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The Impact of a Product Line Launch on Supply Chain Capabilities : A Dual-Site Case Study

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ABSTRACT:

Supply chain capabilities have been studied extensively, yet the supply chain reconfiguration aspect is an underexplored phenomenon in the dynamic capability and supply chain management literature. This study addresses this gap by exploring how supply chain capabilities manifest and evolve during a product line launch in a multi-site manufacturing environment. The research was conducted as a single case study for a multinational technology company, that executed a product line launch in Finland, supported by an established site in Norway. The data was collected across eleven operational, tactical, and strategic organizational perspectives, and analyzed using thematic analysis guidelines. The findings suggest that supply chain capabilities do not develop in a neat, robotic sequence during a product line launch. Instead, lower-order capability gaps constrain the manifestation ceiling of agility and resilience from the outset. Adaptability remained at a developmental stage throughout the empirical study, interpreted as a characteristic of the product line launch itself, rather than evidence of organizational shortcomings. The study contributes to the dynamic capability literature by proposing a temporal offset between supply chain capability dimensions during product line launch, where a degree of operational stabilization is a prerequisite for adaptability to emerge. Practically, the findings offer valuable lessons for organizations planning future expansions particularly in slow clock-speed, dual-site, engineering-to-order manufacturing environments.

KEYWORDS: supply chain capability, dynamic capability, product line launch, agility, adaptability, resilience, lower-order capability, dual-site, engineering-to-order, manufacturing

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1 Introduction

Supply chain management is the cornerstone of every organization, evident especially during disruptive scenarios. (Koul, 2019, p. 1). Among firms, competing in today's turbulent market requires navigating through risks and disruptions, all while maintaining business continuity and profitability. (Shekarian & Mellat Parast, 2021, p. 427). Disruptions do not occur to only a select few, as 85% of firms are forced to confront disruptions and recover to the preceding levels. Based on these chances, the firm's and its key stakeholder's readiness will be eventually evaluated during its lifespan. (Bode & Macdonald, 2017, p. 837). The literature suggests that implementing various mitigation measures like cost optimization, strategic partnerships, and contingency tactics can be utilized to reduce the impact of these disruptions. (Sudan et al., 2023, p. 2). In the search for efficient production, multinational companies tend to operate multiple plants, as a dual-site manufacturing setup. The complexity of this arrangement makes the plants especially vulnerable for disruptions, which solidifies the need for seamless network coordination and supply chain configuration. (Lohmer et al., 2022, pp. 5108–5109).

Navigating an unstable environment is not a static task, but instead, supply chains must be reconfigured to meet emerging market demands and trends. (Zidi et al, 2023, p. 1; Christopher, 2011, p. 99). Notably, supply chain configuration is an evolutionary process which differs based on factors such as organizational strategies, product needs, and change management. Supply chains are to be dynamic in a way to adapt swiftly and cost-effectively to changing requirements of the industry. (Zidi et al, 2023, pp. 1–2). To match the challenges driven by volatile environments, organizations need to focus their effort on becoming agile business, including the entirety of the firms' structures, processes, and supply chains. (Christopher, 2011, p. 99; Zidi et al., 2023, pp. 1–2). While the concept of reconfigurable supply chains does exist in the present literature, the literature on reconfigurable supply chains is still relatively scarce. (Zidi et al, 2023, p. 2).

Supply chain integration is the coordination of key activities between a company and its suppliers, customers, and other players of the supply chain. In addition to these external

actors, supply chain integration consists of the synergy between intra-organizational functions simultaneously. (Ali & Mahmood, 2024, pp. 1–2). According to Ali & Mahmood (2024, p. 2), supply chain integration is vital in terms of efficiency, cost reductions, and improved customer satisfaction. Flynn et al. (2010, p. 58) elaborates that continuously increasing global competition has demanded organizations to invest in mutually beneficial partnerships, while simultaneously prioritizing the improvement of intra-organizational processes. Besides supply chain integration, product innovation capabilities are the key enabler of sustainable competitive advantage by enhancing operational performance. (Ali & Mahmood, 2024, p. 15). The existing research related to supply chain integration and product innovation is lacking, specifically in supply chain capability evolution, and operational capability dimensions. (Ali & Mahmood, 2024, p. 15).

According to Koul (2019, p. 1), supply chains form the backbone of every organization, evident especially during challenging circumstances like natural disasters, conflicts, and other disruptions. Complex and turbulent environments can be managed through the means of supply chain agility and resilience. (Koul, 2019, p. 1). To emphasize, “business as usual” is not a viable strategy. (Christopher & Peck, 2004, p. 1). Innovative supply chain practices promote characteristics like agility and resilience, manifesting in improved finances, cycle times, and customer satisfaction. (Koul, 2019, pp. 1–3). Koul (2019, pp. 1–3) presents the innovation capabilities of constant improvement, collaboration, business model innovation, demand management, and performance measurement. The preceding capabilities lead to hypothesized outcomes of supply chain agility, stakeholder engagement and value creation, and sustainability. (Koul, 2019, pp. 1–3). While these innovation capabilities are examined theoretically, Koul (2019, p. 3) explicitly calls scholars to test the capabilities and their outcomes empirically, opening research gaps in supply chain innovation related dimensions. A new product line launch is a particular supply chain innovation related dimension. (Koul, 2019, p. 3). Product line launch enables an environment where the coordination of supply chains can be observed during its evolutionary phases. (Li & Yang, pp. 328–329).

Taken together, these studies highlight the demand for research related to supply chain capability reconfiguration, specifically in the context of developing supply chains. The supply chain development is triggered by a product line launch, leading the firms to integrate, build, and reconfigure their internal and external resources. In the end, organizational efforts connected to capability dimensions may lead to sustainable competitive advantage. (Zidi et al., 2023, p. 2; Ali & Mahmood, 2024, p. 15; Li & Yang, pp. 328–329; Wagner & Zanger, 2024, p. 1659; Koul, 2019, p. 3). Therefore, the goal of this study is to explore the phenomenon of supply chain capability reconfiguration, with the support of the following research questions:

Research question 1:

- How do supply chain capabilities manifest during product line launch?

Research question 2:

- How do supply chain capabilities evolve during product line launch?

This study contributes to existing literature in the following ways. First, the study answers to the calls of preceding academic research by providing data on how supply chains reconfigure during product line launch. This study offers real-world analysis on how supply chains transform in practice, providing contribution to the existing literature base. (Zidi et al, 2023, p. 2; Ali & Mahmood, 2024, p. 15; Koul, 2019, p. 3). In addition, supply chain management (SCM) is a major source of competitive advantage and creator of net positive financial outcomes in business environments. Therefore, supply chain management strategy can function as either a bottleneck or success factor of both already established and new companies. (Wagner & Zanger, 2024, p. 1659; Koul, 2019, p. 1). Building on the bottleneck metaphor, companies reconfiguring their supply chains in a turbulent environment must be prepared to tackle emerging challenges. (Shekarian & Mellat Parast, 2021, p. 427). As after all, the scholars argue that in general, 85% of companies face

disruptions. (Bode & Macdonald, 2017, p. 837). Theoretically, dynamic capabilities themselves enable the firm to integrate, build, and reconfigure internal and external resources to preserve and develop their market position. (Wagner & Zanger, 2024, p. 1659). Similarly, certain firm resources hold the possibility of sustained competitive advantage. These are included in the VRIN framework, which includes valuable, rare, inimitable, and non-substitutable resources respectively. (Barney, 1991, pp. 101–112).

This thesis consists of the following chapters: introduction, literature review, methodology, results, discussion, and conclusion. The structure flows coherently, starting with the research introduction, and the theoretical framework. Then, the research methods are defended, the selected case study is presented, and the data structure is revealed. The results of the 11 operational, tactical, and strategic interviewee participants are analyzed in the results section, while the significance of the findings is further discussed in the discussion chapter. In addition, the study proposes theoretical contributions and managerial suggestions for the case company. The concluding remarks are expressed in the final paragraph of this study.

2 Literature review

2.1 Supply chain management

Supply chain management (SCM) includes activities implemented on firms' internal and external levels. Internally, supply chain management consists of activities related to sourcing, purchasing, procurement, and logistics — including the planning, interplay, and operational execution of these functions. (Lau et al, 2019, pp. 25–26). Externally, it includes collaboration with partners such as suppliers, transporters, warehouses, retailers, and the customers themselves. (Hugos, 2024, p. 3). Simplifying these SCM definitions, supply chains can be defined as the alignment of companies that deliver products or services to market. In a customer-centric view, the supply chain consists of all stages that are involved in fulfilling a customer order. (Hugos, 2024, p. 3). Supply chain management can be segmented into both upstream and downstream operations across the value chain. Upstream operations include dimensions like procurement and supplier selection, while downstream activities consist of activities such as logistics and distribution. Effective supply chain management requires efforts both at external and internal levels. (Lau et al. 2019, p. 26; Hugos, 2024, p. 5). All in all, supply chain management is the strategic orchestration of business functions within a singular company and across companies within its supply chain, serving the purpose of creating a long-term advantage for each player of the value chain. (Hugos, 2024, p. 4).

Due to the umbrella definition of supply chain management, the application of supply chain can be specified further within the lens of this study. According to Fatouh & Rego (2023, pp. 1868–1869), engineering-to-order (ETO) branch of supply chains appear in industries such as shipbuilding, construction, machinery, all of which require substantial engineering work before, during, and after customer order fulfilment. Typical shipbuilding ETO supply chain includes low volumes, tailored customer needs, long lead times, customized components, and high capital requirements – to name a few. ETO projects require the establishment of new supply chain processes within the organizations, and a large chunk of the actual work begins after receiving an actual order from the customer.

Specifying the operating environment further, the key players of a shipbuilding supply chain are ship owners, ship designers, shipyards, primary equipment suppliers, and additional suppliers. (Fatouh & Rego, 2023, pp. 1868–1869). According to Alfnes et al. (2021, p. 2), ETO supply chains are complex, particularly in shipbuilding ecosystems. For instance, Norwegian shipbuilding industry demands a notoriously high amount of complex engineering work for each customer. Uncertainty in these types of supply chains is high, as many components of the ships, even standardized products such as electrical cables, are prone to disruptions. Thus, the coordination required to supply advanced equipment like engines, propellers, thrusters, and automation is high. The typical ETO delivery process involves multiple temporary actors working together to create complex products. Due to the nature of the industry, most of the ship design is done after the contract has been signed, while production and engineering processes begin before all issues are solved – to reduce lead times. Building on this logic, aiming for high efficiency of the supply base is a must, not a convenience. (Alfnes et al., 2021, p. 2).

According to Fine (2000, pp. 213–214), supply chain design is a key core competence of an organization. Specifically, this means choosing what capabilities to develop and invest in internally, and which development effort to delegate forward to suppliers of the value chain. The concept of industry clockspeed describes the rate of change in an industry, more specifically the change rate of products, processes, and technologies. For instance, in a fast-clockspeed industry like personal computers, redesigning certain capabilities of a company grant competitive advantage, albeit for a temporary amount of time due to the rapid evolution of industry characteristics like technological development and shorter product lifecycles. In contrast, Fine (2000, pp. 213–214) discuss that in slower clockspeed industries such as automobiles, the players have time for deliberate reactions and choice. However, even in industries with slower clockspeed, the relative power between different actors will eventually shift. (Fine, 2000, pp. 213–214). Continuing this topic, Alfnes et al. (2021, pp. 1–3) states that ships require high engineering effort, and the projects steer towards naturally long lead times due to in-depth order dependent activities like complex sub-products involved in manufacturing. They note that 70–80 %

of ship production output is generated by supplier networks. Additionally, coordination work can possess challenges, especially in projects where customer change requests are common. Due to the lengthy project schedules and the maturity of processes, the shipbuilding industry presumably falls towards a slower clockspeed industry in Fine's (2000, p. 214) clockspeed theory. However, when a company operates in multiple industries in addition to marine (shipbuilding), for instance – it is possible that significant clockspeed differences exist and need to be accounted for between these different, yet at times overlapping supply chains. (Alfnes et al., 2021, pp. 1–3; Fine, 2000, p. 214).

Like ETO supply chains and their volatile and time-sensitive operational environment (Alfnes et al., 2021, p. 2; Fine, 2000, pp. 213–214), Kanike (2023, p. 1) emphasizes the importance of SCM in relation to the manufacturing operations (MSC). According to Kanike (2023, p. 1), a viable supply chain setup is essential in order for the production processes to run seamlessly. In contrast, interruptions to these processes can lead to cost increases, declining sales, delays, and damaged reputation, and customer relationships, in the broader view. However, Kanike (2023, p. 20) presents actions that can mitigate these disruptions. As such, a risk management plan, technological commitments and collaboration with key external stakeholders are practical tools to tackle these issues. (Kanike, 2023, p. 20). Continuing this topic, Costantino et al. (2012, p. 451) argues that the manufacturing supply chain (MSC) requires efficient supply chain design, and management, that leads to optimized logistical flows among the supply networks. The manufacturing supply chain design (MSC) must consider several attributes, like costs, quality and transportation time. (Costantino et al., 2012, p. 452). To increase agility of a manufacturing setup, a common method is to operate in geographically different sites, that are connected through the flow of knowledge. (Costantino et al., 2012, p. 451). In addition, they elaborate that an agile MSC includes a network of companies that possess complementary competences which are integrated seamlessly into material, knowledge, and financial flow of the enterprises. Integrated together, the slow clockspeed, engineering-to-order (ETO) industry set in a specific global manufacturing supply chain (MSC) environment is the contextual lens of this study. (Fine, 2000, p. 214; Fatouh & Rego, 2023,

pp. 1868–1869; Alfnes et al., 2021, p. 2; Costantino et al., 2012, p. 451). This supply chain setting logic is illustrated in Figure 1.

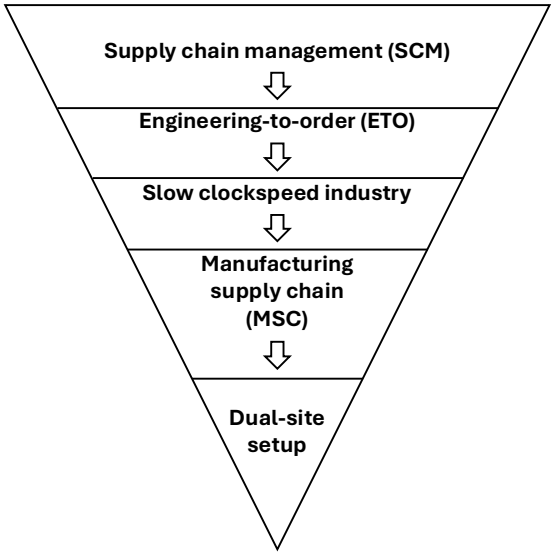

Figure 1. Dual-site supply chain formula. Adapted from Lau et al. (2019, pp. 25–26), Fatouh & Rego (2023, pp. 1868–1869), Alfnes et al. (2021, p. 2), Fine (2000, p. 214) and Costantino et al. (2012, p. 451).

2.2 Dynamic capability theory

This study draws on the theoretical foundation of dynamic capabilities (DC) theory that extends the resource-based view (RBV) approach. Dynamic capabilities address the firms' ability to integrate, build, and reconfigure their internal and external resources, while the resource-based view focuses on analyzing the existing, internal resource base of a company. (Wagner & Zanger, 2024, p. 1659; Barney, 1991, p. 101). The theoretical

backbone of the study is based on DC, RBV, and their branches, while the empirical setting is connected to the strategic initiative of a product line launch, that requires structural changes from the supply chain. (Morita et al., 2025, p. 383).

The key question of strategic management remains: how companies may reach sustainable competitive advantage in rapidly developing environments? (Teece et al., 1997, p. 509). Thus, the theory of dynamic capabilities formed as another perspective on traditional strategic approaches. The foundational concept of dynamic capabilities supports in analyzing the sources of wealth creation and capturing of organizations. They define that the term “dynamic” means the organizations' capacity to remake competences to battle in rapidly changing environments. Furthermore, the term “capabilities” is illustrated as the firms' ability to integrate, build, and reconfigure their internal and external resources. Additionally, a key strategic challenge is to identify which internal and external competences are the most valuable and difficult to imitate. The choices about how much to invest in dynamic capabilities are one of the core factors in any firm’s strategy. (Teece et al., 1997, pp. 509, 515).

Answering the call of changing environments requires companies to renew themselves by changing organizational resources, products, and competence over time. The desired change can be achieved by leveraging, creating, accessing, and releasing firm’s resources. (Danneels, 2010, pp. 1–2). Also, dynamic capabilities theory indicates that while some companies thrive in environments demanding change, others may lack the resources to do so, resulting in consequences like bankruptcy. (Danneels, 2010, pp. 1–2; Teece et al., 1997, p. 509). Danneels (2010, pp. 1–2) introduces an empirical case that ties deep into dynamic capabilities literature: the Smith Corona case study. Smith Corona was a typewriter manufacturer that needed to drastically redesign its resource base due to emerging obsolescence of its main products, typewriters. Thus, to avoid declining with its typewriter business, Smith Corona had to find an entrance to other product categories, and the set of resources required to access the respective categories. First, Smith Corona attempted to utilize its existing brand, distribution, and customer accounts (leveraging).

Second, they built a portfolio in typewriter related electronics products (creating). Third, Smith Corona tried to capture resources through alliance partners (accessing). Finally, they attempted to reduce the workforce and sell assets (releasing). Despite these efforts, Smith Corona announced liquidation of the company, serving as an important case study for future ventures requiring alteration of key resources. (Danneels, 2010, pp. 1–2).

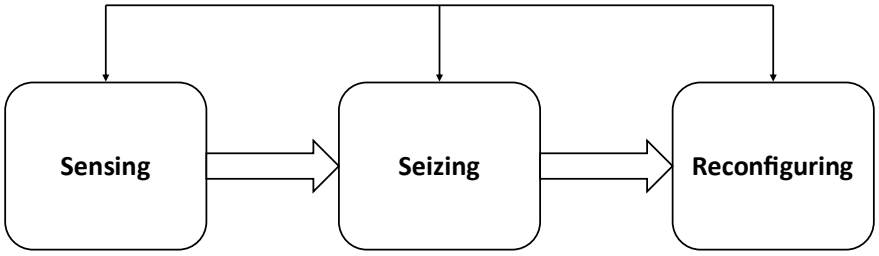

Figure 2. Foundation of dynamic capabilities. Adapted from Teece (2007, pp. 23–25).

As an extension to the dynamic capability literature, the source of sustainable advantage demands companies to possess difficult-to-replicate dynamic capabilities. (Teece, 2007, pp. 1–2). Additionally, the development and implementation of dynamic capabilities are the core principles of either organizational success or failure. As shown in Figure 2, Teece (2007, pp. 1–2) illustrates the core concepts of dynamic capabilities: sensing, seizing, and reconfiguring. This framework serves as an enterprise-level entry barrier for the creation of competitive advantage, in the context of rapidly developing industries.

Sensing is the form of market exploration and monitoring, involving efforts to discover new key opportunities. The costs of sensing are relatively small compared to later phases of the process. For instance, the cost of early-stage research related to new product

development was a tiny percentage in comparison to total development costs. (Teece, 2007, p. 25). Sensing opportunities require organizations to scan and search meticulously across different technologies and markets, both familiar and distant. (Teece, 2007, p. 4). Seizing is an investment to access the recently identified products, processes, and services. To access and eventually exploit the sensed opportunities, firms must develop technological competences and assets, to seize the opportunity when the marketplace timing is right. In terms of strategic decision-making, juggling and selecting the correct investment decisions, and leveraging products and services between application areas is a core aspect to consider. (Teece, 2017, p. 8). Finally, reconfiguring is the ability to adjust existing assets and organization structures according to the demands of a growing enterprise. As the processes of a company reach a mature stage, set routines are inevitable and even preferred from an operational lens. However, to evolve, change must be embraced. Change can also lead to uncertainty and resistance within the organization. One tool to combat this behavior is to implement change gradually, in small steps. Another more radical option is to create a completely new break-out structure and processes to match the level of organizational learning. (Teece, 2007, pp. 16–17).

The research of Eisenhardt & Martin (2000) aligns with preceding dynamic capability literature. Dynamic capabilities are the organizational and strategic resource sets that companies attempt to capture during shifts in the markets. (Eisenhardt & Martin, 2000, pp. 1106–1107; Teece et al., 1997, p. 515). Concrete examples of these strategic and organizational processes are product development, partnerships, and other forms of strategic decision-making. (Eisenhardt & Martin, 2000, pp. 1106–1107). Therefore, these dynamic capabilities fundamentally differ from routine operational processes, such as the supply chain management activities of sourcing, purchasing, procurement, and logistics. Like its strategic counterparts, these operational capabilities require seamless planning, interplay, and execution between these functions. (Eisenhardt & Martin, 2000, pp. 1106–1107; Lau et al., 2019, pp. 25–26). To add, Winter (2003, p. 991) argues that the ordinary capabilities, like those within the identified supply chain management

functions, allow firms to “make a living”, whereas dynamic capabilities enable the reconfiguration of these ordinary capabilities. (Winter, 2003, p. 991; Lau et al., 2019, pp. 25–26).

The creation and evolution of dynamic capabilities are significant in terms of organizational development. (Zollo & Winter, 2002, pp. 339–341). In relatively static environments, operating routines that are sufficient for the task, with sporadic innovation, may be enough for a source of advantage. However, in an environment where technological, regulatory changes are rapid, and competition is fierce, failing to systematically develop dynamic capabilities may become costly, and lead organizations to operate with relatively static capabilities. In addition, Leonard-Barton (1992, p. 118) emphasizes that the core capabilities which may have served the organization well in the past, while still being viable in some context, may convert into core rigidities – sets of inappropriate knowledge that actively create issues. Similarly, Levitt & March (1988, p. 333) argues that the same processes which lead to organizational wisdom may also convert into competency traps, superstitious learning, or incorrect conclusions related to past experiences. This indicates that while capability development is essential, past experiences are not perfect in predicting the future, especially if the organization does not possess enough precedent experiences. (Zollo & Winter, 2002, pp. 339–341; Leonard-Barton, 1992, p. 118; Levitt & March, 1988, p. 333). However, successfully accumulated organizational experience leads to large increases in productivity. This concept can be defined as the learning curve. In addition to being relevant in a wide variety of industries, the learning curve leads to productivity gains in product launch and production ramp-up contexts as well – events central to this study. (Argote et al., 2021, p. 5399).

2.3 Manifestation of supply chain capabilities

Ordinary capabilities translate the understanding of the dynamic capabilities' theory into a practical, operational level. (Winter 2003, p. 991; Teece et al, 1997, p. 515). Thus, the following dimensions of dynamic supply chain capabilities are introduced: supply chain agility, supply chain adaptability, and supply chain resilience. (Aslam et al., 2023, pp. 2–

3; Brusset & Teller, 2017, pp. 1–2). As the operational expression of dynamic capabilities, these three dimensions provide a solid framework to analyze the manifestation and evolution of supply chain capabilities, in response to supply chain innovation trigger like a product line launch. (Teece et al., 1997, p. 515; Aslam et al., 2023, pp. 2–3; Brusset & Teller, 2017, pp. 1–2).

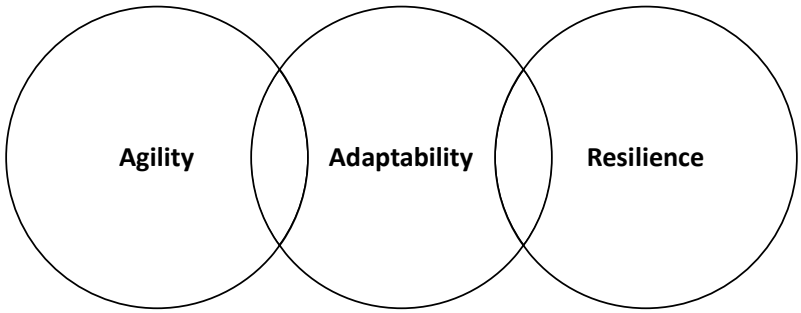

Figure 3. Dimensions of supply chain capabilities. Adapted from Aslam et al. (2023, pp. 2–3) and Brusset & Teller (2017, pp. 1–2).

According to Aslam et al. (2023, p. 3), supply chain agility is the firm's short-term ability to efficiently solve emerging changes both in the internal and external environment, in collaboration with key supply chain partners such as suppliers and customers. Next, supply chain adaptability is the firms and related supply chain partners with long-term competence to make supply chain configuration changes over time in response to sensed market shifts. In addition, Brusset & Teller (2017, pp. 1–2) define supply chain resilience as the capability that allows organizations to rebuild their wounded supply chain, during a reasonable time frame after the disturbance. These three supply chain capability dimensions, essential to this study, are illustrated in Figure 3. (Aslam et al, 2023, p. 3; Brusset & Teller, 2017, pp. 1–2).

Aslam et al. (2023, pp. 7–8) discusses that agility consists of characteristics such as flexibility and responsiveness, covering the entirety of the organization's structures, processes, and managerial behavioral patterns. Therefore, this capability acts as an expansion beyond traditional firm boundaries and demands alignment both with key customers and suppliers. Additionally, agility is an enabler that allows supply chain players to seize opportunities after they are sensed. Agility is a fundamental capability, a requirement to thrive and succeed in a volatile environment, and as a dynamic capability, it is a positive driver of the operational performance of a company. Besides agility, supply chain adaptability is focused on the long-term horizon and competence of the supply chain actors to reconfigure their entire supply chain structure, in order to match the demands of the expected environmental changes – creating a sustainable competitive advantage. (Aslam et al. 2023, pp. 7–8). Brusset & Teller (2017, pp. 1–3) define that resilience, at general level, is the ability of an organization or a social body to rebuild itself despite facing an external attack. These external attacks can range from natural catastrophes, conflicts, and turbulent world economics. In terms of resiliency, supply chain managers control the resources, processes, routines, assets, investments and systems that each contribute to the strategic goal of a resilient supply chain. Supply chain resilience is considered a critical capability to continue operations such as on-time product deliveries. In supply chains, characteristics like value chain fragmentation, geographic dispersion, increased complexity, and reduced material supplies can act as a threat to the supply chains. (Brusset & Teller, 2017, pp. 1–3). The successful integration of agility, adaptability, and resilience leads companies to seize short-term opportunities, reconfigure entire supply chain structures to match the long-term market demands, while allowing the organization to recover from unexpected setbacks. (Aslam et al., 2023, pp. 7–8; Brusset & Teller, 2017, pp. 1–3).

As an extension to the capability manifestations of agility, adaptability, and resilience, it is vital to understand the concept of lower-order capabilities which are an essential part of the dynamic capability theory in a context like supply chain capabilities. (Aslam et al., 2023, pp. 7–8; Brusset & Teller, 2017, pp. 1–3; Teece et al., 1997, p. 515). To clarify, lower-

order capabilities, when applied throughout all members of the supply chain, generate a higher-order capability. Lower-order capabilities are defined as a structure of organizational, technological, human, financial, and physical resources that are orchestrated by organizational routines and implemented in and across organizations. The combination of these lower-order capabilities will translate into generating a higher-order capability, such as agility, adaptability, and resilience. (Brusset & Teller, 2017, p. 4). The lower-order capabilities are illustrated as hierarchical constructs that create higher-order capabilities. Building on this preceding logic, the lower-order capability sets are static processes that create value, while higher-order capabilities, that drive competitive advantage, are inevitably required to alter the lower-order capabilities. (Bhatia et al., 2024, pp. 2–4; Brusset & Teller, 2017, p. 4). According to Bhatia et al. (2024, pp. 2–4), lower-order capabilities manifest as information technology (IT) and organizational learning in a specific context of closed-loop supply chains. First, IT data analytics techniques such as data collection reduce process variabilities, improve efficiency, and guide manufacturing decision-making. Second, organizational learning is crucial for strategic renewal, and it acts as antecedent to supply chain planning, capabilities, and efficiency. To conclude, firms need to focus on building key capabilities to fit their practices, instead of allocating resources on each unique capability simultaneously. (Bhatia et al., 2024, pp. 2–4).

The higher-order supply chain capabilities of agility, adaptability, and resilience operate on different, yet complementary time horizons. (Aslam et al., 2023, pp. 7–8; Brusset & Teller, 2017, pp. 1–3). The concept of different temporal horizons is further explained in foundational studies related to dynamic capabilities. Supply chain agility reflects the ability to respond rapidly to short-term disruptions in supply and demand conditions. In contrast, supply chain adaptability means reconfiguring the supply chain's long-term design to match anticipated market changes. (Lee, 2004, p. 4). Supply chain resilience is placed in the recovery dimension, by emphasizing the capability to respond and restore operational performance from unexpected events over time. (Ponomarov & Holcomb, 2009, p. 131). In addition, these definitions that are observed through a temporal lens align with modern academic contributions assessed in this study. Taken together, these supply

chain capabilities create a framework that guides in analyzing major events such as product line launches over distinct, yet complementary time horizons. (Lee, 2004, p. 4; Ponomarov & Holcomb, 2009, p. 131; Aslam et al., 2023, pp. 7–8; Brusset & Teller, 2017, pp. 1–3).

2.4 Product line launch and supply chain management

Product development is the conversion of market opportunity into a final product, available to customers. (Krishnan & Ulrich, 2001, p. 1). Decisions within development projects can be divided into the following interconnected categories: concept development, supply chain design, product design, and production ramp-up and launch. The essential aspects for this study are supply chain design and production ramp-up and launch dimensions. Supply chain design includes attributes like inbound and outbound material flow and services. Additionally, supplier selection, production, and distribution are included in supply chain design characteristics. Production ramp-up and launch includes communicating the product launch to market, and planning production ramp-up in practice. (Krishnan & Ulrich, 2001, pp. 4–10). While Krishnan & Ulrich (2001, p. 10) explore production ramp-up only briefly, that phase highlights the transition from planning to operational implementation. Product development is based on a decision perspective which means that the methods used in product development vary by firms' functions such as marketing, organizations, engineering design, and operations management. These functions may make different decisions to reach the goal, but the product development issues that are resolved stay the same. Finally, this indicates that these decisions are connected and interdependent between functions, meaning that development work cannot be treated as independent silos, but requires co-operation between domains. (Krishnan & Ulrich, 2001, pp. 2–3).

The ramp-up phase is pivotal for a multitude of reasons: length of the ramp-up, product launch costs, supply chain and production system complexity, and general uncertainty are linked to the company's overall profitability. (Surbier et al., 2024, pp. 1264–1265). Additionally, production ramp-ups are becoming increasingly complicated due to shorter

product lifecycles caused by the demand for tailored products and technological advancements. Production ramp-up is the most challenging part to manage during the whole development process, and in the end, 60% of production ramp-ups are unsuccessful in terms of meeting technical and economic targets, indicating high levels of instability and complexity. (Padrón Hinrichs et al., 2026, p. 168). In contrast, Surbier et al. (2024, pp. 1264–1265) states that 57% of production ramp-ups are unsuccessful – ending on similar figures as Padrón Hinrichs et al. (2026, p. 168), highlighting the relevance of research in guiding companies towards successful product line launches.

Beyond a significant probability of failing to meet technical and economic targets (57%–60%), the complex nature of production ramp-ups places organizational stress and high coordination requirements across different functions. Namely, supply chain, production planning, and product development functions are under the most stress. (Surbier et al. 2024, p. 1265). Similar need for cross-functional collaboration is found by Krishnan & Ulrich (2001, pp. 2–3), eliminating silos between developing organizations' functions. In addition, shorter product lifecycles and increased tailoring demands reduce the margin for error in stabilizing production ramp-ups. (Padrón Hinrichs et al., 2026, p. 172). All in all, prior academic contribution suggests that production ramp-up can be defined as demanding and uncertain, requiring high levels of coordination and cross-functional effort. (Surbier et al., 2024, p. 1265; Krishnan & Ulrich, 2001, pp. 2–3; Padrón Hinrichs et al., 2026, p. 172).

While product development and production ramp-ups are discussed in this chapter, the implications of product innovation remain for investigation. (Ambulkar et al., 2022, pp. 7194–7199). Namely, product innovation means the creation of new products and solutions to meet new customer demands – a new offering with significant value leading to profits and growth. However, product innovation may increase the risk of supply chain disruptions. In its entirety, product innovation is characterized as an uncertain process, which demands the supply chain to survive in a constantly evolving environment. In addition to regular product innovation activities, they highlight that companies are likely to

launch completely new and distinct product lines, additionally elevating operational complexity. (Ambulkar et al., 2022, pp. 7194–7199). When the operational complexity increases due to product innovation and additional product lines, information processing demands increase, requiring an accurate interpretation of external and internal environments that can be eventually translated into strategic decisions inside the organization. Additionally, constant operational reconfiguration may lead to delays in the company's lead time due to breaks in manufacturing processes. Furthermore, due to poor information processing causing demand fluctuations, firms risk introducing the bullwhip effect that spans across the supply chain. Collaboration with supply chain partners, namely suppliers, may assist in reducing the costs and risks associated with product innovation. However, relying on supply chain partners comes with risks too. For instance, issues faced by companies operating on an upstream level will fall downstream. Managing suppliers' R&D processes are complex, suggesting the managers to consider make-or-buy decisions again, "to prevent a crisis". (Ambulkar et al., 2022, pp. 7197–7199)

As the literature suggests, the cluster of product development (Krishnan & Ulrich, 2001, p. 1), production ramp-up (Padrón Hinrichs et al., 2026, p. 168; Surbier et al., 2014, pp. 1264–1265), and product innovation (Ambulkar et al., 2022, pp. 7194–7199) create operational instability, structural complexity, and disruptions across the supply chain. Answering the call to tackle these challenges, dynamic supply chain capabilities highlight their value as drivers of organizational performance. Namely, agility (Aslam et al., 2023, p. 7–8; Lee, 2004, p. 4) is characterized as short-term organizational flexibility and responsiveness to thrive in a volatile environment. Then, adaptability is the long-term supply chain configuration that matches the anticipated demands of the external environment. To conclude, resilience (Brusset & Teller, 2017, pp. 1–3; Ponomarov & Holcomb, 2009, p. 131) is the capability to restore supply chain performance after unexpected events.

2.5 Evolution of supply chain capabilities

Resource-based view (RBV) and dynamic capabilities (DC) indicate that the companies possess a heterogenous set of resources and capabilities. (Wagner & Zanger, 2024, p. 1659; Barney, 1991, p. 101). However, the prior academic contributions lack depth in clarifying how the capabilities evolve over time. Dynamic capabilities, such as agility, adaptability, and resilience are not static, or found ready, but go through stages of capability lifecycle (CLC). Additionally, the CLC concept hypothesizes that the operational capabilities can branch into multiple alternate forms. (Helfat & Peteraf, 2003, pp. 997–998; Aslam et al., 2023, pp. 2–3; Brusset & Teller, 2017, pp. 1–2). Capability lifecycle illustrates the general pattern and the set of possible paths for theoretically any capability type, in any industry, even expanding across firm boundaries, manifesting in supply chains and joint ventures. The capability lifecycle involves the following stages: founding – the basis for evolution, development – gradual capability building, maturity – capability building halts. However, evolution does not end in the mature stage. At this phase, the capability can branch into six dimensions: retirement (death), retrenchment, renewal, replication, redeployment, recombination. (Helfat et al., 2003, p. 1000). Prior to the hypothesized capability branching, Helfat & Peteraf (2003, p. 1000) argues that historical antecedents play a major role in the consequent capability evolution. This logic aligns with the prior contribution of Leonard-Barton (1992, p. 118), who indicates that prior experiences may act as a burden, converting core capabilities into core rigidities. While Zollo & Winter (2002, pp. 339–341) note that development work is essential to avoid operating with static capabilities, the incorrect conclusions related to past experiences must be recognized as a common pitfall. (Levitt & March, 1988, p. 333). Even though the risks are to be considered, successful capability development enables the favorable effects of the learning curve, leading to notable organizational gains. (Argote et al., 2021, p. 5399; Helfat & Peteraf, 2003, p. 1000;). The capability lifecycle (CLC) process is illustrated in Figure 4.

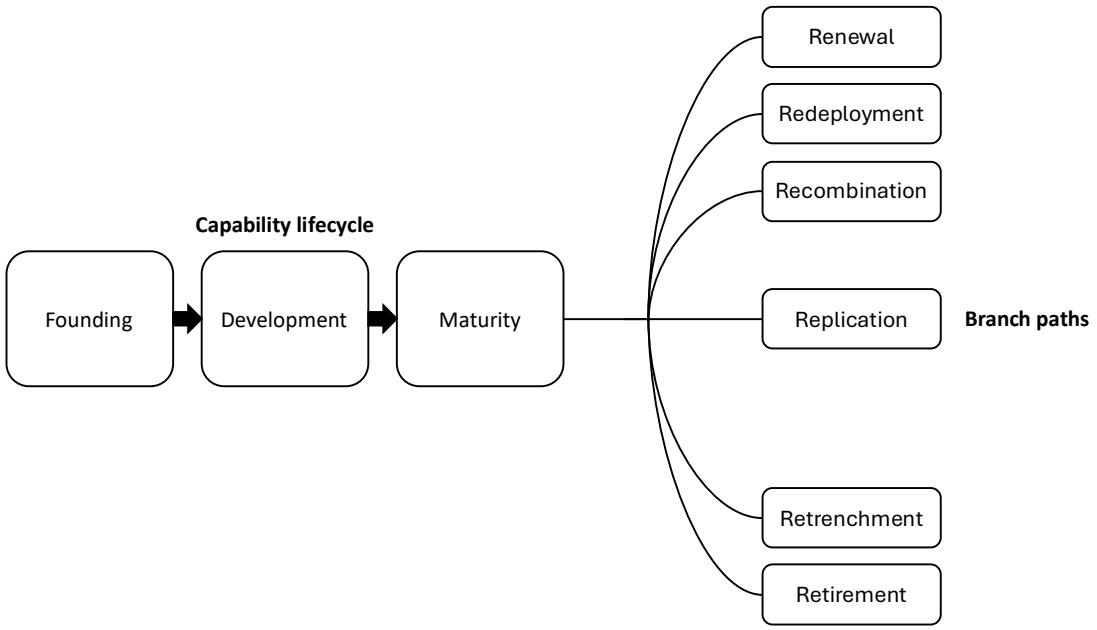

Figure 4. Capability lifecycle. Adapted from Helfat & Peteraf (2003, pp. 1000, 1005).

While the foundational concepts of capability lifecycle are discussed extensively, the branch paths depicted in Figure 4 demand clarification. While six branch possibilities are recognized, discussion about additional emerging paths continues. The identified six represent the capability transformations that occur especially during case-study and large-sample empirical analyses. (Helfat & Peteraf, 2003, pp. 1004–1006). Drawing on this logic, the six branches can be defined. For instance, when business continuation is at risk, firms may be pressured to retire a capability. Then, retrenchment is the gradual decline of a capability triggered by scenarios in internal or external environment. Replicating a capability can happen by for instance transferring the capability into another geographic area. In addition, firms may recombine capabilities, such as merging information technology capability with existing manufacturing capability, leading to an enhanced combination. Redeploying a capability may be beneficial if there is a demand for the capability in a closely related product or service. As the final illustration, renewal of the capability begins a new capability development stage as the company explores suitable alternatives. While these examples are meant to serve as a general direction, the branches reflect two possibilities. Certain branches may render the capability to decline, while other

scenarios can become environments for growth and change. To clarify this logic, new opportunities presumably do not involve retirement or retrenchment evolutionary steps. (Helfat & Peteraf, 2003, pp. 1004–1006).

The dynamic resource-based view introduces the seminal concept of capability lifecycle. However, to understand specifically how evolution happens, aid from other scholars is demanded. As the capability lifecycle theory draws a general pattern, and covers any shape of a capability, practical example can be selected from a wide range of industries. As this study specifically covers agility, adaptability, and resilience as the manifestation of supply chain capabilities, the practical connection should be linked to any of these for academic clarity. (Helfat & Peteraf, 2003, p. 1000). As a result, supply chain resilience is a lens to oversee how supply chains adapt to non-routine events. Specifically, how organizations can learn from disruptions, and transform generally negative events, and the capabilities associated with those, into positive opportunities and a set of evolved supply chain capabilities. (Legg et al., 2025, pp. 1–2; Scholten et al., 2019, p. 431., Helfat & Peteraf, 2003, p. 1000). Organizations develop their resilience capability by intentional or unintentional learning mechanisms. Namely, anticipative learning, or formal training and education enable proactive, intentional knowledge transfer. In contrast, non-routine supply chain collaboration is triggered by the lack of immediate solution or contingency plan, leading to unintentional learning across supply chain players. (Scholten et al., 2019, p. 437). In addition, prior research suggests that supply chain agility is a strong enabler of supply chain resilience. Firms with enhanced agility levels manage disruptions, operational reconfigurations, and decision-making with haste, leading to higher levels of supply chain resilience. This view aligns with the prior argument (Figure 3) in this study, that supply chain capabilities are interconnected entities. (Legg et. al., 2025, p. 11). Furthermore, the contributions of Legg et al. (2025, p. 11) indicate that the hierarchical nature of capabilities exist. Dynamic capabilities of sensing, seizing, and transforming operationally manifest through capabilities like supply chain agility. Continuing this logic, dynamic capabilities provide the strategic building blocks for the manifestation of supply chain capabilities, those that allow the firm to fulfill their operational demands. To

conclude, as the capabilities mature throughout the capability lifecycle stages, dynamic capability routines convert into operational practices – a process this study aims to examine empirically throughout the lens of a product line launch. (Legg et al., 2025, p. 11; Teece, 2007, pp. 23–25; Winter, 2003, p. 991; Helfat & Peteraf, 2003, p. 1000).

2.6 Theoretical framework

The purpose of this chapter is to synthesize the preceding theoretical framework of industrial supply chain management, dynamic capability theory, supply chain capabilities, product line launch and supply chain management, and evolution of supply chain capabilities into a concise discussion and theoretical framework model. The synthesis describes the hypothesized framework on a general level, while the in-depth analysis is conducted in the preceding chapters. Together, these theory streams provide the foundation for analyzing how organizations reconfigure their supply chains during product line launch. The goal of this literature review is to provide grounding for the upcoming empirical study and create a framework model in relation to predefined research questions.

The supply chain management (SCM) setting of this literature review is described on a hierarchical level. (Figure 1). The broad lens of supply chain management includes activities implemented internally by sourcing, purchasing, procurement, and logistics functions. Externally, it includes collaboration with key stakeholders like suppliers, transporters, warehouses, retailers, and the customers themselves. (Lau et al, 2019, pp. 25–26). Then, engineering-to-order (ETO) branch of supply chains appear in industries like shipbuilding, construction, and machinery. Hence the definition, all these industries demand substantial engineering work during order fulfilment. (Fatouh & Rego, 2023, pp. 1868–1869). Building on the theory of Fine (2000, pp. 213–214), Alfnes et al. (2021, pp. 1–3) discusses that the shipbuilding industry presumably leans towards slow clockspeed industry configuration. In addition, Costantino et al. (2012, p. 451) presents that the agility of the manufacturing setup is increased when operating in geographically different sites.

Product line launches are complex and challenge the entirety of the supply chain. Product line launches involve several interconnected organizational events, including product development, production ramp-up, and product innovation, demanding high levels of coordination and cross-functional effort. For instance, only 57–60% of production ramp-ups are successful in meeting set targets, indicating operational instability, structural complexity, and disruptions across the supply chain. (Padrón Hinrichs et al., 2026, p. 168; Surbier et al., 2014, pp. 1264–1265).

In response to these challenges, organizations implement dynamic capabilities that enable them to integrate, build, and reconfigure their internal and external resources to match the demands of rapidly changing environments. Sensing is a form of exploration and monitoring to discover new key opportunities, while seizing is the investment required to access and exploit the identified products, processes, and services. Then, reconfiguring is the ability to alter existing assets and structures according to new strategic demands. (Teece, 2007, pp. 23–25).

During product line launches, these dynamic capabilities manifest operationally through higher-order supply chain capabilities, namely agility, adaptability, and resilience. Agility allows organizations to respond rapidly to short-term disruptions, and adaptability enables the creation of long-term supply chain configuration to match anticipated market changes, while resilience is the capability to rebuild a wounded supply chain, and restore operational performance after unexpected events. In addition, the lower-order capabilities of organizational, technological, human, financial, and physical resources are hierarchical constructs that generate higher-order capabilities. (Aslam et al., 2023, pp. 7–8; Brusset & Teller, 2017, pp. 1–4).

Supply chain capabilities like agility, adaptability, and resilience evolve throughout capability lifecycle model. The model serves as a general direction of capability evolution and enables the analysis of other emerging capabilities as well. Capability lifecycle indicates that capabilities go through founding, development, and maturity stages. After these

phases, the capabilities branch into six dimensions. The literature suggests that as capabilities mature, dynamic capability routines of sensing, seizing, and transforming convert into operational practices like supply chain agility, adaptability, and resilience. (Legg et al., 2025, p. 11; Teece, 2007, pp. 23–25; Winter, 2003, p. 991; Helfat & Peteraf, 2003, p. 1000).

Based on the preceding theoretical discussion, this study introduces a theoretical framework (Figure 5) that indicates how supply chain capabilities manifest and evolve during product line launch:

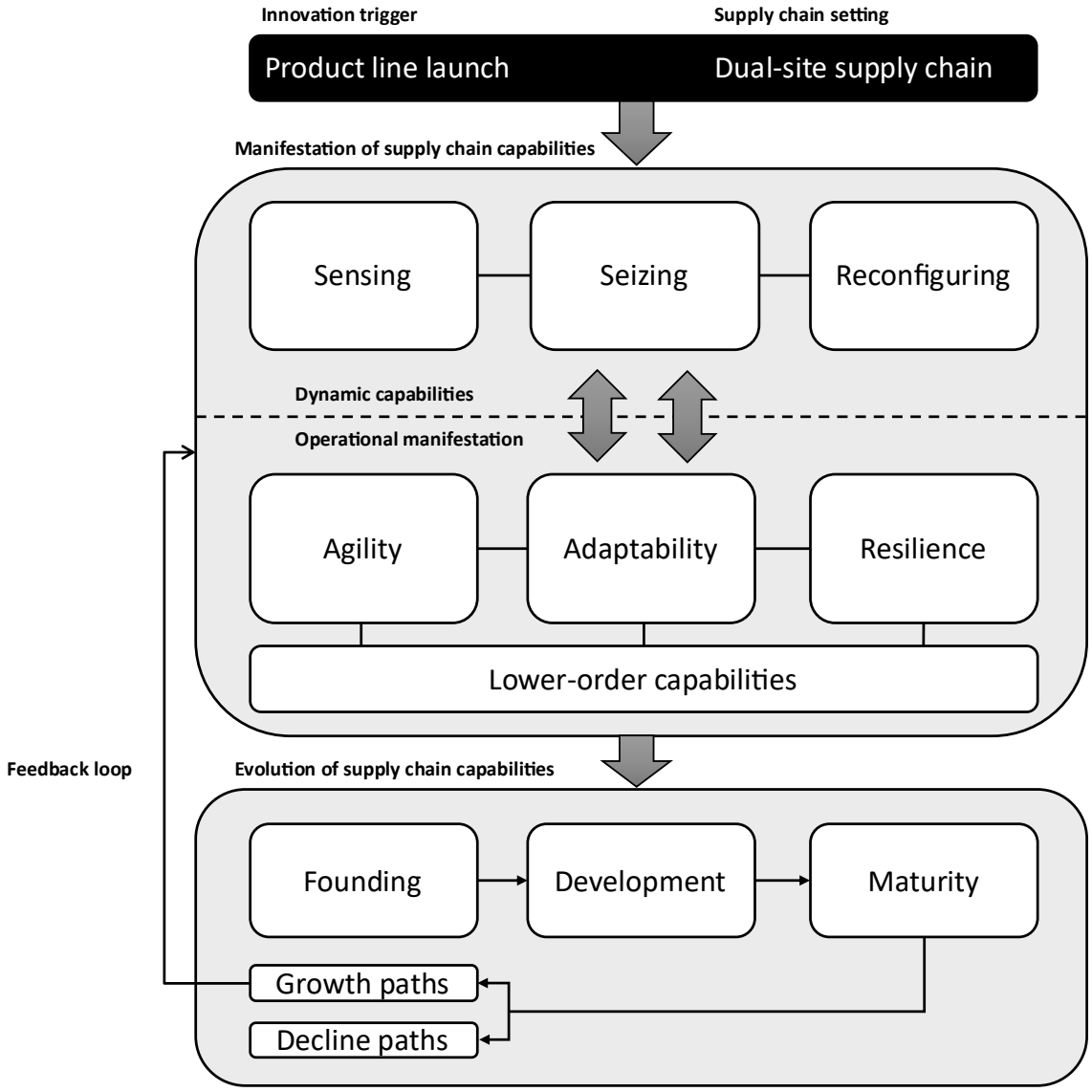

Figure 5. Theoretical framework.

3 Methodology

3.1 Research strategy

Saunders et al. (2023, pp. 161–162) defines research philosophy as the set of beliefs and presumptions related to the development of knowledge. The chosen research philosophy shapes the way in which the scholars view the world, and importantly, the adopted research philosophy alters research projects in their entirety. To discover one's research philosophy, self-reflection is demanded, meaning that the researchers must ponder questions about their beliefs and presumptions. There is no one-size-fits-all philosophy, but instead, each research philosophy offers a unique method to observe the world. Research philosophies consist of their similarities and differences regarding the major types of assumptions: ontological, epistemological, and axiological. Ontological assumptions appear as the way the researchers view reality, emerging as how one approaches the research objects and the topic of focus. Then, epistemological assumptions are related to knowledge and communication, particularly how one specifies what is deemed acceptable knowledge, and how that knowledge is communicated forward to others. In terms of research, epistemology shapes the contribution made to knowledge from the results of the research project. In addition, axiological assumptions connect to the core values and ethics, and the research actions done based on those.

The purpose of this section is to apply the theoretical contributions of Saunders et al. (2023, pp. 161–162) into the context of this study. The ontological assumption is that an organizational structure like supply chain capabilities and strategic events such as product line launches can be perceived differently by individuals associated with the process due to personal biases, experience, and organizational role differences. As a result, multiple valuable perspectives will be collected from individuals involved with the product line launch, each with their own unique background.

Then, from an epistemological perspective, this study takes an interpretivist approach. (Saunders et al., 2023, pp. 161–162). The intention of interpretivism is to create rich

interpretations of social perspectives and contexts. For instance, the CEO, managers, and assistants, from top to bottom in hierarchy, all experience a different reality that could be interpreted as living in a completely contrasting workplace environment. Interpretivist approach focuses especially on interpreting individuals' experiences and attempts to collect what is meaningful per unique participant. This study interprets participants' unique experiences related to product line launch and its impact on the manifestation and evolution of supply chain capabilities. (Saunders et al., 2023, pp. 150–151).

Next, the axiological perspective of the study is that the researcher's own values, ethics, and prior knowledge of the organizational context can influence the research process. (Saunders et al., 2023, pp. 161–162). The core value of the study is that interview responses are treated confidentially and anonymized in the final publication. Additionally, the researcher is an employee of the case company and knows the study participants on a personal level which may lead to biases in the data collection phase. To address this, the methodology will focus on transparent research design and rigorously discuss values, ethics, and personal biases.

To clarify, interpretivism is the chosen research philosophy in this study. According to Saunders et al. (2023, p. 146), this philosophical lens focuses on the interpretation of different perceptions, emphasizing the data analysis conducted by the researcher as a key contributing factor. In terms of methods, interpretivism typically includes qualitative analysis, in-depth research, and inductive, relatively small sampling.

Saunders et al. (2023, pp. 154–157) introduces three approaches to theory development: deductive, inductive, and abductive approach. Of these methods, each with their unique characteristics, inductive research approach is chosen for this study. Inductive research aims to expand known topics to create untested conclusions, and the research data should be generalizable in a particular setting. The data collected is utilized to investigate a specific phenomenon, analyzed through themes and patterns and placed in a theoretical framework. In the results section, the goal is to interpret the collected data and

place them in a conceptual framework. The reasoning of inductive approach is rather straightforward: theory follows data rather than vice versa. (Saunders et al., pp. 154–157).

3.2 Data collection and case company

According to Yin (2018, p. 50), case study research is an empirical method that enables in-depth investigation of an emerging phenomenon within a real-world context. Case study gains advantage from prior theoretical propositions to guide research design, data collection, and interpretations. Case study is especially suitable if the boundaries between the phenomenon and context are not evident, and when a deeper knowledge of real-world processes is searched for. In other words, the phenomenon refers to the relationship between a product line launch and the presumed manifestation and evolution of supply chain capabilities within the case organization. Yin (2018, pp. 97–98) proposes different justifications for single case selection. First, the existence of the case organization is critical in relation to the development of the theoretical propositions included in this study. Then, the researcher's employee relationship with the case organization allows access to data, participants, and insights, that for an outsider would be challenging, if not impossible, to access.

The case company selected for this study is a Finnish technology company operating primarily in the marine industry. The company functions on a global scale and employs around 250 personnel ranging from executives, white-collar, and blue-collar employees. The upcoming case company respondents, involved with the supply chain, are working in Finland and Norway sites. The recently launched product line, primary focus of this study, is in Finland. The strategic initiative to expand and open a new product line in the company simultaneously opened a case-specific research gap. Drawing on this dual-site context, Dhaigude et al. (2025, p. 19) emphasizes that understanding cultural influences are essential for successful supply chain integration. At the national level – Norway and Finland in this study, cultural differences shape the cross-border collaboration environment in the form of values and communication styles.

Purposive sampling is utilized to select participants for this study. According to Campbell et al. (2020, pp. 653–654), this strategy can be used in a qualitative study to collect a relatively small, but purposively selected sample with the goal to increase in-depth understanding of the matter. This concept is utilized to select respondents that are the most probable candidates for gathering valuable information related to the case study. In this research project, the respondent pool consists of employees who are involved with the product launch or related supply chain activities in the case organization. To maintain anonymity within the relatively small case organization and in the research community, the participants are described on a broad level.

To capture multiple perspectives for this study, the participants are selected to represent a wide spectrum of roles within the firm, while still maintaining sample relevance to the case. In a classic supply chain management study, Schmidt & Wilhelm (2000, pp. 1501–1502) argue that organizational decision-making, especially supply chain related, can be categorized into strategic, tactical, and operational levels. Additionally, Saunders et al. (2023, pp. 150–151) discusses that all employees interpret the workplace reality differently, which offers the potential for rich data collection. Building on this logic, this study categorizes the interviewees into strategic, tactical, and operational levels. This approach provides transparency while protecting the anonymity of the participants and academic integrity. The strategic interviewee's organizational role is to focus on the long-term direction of the company and make major business decisions. Then, tactical level participants convert the strategy into planning and coordination. Finally, operational level employees focus on the day-to-day execution of activities. In the preceding categories, typical roles corresponding to these levels may include executives at the strategic level, managers at the tactical level, and specialists at the operational level. Strategic-level participants are coded as S, tactical-level participants as T, while operational-level participants are coded as O. (e.g. S1, T1, O1). Naturally, the pool of strategic participants in the relatively small case organization is limited, compared to the amount of tactical or operational respondents available for the study.

The interview form is based on the research questions and theoretical framework (Figure 5) of the study, to maintain the logic between theoretical and empirical findings. The form has two copies, one in Finnish (Appendix 1) and one in English (Appendix 2). In this study, native Finnish speakers answer in Finnish, while non-native respondents participate in English. In the end, Finnish data is translated to English to maintain linguistic unity. Regarding the translation process, van Nes et al. (2010, pp. 313–314) notes that qualitative research is valid when the original meaning and the interpretation in the results section is as close as possible. The translated findings, and all findings in general, should be communicated in a way that the findings can seamlessly be traced back to the source data and original perspective of the participant.

The interview process follows a semi-structured interview approach. According to Karatsareas (2022, p. 100) semi-structured interviews include a series of open-ended questions that enable the participants to freely express their opinions based on their own personal perspectives. The questions are open-ended in a way that ensures guiding discussion to fulfill research objectives. The role of the researcher is to refocus the interview on the research agenda, in case the respondents steer away from the structure. However, the researcher can also spontaneously ask clarifying questions, if interesting dimensions are revealed during the process.

The interviews are recorded for transcribing purposes with the permission of the participants. Captured research material is handled confidentially and permanently deleted after publication of this study. At the beginning of the data collection process, the respondents are contacted via organizational channels. Then, the interviews are conducted in Microsoft Teams due to the large distance between the participants and the researcher. Because the interviews are handled remotely, both parties are encouraged to find a quiet space for full focus. Prior to the interviews, respondents are informed about the purpose of this study, confidential and anonymous data handling procedures, and that their participation is voluntary. The recorded interviews are transcribed shortly

after the interviews, to enable systematic analysis of the data. The interview form is designed in a way that allows for in-depth exploration of the topic and potential emerging patterns, while placing the average interview length between 30 to 60 minutes — a perfect time slot to schedule with the participants.

The data collection process lasted until thematic saturation was reached, meaning that new interviews did not yield major, unique insights. In the end, 11 semi-structured interviews were conducted with strategic, tactical, or operational respondents that were purposefully selected for this study. The average duration was 46 minutes, and the total interview material length was 8 hours and 26 minutes. The data collection phase is illustrated in Table 1.

Table 1. Interview data

Interview Number	Organizational Perspective	Participant Code	Duration
Interviewee 1	Operational	O1	32 minutes
Interviewee 2	Tactical	T1	56 minutes
Interviewee 3	Tactical	T2	37 minutes
Interviewee 4	Operational	O2	22 minutes
Interviewee 5	Operational	O3	44 minutes
Interviewee 6	Operational	O4	33 minutes
Interviewee 7	Tactical	T3	91 minutes
Interviewee 8	Operational	O5	48 minutes
Interviewee 9	Strategic	S1	47 minutes
Interviewee 10	Tactical	T4	31 minutes
Interviewee 11	Strategic	S2	65 minutes

3.3 Data analysis

As a data analysis guideline, this study utilized a reflexive thematic analysis approach. Thematic analysis is a method used to develop, analyze, and interpret patterns throughout the collected qualitative dataset. (Braun & Clarke, 2021, pp. 3–6). In addition, reflexivity manifests as a critical, self-aware reflection about the researcher role, research

practice, and processes. The analytic process can be elaborated with six steps: familiarization with the data, coding data to segments, preliminary theme generation, theme reviewing, theme finalization, and creating the report. Braun & Clarke (2021, p. 10) emphasizes that rigidly following these steps will not, by itself, lead to in-depth analysis. Instead, these phases act as general principles of thematic analysis, but they are not a strict set of rules that should be followed rigorously. In this study, while the thematization was predominantly guided by the theoretical framework (Figure 5), the data collection and analysis parts remained open to potential themes emerging from the empirical data.

After an interview, the material was immediately stored in a safe destination, and the transcribing process was initiated. After finalizing each interview transcription, the collected data was mapped using thematic analysis guidelines of Braun & Clarke (2021, pp. 3–6). This tentative data set was further processed with the foundational analysis guidelines of Corley & Gioia (2004, p. 184) that visualize the data analysis phases to the following steps: first order concepts – direct ideas from participants, second order themes – grouping of the participant ideas into sub-themes, and aggregate dimensions – highest level consisting of second order themes. The final themes, those to be converted into report-form in this study, were the results created by following the structure of Braun & Clarke (2021, pp. 3–6) to create preliminary themes. Then, these themes were enhanced further with the data structure of Corley & Gioia (2004, p. 184). In practice, this process is illustrated in Figure 6.

Aggregate Dimensions	**Product line launch**		
2nd Order Themes	**Project overview**		
1st Order Concepts	Motives Planning Kick-off Workshops Practical implications Targets achieved Phase 1 and Phase 2 Grading		
Aggregate Dimensions	**Manifestation of supply chain capabilities**		
2nd Order Themes	**Dual-site supply chain**	**Supplier management**	**Lower-order capabilities**
1st Order Concepts	Internal transfers Loaning goods Site selection Project changes Site alignment Considerations	Supplier network Supplier A outsourcing Technical documentation Procurement strategy Quality control	Digital tools Knowledge flow Organizational culture Site co-operation
Aggregate Dimensions	**Evolution of supply chain capabilities**		
2nd Order Themes	**Lessons learned – Dual-site supply chain**	**Lessons learned – Supplier management**	**Shaping the future**
1st Order Concepts	Product line management Internal transfers Unified way of working	Make-or-buy Outsourcing documentation	Site independency Future expansion

Figure 6. Structured empirical data. Adapted from Corley & Gioia (2004, p. 184).

3.4 Study integrity

The quality of research is based on the trustworthiness of the findings. (Korstjens & Moser, 2018, p. 121). In qualitative research, the dimensions of credibility, transferability, dependability, confirmability, and reflexivity must be considered, as together they evaluate the rigor and reliability of the research process. In these research dimensions, several practical approaches exist to ensure the trustworthiness of the study.

Credibility can be strengthened through prolonged engagement in the data environment, forms of data triangulation, as well as other techniques like persistent observation and

member checking. Transferability of the findings can be ensured through thick descriptions of the research context. In addition, dependability and confirmability is founded upon a comprehensive audit trail from the start to finish of a research project. Reflexivity manifests as examining the researchers' own research behavior, including assumptions, preconceptions, core values, potential biases, and how all of these may affect the qualitative research process.

In this paragraph, the qualitative study guidelines of Korstjens & Moser (2018, p. 121) are applied in practice, for the context of this study. The time slots reserved for the interviews were generous, for the participants to express themselves without time constraints. In addition, the researcher has been employed in the case company for several years, which has allowed the researcher to become proficient with the study setting. (Prolonged engagement). While the motivation for the study was based on a theoretical background, the access and prior understanding of the case created a solid foundation for the research work. (Persistent observation). The collected data was analyzed through themes and triangulated between interview participants. In addition, the data was collected from two different sites, which tests for cross-site references. (Triangulation). The research process was documented rigorously throughout the study, with the purpose that an outsider can grasp the findings effortlessly. (Thick description). Research phases were described transparently from start to finish, and the data records are stored until a set deadline. Also, the empirical findings can be traced back to the participants' original views. (Audit trail). To conclude, the researchers own conceptual lens is thoroughly discussed in the next section. (Diary).

As the researcher is employed in the supply chain department of the case company, this study involves an insider perspective. While this opportunity provides a valuable access to data, as well as the understanding of the organization's processes, culture, and people – it also comes with certain risks. The existing role in the organization can influence the research through assumptions, personal experiences, and biases, especially in data collection and interpretation phases. To address this, reflexivity was applied throughout the

study by reflecting on past organizational experiences – and how they could affect this project, maintaining critical analysis as the cornerstone of data analysis, as well as ensuring the data interpretation relied on collected data, rather than prior employment-related inputs. In contrast, the positive angle is that the prior knowledge provided support in interpreting the large amounts of data relatively swiftly and converting those into synthesized themes – as the contextual setting was clear from the beginning. (Korstjens & Moser, 2018, p. 121). To maintain transparency during this research project, the methods utilized in this study are presented in Table 2.

Table 2. Research methodology

Element	**Selection**
Research Philosophy	Interpretivism
Research Approach	Induction
Research Design	Single Case Study
Sampling Strategy	Purposive Sampling
Participant Categorization	Strategic, Tactical, Operational
Data Collection	Semi-Structured Interviews
Data Analysis	Thematic Analysis
Data Structure	Gioia Methodology Adaptation
Study Integrity	Trustworthiness Criteria's

4 Results

The results chapter is structured in three sections. The first section provides a contextual overview of the product line launch. While not directly addressing supply chain capabilities, empirical overview is essential for interpreting the following product line launch related findings. The second and third sections address the research questions explicitly, by investigating how supply chain capabilities manifest and evolve during the launch process. The text has been structured by synthesizing participant views, while adding narrative quotations from operational, tactical, or strategic-level participants.

4.1 Product line launch

4.1.1 **Project overview**

The product line launch project started in Finland with the creation of a project plan, budget, and by assembling a project team. The company already had operations in Finland, and this project was set to reconfigure the processes of an entire factory. The reasoning behind this expansion was that an adjacent production line located in Norway could not answer the call of rising demand due to already operating at a maximum capacity. Despite orchestrating a full capacity product line and possessing a valuable outsourcing partnership, the company would not have been able to match the market demand in the future. The situation was clear – expansion was required. (S1; T2; T4). Regarding project timing, the consensus among all participants was that preliminary planning of the project began in spring 2024. Then, project kick-off was held same year in fall 2024, marking the official starting date for the project. The first phase of the project was interpreted to be finalized in 2025 spring, as the company was able to start manufacturing and testing processes at the reconfigured Finnish facility – albeit at a limited capacity compared to its Norway counterpart. Finally, the first project assemblies began in fall 2025. (O1–O5; T1–T4; S1–S2). At the time of writing this, in spring 2026, the opinion of the product lines status is contradicting among the participants. The first party states that the product line is already operating at full swing, even though ongoing

development work is acknowledged. (O1; T1; T2; O4; S1; T4) The second block labels the project to still be in a developing phase. (O2; O3; O4; T3; S2).

Project completed

"Project acceptance criteria are fulfilled. Assemblies, testing, and project operations are ongoing. The ramp-up project itself is finished." (Tactical 2)

"Production ramp-up project went in schedule, budget, and set targets were achieved. We have the capability to manufacture and test products." (Strategic 1)

Development phase

"Depends on the interpretation. We have a line, but it is developing all the time, since we have new products incoming and readiness increases from layout changes." (Tactical 3)

"Both Finland and Norway production lines are still in development phase. We have issues with capacity, floor space, and the project deliveries are too tight." (Operational 4)

The product line launch project demanded a nominated project team and a manager. The effort was cross-functional, as for instance specialists from production, engineering, and procurement, as well as managers and product line executives from various functions were specifically named and connected to launch related contributions. (T1–T4; O5; S1–S2). The set financial targets were budgeting and scheduling related, while the practical aim was to ramp-up the manufacturing and testing capabilities. (T2; S1). After the project kick-off, several workshops were hosted by the project team related to practical implications. Tactical participants noted that product line launch is not as simple as just ordering components and starting assemblies, since there are many events that you cannot specifically plan for in advance. Strategic participant noted that if the foundational work is done properly, a product line launch resembles traditional project

management – while emphasizing that the demands of a project this caliber should not be downplayed. Then, operational participant elaborates that the challenges to be tackled are cross-functional, explicitly naming testing, procurement, engineering, and production dimensions. (T1–T3; S1; O5).

Workshops

"We sat at the same table and started listing tasks and things to consider. Specifically, how to handle this project." (Tactical 1)

Practical phases

"The most critical step was establishing product testing capacity at the factory. Then, to start manufacturing, we had to form a supply chain with a very quick timetable. Shortly after, we started building the first assemblies here in Finland." (Tactical 2)

"At the beginning, we limited the amount of different products Finland should manufacture, because we do not want overwhelm the new production site with a lot of unique assemblies." (Strategic 2)

As the first phase of the product line launch is completed, the company is moving to a second phase. The second phase includes moving a already established product line of a different category, into another factory in Finland. This reconfiguration enables the expansion of the new product line on the premises. The expansion will free space for additional production, testing, and warehousing needs. While the initial ramp-up was the first phase, the purpose of this second phase is to increase volumes the company can produce. (T2; T3; S1; S2).

Future of the product line

"In the long run, we are pursuing to have a similar capacity in Finland, that we already have in Norway." (Strategic 1)

> “Finland operations say that they are ready for new challenges or kind of expand. I am going to call for a meeting to discuss further increase in scope for Finland.” (Strategic 2)

As an historical insight, similar products have been manufactured previously in Finland during late 2000’s and early 2010’s. There are just a few assemblers still working in the company that have gathered experience from this era. The operational participant first brought this insight to light, while the strategic participant noted that the knowledge provided by these employees has been valuable, as the products have similarities. (O3; S1).

> **Former manufacturing talent**
> “We still have few employees, who were working in the 2000-2010s when we made hundreds of similar products a year.” (Strategic 1)

By the end of the interviews, each participant was requested to grade the planning and implementation phases of the product line launch project. (1 = lowest, 5 = highest). The collected grades are presented in Table 3. While the primary data was collected by qualitative means, numerical grading offers subtle addition to the depth of the data analysis.

Table 3. Planning–Implementation grading

Participant Code	Planning	Implementation	Planning-Implementation	Sample Size
O1	4.00	4.00	0.00	n = 1
T1	3.00	4.00	-1.00	n = 1
T2	2.50	4.00	-1.50	n = 1
O2	3.00	3.00	0.00	n = 1
O3	3.00	3.00	0.00	n = 1
O4	3.00	3.00	0.00	n = 1
T3	3.00	3.50	-0.50	n = 1
O5	3.00	4.50	-1.50	n = 1
S1	4.00	3.50	0.50	n = 1
T4	3.00	4.00	-1.00	n = 1
S2	2.00	3.00	-1.00	n = 1
Categorical Analysis				
Total average	3.05	3.59	-0.55	n = 11
Operational average	3.20	3.50	-0.30	n = 5
Tactical average	2.88	3.88	-1.00	n = 4
Strategic average	3.00	3.25	-0.25	n = 2
Total low	2.00	3.00	-1.00	n = 11
Total high	4.00	4.50	-0.50	n = 11

Overall, across all participants, the implementation phase was rated higher compared to the planning phase, with a gap of -0.55. This suggests that the organization executed the project better than it was planned. The spread between the low/high grades issued were substantial, as planning had a spread of 2.00 – 4.00, while implementations spread was 3.00 – 4.50. This mirrors the organizational split mentioned before, as certain participants interpret the project to still be in a development phase, while others were confident that the product line is in full swing. Operational level shows a modest gap of -0.30, suggesting that the frontline felt both phases to be somewhat aligned. The two strategic participants carry a gap of -0.25, which must be interpreted further. S1 rated the phases as 4.00 and 3.50, while S2 gave a grade of 2.00 and 3.00, indicating that the process between the strategic participants was perceived differently. The number of strategic participants (n = 2) was relatively limited, which means that these findings should be considered as descriptive individual opinions, rather than the general view of all strategic employees. Emerging limitation across participants was that the line between planning

and implementation phases was somewhat unclear, as the stages tended to merge into each other in practical execution. (O1–O5; T1–T4; S1–S2).

The most valuable finding is that the tactical level felt the greatest difference between the planning and implementation phases with a gap of -1.00. In terms of grading, the middle managers were the most critical in interpreting how the project was planned, compared to the execution. The lowest and highest tactical ratings were 2.50/3.00 for planning and 3.50/4.00 for implementation. This may suggest that the tactical participants felt a certain weight in coordinating strategic decision-making into operational reality. (T1–T4).

Project evaluation

"There's always space for development and some questions that we can't figure out until it happens. It's also a learning phase for us." (Operational 2)

"The beginning of the project was intense, and we were unable to think all scenarios through. However, people have worked hard for this even though there have been own role-specific tasks to do, in addition to this project." (Tactical 2)

"It's quite complex what we're trying to do, and sometimes it feels like we're building the runway strip for a plane already taking off." (Strategic 2)

Analytical insights

As the literature review indicates, 57-60% of ramp-ups fail to meet technical and economical targets. In that sense, the case organization has succeeded competently, as the product line itself has launched and the firm ponders future reconfiguration efforts. The quantitative findings (Table 3) indicate differences between the operational, tactical, and strategic levels. The most statistically significant finding was that in an engineering-to-order, dual-site manufacturing environment, the tactical level felt the most burden when implementing strategy into operational execution. In the capability framework, these

findings connect to lower-order capabilities, specifically the human and organizational resources that are prerequisite for higher-order capabilities to emerge.

4.2 Manifestation of supply chain capabilities

The purpose of this section is to assess how supply chain capabilities, and relevant lower-order capabilities manifest during a product line launch. The identified themes are dual-site supply chain, supplier management, and lower-order capabilities. The first two directly address research question 1, while lower-order capabilities act as the building blocks of these higher-order capabilities. This logic is illustrated in Figure 5. (Theoretical framework).

4.2.1 **Dual-site supply chain**

Internal material transfers between the product lines of Finland and Norway were discussed by every participant, no matter their role or organizational perspective, leading it to become one of the most richly developed themes emerging from the data. (O1–O5; T1–T4; S1–S2).

Operational level describes that as the deliverables made across the two product lines are equal, the company has components available in both locations. This enables the borrowing of items between site stocks, especially those with long lead times that are difficult to source locally. The ability to ship the parts between stocks increases flexibility of the supply chain. One identified challenge related to internal transfers is project scheduling, that converts to efforts required in the operational level on various dimensions. (O1–O5).

Tactical participants continue with a practical example, that if a project in Norway is dependent on an assembly that is manufactured in Finland, it is essential for the delivery information to flow seamlessly between sites – especially if the delivery dates change. This internal transfer setup was a major new change, requiring cash and material flow

between sites, as well as efforts in purchasing and sales order dimensions, supported by tailored digital tools. (T1–T4).

Strategic participants discuss that an equal product, and unified organizational goals, makes co-operation between the two sites more convenient. The components, manufactured assemblies and ready products are shipped between the two countries, meaning that the co-operation must be planned well. (S1–S2).

> **Norway - Finland operations**
> "These assemblies that were built in Finland, and we need to transfer to Norway. It was planned good, but we have some delays in the delivery of those last year." (Operational 2)
>
> "We are exchanging assemblies. We are making some and sending to Finland. Finland is making some and sending to us. We do them independently, but in a common production schedule between the sites." (Tactical 4)
>
> "Component deliveries to two different factories, just in time, has demanded a lot of co-operation between the sites." (Strategic 1)

As this theme has been discussed extensively across all participants, there are multiple perspectives, including solutions, challenges and general discussion about the workability of the two sites located in Finland and Norway. (O1–O5; T1–T4; S1–S2).

Operational participants elaborate that the co-operation between the sites has generally been effective. For instance, the material has been moving well, and extreme scenarios such as production stoppages due to material unavailability have been rare if not nonexistent. Also, loaning components between sites has reduced since the launch, but this backup option is wise to keep. However, the assemblies that are sent between the sites require a notable amount of practical work related to logistics, such as packing, shipping,

installations, and quality control. Sudden changes, such as the production place changing from Finland to Norway manifests immediately on the operational level. As a practical example, a certain project was planned to be manufactured in Finland, but it was decided to be assembled in Norway instead due to identified capacity challenges in the newly established line. This event triggered certain time-sensitive logistical transfers between the locations. However, this resource-intense example has not occurred again. As a vital consideration to this configuration, the goods movement inside the European Union is relatively free, while Norwegian export and import shipments always require customs clearance. This particularly impacts a supply chain that operates between Finland and Norway. (O1–O5).

Tactical participants discuss that the firm operates a supplier-customer relationship between the two sites, meaning that Finland acts as both the customer and a supplier for the Norwegian factory, and vice versa. Overall, the two sides need to be aligned in separate countries, which can be difficult due to the long-distance connection between the sites. Development work and strategy regarding this seem to still be under evaluation, to improve the existing setup. Additionally, they ponder if it is cost-efficient to manufacture these assemblies between countries, after the costs associated with internal transfers are added to the equation. (T1–T4).

Strategic participants note that as certain purchased components have a long lead time, planning well in advance is a must. The procurement in the company tends to follow order forecasts that aid in placing material orders. With component delivery times the company has experienced challenges, and dividing the material stock efficiently between Finland and Norway sites is a demanding task. One view is that despite having quality control on both sites, the quality has not always been as expected. (S1–S2).

Dual-site implications

> “The supply chain is very vulnerable, and things tend to pack to the end of the chain, which is production and testing.” (Operational 5)

> "Sometimes dividing the project phases between the two sites has brought its own challenges. Assembly at one site and then testing and finalization at another location." (Tactical 2)

> "They need to order 15 pieces of something, and X amount should go there (to Norway) and Y amount should go there (to Finland). I think it's quite impressive how they manage to get materials to us sometimes." (Strategic 2)

Analytical insights

The ad hoc material transfers and production location shifts demand agility from different supply chain players. These findings suggest reactive, damage control style of approach that will be eventually mitigated, when the adaptability and lower-order capabilities of the firm presumably develop. In addition to agility, the data indicates resilience as a secondary capability. An organization equipped with weaker resiliency could crumble under these circumstances, but instead, critical issues have been avoided even when faced with challenges like production location shifts.

4.2.2 **Supplier management**

The findings of this theme are primarily related to the supplier network of the company and outsourcing related processes. Most of the participants contributed to this theme, due to their direct involvement with the supplier base, or by sharing indirect procurement-related experience within the organization. The depth of data is relatively rich for this section as well, especially among participants with direct supplier management responsibilities. (O1; O3; O5; T1; T2; T3; T4; S1; S2).

Operational participants discuss that not every supplier that works with the Norwegian part of the chain can deliver goods to Finland as well. There have been several incidents like this, as local suppliers from Finland had to be sourced instead of relying on long-term partnerships. Anyhow, the legacy supplier network built for the Norwegian product line

is seen as a significant advantage for the new product line, as starting from scratch is perceived to be a more challenging obstacle. However, forming new supply agreements in Finland comes with its own benefits such as reduced physical distance. As an additional insight, relying on only one supplier is risky, so the goal is to maintain at least two supply partnerships if feasible. Finally, the supplier cluster that is located close to the product line of Finland is deemed valuable for the supply chain. (O1; O3; O5).

Supplier cluster

"Pretty easily you could walk a kilometer to the neighbor and go see what the items look like before they are shipped or arrive." (Operational 1)

"Not every existing Norway supplier can deliver to Finland and then we must find a local dealer." (Operational 3)

Tactical participants primarily discuss supplier management by reflecting the outsourcing procedures with Supplier X. Component sourcing from Supplier X has been vital for the product line, as they manufacture key assemblies for the products in Finland. The procurement spend (€) for this supplier contributes to a major share of the total product line component expenses. One root challenge for the supplier has been to fulfill the order demands for both Finnish and Norwegian factories, leading to dissatisfactory delivery performance at times. Multiple reasons behind this can be identified. Instead of solely criticizing the supplier, the case company's outsourcing documentation (technical drawings, assembly instructions) has been deficient especially during early stages of the ramp-up. Then, the speed of the ramp-up and demand for quality assemblies was high already at the beginning of the relationship, leaving little time for the supplier to orientate themselves with the products. Supplier X was perhaps surprised by the high demand and volumes. However, Supplier X failed to proactively communicate the issues with the case company. All these manifested operationally as late deliveries and quality control issues that caused issues along the supply chain. Luckily, after a few crisis meetings and mutual co-operation, the performance with Supplier X has been managed to turn around.

Supplier X remains to be one of the most valuable partnerships for the firm and a critical component supplier for the product line. While the participants primarily discussed this topic through the lens of Supplier X, there were subtle mentions of similar patterns with management of other suppliers too, especially during early stages of the product line launch. To conclude, one participant interprets the Supplier X outsourcing ramp-up as the third product line of the case firm, as the supplier ramp-up has been almost parallel with the launch of the new product line in Finland. (T1–T4).

Supplier X

"Outsourcing the first prototype assemblies that include hundreds of components were work heavy. We misjudged that the supplier knows how to do these assemblies, if we can too. But we need to consider that suppliers start production while possessing zero prior experience with the products." (Tactical 1)

"Our design was not suitable for outsourcing. But also, the supplier did not have the know-how that we thought they would have. To add, the supplier volume is high when delivering for two factories simultaneously. Corrective steps: we will prototype an improved design at our facility and then start the outsourcing again." (Tactical 3)

"It was parallel consulting, with questions from product line Finland, and questions from supplier X related to the assemblies." (Tactical 4)

Strategic participants note that in addition to the product line launch, outsourcing to Supplier X was one action to raise capacity. Outsourcing production to either Supplier X or to the product line of Finland follows a similar process. If you expand to Finland, you need a certain level of different drawings, descriptions, or assembly procedures. If you outsource them to Supplier X, the document package needs to be comprehensive as well. The first prototypes demanded a lot of work with the suppliers, and there have been

quality control issues along the way too. The key takeaway is that the products are made with co-operation now, and in the future, which every party should realize. (S1–S2).

Outsourcing process

"There needs to be a checklist, what is needed, what is the requirement for someone else to produce this?" (Strategic 2)

Analytical insights

The supplier-customer relationship between the case company and Supplier X has certainly demanded managerial effort and resilience from both parties. The identified obstacles with the outsourcing process, like the level of technical documentation, have demanded adjustments during the manufacturing process. In a broader view, this is an example of engineering-to-order industry, where order fulfillment requires significant engineering work, before, during, and after the process. In that sense, the organization's behavior is common, and the issues are relatively predictable especially during early stages of the ramp-up. In addition, the learning curve effects will presumably smoothen out this supplier-customer relationship in the future.

4.2.3 Lower-order capabilities

The lower-order capabilities that affect either the manifestation or evolution of supply chain capabilities are presented in this section. Like the preceding empirical findings, relevant data was available from each organizational perspective. In the broad view, these findings offer insights related to the hierarchical structure of the higher-order capabilities, which demands a condensed presentation of this topic. (O1–O5; T1–T4; S1–S2).

Several digital tools, like ERP and PowerBI are utilized in all operations. The product structures created or in other words, the bill of materials (BoM) are the triggers of purchasing demand. The reports created in PowerBI seem valuable, but changes in those (e.g. new reports) require learning effort from the users. Currently, the digital tools used

in Finland and Norway site considerably differ from each other, creating confusion among the operational participants. (O1; O3; O5). Tactical participants discuss that the separate IT tools between Finland and Norway seem to make processes stiffer. Differing production planning systems between the sites is a complicated factor. One product assembly may have 300 different components that need to be appropriately listed in the supply chain systems. Additionally, the current tools are unable to provide reliable reports related to cost structures – for instance. The original cause behind this is that the Finnish and Norwegian organizations have used differing digital tools since the beginning, and the creation of identical tools at this stage is challenging. Regarding the product line launch, the purchasing tool for the purposes of that project was created from scratch during the ramp-up. (T1; T2; T3). Strategic participants confirm these findings by discussing that the ERP processes differ between sites, that have created challenges in topics like scheduling. For instance, Norway-site utilizes Project Online in planning – a tool that is not used in Finland. One participant emphasizes that the differing tools are likely stressful for sourcing and purchasing. However, late deliveries do not always impact the production pipeline, because of set buffer times on the material deliveries. (S1–S2).

Digital systems

> "The Finnish purchasing tool is separated compared to the Norwegian system. From a purchasing point of view, we must learn to use two different tools." (Operational 1)

> "The Finnish purchasing tool was planned and created from zero. In that sense, the performance is good." (Tactical 1)

> "Challenge for sourcing and purchasing is that there are different tools within the material flow. It's black magic what these purchasers are doing." (Strategic 2)

As a minor finding, operational participant interprets the work culture between Finland and Norway to be relatively similar, appearing as a desire to quickly handle emerging

situations. Another participant points out that there are differences. For instance, Finnish assemblers prefer written instructions, while Norwegian assemblers operate with open-ended 3D –models in the manufacturing. Regarding communication, a tactical participant states that Norwegian personnel like to discuss and solve problems that way, while Finnish employees are agenda-driven, pursuing to achieve certain goals and then moving on. (O1; O4; T3).

Operational participants note that cross-functional meetings have been the enabler of information flow between sites. The ongoing communication between the teams has been on a proficient level. Employee visits between sites have contributed to the flow of knowledge and enabled the training of key individuals. (O1–O5). Tactical participants confirm the advantages of cross-functional meetings, namely manufacturing, and production planning related sessions. In addition to these meetings, unified organizational targets are set within the two product lines. Regarding the start of the project, workshop events between functions were arranged. About the cross-site support, the assistance from Norway has been essential for the product line launch. Likewise, the cross-site orientation sessions in Norway for production personnel from Finland contributed significantly to the beginning of the ramp-up in Finland. (T1–T4). Strategic participants discuss that unified goals and products aid in cross-functional communication. For instance, production planning has been made in collaboration between the sites. Another practical action is the common daily meeting between the product lines. If there are changes to the project plans, due to the company, or customer, or for any reason, the later the plans change, more challenges may arise in production. Because then they must modify almost-ready products. (S1–S2).

Cross-site visits

"When I was visiting the Finnish site, we looked at the production and the material flow, and how they organize things. I gave them my opinion about how we organize things in Norway." (Operational 4)

> "The visit to Norway was eye-opening. It has made the work easier, after seeing how they run the production processes. Now I can check with a fresh perspective that what we could improve, or what is already working well here in Finland." (Operational 5)

Analytical insights

In terms of connecting these findings to the broader overview, the logic is clear. Lower-order capabilities like the differing digital tools, and flow of the knowledge act as hierarchical antecedents to the manifestation of higher-order capabilities. The IT tools can cause various issues that impact the material flow of the organization, triggering resilience and agility capabilities. Theoretically, this logic could work both ways, meaning that enhanced digital tools could appear as increased levels of adaptability, rather than agility or resilience.

4.3 Evolution of supply chain capabilities

Capability evolution evidently requires the manifestation of supply chain capabilities. This logic is illustrated in Figure 5. (Theoretical framework). Therefore, this section is based on the preceding chapters, including the lessons learned about the themes of dual-site supply chain, supplier management, and an emerging theme of shaping the future. This section directly addresses research question 2.

4.3.1 **Lessons learned – Dual-site supply chain**

Operational participant emphasizes that even a small mistake in one project may affect all the following projects in the delivery pipeline. If the production is not directly affected, then the testing capacity will suffer. After this, production plan needs to be reorganized, and the customer as well as other relevant stakeholders need to be informed. About the ramp-up itself, a broad strategic picture must be clear, because if there are any uncertainties, then the execution can be inefficient. Perhaps now, they have been stuck on certain matters because they have not been 100% clear about the direction. Additionally,

human resources should be allocated generously to a project of this scale, so the things can be done properly, the first time they are done. (O5). One important topic is training, the personnel who start manufacturing should go to other sites to learn about ongoing projects. Also, the possibility of cross-site visits should be prioritized. In addition, there should be a dedicated employee, who keeps the internal transfers of Norway and Finland under control. The participant also ponders if the internal transfers are worth it cost and resource-wise, as the shipping includes multiple phases like packing, sending, unpacking, quality control, installation and so forth. (O4). The decision for a product line launch may seem convenient, but the organization also needs to consider what the effects are on the whole chain. (O3). Finally, making flexibility the core value of supply chain work is important. (O2).

Tactical participant notes that more effort should be put into cross-site visits, especially for production employees, because it will make the ramp-up phase in a new site significantly easier. (T4). The organization should be able to sense different bottlenecks, as well as realize the importance of cross-functional collaboration. The supply chain related data, including forecasts, bill of materials, quantities for instance must be correct. As an organization, the firm is exceptionally agile and flexible, and they are the core values. (T3). About the product line launch project, there should be a clear plan that how much worktime and resources can be allocated to this project. This would reduce the mixing of routine responsibilities and launch related tasks. (T2). In addition to the resource-intensive internal logistics transfers of Norway and Finland, the domestic transfers seem to resemble that process cost-wise. As the product line in Finland is reconfigured, it has also triggered a need for domestic shipping between the sites in Finland. (T1).

Strategic participant continues that not having unified digital tools between the Finland and Norway may have been a mistake. However, the decision at the time was made due to a time constraint and now, the plan to merge the tools is prioritized. As another topic, the internal transfers between the two sites are currently creating waste. For instance, quality control is currently done at both ends, in the sender and receiver phases. This

should be reduced to just one quality control step. In addition, transportation between the sites is an obvious form of waste. (S2). The product line human resources are followed closely by the management team. In hindsight, even more employees should have been hired across the board to secure talent for the various projects. However, this demands balance between the anticipated growth and the actual production volumes. (S1).

As a unique finding, several participants mentioned an ERP implementation project in the case organization. The new ERP may automatize and develop certain processes such as production plans, while most importantly unifying the way of working between the sites. The old ERP may have been one root cause for the differing digital tools between the sites. Certain participants mention the ERP project to still be in an early phase, and that proper adaptation will require time. (O3; T2; T3; S2).

As illustrated in the preceding discussion, the lessons learned are relatively scattered across individual points of view. Despite this, certain unified matters can be drawn from the data that strengthens the arguments. The lessons learned related to the dual-site supply chain setup are the following:

- Human resource allocation (O5; T2; S1)
- Cross-site employee visits (O4; T4)
- Internal logistics transfers (O4; T1; S2)
- Strategic launch direction (O5; O3; T2)
- Supply chain agility and flexibility (O2; T3)
- Digital tools: ERP implementation project (O3; T2; T3; S2)

Analytical insights

The findings of this section are relatively scattered, presenting individual role-specific views rather than common causes. However, certain remarks can be drawn from this data. The participants are aware of the challenges associated with the dual-site setup. For instance, the waste generated by the internal transfers of the sites is recognized and to be assessed in the future. In addition, the strategic direction and resource allocation sparked discussion among the organizational levels. Finally, the root cause issues related to the digital tools can be potentially addressed with the upcoming ERP implementation project.

4.3.2 **Lessons learned – Supplier management**

Operational participant opens the discussion with make-or-buy decisions. Currently there are situations where certain project components are outsourced from Supplier X, or from other suppliers, for a single project. Then, the components are decided to be made in-house for another project. The participant requests for a clearer direction with these processes. As another note, the technical documentation for outsourcing purposes has been lacking. As an additional consideration to supplier management, there should be at least two suppliers for critical components. (O3). Another participant confirms the documentation finding by stating that the designs have the tendency to change, and it requires effort to stay on top of the situation, that what needs to be purchased. In addition to the lacking assembly instructions, and technical drawings, the packing instructions for the purchased goods has been limited as well, resulting in one-time quality control issues. (O1).

> **Operational view**
>
> "What we produce in-house, and what arrives as outsourced assemblies must be defined clearly". (Operational 3)

Tactical participant discusses that the experiences, ideas, and everything needs to be shared, for the products to be as equal as possible, not dependent on the delivery

location. (T4). Another participant agrees that the products must be unified between the manufacturing sites. Whoever operates the product line, whether it is Norway, Finland, or Supplier X, the quality needs to be the same. The implications to be considered are broad: every step in the manufacturing, technical documentation and packing instructions – for example. (T3). Another participant points out that supplier selection is a topic that will be examined closely in the future. Specifically, the outsourcing process and planning of the process must be organized in the sense that the supplier quality and the manufacturing competences are mapped carefully. Additionally, the level of technical documentation must be high before planning to outsource assemblies. The participant concludes that challenges in the supplier network often manifest as quality control issues. (T2). The discussion with a third participant is aligned, as they note that the outsourcing process was not planned properly. The issue was lacking assembly instructions, and that the process was planned based on assumptions. Specifically, the company expected that, for instance, Supplier X has the competence required for production of complex assemblies. However, to defend the supplier, they are starting the production from scratch, while the case firm possesses a set of foundational experiences that supports in the ramp-up phase. (T1).

Tactical view

"As the first statement we need to share experience all the way, need to share ideas, need to share everything, to make this product as equal as possible, not dependent on where it's delivered from". (Tactical 4)

The strategic level discusses the same principles, as the operational and tactical participants. The maturity of the product documentation must be at an acceptable level, before outsourcing it. If you ramp-up a new product line, you need a certain level of technical documentation. However, if you are going to outsource to a third party like Supplier X, the documentation demands an even higher level of accuracy and descriptions. If these assemblies are outsourced again, somewhere far away, the document package must be even clearer than what we have now. (S2). Another participant adds that the technical

documentation, including the shop floor assembly instructions and the bill of materials has not yet been as comprehensive as we would have liked for Finland. If we would outsource these again, the documentation and instructions must be properly made, as it will make the process significantly more manageable. (S1).

> **Strategic view**
>
> **"**Maturity of the development, I would call it. The level of that maturity boils down to all these different drawings, descriptions, and assembly procedures. There needs to be a checklist, what is needed, what is the requirement for someone else to produce this. And we didn't evaluate that at all." (Strategic 2).

This section was clearly aligned between individual participants as well as the organizational levels. What stands out is that all three organizational levels are discussing around the same core topics, yet from different organizational perspectives. This level of triangulation is the most consistent across the entirety of the results chapter, marking the significance of these findings. The lessons learned related to supplier management are the following:

- Outsourcing process and the maturity of technical documentation (O3; O1; T4; T3; T2; T1; S2; S1)

Analytical insights

This section is the most triangulated finding of this study, as it is discussed by 8 out of 11 participants. Addressing the root cause of the Supplier X saga, the case organization has to an extent recognized the issues to focus on, based on this data. The lower-order capabilities, or in practical terms, the level of outsourcing documentation seem to dictate the quality of the supplier relationship. This learning event with the Supplier X should not be viewed only in a negative light, as the breakthroughs made here form a solid foundation for future outsourcing processes in this particularly challenging engineering-to-order environment.

4.3.3 Shaping the future

Operational participants bring to light the concept of site independency. Instead of a dual-site supply chain, the factories could build what is needed themselves. This kind of self-sufficiency would mean that the Finnish factory would produce assemblies for their own purposes, and the Norwegian factory would manufacture products for their own demands. As an advantage, this would eliminate the need for internal logistics transfers between sites. (O5; O4). The tactical participants confirm that the discussion about site independency is ongoing. The strength with this setup would be that there would be savings in the internal transfer dimensions, and the planning would be easier. The risk is that there could be differences in the production quality of the sites, which means that proper control of these matters must be established also in the future. Like in the supplier management section, the product quality must be aligned between the sites, no matter where it is physically made. One participant adds that moving to this setup would require a certain transition period, during which the capabilities of the Finnish site would be developed further. (T4; T3; T2). Strategic participants confirm these findings by discussing that perhaps each site could manage its own assemblies, which would reduce wasteful time, processes and shipping between the sites. For this to work, the sites must have a seamless inventory control, and the high inventory values would possess its own risks. However, this topic is under constant surveillance by the management team, and there are multiple opinions on this. Instead, if they would continue with the dual-site supply chain setup, the current methods including the internal logistics transfers should be honed. The strength of the current setup is that the company can effectively use its outsourcing possibilities and then divide the inventory between the sites. (S2; S1).

> **Site independency**
>
> "We have thought of the idea that the factories would produce their own needs for the standard production. This would reduce the internal transfers between the sites." (Operational 5)

> "We would have to practice and design the assemblies that we would manufacture here in Finland. Then at some point there would be a cut-off time, and we would not order the ready assemblies from Norway anymore." (Tactical 2)

> "We do not have a ready answer yet, as there are multiple opinions on this. If we would move to a site independency model, then it would of course reduce logistics and customs related matters. However, it can also lead us to having too high inventory levels between the two sites, which would not be viable economically." (Strategic 1)

The participants were asked that what should be done differently, if a similar expansion, such as a product line, or a completely new factory in Finland would be ramped up. For a single question, this proved to be valuable for collecting future-oriented insights from the participants. As a unique insight, two participants mention that this thesis should serve as a foundational lesson learned for a project this caliber. (T4; S2).

> **Thesis impact**
> "Your thesis should be the starting point. I guess you have got a lot of different answers from the different people you have interviewed. And so, this should be the kind of lessons learned, right?" (Tactical 4)

> "I think it's really good that you kind of have this (thesis), like these are good questions and kind of hopefully we could use this for something valuable also, to do some changes on how we are working." (Strategic 2)

As a fruitful insight that was collected from the highest organizational level, both strategic participants speculate about a future expansion to Country Y. The participants label the expansion as a high-potential idea, to be evaluated in the future. For success, the documentation, including the assembly instructions and bill of materials must be correct right from the beginning. In Country Y, operating without proper instructions will be

difficult, and thus the foundational work especially related to documentation would have to be prioritized. To conclude, with a broader lens, everything that the organization has learned throughout the product line launch will support the company in the future. (S2; S1).

Future expansion

"These are really valuable lessons of what we have been through now these years. Whether it is expanding the scope in Finland or if it is to actually start production in Country Y at some point. We are learning, and for the time being it's important to kind of try to get the bird's eye view on these things". (Strategic 2)

"Everything that we did in Finland will serve us in the future, especially regarding the potential of Country Y". (Strategic 1)

Analytical insights

The preceding sections have analyzed the past and present, while this chapter focuses on future speculation. This setting is fruitful in terms of gathering a collective understanding of the firm's future. In the capability framework, the site independency and expansion initiatives are placed to the adaptability dimension, as they indicate long-term supply chain reconfiguration. It is evident that the previous findings of this study, and the presumed capability evolution aid in matching the demands of these upcoming supply chain reconfiguration efforts. Specifically, the site independency can mitigate the level of agility and resilience required in the daily operations. Then, the Country Y expansion strategy can be founded upon the cumulative lessons learned of this product line launch project.

Table 4. Results: A Dual-Site Case Study

Empirical Finding	**Capability Dimension**	**Theoretical Connection**
1. Tactical Planning-Implementation gap	Lower-order capability	Padrón Hinrichs et al. (2026); Surbier et al. (2024); Brusset & Teller (2017); (Schmidt & Wilhelm, 2000)
2. Internal material transfers	Agility	Aslam et al. (2023); Lee (2004)
3. Shift of production location	Agility, Resilience	Aslam et al. (2023); Brusset & Teller (2017); Lee (2004); Ponomarov & Holcomb (2009)
4. Supplier X management	Resilience	Brusset & Teller (2017); Scholten et al. (2019); Ponomarov & Holcomb (2009); Fatouh & Rego (2023)
5. Legacy supplier network from Norway	Resilience	Legg et al. (2025); Ponomarov & Holcomb (2009)
6. Differing digital tools between sites	Lower-order capability	Bhatia et al. (2024); Brusset & Teller (2017)
7. Cross-site visits and knowledge flow	Lower-order capability	Zollo & Winter (2002); Argote et al. (2021); Brusset & Teller (2017)
8. The level of outsourcing documentation	Lower-order capability	Ambulkar et al. (2022); Bhatia et al. (2024)
9. Site independency **(speculative)**	Adaptability **(inactive)**	Helfat & Peteraf (2003); Aslam et al. (2023); Teece (2007)
10. Country Y expansion **(speculative)**	Adaptability **(inactive)**	Helfat & Peteraf (2003); Aslam et al. (2023); Teece (2007)
Finding Description		
1. Tactical participants rated implementation consistently higher than planning, revealing middle-management burden during the ramp-up. (Gap of -1.00).		
2. Cross-border material flow and reactive logistics between Finland and Norway demonstrates short-term supply chain flexibility under time constraints.		
3. Sudden project relocation from Finland to Norway triggered a rapid cross-border material flow, testing the flexibility of the case company.		
4. Inadequate results with Supplier X were resolved through collaboration, leading to improved supplier performance. Strong reflection about the root causes.		
5. The inherited Norwegian supplier network provided a procurement buffer for the product line launch in Finland, while local suppliers were sourced simultaneously.		
6. Diverging digital tools (ERP, planning systems, purchasing tools) between the sites created friction related to higher-order supply chain capability performance.		
7. Short-term personnel exchanges between the Norway and Finland sites served as a deliberate employee development opportunity.		
8. Insufficient technical documentation manifested as various operational issues. Documentation maturity is this study's most triangulated finding across all organizational perspectives.		
9. Emerging discussions about site independency represent a future reconfiguration possibility. Active implementation is not yet ongoing.		
10. Strategic-level speculation about a Country Y expansion signals intent to replicate accumulated knowledge in a new geographic location. Active implementation is not yet ongoing.		

5 Discussion

This study set out to examine how supply chain capabilities manifest and evolve during a product line launch, drawing on the dynamic capability theory (Teece, 2007), the capability lifecycle model (Helfat & Peteraf, 2003), and operational manifestation of agility, adaptability, and resilience (Aslam et al., 2023; Brusset & Teller, 2017) as the core theoretical foundations. The findings largely confirm the existing propositions of the theoretical framework, while emerging concepts have sparked from the empirical data. The case study was based on a dual-site supply chain environment located in both Finland and Norway. Finland operated a new, developing product line, while key support was available from the already established site of Norway. The 11 interview participants represented both countries and were categorized into either operational (n = 5), tactical (n = 4), or strategic levels (n = 2). In addition, the role of Supplier X has been major during the events of the case study. Certain participants even interpret the operations located at the suppliers' premises as a third, adjacent product line of the company. Several key contributions emerge from the data: the vital role of lower-order capabilities, the interplay of agility and resilience during the ramp-up, the temporal lag of adaptability during launch, and the perceived planning-implementation gap of tactical participants. The findings are synthesized in Table 4.

Significance of lower-order capabilities

The most consistently triangulated finding across all organizational levels concerns the level of outsourcing documentation (Finding 8) – namely the technical drawings, assembly instructions, and bill of materials that are the prerequisite for adequate launch supply chain performance. In addition, the differing planning system, purchasing tools, and ERP implications (Finding 6) between the two sites was a theme emphasized by majority of the participants. While these topics were framed under the lower-order capability umbrella during the literature review, it was not yet evident during the literature review phase, that how essential the various forms of engineering related data are in fact for operational performance. These findings connect directly to the hierarchical relationship between the lower-order and higher-order capabilities presented by Brusset & Teller

(2017) and elaborated further by Bhatia et al. (2024). The literature suggests that the lower-order capabilities of organizational, technological, human, financial, and physical resources generate higher-order capabilities of agility, adaptability, and resilience, which this study captures in practical settings. The contribution here is that instead of a linear lower-higher model, the technical documentation deficiency was not contained to the lower-order level. Instead, the lower-order capability challenges manifested operationally as delivery complications, quality control issues with Supplier X, strangled the agility of the dual-site supply chain, and demanded significant resilience from the organization. The impacts were identified across operational, tactical, and strategic levels, suggesting that in a product line launch setting, the foundational readiness of lower-order resources determine the capability skill ceiling of higher-order capabilities. This logic suggests that organizations who enter the ramp-up phase with lacking lower-order capabilities are likely to spend a share of valuable resources on agility and resilience related recovery dimensions, instead of allocating the efforts to proactive opportunity seizing, as drawn in the sensing-seizing-reconfiguring framework. (Teece, 2007). The key takeaway is that these lower-order capabilities, like the differing digital systems that may have been valuable in the past, have accidentally converted into core rigidities during the product line launch – practically elaborated as sets of inappropriate knowledge that actively create issues. (Leonard-Barton, 1992).

Interconnected nature of agility and resilience

The empirical findings further confirm the interplay of supply chain agility, and resilience, which is consistent with the theoretical contribution of Legg et al. (2025), who argue that supply chain agility functions as a strong enabler of resilience. In the empirical section, the two capabilities were inseparable during the ramp-up. In fact, the dimensions were merged as such, that labeling certain findings as both agility and resilience would be relatively rational. To illustrate, the dual-site supply chain demanded continuous short-term responsiveness – manifesting as reactive international logistics, cross-border stock borrowing, and rapid production site reallocation (Finding 2 and 3) that all are characteristics of supply chain agility. (Aslam et al., 2023; Lee, 2004). Then, the Supplier X arc

(Finding 4), presenting a story about quality and delivery time challenges to crisis collaboration and eventual recovery, which highlights the resilience required from both the case organization and Supplier X. (Brusset & Teller, 2017; Ponomarov & Holcomb, 2009). As mentioned in the literature review, managing suppliers' R&D is a complex scenario, and managers should evaluate make-or-buy decisions carefully, "to prevent a crisis". (Ambulkar et al., 2022). Notably, the data suggests that a crisis was truly avoided thanks to the resilience and agility efforts. In addition, the legacy supplier network of Norway provided buffer for the supplier network of Finland to reconfigure itself. (Finding 5). The data indeed confirms that the two capabilities are not exercised sequentially (Legg et al., 2025), in neat succession. Instead, the culture of flexibility and responsiveness described by participants across organizational perspectives enables the firm to react to supplier disruptions before they cause further damage along the supply chain. In this context, agility acts as a safety mechanism before the organization must fully rely on resiliency efforts, which materializes as the interplay of these two higher-order capabilities. As an additional building block of organizational flexibility and responsiveness, the employee cross-site visits and knowledge transfer between Finland and Norway sites (Finding 7) functioned as deliberate organizational learning mechanisms that supported in creating operational familiarity which is essential for both rapid response (agility) and recovery dimensions (resilience). (Zollo & Winter, 2002). Finally, the learning curve of Argote et al. (2021) in production ramp-up contexts are empirically observable in this study. The findings indicate that these cross-site exchanges accelerated capability development on the Finnish site at both process and human resources dimensions, in a way that static on-site training perhaps would not have achieved.

The role of adaptability

In contrast to the empirical richness of agility and resilience, adaptability remains at a developmental stage in the dual-site setting. Adaptability –the long-term reconfiguration of supply chain structure in response to sensed market shifts describes a capability that demands organizational stability and strategic clarity that the ramp-up phase has not yet provided. (Aslam et al. 2023; Lee, 2004). The emerging discussion about site

independency across all organizational levels (Finding 9) and strategic-level expansion initiatives to Country Y (Finding 10) are fruitful additions to the empirical study and strengthen the future direction of the company. However, in theory, as these reconfigurations have not yet been executed, it signals that the organization is in the sensing phase of the dynamic capability framework, actively scanning for the structural adjustments that best serves its long-term interests. (Teece, 2007). When mapped to the capability lifecycle model of Helfat and Peteraf (2003), the firm's higher-order capabilities appear to be transitioning from a development phase towards maturity, with various available growth or decline branch paths. (Figure 4 and Figure 5). Namely, the findings indicate a growth-oriented cycle, which means that the capabilities are sorted into either renewal, redeployment, recombination, or replication dimensions. If the capabilities are not suitable for these new ventures, then a form of retrenchment or retirement is likely. Even though the maturity of adaptability is not captured in real-time, this study captures a temporal snapshot of adaptability evolving from development phase towards maturity in the capability lifecycle model. (Helfat & Peteraf, 2003).

Tactical perspective of product line launch

At the end of each interview, the participants were requested to grade the product line launch project. (Table 3). As a striking finding, the tactical levels reported the largest gap with the planning-implementation grades. (Finding 1). With an average gap of -1.00, the tactical participants have felt the highest divergence between the planning (2.88) and implementation (3.88) phases. Padrón Hinrichs et al. (2026) describes that production ramp-ups as highly unstable and complex. The perceived gap of tactical participants is aligned with the discussion of Surbier et al. (2024) that emphasizes the high organizational stress and coordination requirements associated with product line launches. In comparison, the planning-implementation gaps of operational (-0.30) and strategic (-0.25) participants indicate that those organizational levels perceive the phases more equally. Out of all organizational levels (Schmidt & Wilhelm, 2000), the tactical participants responsible for converting strategy into operational execution may have felt the most burden during the product line launch.

Theoretical contribution

In essence, these findings contribute to the theoretical understanding of how supply chain capabilities manifest and evolve during product line launch. The empirical setting indicates that the capability dimensions are not expressed in a robotic sequence. Instead, the lower-order capability gaps limit the development of agility and resilience from the outset, while adaptability lags in the background, due to its dependency on the level of operational stabilization that the ramp-up phase has not yet reached. Instead of organizational failure, the data suggests that the lag is a characteristic of a product line launch itself. As the empirical setting is only 1.5 years from project kick-off to this date, adaptability requires time to catch up. Adaptability is hinting transformation from development to maturity stage with the site independency and Country Y expansion speculations highlighted in this study. This temporal offset between the supply chain capabilities during a product line launch – where stabilization is a requirement for adaptability manifestation, has not been directly addressed in the prior dynamic capability and supply chain management research streams.

5.1 Practical implications

The purpose of this section is to discuss practical implications and answer the call of Tactical 4 and Strategic 2 participants – connected from the empirical study:

> "Your thesis should be the starting point. I guess you have got a lot of different answers from the different people you have interviewed. And so, this should be the kind of lessons learned, right?" (Tactical 4)

> "I think it's really good that you kind of have this (thesis), like these are good questions and kind of hopefully we could use this for something valuable also, to do some changes on how we are working." (Strategic 2)

The most consistently triangulated findings across operational, tactical, and strategic levels were the level of outsourcing documentation and digital tools of the Finland and Norway sites. The technical drawings, assembly instructions, bill of materials – as well as the differing planning systems, purchasing tools, and (new and old) ERP implications are all part of the company's product line launch performance. While this thesis primarily concerns supply chain capabilities, it is evident that these tools and documentation are likely to convert into other subject matters as well within the organization. In addition, the grades collected across the 11 participants highlighted that the tactical level felt the most weight during the ramp-up, compared to their operational and strategic counterparts. The tactical grades (n = 4) were 2.88/5.00 for planning and 3.88/5.00 for implementation phases, which indicates that the implementation phase was perceived to be executed with more clarity, compared to the planning stage.

Importantly, the possibility of expanding further, like hinted in the empirical study as Country Y, is now considerably easier for the organization due to the lessons learned across documentation, digital systems, and cross-site collaboration aspects. To support future launch initiatives, whether it is an existing product line reconfiguration or a new venture abroad, these priorities stand out: adequate support for the work of tactical employees especially in the planning phase, development of outsourcing documentation, and unifying digital tools between the sites.

Tactical-level support

The planning-implementation gap (-1.00) identified among tactical interviewees suggests that the coordination burden of a product line launch falls the most on the middle management. As a suggestion for future launches, the launch-related tasks should be clearly separated from routine responsibilities. As noted in the study, the mixing of day-to-day work and launch duties create inefficiencies and stress that a clearer resource allocation could partly solve. Allocating human resources generously and early, rather than reactively is the practical takeaway, which also aligns with the reflective discussion of Strategic 1 participant.

Outsourcing documentation maturity

The most triangulated finding of this study points out to a clear direction: technical documentation must reach a certain level of maturity before outsourcing decisions are executed, not during or after the manufacturing process. These include assembly instructions, technical drawings, bill of materials, and packing instructions. Strategic 2 participant discussed that minimum documentation requirements, or a "checklist", should be defined before a supplier or a new site is handed production responsibility, which would secure the high competence level of the employees. The greater the complexity of the assemblies, and physical distance, even more emphasis should be placed on the quality of the documents – especially when discussing the potential of Country Y.

Digital tool unification

The diverging purchasing tools, planning systems, and ERP interfaces between the Finnish and Norwegian sites appeared as frictions related to project planning, material flow and general cross-site coordination. The ongoing ERP implementation project itself presents a corrective path, and it is promising for the future. For a similar product line launch project across two geographic locations, the digital tools should be aligned right from the beginning, instead of in a parallel effort with the launch.

Practical implications

All in all, prior academic research highlights that 57-60% of production ramp-ups fail to meet technical and economic targets. (Padrón Hinrichs et al., 2026; Surbier et al., 2024). By reflecting on these numbers and interpreting the participants' thoughts, the conclusion is that the organization has succeeded well, since the launch project itself has progressed seamlessly. The practical suggestions of tactical-level support, outsourcing documentation, and digital tool unification, along with the other findings, are significant contributors to the success of future launches. In addition, the supply chain challenges presented are relatively contained and represent process-related improvements, instead

of dramatic organizational overhauls, which reveals that the case company is in the correct path.

5.2 Limitations

As with all studies, certain limitations exist that can be drawn as the boundaries of this contribution. To maintain academic rigor, the limitations and reflexivity must be discussed transparently. (Korstjens & Moser, 2018, p. 121). The data is based on a single case study which limits generalization of the results. Like Scholten et al. (2019, p. 440), the aim was to develop theoretical concepts, instead of generalizing to populations. Thus, the approach angle leaned towards analytical significance rather than statistical credibility.

The supply chain role of the researcher in the case company can influence the research. While insider opportunity provides valuable access to data, the assumptions, personal experiences and biases must be navigated throughout the process. To address this, reflexivity was applied throughout the study, by reflecting on how past experiences could affect this project, while maintaining objective analysis as the cornerstone of data management.

About the empirical study itself, the number of strategic participants is relatively limited (n = 2). However, the pool of participants available for strategic interviews is naturally narrow, compared to the operational and tactical counterparts. In addition, the data was collected in a phase when long-term capability evolution – namely adaptability is still speculative, instead of directly observable.

5.3 Avenues for future research

Based on the findings of this study, future research should focus on two distinct avenues. The temporal lag of adaptability can be, in theory, captured in an empirical setting where the launch and operational ramp-ups have stabilized past a certain level. To support, the

data of this study was collected 1.5 years after the product line launch kick-off, which in essence provided contribution related to the lower-order capability, agility, and resilience dimensions. However, in this study, adaptability as a phenomenon seemed to slowly emerge from the background, but the capability was still on a rather speculative level, as highlighted with the site independency and Country Y expansion discussion. A longitudinal snapshot of a similar case, conducted during appropriate time from the project kick-off could capture how adaptability transforms from a speculative dimension into active implementation. Similarly, a follow-up study of this same case would highlight whether the site independency and Country Y expansion scenarios have materialized in the future.

With a broader organizational lens, a promising path could be related to the tactical planning-implementation gap found during the empirical study. The grading suggests that the coordination burden of a product line launch falls to tactical levels excessively, compared to the operational and strategic counterparts. Tactical participants rated the planning (2.88/5.00) and implementation (3.88/5.00) phases unevenly, which suggest that product line launch planning demands resources excessively. This finding opens a direction towards future academic contribution in the strategic management or human resources fields, depending on the path selected by the scholar.

6 Conclusion

The aim of this study was to explore how supply chain capabilities manifest and evolve during product line launch. Logically, theoretical framework was based on two distinct modules, manifestation of supply chain capabilities, and evolution of supply chain capabilities. Empirical setting captured a multinational technology company that executed a product line launch project in Finland. The capabilities manifested in lower-order capability, agility, and resilience dimensions. Then, adaptability was captured in an evolving phase, transitioning from development to maturity.

The most triangulated practical takeaways include supporting tactical-level employees during launch, developing outsourcing documentation, and unifying digital tools between the sites. Overall, the case organization is in a correct path, and the process-related improvements emerging from empirical data serve as a valuable lesson for an organization where continuous improvement is a core value. In a theoretical setting, the findings indicate that the various capability dimensions are not expressed in a neat sequence. Instead, certain lower-order capability gaps constrain the manifestation ceiling of agility and resilience from the outset. This study suggests that the interpreted lag of adaptability is a characteristic of product line launch itself, instead of a case-specific tendency.

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Appendices

Appendix 1. Interview form (Finnish).

Pro gradu –tutkielman haastattelu

The Impact of Product Line Launch on Supply Chain Capabilities

Tuotantolinjan avaamisen vaikutus toimitusketjun kykyjen kehittymiseen

- Haastattelut nauhoitetaan analysointia varten. Haastattelumateriaali poistetaan työn valmistumisen yhteydessä.

- Haastatteluvastaukset anonymisoidaan, ja haastateltaviin viitataan näin: Haastateltava 1 – strateginen, taktinen, tai operatiivinen rooli organisaatiossa.

- Tässä haastattelussa toimitusketjun hallinnalla (supply chain management) tarkoitetaan tavaroiden, palveluiden, tiedon ja rahavirtojen suunnittelua ja ohjausta toimittajalta tehtaalle – ja aina loppuasiakkaalle saakka.

- **Parts of this version have been anonymized (in bold) for thesis publication.**

Taustat ja nykytilan kartoitus

1. Mikä oli roolisi ja työpanoksesi **Suomen X**-tuotantolinjan avaamisessa?

2. Millä aikavälillä **X**-tuotantolinjan avaus ja käyttöönotto **Suomessa** toteutettiin?

3. Miten kuvailisit projektin nykytilannetta – onko tuotantolinja mielestäsi jo täydessä vauhdissa vai vielä kehitysvaiheessa?

4. Miten tuotantolinjaan liittyvä yhteistyö on mielestäsi sujunut Suomen ja Norjan **X**-organisaatioiden välillä?

Muutokset ja kokemukset

5. Millaisia muutoksia toimitusketjun prosesseihin tuotantolinjan avaaminen vaati?

6. Mitkä ovat olleet suurimmat toimitusketjuun liittyvät haasteet projektin aikana, ja miten niitä pyrittiin ratkaisemaan?

7. Mitkä ovat olleet suurimmat onnistumiset toimitusketjun näkökulmasta?

8. Miten toimitusketju reagoi projektin aikana yllättäviin muutoksiin tai häiriöihin?

Reflektointi

9. Mitä oppeja tästä projektista on mielestäsi jäänyt organisaatiolle erityisesti toimitusketjun näkökulmasta?

10. Jos tämänkaltainen projekti tulisi tulevaisuudessa uudelleen eteen, mitä kannattaisi mielestäsi tehdä eri tavalla?

Loppusanat

11. Voisitko arvioida **X**-tuotantolinjaprojektin suunnitteluvaihetta asteikolla 1–5?

12. Voisitko arvioida **X**-tuotantolinjaprojektin toteutusvaihetta asteikolla 1–5?

13. Onko jotain tuotantolinjan avaamiseen ja toimitusketjuun liittyvää, mitä en osannut kysyä, mutta haluaisit mainita?

Appendix 2. Interview form (English).

Master's Thesis Interview

The Impact of Product Line Launch on Supply Chain Capabilities

- The interviews are recorded for analysis purposes. The interview material will be deleted after the work is done.
- The interview answers are anonymized; the participants are referred to as: Interviewee 1 – strategic, tactical, or operational role in the organization.
- In this interview, supply chain management is defined as the planning and flow of products, services, information and finances from the supplier to the factory – all the way to the end customer.
- **Parts of this version have been anonymized (in bold) for the thesis publication.**

Background and current situation assessment

1. What was your role and effort in the launch of the **X** product line in **Finland**?
2. Over what period of time was the **X** product line in **Finland** launched and ramped up?
3. How would you describe the status of the project – do you think the product line is already in full swing or still in the development phase?
4. How do you think the product line related cooperation between the Finnish and Norwegian **X** organizations has gone?

Changes and experiences

5. What changes did the launch of the product line require in the supply chain processes?

6. What were the biggest challenges related to the supply chain during the project, and how were they solved?

7. What have been the biggest successes from a supply chain perspective?

8. How did the supply chain respond to unexpected changes or disruptions during the project?

Reflection

9. What lessons do you think this project has taught the organization, especially from a supply chain perspective?

10. If a similar project was to come up again in the future, what do you think should be done differently?

Final words

11. Could you rate the planning phase of the **X** product line project on a scale of 1–5?

12. Could you rate the implementation phase of the **X** product line project on a scale of 1–5?

13. Is there anything related to product line launch and the supply chain that I didn't ask about, but that you would like to mention?