics and digital tools for predictive sensing (Ivanov, 2022; Frederico, 2023). The case company is progressing toward such tools but has not fully achieved the theoretical ideal. There remains room to broaden risk sensing to include earlier detection of second-tier supplier issues, regulatory shifts, and macroeconomic warning signs.

5.1.2 Seizing Capability

Seizing capability is the ability to quickly mobilize and implement appropriate responses once opportunities or threats are identified (Teece, 2007). In the context of sourcing under supply risk, seizing involves actions such as adjusting sourcing allocations, securing backup suppliers, increasing safety stocks, or renegotiating contracts (Frederico, 2023; Namdar et al., 2018; Handfield et al., 2015). When link seizing capability to manufacturing continuity and manufacturing flexibility, timely responses can prevent supply disruptions from halting production and allow the manufacturing network to flexibly adapt to new circumstances (Chiang et al., 2012; Namdar et al., 2018).

The case evidence indicates that the company's seizing capability is active. Interviewees recounted several episodes of rapid sourcing decisions made to counter looming or actual disruptions. For instance, upon sensing that a critical supplier would not meet demand due to a factory fire, the sourcing team swiftly engaged an alternate approved supplier, securing additional volume within weeks to avoid a production stoppage. Similarly, when global shipping delays threatened inventory levels, managers proactively re-sequenced orders and expedited shipments for high-priority components. These examples reflect the firm's ability to act on risk intelligence, translating early warning signals into concrete measures to maintain production. This is consistent with theoretical notions of seizing as a dynamic capability, where firms realign resources or re-negotiate supply arrangements to capitalize on opportunities or mitigate threats (Teece, 2007).

Such seizing actions directly contributed to manufacturing continuity, ensuring that factory output could continue despite supply challenges. They also enhanced manufacturing flexibility by demonstrating that the company could adjust where it sources materials at short notice. These align with resilience practices highlighted in literature, such as maintaining multiple sourcing options and flexibly reallocating volumes (Sawik, 2014; Namdar et

al., 2018). Collectively, the empirical evidence supports the theoretical premise that seizing capability is vital to translate awareness (sensing) into effective interventions that keep long-term plans on track.

However, the case also reveals constraints on seizing capability in practice. Sourcing management often had to navigate organizational inertia and procedural requirements when acting on risks. For example, moving to a new supplier sometimes required lengthy approval processes, technical validation by R&D, and contractual negotiations. These steps slowed the response, causing a lag between risk detection and response execution. The literature generally portrays seizing as a swift, agile process (Eisenhardt & Martin, 2000; Teece, 2007), but in reality, corporate governance, cost concerns, and supplier qualification protocols can restrain agility. Thus, the case partly diverges from the ideal of unconstrained seizing capability, suggesting that firms need to streamline internal processes to truly achieve the theoretical agility and responsiveness.

5.1.3 Reconfiguring Capability

Reconfiguring capability is the ability to restructure and realign the supplier networks and sourcing strategies to better fit the changing environment (Teece, 2007; Eisenhardt & Martin, 2000). This capability enables firms to adapt sourcing arrangements, redesign supplier networks, and increase sourcing flexibility to maintain operational adaptability and resilience under supply uncertainty (Sawik, 2014; Guo et al., 2024). Reconfiguring often involves deliberate long-term moves such as adding or substituting suppliers, altering sourcing geographies, or changing make-versus-buy decisions (Teece et al., 1997; Namdar et al., 2018).

The case company has pursued significant reconfigurations of its sourcing structure to bolster resilience. Over recent years, it initiated a multi-sourcing strategy to replace sole-supplier arrangements for key components, as multiple interviewees described efforts to qualify and onboard extra sources wherever feasible. For example, after experiencing a disruption with a single-sourced part, the company's sourcing and engineering teams collaborated to qualify an alternate supplier and redesign the part slightly to accommodate a second source. The company also undertook regional rebalancing of its supply base, shifting portions of volume from overseas suppliers to nearer or dual suppliers to mitigate geopolitical and logistical uncertainties. These actions align with theoretical recommendations to diversify and reconfigure supply chains as a buffer against risk (Tukamuhabwa et al., 2017; Namdar et al., 2018). They also reflect a commitment to continuous improvement of the sourcing network, which is a trait associated with dynamic capabilities in turbulent environments (Teece, 2007).

The reconfiguration initiatives observed in the case contribute to enhanced manufacturing flexibility and adaptability. By having multiple

qualified suppliers and diversified sourcing regions, the company's manufacturing network gains alternative paths for material supply. This flexibility is essential for adjusting production plans when a particular source is compromised. The capacity to make structural adjustments to the supply network also supports operational adaptability under supply uncertainty, as it enables the firm to change its supply configurations in line with shifting risk profiles or strategic goals. These outcomes echo Ivanov et al. (2016) and Frederico (2023), who highlight that a flexible and reconfigurable supply base is crucial for ensuring production continuity and resilience in global operations.

Despite positive steps, the case also shows that reconfiguring capability is inherently challenging. Interviewees noted that integrating new suppliers or altering sourcing locations can be a slow process due to technical qualifications, required capital investments, and the need for cross-functional consensus. For example, shifting a critical component to a new supplier took over a year, reflecting the deep engineering and quality assurance efforts required. This gradual pace of reconfiguration is in partial tension with the literature's portrayal of dynamic reconfiguration as a relatively continuous and agile process (Eisenhardt & Martin, 2000). The case underscores that reconfiguring a global supply network is a strategic endeavour requiring time and resources, rather than an instant capability. Nonetheless, over the long term, such reconfigurations significantly reinforce the robustness of manufacturing plans, by reducing risk exposure and embedding flexibility into the operations strategy.

5.1.4 Relational Capability

Relational capability is the ability to establish and leverage collaborative supplier relationships that support information sharing, coordination, responsiveness, and joint problem-solving (Handfield et al., 2015; Jean et al., 2014). (Handfield et al., 2015). The conceptual framework posits that strong relational capability supports manufacturing continuity and planning reliability by fostering alignment and agility across firm-supplier boundaries, thereby enabling better coordinated responses to risks. Existing literatures also suggest that strong supplier relationships facilitate collaboration and improve firms' ability to respond to disruptions and changing operational requirements (Oh & Rhee, 2008; Squire et al., 2009; Zhou et al., 2024).

The case study provides clear examples of relational capability in action. The company has cultivated strategic partnerships with key suppliers, characterized by frequent communication and mutual commitment to long-term goals. Several interviewees described instances where close supplier relationships yielded vital benefits during volatile periods. For instance, a trusted supplier proactively informed the company about an impending raw material shortage, allowing the firm to adjust its procurement and production plans in advance. In another case, the company collaborated with a supplier to

redesign a component to use a more available material, jointly overcoming a regulatory compliance issue. These examples reflect the value of high relational alignment, which resulted in improved manufacturing continuity and less production downtime thanks to early information sharing and co-developing solutions. The evidence aligns with the literature that views close buyer-supplier relationships as integral to supply chain resilience and flexibility (Squire et al., 2009; Handfield et al., 2015). Trust and open communication were repeatedly cited by respondents as enablers of timely troubleshooting and innovation.

The collaborative practices observed in the case support planning reliability and robustness by bridging information gaps and aligning expectations. When suppliers share capacity forecasts or risk concerns, the firm can incorporate these into its long-term GMOP assumptions, reducing surprises. Moreover, working closely with suppliers enables a form of extended enterprise planning, where suppliers' capabilities and constraints are embedded in the company's strategic thinking. This integrated perspective has positive effects on operational adaptability: the firm can adapt production strategies with supplier buy-in and support, for example jointly ramping up capacity or finding alternatives under stress. These findings resonate with theoretical models of extended resource-based views which claim that inter-firm collaboration enhances the overall capability to respond to environmental changes (Lavie, 2006; Dyer & Singh, 1998). The case thus validates relational capability as a key component of the conceptual framework.

However, not all supplier relationships in the case were equally strong. Interviewees noted that the company's deep collaboration is typically concentrated with a subset of strategic suppliers. With other suppliers, particularly those less critical or with more arms-length contracts, trust and information sharing were limited. This suggests that, while theory often promotes strong relationships broadly (Namdar et al., 2018; O'Brien, 2022), in practice the extent of relational capability can vary widely across the supply base. Moreover, some suppliers, especially those with significant power or unique offerings, may be less willing to engage in joint risk mitigation beyond contractual obligations. These nuances indicate that relational capability's impact on GMOP is conditioned by partner characteristics and mutual dependency. The case highlights the benefit of investing in relational capability where it matters most (e.g., for critical components) and suggests that broadening collaborative approaches more widely could further support stable and flexible long-term planning.

5.1.5 Governance and Integration Capability

Governance and integration capability refers to the organizational ability to coordinate sourcing across functions and geographies and to integrate sourcing considerations into broader planning processes (Handfield et al., 2015;

Tsinopoulos & Mena, 2015). This capability is enabled through formal governance structures, such as category management and cross-functional planning operations, as well as integrated information systems that link sourcing and manufacturing planning (Axelsson et al., 2005; Kocabasoglu & Suresh, 2006; Handfield et al., 2015). Within the conceptual framework, governance and integration capability is primarily associated with planning reliability and robustness, as effective coordination ensures that long-term GMOP reflects realistic supply assumptions and aligned strategic priorities (Olhager et al., 2001).

The empirical findings provide clear evidence that governance and integration in the case company are strongly shaped by cross-functional collaboration. Global category managers are responsible for long-term sourcing strategies and actively participate in strategic planning cycles. Through these interactions, sourcing-related constraints, including supplier capacities, lead times, and risk assessments, are jointly discussed with manufacturing, logistics, and planning functions. This collaborative governance approach enables sourcing information to be embedded into GMOP decisions rather than treated as a separate functional input. The use of enterprise resource planning systems and supplier management tools further supports this integration by aligning sourcing strategies with production planning, consistent with theoretical recommendations for integrated planning under uncertainty (Dreyer et al., 2009; Seeling et al., 2021). Interview evidence suggests that such cross-functional coordination has improved planning robustness by increasing the consistency between forecasts, capacity plans, and actual supply chain capabilities.

These governance and integration practices contribute directly to planning reliability, as production volume and location decisions are made with shared understanding of sourcing feasibility. Cross-functional collaboration also indirectly supports manufacturing continuity. When supply risks are identified, integrated planning forums allow sourcing, manufacturing, and logistics functions to jointly evaluate implications and translate risk information into timely production plan adjustments. This observation aligns with the literature emphasizing that cross-functional governance mechanisms and joint planning processes are essential for ensuring feasible and resilient manufacturing plans (Olhager et al., 2001; Seeling et al., 2021).

Despite progress, the case company's integration is not yet seamless. Some interviewees noted regional silos in how sourcing decisions are made and communicated, as well as incomplete standardisation of risk information sharing across the organization. These gaps mean the company sometimes struggles to maintain unified global visibility of supply risks and responses, slightly undermining planning consistency. The tension between global integration and local autonomy is a known challenge (Trent & Monczka, 2003; Tsinopoulos & Mena, 2015). The case indicates that further harmonisation of processes and data systems across regions is needed to fully realise the

benefits of governance capability for GMOP. This partially diverges from the theoretical ideal, which envisions fully integrated planning systems and governance frameworks ensuring alignment across all units (Dreyer et al., 2009). Enhancing this capability would likely yield even greater improvements in planning reliability and manufacturing continuity, as supply and production decisions could be coordinated more efficiently on a global scale.

5.2 Cross-Capability Interdependencies

The case evidence strongly supports the conceptual framework that the five sourcing capability dimensions are interdependent and mutually reinforcing when responding to supply risks.

Sensing, seizing, and reconfiguring capabilities form a continuous loop of adaptation (Teece, 2007). In practice, the company's sensing capability (triggered seizing actions, which sometimes led to reconfiguring the sourcing network as a longer-term solution. For example, an early warning from a supplier (sensing) led to an immediate purchase quantity adjustment (seizing) and later to adding a second supplier for that component (reconfiguring). This confirms that the capabilities function as sequential stages of a broader dynamic process, as theorized by Teece (2007).

In addition, relational and governance & integration capabilities serve as enablers that weave through all stages. Good supplier relationships made sensing more accurate (as suppliers willingly shared information) and seizing more effective (as suppliers were open to urgent requests). Strong internal integration ensured that when one function sensed a risk or seized an opportunity, the information was disseminated across planning and manufacturing teams. This interplay aligns with the dynamic capability concept that emphasises co-evolution of capabilities and cross-functional coordination (Teece, 2007; Aslam et al., 2018).

These interdependencies amplify the impact on GMOP outcomes. The integrated use of capabilities produced more resilient outcomes than any single capability alone could. For example, robust long-term planning emerges when sensing is complemented by swift seizing actions, and both are underpinned by supplier collaboration and planning integration. Indeed, the case implies that without concurrent development of relational trust or integrated governance, the benefits of better sensing or seizing might not fully translate into improved manufacturing continuity or flexibility. The synergy among capabilities is thus crucial, reflecting the literature's view that dynamic capabilities are an orchestrated set of processes that collectively enable adaptation (Teece et al., 1997; Frederico, 2023).

5.3 Gaps Between Theory and Practice

While the core elements of the conceptual framework find support in the case, there are notable divergences where actual practices do not fully match theoretical ideals. Recognizing these gaps is important for understanding both the framework's practical validity and its limitations.

One set of gaps was found in the scope and proactivity of capabilities. The case showed that sensing capability, although present, is somewhat narrower and less predictive than theory would suggest. The literature envisions comprehensive, data-driven sensing that yields early warnings for all critical risks (Teece, 2007; Wiedenmann & Größler, 2021). In contrast, the firm's sensing relied in part on manual monitoring and first-tier supplier communication, indicating less automated prediction and limited multi-tier visibility. Similarly, seizing capability exists, but is tempered by organizational frictions (Eisenhardt & Martin, 2000). Instead of seamless agility, the firm's responses can be slowed by internal decision processes. Reconfiguring capability is practiced, but not continuously as an ideal agile routine, rather it occurs with notable effort and lead time due to internal and external constraints. These observations highlight a theory-practice gap: dynamic capabilities are conceptually broad and fluid, whereas in practice they develop gradually and may be constrained by resources, legacy systems, or culture (Colicchia et al., 2010).

Another gap lies in the breadth and focus of capabilities. Theory implies that all capabilities should be broadly applied across the organization and its network (Teece, 2007; Handfield et al., 2015). However, the case demonstrates that the application can be focused and selective. For instance, the company's relational capability was very strong with a few key suppliers, but weaker elsewhere. Similarly, governance and integration capabilities were more effective at global level than in some regional operations, leading to inconsistent integration. These practical nuances suggest that the uniform, idealized depiction of capabilities in the literature might not fully account for the contingent nature of capability deployment, where focus is directed to critical areas first (Christopher & Peck, 2004; Qrunfleh & Tarafdar, 2014).

Despite these gaps, it is notable that they represent differences of degree rather than contradictions of kind. The case did not reveal any entirely new capability beyond those in the framework, nor did it disconfirm the fundamental premise that these capabilities are valuable. Rather, the divergences highlight areas where the company's capabilities can be strengthened, offering insight into the journey of capability development.

5.4 Validation and Refinement of the Conceptual Framework

Overall, the case supports and refines the practical relevance of the conceptual framework. The five sourcing capabilities support firm's long-term GMOP with outcomes on manufacturing continuity, manufacturing

flexibility and operational adaptability, and planning reliability as well as robustness. The alignment between empirical findings and prior literature indicates a solid theoretical foundation.

However, the empirical findings suggest that the original framework can be refined to better reflect how sourcing capabilities function in practice. These refinements are incorporated into the refined conceptual framework presented in Figure 3, which synthesizes the empirical insights from this study.

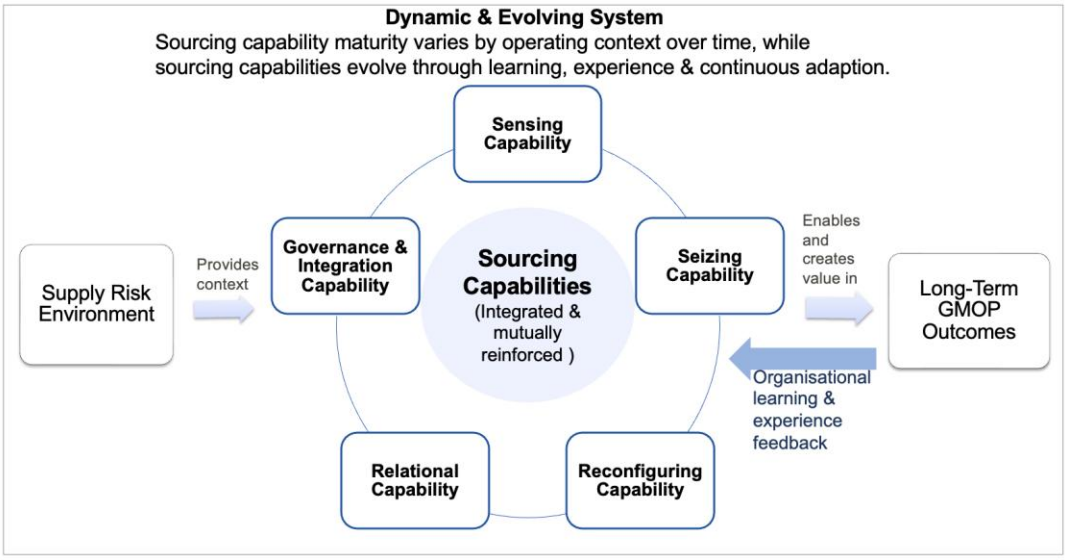


Figure 3 Refined Conceptual Framework

Explicit Interdependencies and Feedback Loops. As shown in Figure 3, sourcing capabilities function as an integrated system rather than as isolated elements. Sensing enables seizing actions and may trigger reconfiguration of the sourcing network. Reconfiguration can strengthen future sensing by reducing vulnerabilities and improving supplier relationships. Similarly, positive GMOP outcomes, such as improved manufacturing continuity during disruptions, feed back into organizational learning and reinforce governance, relational practices, and future decision-making. This dynamic, cyclical view is consistent with the dynamic capability perspective (Teece, 2007) and should be emphasized to portray sourcing capabilities as an evolving, interactive set of processes rather than static pillars.

Capability Maturity and Contextual Emphasis. The framework should acknowledge that the strength and application of each capability can vary by context and evolve over time as indicated in the Figure 3. The case evidence indicates that capabilities are at different levels of maturity within the organization and are focused where most needed (e.g., high with strategic suppliers, lower with others). Incorporating a maturity or readiness dimension would allow the framework to serve as a diagnostic tool, helping practitioners

identify which capability areas are well-developed and which require investment (Colicchia et al., 2010). It is also valuable to highlight how capabilities progress through learning and experience—organizations refine their processes by reflecting on past disruptions and successes, which is a core idea in dynamic capability theory (Eisenhardt & Martin, 2000).

By incorporating these refinements, the conceptual framework becomes more precise and actionable. The refined framework in Figure 3 remains grounded in the literature but better captures the dynamic and systemic nature of sourcing capabilities. The refined framework underscores the holistic nature of sourcing capabilities and their role in reinforcing the resilience and adaptability of long-term manufacturing planning. This enriched framework can guide managers in the case company (and similar organizations) to evaluate their sourcing capabilities systematically, identifying strengths to leverage for competitive advantage and gaps that need to be addressed to fortify long-term GMOP against supply risk.

6 Conclusion

This chapter concludes the study by answering the research question, summarizing the theoretical contributions, discussing the managerial implications, and outlining the limitations and directions for future research.

6.1 Conclusions to the Research Question

This study examined strategic sourcing capabilities for firms' long-term GMOP under supply risks in a global manufacturing context. It drew on insights from research in global manufacturing management, supply risk management, supply chain resilience, strategic sourcing, and dynamic capability theory. The study aimed to answer the following research question:

How do strategic sourcing capabilities support industrial firms' long-term global manufacturing operations planning under supply risks?

The key findings of this research provide answers to the research question. Firstly, supply risks such as capacity constraints, geopolitical uncertainty, long lead times, and supply network complexity create significant challenges for long-term manufacturing planning. These risks increase the need for planning visibility, sourcing flexibility, cross-functional coordination, and adaptive responses. Moreover, the findings show that sourcing capabilities support long-term GMOP through five interrelated dimensions. Sensing capability improves early visibility into supply risks and market changes. Seizing capability enables timely sourcing responses that help maintain manufacturing continuity. Reconfiguring capability supports the adjustment of supplier networks and sourcing structures in response to changing conditions. Relational capability strengthens supplier collaboration and information sharing, while governance and integration capability enhance coordination and alignment across sourcing, manufacturing, and planning functions. Additionally, the findings indicate that these capabilities work together to improve planning stability, manufacturing continuity, sourcing flexibility, and resilience in uncertain supply environments. Although the study acknowledges that these capabilities in the case company were not uniformly mature or unconstrained, the evidence suggests that continued capability development via continuous learning can strengthen the firm's ability to adapt its sourcing and manufacturing planning practices over time.

In overall, the study demonstrates that sourcing capabilities are not isolated procurement practices but integrated organizational capabilities that support resilient and adaptive long-term GMOP under supply uncertainty. Specifically, the study conceptualises sourcing capabilities as five integrated and mutually reinforcing organizational capabilities: sensing, seizing,

reconfiguring, relational, and governance and integration capability. Together, these capabilities support long-term GMOP by improving planning visibility, maintaining manufacturing continuity, enhancing sourcing flexibility, strengthening coordination across functions and suppliers, and enabling firms to adapt their supply networks under conditions of uncertainty.

6.2 Theoretical Contributions

This study makes several contributions to the academic literature on global manufacturing management, strategic sourcing, supply risk management and resilience, and dynamic capability theory by offering a capability-based explanation of how sourcing capabilities support long-term GMOP under supply risks.

First, the study extends global manufacturing management literature by emphasizing the organizational capabilities that enable effective long-term planning under uncertainty, rather than focusing solely on structural or coordination-related aspects of global manufacturing systems (Ferdows, 1997; Shi & Gregory, 1998; Friedli et al., 2014). The findings show that sourcing capabilities contribute to manufacturing continuity, planning stability, sourcing flexibility, and coordination across global operations.

Furthermore, the study contributes to supply chain resilience and strategic sourcing literature by conceptualizing sourcing capability as five integrated and mutually reinforcing organizational capabilities: sensing, seizing, reconfiguring, relational, and governance and integration capability. Together, these capabilities enable firms to anticipate supply risks, respond through sourcing actions, adapt supplier networks, strengthen supplier collaboration, and improve cross-functional alignment (Kraljic, 1983; Monczka et al., 2015).

In addition, the study contributes to the dynamic capability theory by operationalizing the sensing, seizing, and reconfiguring framework in the context of sourcing and GMOP, while showing that relational and governance and integration capability strengthen the effectiveness of these dynamic capabilities in practice (Teece et al., 1997; Teece, 2007).

6.3 Managerial Implications

The findings also have important implications for managers and operations practitioners in global manufacturing firms facing supply risks. The refined conceptual framework developed from the literature review and empirical findings provides practical guidance on how strategic sourcing capabilities can be leveraged to strengthen long-term GMOP under conditions of supply risk. Although the framework was developed in the context of the case company, its applicability can be extended to other global manufacturing environments facing similar supply-related uncertainties and disruptions.

Building on the refined conceptual framework, several managerial implications can be identified for strengthening sourcing capabilities and improving long-term GMOP under supply risk.

First, firms can consider strengthening proactive risk sensing through systematic supplier monitoring, market intelligence, and regulatory horizon scanning. In addition to monitoring supplier performance, geopolitical developments, and logistics disruptions, firms also benefit from tracking emerging sustainability and regulatory requirements that could affect supplier compliance, material availability, and sourcing continuity. The utilization of emerging digital technologies, real-time monitoring systems, and advanced analytical approaches can further enhance visibility and support the proactive prediction and preparation for supply risks.

Second, firms can benefit from enhancing sourcing flexibility while balancing efficiency. Multiple sourcing, alternative suppliers, regional sourcing adjustments, and diversified supplier networks can help reduce dependence on critical suppliers and support manufacturing continuity. Such measures should be applied selectively according to product criticality, supply risk exposure, and sustainability considerations in order to avoid unnecessary complexity and cost.

Third, firms may consider investing in supplier relationships and cross-functional integration. Close collaboration with suppliers can improve information sharing, joint problem-solving, and responsiveness to supply disruptions. At the same time, coordination among sourcing, manufacturing, planning, and sustainability functions can help align sourcing decisions with long-term manufacturing plans and broader business objectives. Effective GMOP therefore depends not only on planning tools but also on organizational structures that support communication and joint decision-making across functions and regions.

Fourth, firms can benefit from utilising continuous learning and feedback loops to strengthen sourcing capabilities. The findings suggest that sourcing capability maturity level can vary due to organizational complexity, limited multi-tier supplier visibility, coordination challenges, and changing supply conditions. These gaps influence the effectiveness of long-term GMOP under supply risk. The conceptual framework developed in this study highlights the interconnections between the sourcing capabilities and long-term GMOP outcomes, suggesting that sourcing capability development is an ongoing and adaptive process. Managers may therefore consider establishing structured feedback mechanisms to capture lessons from supply disruptions, planning outcomes, supplier performance, and sustainability-related requirements. Such insights can be used to improve risk sensing, supplier collaboration, information visibility, sourcing flexibility, and cross-functional coordination. By fostering continuous learning and organisational adaptation, firms may strengthen their sourcing capabilities over time and improve the resilience and adaptability of long-term GMOP.

Finally, the study's findings indicate that sourcing strategy needs to be more explicitly embedded in long-range manufacturing planning processes. Under conditions of high supply risk, sourcing decisions should be tightly combined with manufacturing footprint choices, capacity planning, inventory strategy, and risk management. Traditionally, procurement decisions were often made separately from strategic operations planning, but this is no longer viable when upstream uncertainties can derail manufacturing plans. Managers of global manufacturing networks should include sourcing leaders in strategic planning forums to ensure that supply considerations inform manufacturing plans and vice versa. By coordinating sourcing and manufacturing strategies over the long term, firms can better safeguard manufacturing continuity, flexibility, and adaptability in the face of an uncertain global supply environment.

6.4 Limitations and Future Research

Despite theoretical contributions and managerial implications, this study has several limitations that provide opportunities for future research.

The research is based on a single-case study of one division within a global manufacturing company, which enabled an in-depth understanding of the context but limits the generalizability of the findings to other industries, supply chain structures, and organizational settings (Yin, 2018; Eisenhardt, 1989). Future studies could strengthen external validity by conducting comparative multiple-case studies across diverse sectors and firms.

Moreover, the empirical findings rely primarily on managerial interviews and interpretations of sourcing practices. Although these interviews provided rich insights, they may be influenced by respondent bias and retrospective interpretation (Yin, 2015; Miles et al., 2014). Future research could enhance robustness by triangulating interview data with operational performance indicators, sourcing records, planning documents, and direct observations.

Beyond the data source, the study focuses on sourcing capabilities as a key explanatory factor for long-term GMOP under supply risks. However, manufacturing planning may also be affected by other organizational capabilities and external contingencies, such as technological developments, digital supply chain systems, organizational culture, sustainability pressures, macroeconomic conditions, and regulatory changes (Friedli et al., 2014; Ivanov et al., 2016; Mourtzis, 2016). Future research could broaden the analytical framework by examining how these factors interact with sourcing capabilities in shaping resilient manufacturing planning.

Furthermore, the five sourcing capability dimensions in this study are analytically defined but not always sharply delineated in practice. The findings indicate interdependencies among sensing, seizing, reconfiguring, relational, and governance and integration capabilities, reflecting the systemic nature of

dynamic capabilities. Follow-up studies could further refine how these capability dimensions are operationalized and examine their interactions.

Another limitation concerns the integration of sustainability into sourcing capabilities. Sustainability and regulatory requirements were recognized as factors influencing supply risks and sourcing decisions. However, sustainability integration was not examined as a primary analytical focus of this study. Future research could investigate more comprehensively how sustainability-oriented sourcing practices are embedded in sourcing capabilities and how they contribute to resilient and adaptive long-term GMOP.

In addition, this study concentrates on supply-side uncertainty and sourcing responses to such uncertainty. However, long-term GMOP is also influenced by other risks. Future research could explore how sourcing capabilities interact with broader sources of uncertainty and whether the same capabilities support resilience across different planning contexts.

Finally, the empirical findings suggest that the maturity of sourcing capabilities vary across different capability dimensions and organizational practices. This indicates a need for future research to develop a more systematic framework or assessment criteria for evaluating sourcing capability maturity. A longitudinal research design could help examine how sourcing capabilities evolve over time through regular assessments of sourcing capability maturity, thereby providing deeper insight into how sourcing capability development influences long-term GMOP outcomes.

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A. Interview Protocol

A1. Study Purpose and Objectives

This study investigates how strategic sourcing capabilities support long-term global manufacturing operations planning (GMOP) under supply risks in an industrial manufacturing context. Guided by the central research question "How do strategic sourcing capabilities support industrial firms' long-term global manufacturing operations planning under supply risks?", the research aims to identify key sourcing capability dimensions and examine their influence on global manufacturing planning outcomes.

A2. Case Context and Participants

The study is a qualitative single-case study of an industrial manufacturing company with a global production network and supply base. The unit of analysis is the firm's strategic sourcing function and its role in long-term GMOP under uncertain supply conditions. Participants were purposefully selected to capture diverse perspectives at the intersection of sourcing and manufacturing planning. Twelve semi-structured interviews were conducted with supply chain managers, global category managers, S&OP specialists, and sustainability/compliance managers. Several interviewees have prior experience in R&D or production, providing cross-functional insights.

A3. Ethical Considerations

Ethics and confidentiality protocols were strictly observed. Prior informed consent was obtained for each interview, with assurances of participant anonymity and confidential handling of data. All interviews were audio-recorded (with consent), transcribed verbatim, and anonymized by removing personal and company identifiers. Data were stored securely and used solely for academic analysis.

A4. Interview Procedure and Structure

The interviews were semi-structured to allow flexibility while covering all key topics. Each interview lasted approximately 60 minutes, conducted in English via Microsoft Teams. Interviewer instructions emphasized neutrality and consistency: open-ended questions were posed without leading language; follow-up probes were used to encourage depth and clarity; the order of questions could be adjusted based on conversation flow; and all thematic areas were covered by the session's end. Although a predefined set of open-ended questions was developed based on the conceptual framework and research

objectives, the interview process remained adaptive to participants' professional backgrounds, organisational roles, and areas of expertise. Consequently, certain questions were emphasized, adjusted, or contextualised depending on the interviewee's relevance to specific sourcing and planning processes. This ensured each participant's insights were fully explored while maintaining a uniform approach across interviews.

A5. Interview Questions

The interview questions were organized into five thematic areas corresponding to the conceptual sourcing capability dimensions (sensing, seizing, reconfiguring, relational, and governance & integration). The interviewer did not necessarily mention these labels to interviewees but used them to guide the discussion. Each section below lists the main questions posed, along with example probes (sub-questions) that the interviewer could use to elicit further detail or clarifications.

A5.1. Role & Background

Q1. Can you briefly describe your role and involvement in sourcing or manufacturing planning decisions?

Q2. Can you give an overview of how long-term global manufacturing operations planning is done in this organisation?

Probe:

- How are these decisions structured, made, documented, and communicated in the organisation? (e.g., via S&OP meetings, strategic plans)?

Q3. From your perspective, how do supply-side risks or uncertainties influence the long-term manufacturing planning in the organisation?

Probe: Do you explicitly consider potential supply disruptions or supplier constraints when making long-term plans? Can you think of any past example where a risk (like a supplier issue or market disruption) led to a change in the manufacturing plan?

A5.2. Theme 1: Sensing Capability – Identifying and Anticipating Supply Risks

Q4. In your experience, what supply risks most affect the sourcing decisions in the organization that could affect our company's long-term manufacturing operations?

Probes:

- What types of risks in the supply chain concern you the most?
- Which risks have historically impacted or threatened your operations?

Q5. How does the organization identify or anticipate these supply risks ahead of time?

Probes:

- Are there formal processes or tools for supply risk monitoring (e.g., risk registers, market intelligence systems, early warning indicators)?
- How do you gather information about potential supplier issues or industry changes (regular supplier reviews, news monitoring, cross-functional meetings)?
- Can you provide an example of a risk that was detected early and how you became aware of it?

A5.3. Theme 2: Seizing Capability – Proactive Sourcing Actions and Coordination

Q6. Once a potential supply risk or opportunity is identified, how does the company typically respond in terms of sourcing actions?

Probes:

- What steps are taken to address or mitigate the risk? (e.g., engaging with the supplier, adjusting order volumes or safety stocks, finding alternative sources, accelerating qualification of new suppliers).
- Could you describe a situation where an identified risk led to specific sourcing decisions or contingency plans?

Q7. Under supply risks, how are sourcing decisions integrated towards long-term manufacturing planning such as manufacturing network design, capacity and resource allocation?

Probes:

- If a risk is anticipated (say a supplier delay or shortage), how does that information flow into production planning or S&OP processes?
- Can you recall an instance where sourcing and manufacturing teams worked together to adjust a long-term plan (like rescheduling production or rebalancing capacity) in light of a supply risk?
- How were the decisions made and by whom?

A5.4. Theme 3: Reconfiguring Capability – Adapting Supplier Network and Sourcing Strategy

Q8. How does the organization design and manage the supplier network to support long-term manufacturing plans under potential supply risks?

Probes:

- What factors do you consider when deciding on the structure of the supplier base for key materials/components (e.g., number of suppliers per item, geographic diversification vs. local sourcing, developing backup suppliers)?
- Are there policies or strategies like dual sourcing, localization, or maintaining strategic inventory for certain items?

Q9. How does the organisation adjust its supplier base or sourcing strategy in response to supply risks or uncertainties to support long-term manufacturing planning? Please describe a case where sourcing capabilities supported or changed long-term manufacturing planning under supply risks.

- What was the issue?
- How was it identified?
- What sourcing decisions were made?
- What changed in network, capacity, or allocation?
- What was the outcome?
- Was supplier capacity a constraint or enabler?
- How was capacity adjusted (internally or externally)?

Probes:

- What triggered the change (e.g., a disruption event, risk assessment findings, new strategic priorities)?

- What changes were made (for example, adding a new supplier, phasing out a high-risk supplier, shifting sourcing to a different region, or even altering the manufacturing footprint)?
- How did this reconfiguration affect long-term planning (e.g., improved flexibility, required changes in manufacturing plans)?

A5.5. Theme 4: Relational Capability – Supplier Relationship Management and Collaboration

Q10. How does the organization build and maintain relationships with suppliers, and in what ways do these relationships contribute to help the organisation manage capacity and respond to supply risks?

Probes:

- Do you engage in collaborative planning or communication with suppliers (e.g., joint forecasting, sharing long-term plans, regular business reviews)?
- How do trust and communication with suppliers influence your ability to deal with disruptions or capacity issues?
- Can you think of an instance where a close supplier relationship helped the company respond to a sudden change or challenge?

Q11. How are suppliers involved in planning or risk mitigation activities?

Probes:

- Are there processes for joint risk management or contingency planning with suppliers?
- Do suppliers share information about their own constraints or capabilities that feed into your planning?
- How does the company ensure important information (like changes in production forecasts or design requirements) is effectively communicated to suppliers in advance?

A5.6. Theme 5: Governance and Integration Capability – Cross-Functional Alignment in Planning

Q12. How is the sourcing function integrated into the company's long-term manufacturing planning processes?

Probes:

- Are sourcing managers involved in strategic planning meetings, such as S&OP, long-term GMOP, NPD or network design discussions?
- How do sourcing and manufacturing teams collaborate when setting multi-year plans or strategies?
- What formal governance structures (committees, cross-functional teams, etc.) exist for aligning sourcing decisions with production plans?

Q13. When facing significant supply risks or uncertainties, how does the organization coordinate between sourcing and other functions (like production, engineering, or logistics) for the long-term plans?

Probes:

- Can you describe the decision-making process when a major supply disruption or risk requires changes to manufacturing plans (for example, who is involved, how are decisions made)?
- Is there a special task force or escalation mechanism for handling such situations?
- How are trade-offs between cost, quality, delivery, and risk resolved among different departments?

Q14. How does the company decide whether to produce a component internally or source it from an external supplier (make-or-buy), particularly when considering long-term risk and capacity planning?

Probes:

- Who typically involved in the make-or-buy decisions?
- What criteria are evaluated (cost, capability, capacity, risk, strategic importance, sustainability)?
- Can you provide an example where a supply risk or opportunity influenced a strategic decision to either outsource production or bring it in-house?
- How did that decision affect the manufacturing network or capacity plans?

A5.7. Closing and Reflection:

Q15. Overall, how well do you feel the organization's current sourcing capabilities support its long-term manufacturing planning under supply risks and what other

sourcing capabilities are critical for supporting long-term manufacturing planning under supply risks?

Probes:

Are there any capability gaps or areas for improvement that you think need to be addressed to better support global operations planning in the future?

Q16. Is there anything else you would like to add about the role of sourcing in long-term manufacturing operations planning that we haven't already covered?