Linköping Studies in Science and Technology. Thesis No. 1932
Licentiate Thesis

Logistics Strategy for Building Contractors

CONTEXT, CONTENT, AND PROCESS

Petter Haglund

LINKÖPING UNIVERSITY

Logistics Strategy for Building Contractors: Context, Content, and Process

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Abstract

A logistics strategy is at the foundation of how a company manages the flow of resources in the supply chain. It ensures that the logistics function of a company contributes to fulfilling strategic goals. In the project-based building construction industry, logistics is a means of supporting building operations by ensuring that resource flows are managed efficiently in the supply chain and at the construction site. However, there is a tendency to focus on operational logistics issues and to adopt established logistics principles from other industries to solve logistics-related problems in building construction, which typically favour "one size fits all" solutions. These approaches to construction logistics are problematic because building contractors target different market segments through their type of products, production methods, and supply chains. Therefore, there is not a "one best way" of managing logistics in building construction.

This thesis focuses on how a building contractor can adopt a more strategic and long-term approach to logistics. Strategy is typically regarded in terms of three dimensions: context, content, and process. Consequently, building contractors need to understand the logistics strategy context, how it influences the logistics strategy content, and the process of formulating and implementing a logistics strategy. The purpose of this licentiate thesis is therefore *to investigate the fit between logistics strategy context and content for building contractors*.

To fulfil the purpose, the following two research questions are answered:

RQ1: What elements of logistics strategy context and content can be used to assess the fit of building contractors' logistics strategies?

RQ2: What leads to fit/misfit in building contractors' logistics strategies?

To answer the research questions, a combination of conceptual and empirical research methods has been used. The conceptual part comprises a literature review that was used to derive constructs to develop conceptual research frameworks. The literature review also served as input to defining research questions and as guidance for collecting empirical data. The empirical methods used are based on case studies to further develop and verify the conceptual research framework.

The main findings of this thesis are four logistics strategy context elements and five content elements that can be used to assess the fit between a building contractor's logistics strategy context and content. This fit is important to facilitate logistics' role as a support function for a cost/delivery or flexibility-oriented competitive strategy. However, fit is difficult to achieve in practice and the logistics strategy process can be constrained by the building

contractor's previous investments and the support given by internal stakeholders. This means that fit is not solely a deliberate choice made for efficiency/effectiveness reasons but includes comprises between previous and future directions and managerial discretion.

This thesis contributes to the logistics strategy body of knowledge concerning the context, content, and process dimensions of logistics strategy within building construction. The thesis shows that there are trade-offs in selecting a logistics strategy that supports a cost/delivery or flexibility-oriented strategy. These trade-offs emerge as a consequence of different degrees of pre-engineering, type of production systems, and supply chain structures employed by building contractors, which building contractors needs to address during logistics strategy formulation. A logistics strategy profiling template was developed, which is a tool that managers in building contractor organizations can use to analyze and reconfigure a logistics strategy. Furthermore, the thesis highlights that building contractors should establish a central logistics function that takes responsibility for strategic logistics decisions, regardless of their logistics strategy context.

Populärvetenskaplig sammanfattning

En logistikstrategi utgör grunden för hur ett företag hanterar flödet av resurser i försörjningskedjan och säkerställer att logistikfunktionen bidrar till att uppfylla företagets övergripande strategi. Inom husbyggande har logistik en stöttande funktion som avser att hantera resursflöden effektivt i försörjningskedjan och på byggarbetsplatsen. Byggentreprenörer tenderar dock att fokusera på logistiken i enskilda projekt och på att föra in etablerade logistiska principer från andra branscher. Detta tillvägagångssätt är problematiskt eftersom logistiklösningar som fungerar i andra branscher inte nödvändigtvis fungerar i byggproduktion. Byggproduktion skiljer sig från industriell produktion och husbyggnadsbranschen är mångsidig med olika typer av entreprenörer som riktar sig till olika marknadssegment genom att leverera olika typer av produkter, vilket i sin tur kräver olika typer av produktionsmetoder och försörjningskedjor. Därmed behöver byggentreprenörer anpassa sin logistikstrategi till dess kontext eftersom generella lösningar riskerar att vara dåligt anpassade för att hantera logistiken i olika typer av husbyggande.

Forskningen som presenteras i denna licentiatavhandling fokuserar på hur en byggentreprenör kan ta ett mer strategiskt och långsiktigt förhållningssätt till logistik. Syftet är därför att undersöka hur logistikstrategin bör anpassas till dess kontext. Studierna som avhandlingen bygger på har genomförts hos stora byggföretag som i huvudsak har sin verksamhet i Sverige.

I denna avhandling har fyra beståndsdelar identifierats som representerar logistikstrategins kontext samt fem beståndsdelar som representerar logistikstrategins innehåll. Dessa beståndsdelar kan användas för att bedöma hur väl anpassad logistikstrategins innehåll är till dess kontext. Denna situationsanpassning är viktig för att underlätta logistikfunktionens roll som stöd för en kostnadseffektivitets- eller flexibilitetsinriktad konkurrensstrategi. Forskningsresultaten visar dock att detta är svårt att uppnå i praktiken då implementeringen av logistikstrategin begränsas av byggentreprenörens tidigare investeringar och av olika interna aktörers intressen. Detta innebär att det inte enbart går att utforma sin logistikstrategi utifrån effektivitetshänseende, utan det behövs tas hänsyn till balansgången mellan tidigare och framtida strategiska inriktningar.

Denna avhandling bidrar till kunskap om logistikstrategi i termer av strategikontext, innehåll och process hos byggentreprenörer. Avhandlingen visar att det finns avvägningar i att välja en logistikstrategi som stödjer en kostnadseffektivitets- eller flexibilitetsinriktad strategi. Dessa avvägningar uppstår som en konsekvens av att logistikstrategin måste vara utformad för att tillgodose den komplexitet och förutsägbarhet som finns i logistikprocesser, vilket i sin tur beror på graden av förprojektering, typ av produktionssystem samt försörjningskedjans struktur. För att underlätta för byggentreprenörer i deras logistikstrategiarbete har en profileringsmall utvecklats. Mallen är ett verktyg som logistikchefer och logistikansvariga i byggföretag kan använda för att analysera en befintlig, eller formulera en ny, logistikstrategi. Detta arbete bör ha sin utgångspunkt i en central logistikfunktion som tar ansvar för strategiska logistikfrågor, vilket i dagsläget är ovanligt hos byggentreprenörer.

Foreword

As of writing this foreword in March 2022, being a PhD student has been better than I could imagine before I started about two and a half years ago in September 2019. I have no doubt that this is because of the people around me that make life at work and outside work a fun experience. The next few lines are dedicated to the people that have supported me, directly and indirectly, up until this point in my PhD-studies.

First, I would like to give a big thank you to my supervisor duo, Martin Rudberg and Ahmet Sezer. I was fortunate to get you two as my supervisors when I started my PhD and I look forward to continuing working with both of you.

Second, I wish to thank my colleagues in the construction logistics group, Mats Janné, Micael Thunberg, Anna Fredriksson, Yashar Gholami, Farah Naz, and Abdalla Mubder. Thank you, Mats, for being the best (and possibly my only?) mentor I have ever had. To Yashar and Farah, SP6202 would not be the same without you!

Third, I want to thank my colleagues at the division of Communcation and Transport Systems. Special thanks go to Viveka Nilson and Sophie Lindesvik, your help to me (and to everyone else at the division) is invaluable.

Last but not least, my thanks go out to my dear friends and family. To those in Norrköping, Ulricehamn, Umeå, and Göteborg, your support means everything, and you make life outside work the best. I want to thank you Fanny for the life we have here together in Norrköping with our two "kids" (two slightly overweight, but adorable, domestic cats).

Petter Haglund

Norrköping, April 2022

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Thesis Outline

This licentiate thesis is a compilation thesis (thesis by publication) comprising three articles: one under review in *Construction Management and Economics,* one published in the proceedings of the CIB International Conference on Smart Built Environment, ICSBE, 14-15 December 2021, and the final one under review in *International Journal of Logistics Management*. The thesis is titled *Logistics Strategy for Building Contractors: Context, Content, and Process* and consists of two parts. The first part includes the introductory chapters and describes the background to why this thesis is necessary, together with the formulation of the research problem, purpose, and research questions. It also includes the theoretical frame of reference and a summary of the included papers. Furthermore, the first part answers the thesis' research questions followed by a discussion of the thesis' purpose. Finally, the contributions of the thesis are outlined along with suggestions for further research. The second part consists of the three papers that the thesis is based on, which are listed below.

Paper 1

Haglund, P. (2021). "Logistics strategy, structure, and performance – A typology of logistics configurations in construction. In *CIB International Conference on Smart Built Environment*, 14-15 December 2021.

Paper 2

Haglund, P., Rudberg, M., and Sezer, A. (2022). "Organizing logistics to achieve strategic fit in building contractors – A configurations approach". Under review in *Construction Management and Economics*.

Paper 3

Haglund, P. and Rudberg, M. (2022). "Logistics strategy implementation in construction – The influence of strategic choice". Under review in *International Journal of Logistics Management*.

Vad har du blitt? Ingenting! Och vad kan du? Ingenting!

Näe, far har ju lärt mej allt han kan!

— Nils-Erik och Lennart Kristersson (Snålvatten och Jäkelskap)

Table of Contents

1. Introduction

In this section, the background is described to motivate the focus on logistics strategy for building contractors. Next, the research problem is described, which highlights a contingency approach to logistics strategy in building construction. This leads to the purpose and scope of the thesis, followed by a presentation of the thesis outline.

1.1 Background

Logistics in construction projects is critical for delivering projects on time, budget, and at the right quality. Better managed material flows reduce the time used for material handling and the number of transports. This in turn can increase the efficiency on the site (Janné and Rudberg, 2022, Sundquist et al., 2018) and in the supply chain (Ying et al., 2018), while reducing greenhouse gas emissions generated from transports to and from the construction site (Sezer and Fredriksson, 2021). Therefore, logistics is an important supportive function and has a central role in construction projects, in terms of both efficiency improvements (project cost and duration) and reduced environmental impact (Browne, 2015).

Despite the benefits of improving logistics management in construction, not all types of construction projects can apply the same measures. There is a great deal of variety in the scale and complexity of construction projects that impact logistics management (Browne, 2015). Previous research advocates that construction should borrow logistics principles from other industries, such as manufacturing (Vrijhoef and Koskela, 2000). However, this has faced scepticism due to the major differences between the typically one-off, project-driven construction and the relatively stable and repetitive production environment in manufacturing (Green et al., 2005). This suggests that logistics principles from manufacturing may not be applicable to all types of construction. Building construction, comprising of residential and non-residential construction, has the closest resemblance to high volume production, and thus it is a more feasible sub-industry to adapt logistics principles from manufacturing than, e.g., the major infrastructure sector (Winch, 2003).

Building construction is a typical engineer-to-order (ETO) type of production, i.e., the product is engineered and produced after a customer order has been received. The products are large and typically produced at its place of use in a “temporary factory”, making building construction a typical project-based production system (Hill and Hill, 2009) where a temporary project organization, comprising several organizations, manages day-to-day operations. Moreover, building projects are characterized by reciprocal interdependencies between activities and actors (Bankvall et al., 2010) in which production activities do not follow a linear sequence (Sacks, 2016). This leads to a high degree of complexity and unpredictability in the process of supplying components, materials, and other resources to sustain efficiency in site operations (Guffond and Leconte, 2000).

However, in contemporary construction logistics practice, there is a tendency among building contractors to set up logistics organizations, processes, supplier bases, and technologies for individual projects to respond to the variations between projects (Dubois et al., 2019). Consequently, strategic decisions are delegated to project and/or site managers who do not possess sufficient time, budget, and logistical expertise (c.f. Elfving, 2021, Janné and Rudberg, 2022). This typically leads to a situation where the strategic level is neglected and all efforts are made to solve logistics-related problems at individual construction sites (Thunberg and Fredriksson, 2018).

1.2 Research Problem

The research problem addressed in this thesis comprises two parts. The first part concerns the absence of a strategic approach to logistics among building contractors. This is a general problem in building construction because it increases logistics-related problems at the construction site, which can be avoided through strategic logistics planning (Thunberg and Fredriksson, 2018). A logistics strategy can be a means of achieving economies of scale that is not possible at the project level due to time, budget, and resource constraints. Furthermore, a logistics strategy helps with establishing a suitable logistics organization, processes, supplier base, and technologies that follow a logical pattern so that the logistics function contributes to the company's business objectives (Klaas and Delfmann, 2005). A logistics strategy is thus not only means of improving efficiency and reducing costs, but can contribute to gain a competitive advantage (Heskett, 1977). In this pursuit, logistics in production environments ensures that materials, components, and products are available at production facilities at the right time, amount, and quality. However, to achieve the desired outcomes, the logistics strategy must exhibit a fit with the logistics strategy context, which determine the complexity and predictability of logistics tasks (Christopher, 1986). This leads to the second part of the research problem.

The second part of the research problem concerns what type of logistics strategy that is effective under certain conditions. Based on the definition of strategy by De Wit and Meyer (2010), a logistics strategy comprises three dimensions: context, content, and process. The logistics strategy context determines the feasibility of the logistics strategy content, that is, a set of logistics strategy components. The strategy process is the formulation and implementation of the strategy content. This definition of strategy is used in this thesis, which focus on the three separate, but interrelated dimensions: the logistics strategy context, the logistics strategy content, and the logistics strategy process.

The notion that the logistics strategy content should be consistent with a company's logistics context is not new. Previous research advocates the contingency approach to logistics strategy to study the relationship between logistics strategy context and content (Klaas and Delfmann, 2005). Christopher (1986) suggest two contextual factors: the product and production process dimensions in the product/process-matrix, which determines the feasibility of logistics strategy alternatives. In other words, the contingency approach to logistics strategy suggest that the logistics strategy is dependent upon a combination of product and production process characteristics. In addition to product and production process characteristics, logistics researchers highlight the supply chain structure as a third contextual factor. This is defined as the geographical dispersion of the supply chain and the type of business relationship with suppliers and customers (Hofer and Knemeyer, 2009, Rao and Young, 1994).

However, there is a lack of knowledge concerning how building contractors' product, production process, and supply chain characteristics influence the logistics strategy content, and the implications this has on the performance of their logistics system. As such, there is a risk that contractors' logistics strategy content exhibits a misfit with their logistics strategy context. Logistics strategy research suggests that such a misfit negatively impacts firm performance (Chow et al., 1995, Klaas and Delfmann, 2005, Stank and Traichal, 1998). To establish logical patterns in strategic logistics decisions, the decisions need to be based on a logistics strategy that is consistent with the type of product, production process, and supply chain (c.f. Christopher, 1986, Klaas and Delfmann, 2005). However, there is little known how this can be achieved within building construction.

1.3 Purpose and Research Questions

The short-term focus of logistics in construction hinders contractors in establishing a fit between their logistics strategy context and content. There is a need to adopt a more long-term approach, where strategic decisions are made at the company level that span across contractors' projects, programs, and portfolios. To address this issue, the purpose of this licentiate thesis is therefore *to investigate the fit between logistics strategy context and content for building contractors*.

The thesis considers three dimensions of logistics strategy: the logistics strategy context, content, and process. The first research question aims to identify ideal logistics strategies, i.e., where there is a fit between the first two dimensions of logistics strategy, context and content. The first part is addressed by the following research question:

RQ1. What elements of logistics strategy context and content can be used to assess the fit of building contractors' logistics strategies?

The second research question focuses on applying the framework developed in the first research question to building contractors. The theoretical constructs and the postulated relationships are used to investigate contemporary logistics strategy practices among building contractors, which also includes the logistics strategy process that is left out of RQ1. The second research question addresses how fit and misfit is established, including the process of establishing fit in building contractor organizations. The second research question is formulated as follows:

RQ2. What leads to fit/misfit in building contractors' logistics strategies?

The thesis considers two perspectives on fit that are described in strategic management research: the content of fit and the process of arriving at fit (Venkatraman and Camillus, 1984). The two perspectives are complementary and share the same assumption, i.e., that there needs to be a fit between the strategy context and content. However, they have different theoretical and practical implications. The first part only takes the content of fit perspective, which describes the fit between the logistics strategy context and content. This can provide general advice to building contractors for how their logistics system should be designed to establish a fit with their product, production process, and supply chain characteristics. However, the content of fit perspective only provides a snapshot of fit. This is where the second part plays a complementary role in this thesis by also including the process of establishing fit between the logistic strategy context and content. This can answer questions about the practical constraints to establishing fit in building contractor organizations, which are not addressed in the first part of this thesis.

1.4 Scope

This thesis takes a starting point in logistics management with a focus on how building contractors manage the overall flow of resources, including materials, components, and equipment to produce buildings efficiently and effectively. The term "Logistics Strategy" is used to denote that the emphasis is on the strategic level that involves the long-term decisions that lays the foundation for managing logistics at the building contractor's tactical and operational levels.

This thesis considers the building construction sector, including both residential (multi-family residencies) and non-residential buildings (hotels, schools, commercial buildings, office buildings). This includes contractors that employ a variety of building methods, ranging from prefabricated volumetric modules to on-site production of buildings. Single family residences, infrastructure (e.g., construction of railways, bridges, and tunnels), and industrial construction (e.g., nuclear powerplants and oil and gas platforms) are not considered in this thesis. The thesis mainly considers large building contractors (i.e., companies with a staff headcount above 250 employees and/or an annual turnover over €50 million according to the European Unions recommended definition of small and medium-sized enterprises). The companies studied in this thesis mainly operate in the Swedish building construction sector.

1.5 Thesis Outline

This is a thesis by publication comprising three papers that are the result of three studies carried out during the research process. The thesis is structured as follows: The first section introduces the background and the research problem. The theoretical frame of reference is outlined in the second part, which provides an overview of previous logistics strategy research, a description of fit derived from organization design and strategic management research, and definitions of logistics strategy context, content, and process in building construction. In the next section, the research design of the thesis is described, including individual descriptions of the three studies' research designs. This is followed by a summary of the three papers and a sub-section with a discussion of the paper findings in relation to the thesis purpose and research questions. The final section outlines the contributions of the research, addressing the three research questions, and presents ideas for future research.

The three papers that the thesis is based upon are listed below and includes a statement of the author's contribution to each paper.

Paper 1: Logistics strategy, structure, and performance

Paper 1 is a conference paper presented at the CIB International Conference on Smart Built Environment in December 2021. The author of this thesis is the single author of Paper 1, but the main supervisor and co-supervisor provided support in the form of ideas and feedback on the paper.

Paper 2: Organizing logistics to achieve strategic fit in building contractors

Paper 2 is currently under review in *Construction Management and Economics*. The author of this thesis took main responsibility for the literature review, data analysis, writing of the paper, and developing the paper into the journal version. Both the main supervisor and co-supervisor contributed with feedback, overall discussion during the writing process, and finalizing parts of the paper in the development of the journal version. The author of this thesis and the main supervisor both contributed to the data collection.

Paper 3: Logistics strategy implementation in construction

An early version of Paper 3 was presented at the 28^{th} Annual EurOMA Conference in July 2021. The conference version of the paper has been further developed and is currently under review in the *International Journal of Logistics Management*. Both authors contributed to collecting the primary data, but the main supervisor provided the secondary data. The author of this thesis took main responsibility for the literature review, data analysis, writing of the paper, and developing the paper into the journal version. The main supervisor contributed with feedback and overall discussion throughout the writing process and in the development of the journal version.

2. Theoretical Frame of Reference

In this section, an overview of logistics strategy research is presented, which leads to the next sub-section where the central concept of "fit" is described. Next, the three logistics strategy dimensions: context, content, and process, are described.

2.1 An Overview of Logistics Strategy Research

Logistics strategy research has evolved in three streams: the "one best way" stream, the lifecycle stream, and the contingency stream. This thesis rests upon the research within the contingency stream to account for the influence of contextual factors on the logistics strategy content, which is neglected with the first two streams. Table 1 provides a short description of the dominant view of logistics strategy within each research stream.

Table 1 Streams within logistics strategy research

Stream	*Dominant view*	*Representative papers*
"One best way"	Companies should appoint a logistics manager that integrate logistics activities that cross functional boundaries. Proponents argue for a matrix organization where the logistics manager is a programme manager.	De Hayes and Taylor (1972)
Lifecycle	Early logistics operations in companies' lifecycle focus on individual logistics activities. As the company grows and matures, these activities become more advanced, taking a coordinating role that resembles the integrating role of the logistics manager as prescribed in the "one best way" stream.	Beier (1973), Bowersox and Daugherty (1987)
Contingency	There needs to be a fit between the logistics strategy and contextual factors. This gives rise to trade-offs because the logistics strategy can only exhibit a fit with one type of logistics context. A logistics manager is not necessarily a viable option for all companies, and it ultimately depends on the logistics context.	Persson (1978), Shapiro (1984)

The contingency stream was introduced in logistics strategy research because the "one best way" and the lifecycle stream did not consider the advancements in generic strategy and organizational design research. Furthermore, the research within the "one best way" and lifecycle stream had little empirical support, which pushed logistics strategy researchers towards using, at the time, advancements in contingency theory to study logistics strategy. In contrast to the "one best way" and the lifecycle stream, the researchers within the contingency stream argue that the logistics strategy involves making deliberates choices that need to be consistent with logistically relevant contextual factors (Persson, 1978).

Consequently, the logistics strategy needs to have a strategic orientation that support the corporate/business strategy of the company (Bowersox and Daugherty, 1995).

Researchers within the contingency stream advocate that the company must select either a cost/delivery or flexibility-oriented logistics strategy. Heskett (1977) was among the first to highlight the role of logistics as a competitive weapon for manufacturing firms. This was highly influenced by the neighbouring research field, manufacturing strategy, which Wickham Skinner set the research agenda for with his article “The focused factory” (Skinner, 1974). However, it was not until 1984 before Roy D. Shapiro published his article in the Harvard Business Review “Get leverage from logistics” (Shapiro, 1984) that the idea grew that a logistics strategy involves making choices between being cost-efficient and responsive to the market. Inspired by manufacturing strategy research and by the work of Skinner, Shapiro argues against the idea of “one best way” when companies design their logistics systems. Thus, the contingency stream introduced the notion of trade-offs into logistics strategy research:

> *Much as with Wickham Skinner's notion of the "focused factory", no single logistics system can do everything well. Trade-offs are inevitable, for example, among considerations of low cost, range of services, and flexibility to changes in product specifications, volume, and customer preferences. Thus, the crucial question for managers is, "What must our logistics system do particularly well?”.*
>
> *(Shapiro, 1984, p. 120)*

A central concept within the contingency stream is “fit”. The main form of fit is the configurational approach, which view fit as “a pattern of structure and processes that matches the contextual setting and is internally consistent” (Drazin and Van de Ven, 1985, p. 521). This is the main definition of fit used by logistics strategy researchers within the contingency stream. A configurational approach to fit assumes that the logistics strategy must exhibit “fit” with several contextual factors that are logistically relevant. As such, the system boundary for a logistics strategy is smaller than for a corporate/business strategy and logistics strategy context is primarily characterized by the internal characteristics of a company, i.e., their product, production process, and supply chain.

2.2 Defining Fit

The concept of fit is defined in many ways in contingency research, ranging from precise definitions of fit typically involving two variables to a larger set of variables known as “configurations” (Venkatraman, 1989). This research adopts the latter definition, the configurational approach to fit, in which there are two main perspectives: the content of fit and the process of establishing fit. The content of fit describes how the context and content elements interact, while the process of establishing fit describes fit as an ongoing process of retaining or regaining fit. The two perspectives are complementary; the content of fit provides a snapshot of the interaction between context and content elements, while the process of establishing fit looks at how the interaction between contextual and strategic elements change over time. The first is important to understand which elements that determine the fit between the strategy context and content, while the second perspective provides insights into how this fit is influenced by factors beyond the strategy context. The two perspectives to fit are described in the following sub-sections.

2.2.1 Content of Fit

The content of fit perspective considers the interaction of a company's external and internal context with its strategy (Drazin and Van de Ven, 1985). There are thus two types of fit: external and internal fit (Mintzberg, 1979):

1. External fit – The fit between external strategy context and content (e.g., the fit between the logistics strategy and the marketplace).
2. Internal fit – The fit between the internal context and strategy content (e.g., the fit between the logistics strategy and other functional strategies).

While external and internal fit comprise different aspects, Mintzberg (1979) argue that they are not mutually exclusive and that both can be achieved simultaneously. He therefore proposes an integrated view of external and internal fit, the extended configuration hypothesis, in which fit is an ideal configuration of the external and internal context and strategy. Consequently, companies can achieve the same outcome, often regarded in terms of financial performance, by the means of many different strategies, as long as they exhibit a fit with the external and internal context of the company. Trade-offs thereby emerge as a result from the existence of multiple ideal types of configurations that respond to different demands in the market (Drazin and Van de Ven, 1985). No company can satisfy the demand of every market segment because trade-offs limit a company's ability to excel within every performance category.

2.2.2 The Process of Establishing Fit

The content of fit is limited by the static view on fit because it does not consider the process behind establishing fit of the external and internal context with strategy. The primary concern of strategic management research is that the content of fit perspective does not consider how and why strategies fail due to misfits. The process of establishing fit perspective focus specifically on this issue. Broadly speaking, this perspective views fit as a dynamic phenomenon (Venkatraman and Camillus, 1984), which involves making strategic decisions for the purpose of retaining or regaining fit. This is also called dynamic fit (Zajac et al., 2000) to highlight that the primary goal of the strategy process is to retain/regain a fit between the strategy context and content.

The strategy process can take the form of a deliberate strategy process or an emergent strategic change (grass-roots strategy), where most strategies are the result of a combination of the two (Mintzberg and Waters, 1985). Therefore, the strategy context alone does not determine a company's strategy, but it is influenced by the choices made under uncertainty and limited decision-making authority (Turner and Miterev, 2019). This is the central argument made by Child (1972) who suggest that the strategic orientation of a company is primarily determined by strategic choice in managerial decision-making. The decision-makers are informed and constrained by the external and internal context that limit their discretion in formulating and implementing strategic alternatives. Their ability to establish a fit between the strategy context and content is then constrained by the level of managerial discretion, which in turn can be determined by organizational objectives, previous performance levels, previous investments, etc. (Montanari, 1978). In short, managerial discretion denotes the level of authority a manager possesses to formulate and implement a strategic plan (Montanari, 1979).

2.3 Logistics Strategy Context, Content, and Process in Construction

One shortcoming of previous logistics strategy research is that it largely neglects developments in related fields such as strategic management and operations strategy. Strategy context, content, and process are established concepts in both these domains, but this is not the case for logistics strategy. However, logistics strategy context and content are implicitly treated by logistics strategy researchers. For instance, the interaction between logistics strategy context and content appears in the view that product/process combinations influence the degree of centralization and formalization in the logistics organization (Chow et al., 1995, Christopher, 1986).

The logistics strategy process has received even less emphasis, which indicates that logistics strategy research can benefit from related domains. Figure 1 illustrates the theoretical foundations of the three logistics strategy dimensions treated in this research: context, content, and process. The fit between logistics strategy context and content is based on the content of fit perspective, which is derived from contingency theory. The logistics strategy process is based on the process of establishing fit perspective, which has its roots in strategic choice theory.

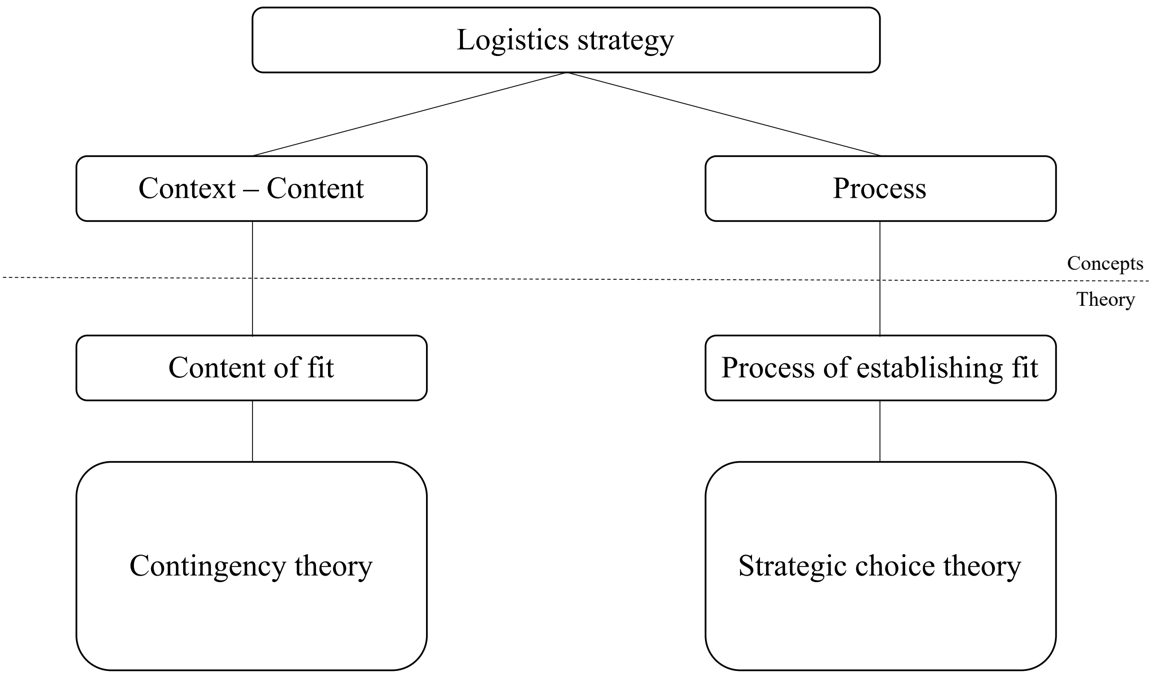

Figure 1 The theoretical foundations of logistics strategy context, content, and process

In the absence of explicit descriptions of logistics strategy dimensions, there are still some common grounds provided by previous logistics research. Persson (1978) suggests that researchers need to identify relevant contextual factors that determine the feasibility of a certain logistics strategy. The contextual factors can include external market related factors, internal characteristics of the company, or both. The logistics strategy need to be aligned with the external and internal context to generate desired performance outcomes and contribute to the company's competitive strategy (Chow et al., 1995). The external context characterize the competitive environment in which a company operates, such as competitors, demand variability, and technology trends within an industry (Stock et al., 1998). The internal context describes the operational characteristics of a company that have logistical consequences (Rushton and Saw, 1992), such as the combination of product, production process, and supply chain characteristics.

The following sub-sections presents the elements that can be used to describe the logistics strategy context, content, and process in building construction. The elements that are used to describe the logistics strategy context are the degree of pre-engineering, production system, and supply chain structure. Logistics strategy content include logistics organizational structure components and logistics process components. The interaction between logistics strategy context and content build on the content of fit perspective. Furthermore, the logistics strategy process is described from the process of establishing a fit perspective.

2.3.1 Logistics Strategy Context

Construction is a heterogeneous industry from a logistics perspective (Lundesjö, 2015) and contractors' have distinct contextual conditions, which their logistics strategy needs to be tailored for. The logistics strategy context denotes a set of logistically contextual factors that affect the building contractor's logistics strategy. Based on Persson (1978) and Christopher (1986), three contextual factors are identified that constitute a building contractor's logistics strategy context: the degree of pre-engineering (product characteristics), the choice of production process, and the supply chain structure. These three factors influence the logistics strategy content through different levels of logistics task predictability and the number of logistics decision elements.

The degree of pre-engineering

The degree of pre-engineering is used to distinguish between different levels of product standardization in an ETO situation. In construction, products are only produced after a customer order has been received. However, this definition can refer to make-to-order (MTO) and to differentiate between MTO and ETO, the product dimension needs to encompass the amount of engineering work that is performed prior to the customer order has been received (Wikner and Rudberg, 2005). When the degree of pre-engineering is reduced, this leads to a low frequency and degree of repetition while ordering materials and components (Schonsleben, 2000). This increases the number of logistics decision elements and reduces the predictability of logistics tasks (Christopher, 1986), which tend to favour decentralized day-to-day management of logistics activities (Pfohl and Zöllner, 1997). Physical constraints may also arise due to a high degree of customization in products, such as special requirements for transportation, storage, and handling (Hofer and Knemeyer, 2009). Based on Wikner and Rudberg (2005), three levels of pre-engineering are identified that determine the number of logistics decision elements and the predictability of logistics tasks:

- Engineer-to-stock (ETS): The product design is fully determined prior to customer order. A high degree of pre-engineering entails a fixed product structure with only standard components. Standard components are shared across all building projects, which enable a design and engineering inventory.
- Adapt-to-order (ATO): The product design is partly determined prior to customer order has been received, but changes to this predetermined design is accepted. A moderate degree of pre-engineering allows some modifications to the product structure. Some standard components are shared across all building projects and can be “stored” by the building contractor, but some customized components need to be designed and engineering for each project.
- Engineer-to-order (ETO): All engineering activities take place after the customer order has been received. A low degree of pre-engineering entails a flexible product structure that comprises many unique components. Although the number of levels and breadth in the product structure can be the same as in ATO and ETS situations, it contains only unique components that are designed and engineered for each customer order.

The choice of Production Process

For the choice of production process, the number and characteristics of production facilities determine the allocation of logistics tasks. Site production is common for products with a high degree of customization (Jonsson and Rudberg, 2015), which in turn increases the interdependencies between on-site activities (Bankvall et al., 2010). This tends to favour decentralized planning and control of logistics activities (Schonsleben, 2000). Although strategic logistics decisions can be aggregated into a central unit, operational activities requires decentralized planning and control units when the number of materials and components that need to be delivered to a production facility increases (Pfohl and Zöllner, 1997). Jonsson and Rudberg (2015) classify four different production systems in building construction that each correspond to different levels of logistics task predictability and number of decision elements:

- Component Manufacture and Sub-Assembly (CM&SA): Production activities and assembly workstations are arranged in accordance with the building layout. As a result, many types of material flows converge to the construction site and production activities are primarily reciprocally interdependent. This means that the inputs and outputs of two or more production activities and assembly works have a cyclical workflow. For instance, a drywall requires the carpenter to build the wooden frame before the electrician installs electrical fittings. However, the electrician must finish the electrical fittings before the carpenter installs the gypsum boards. The two workers are therefore reliant on the intermediary outputs of each other's production activities to produce the final output.

- Prefabrication and Sub-Assembly (PF&SA): This type of production system is similar to CM&SA but panel elements are produced in an off-site factory. This results in fewer material deliveries and consequently fewer on-site assembly works to plan and execute than in a CM&SA production system.
- Prefabrication and Pre-assembly (PF&PA): Panel elements are produced in an off-site factory where sub-assemblies are fitted to the panel elements prior to delivery to the construction site. This results in fewer materials that must be delivered to the construction site and consequently fewer on-site assembly works to plan and execute than in a PF&SA production system.
- Modular building (MB): Volumetric modules comprising usable indoor spaces are prefabricated in an off-site factory. Consequently, the production system in a construction project comprises at least two geographical production facilities: the factory and the construction site, each with distinct characteristics in terms of activity interdependence and number of inbound and outbound material flows. The factory has converging inbound flows with a wide variety of materials and components that are assembled at a production line, a batch flow layout, or a flow shop layout. The factory has few outbound flows that become the inbound flows to the construction site, resulting in a low number of materials, components, and modules and consequently a low number of on-site operations to plan and execute relative to the other production systems.

Supply chain structure

The supply chain structure refers to the geographical dispersion of and type of business relationship with suppliers and customers (Voordijk et al., 2006). It determines the complexity in logistics tasks in terms of the number of logistics decision elements. A geographically dispersed supply chain with many suppliers and customers increases the need for coordination and control (Hofer and Knemeyer, 2009). In particular, the volume and variability in relationships with suppliers and customers influence the uncertainty in delivery reliability and quality (Flynn and Flynn, 1999). Consequently, a geographically dispersed supply chain with many suppliers and customers increases the need for processing information, e.g., related to placing orders, monitoring inbound and outbound material flows, and maintaining buyer-suppliers relationships (Hofman et al., 2009).

2.3.2 Logistics Strategy Content

Logistics strategy content comprises logistics structure and logistics process components (Klaas and Delfmann, 2005). Structure components constitute decisions regarding the degree of centralization, integration, and division of labour in logistics tasks. Process components refer to the degree of formalization in logistics processes and whether these are order-driven or speculative. Table 2 describes structure and process components, which are based on the works of Bowersox and Daugherty (1995), Chow et al. (1995), Pfohl and Zöllner (1997) and Harrison and van Hoek (2008).

Table 2 Logistics strategy content

Content	*Components*	*Definition*
Structure components	Degree of centralization	The degree to which logistics decisions are concentrated to a single unit and its proximity to top management
	Division of labour	The degree to which logistics tasks are pooled in a single unit or to an individual.
	Integration	The degree to which logistics tasks are coordinated within the organization and across the supply chain.
Process components	Degree of formalization	The degree to which logistics processes are documented and their level of detail.
	Order-driven/speculative	Which processes that are order-driven or speculative.

Structure components

Structure components refer to the set of decisions that determine location and allocation of logistics tasks in the organization structure. The decisions are mainly characterized by the degree of centralization and the division of labour. A high degree of centralization is feasible when there is a high degree of uncertainty and complexity in logistics tasks (Pfohl and Zöllner, 1997), e.g., in a CM&SA production system with a low degree of pre-engineering and a geographically dispersed supply chain. However, large project-based organizations can benefit from centralized planning to manage company-level resources, capacity constraints, and interdependencies that are not visible to the individual projects/production facilities (Hill and Hill, 2009). Therefore, a high degree of uncertainty and complexity in logistics tasks will typically lead to that a central logistics department take responsibility for strategic and administrative logistics tasks, while the operational and physical logistics tasks are delegated to projects/production facilities (Pfohl and Zöllner, 1997).

The division of labour is mainly determined by the number of logistics decision elements and predictability of logistics tasks. This refers to the extent that strategic and operational logistics tasks are carried out by separate specialist functions. A low division of labour is feasible in complex and unpredictable logistics contexts, while a low degree of complexity and predictability in logistics tasks typically leads to a high division of labour (Pfohl and Zöllner, 1997).

Process components

Process components refer to the design of logistics processes, which can be characterized by their degree of formalization and whether they are driven by order or speculation. Formally described logistics processes tend to be preferred in stable environments with few logistics decision elements (Pfohl and Zöllner, 1997). As such, formal logistics process become a feasible alternative when there is a high degree of pre-engineering, while generic guidelines are more feasible when there is a low degree of pre-engineering.

The second component, order-driven/speculative, refers to which logistics processes that are carried out under certain/uncertain demand (Harrison and van Hoek, 2008). Since building construction is a typical ETO industry, buildings are seldom made to stock (except for rare cases). However, it is possible to distinguish between order-driven and speculation-driven components and sub-assemblies. At these lower levels in a building's product structure, it is possible for a contractor to build up inventory of standard components (e.g., plaster boards and wooden studs) based on forecasts. For instance, building contractors may prefer to store high volume building materials in a nearby distribution terminal or warehouse to minimize/even out the number of transports to the construction site (Janné and Rudberg, 2022). Other types of components and/or sub-assemblies that are project-unique, such as concrete slabs and wall elements, are typically order-driven and delivered directly from the supplier to the construction site (Elfving et al., 2010). The extent to which logistics processes are order-driven or speculative is mainly determined by the degree of pre-engineering.

2.3.3 Logistics Strategy Process

Logistics strategy process models prescribe an outlined sequence of activities, typically beginning with strategy formulation, which is followed by strategy implementation (Christopher, 1986, Fabbe-Costes and Colin, 2003). These descriptions of the logistics strategy process prescribe a highly deliberate process that aims to realize the intended strategy. Figure 2 illustrates the predominant view on the logistics strategy process in logistics strategy literature.

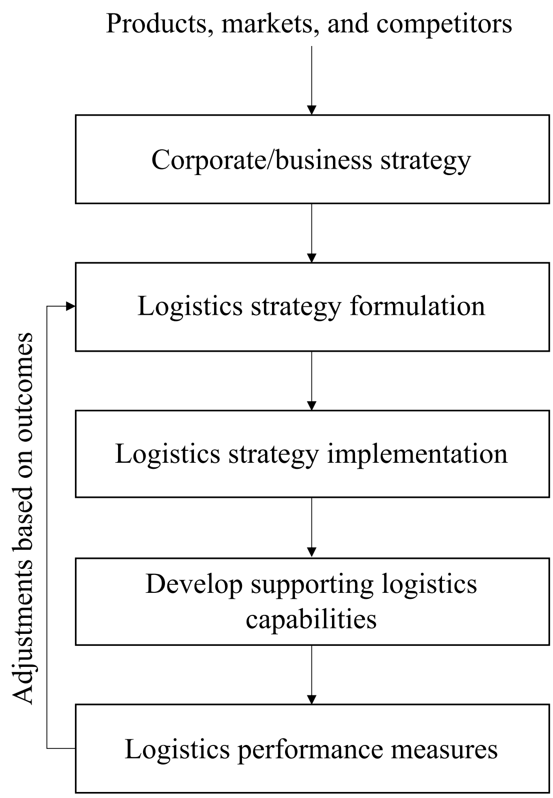

Figure 2 Logistics strategy process model

The model prescribes a top-down strategy process that begins with formulating the corporate/business strategy in line with the external context of the company. This is the competitive strategy of the company, which outlines how it should succeed in the market. Next comes logistics strategy formulation, in which logistics performance objectives are derived from the corporate/business strategy. This is to ensure that logistics provides functional support so that the company can achieve is business objectives, whereby the logistics strategy is a part of the corporate/business strategy (Fabbe-Costes and Colin, 2003). When the performance objectives are set, the logistics strategy content are formalized in a strategic plan. The next step is to implement the logistics strategy. An incremental implementation of logistics strategy content is typically advocated because it provides more immediate performance implications than attempting the "big-bang approach" (Christopher, 1986). For the logistics strategy to be successfully implemented, it needs to be supported by logistics capability building, which includes areas such as inbound and outbound logistics, information management, and coordination capabilities (Mentzer et al., 2004). Finally, the logistics strategy is evaluated based on the performance measures defined during the formulation stage. This is used to adjust the strategy if necessary.

Although these strategy process models may be appealing due to their simplicity, they are criticized for implying a sequential top-down approach (Boyer et al., 2005). Although most strategic change processes involve formulation and implementation, they are seldom conducted in a linear sequence following a top-down approach. Furthermore, the strategy process is influenced by power and internal company politics that limits managers' discretion to implement strategic plans (Rytter et al., 2007). In construction, there are both external and internal factors that influence the implementation of logistics improvement programs, such as low logistics competencies in projects and a lack of industry-level technology standards (Elfving, 2021). In other words, the logistics strategy process cannot be viewed as a deliberate action plan that is simply implemented across an organization. The logistics strategy process does not differ in this way from other strategy processes; the realized strategy is typically a combination of deliberate and emergent strategy (Mintzberg and Waters, 1985). In summary, the logistics strategy process, and in particular the implementation phase, requires change agents to manage expectations of stakeholders, consider the company's historical endeavours, pursue simultaneous formulation and capability building, and realign performance objectives with unplanned/emergent strategies that go beyond the intended strategic plan (Kim et al., 2014).

3. Research Design

This section begins with a description of the research process, including an overview of the three studies and corresponding papers that this thesis is based upon. Next, the methods used in three studies are described and motivated.

3.1 The Research Process

The thesis builds upon three studies (see Figure) that have been conducted over the course of about two years, between the first quarter of 2020 and the first quarter of 2022. The research has been conducted within the research project "Logistics Strategy for Resource Efficient and Sustainable Housebuilding" financed by the Development Fund of the Swedish Construction Industry (SBUF). The purpose of the project was to explore the current state of how building contractors work with logistics strategies, to suggest what a logistics strategy should contain, and how it should be implemented. The research process was divided into three studies, which are presented as papers (see Figure 3).

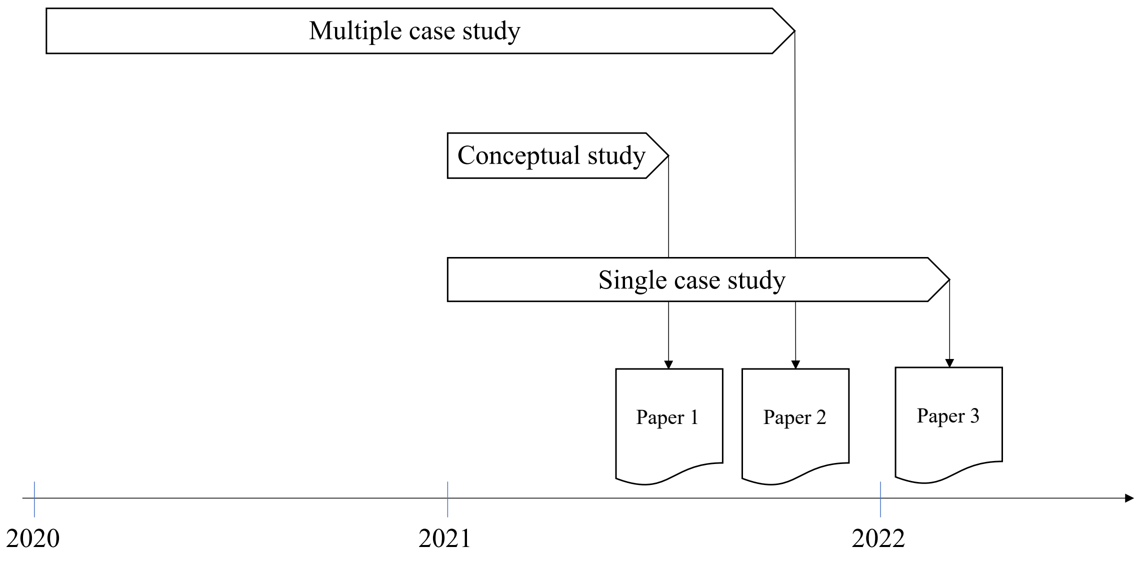

Figure 3 The research process

Figure 4 illustrates the papers' associated research questions. The conceptual study was carried out in Q2 2021 and resulted in Haglund (2021), which is referred to as Paper 1 in this thesis. It describes ideal logistics strategy configurations in building construction. This was done through a conceptual review to identify and describe logistics strategy context and content elements. The multiple case study started in Q1 2020 and resulted in Haglund et al. (2022), which is referred to as Paper 2 in this thesis. It is mainly descriptive to identify relevant logistics strategy context and content elements. The findings from the multiple case study initiated a narrower focus for the thesis, which led to the single case study that started in Q1 2021 with the purpose to study the logistics strategy process at a large building contractor. The single case study therefore took the process of establishing fit perspective and focused on the formulation and implementation of a logistics strategy. Furthermore, since the conceptual study and multiple case study provided a snapshot of building contractors' logistics strategies at one point in time, this study further extended the research by examining the logistics strategy process. The study resulted in Haglund and Rudberg (2022), which is referred to as Paper 3 in this thesis. It is based on a longitudinal single case study approach to enable a deeper examination of a building contractor's logistics strategy process. The methods used in each study is described further in the following sub-section.

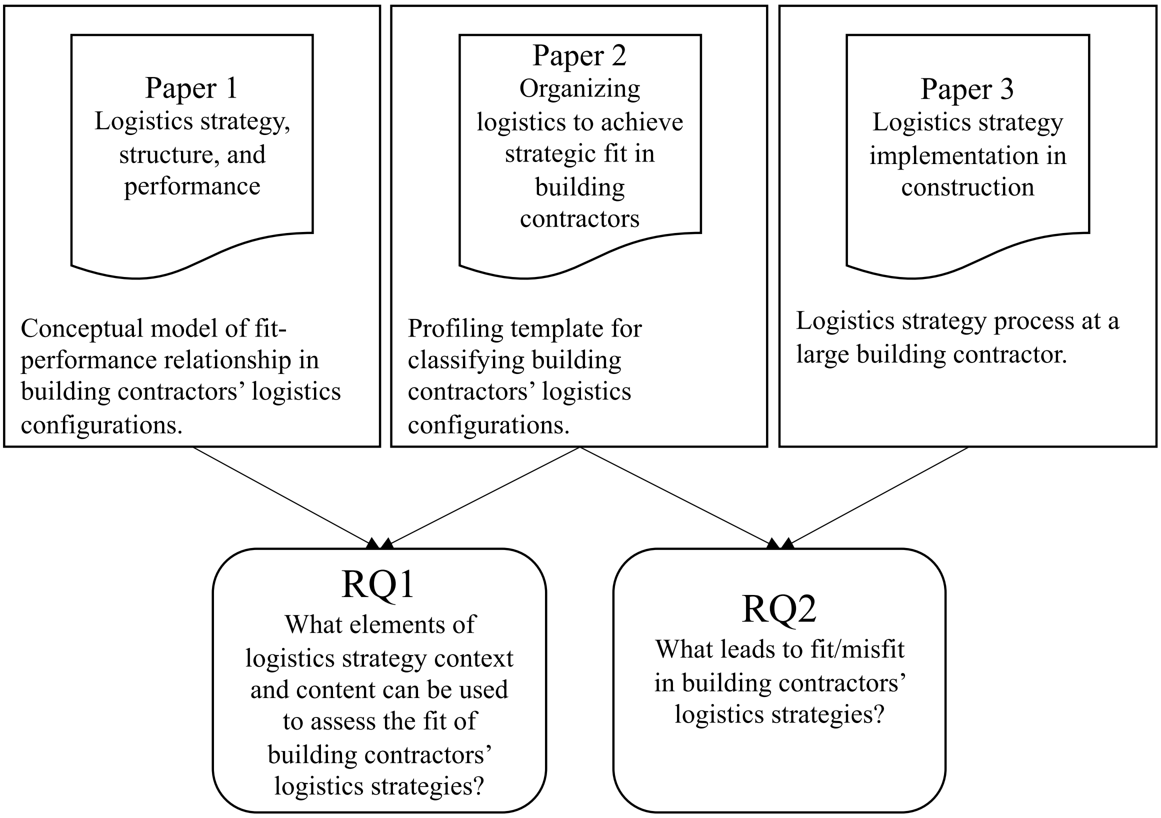

Figure 4 Overview of the papers and corresponding research questions

3.2 Methods

This thesis relies on a combination of empirical and analytical conceptual research methods. Paper 2 and 3 were empirically based, while Paper 1 falls into the analytical conceptual category. Conceptual modelling was used to deduce concepts from literature and their postulated relationships, which is complementary to the empirical methods, such as case studies and survey-based studies (Wacker, 1998). Qualitative case studies were used as the main empirical method because they allow for more depth than, e.g., studies based on statistical sampling and are suitable for contingency research including several strategy context and content elements (Sousa and Voss, 2008). However, the two empirically-based paper (Paper 2 and 3) contains literature reviews to identify and formulate research problems (Jesson et al., 2011) and to modify tentative research frameworks based on empirical observations (Kovács and Spens, 2005). The methods used in each study are further described in the following sub-sections.

3.2.1 The Conceptual Study

The conceptual study focused on identifying logistics strategy context and content elements, which addresses RQ1 in this thesis. This study was conceptual with the purpose to develop a typology of ideal logistics configurations in construction. Here a conceptual review was used to clarify central concepts and how they should be operationalized before conducting empirical research (Jesson et al., 2011). The identified variables were then used to develop a typology of ideal logistics configurations, which were proposed to produce different logistics performance outcomes.

Typologies in conceptual research are used to classify items when there are two or more variables present (Meredith, 1993), which was necessary given that the configurational approach advocates the use of many context, content, and performance variables (Meyer et al., 1993). However, the goal was not to explain the relationships between constructs, but to provide conceptual definitions and how these can be operationalized for further empirical testing (Meredith, 1993). The motivation behind the conceptual design in Paper 1 was thus to focus on theory-building in order to develop relevant measures for the constructs prior to testing the theory (Wacker, 1998).

The conceptual review started with the articles related to logistics strategy context and content, where the articles were found through a snowballing technique. Three types of articles were used in the study: 1) generic research on configurational approaches to strategy and organization design, 2) logistics contingency research, and 3) empirical research on logistics management in construction. The first type of articles (i.e., configurational research articles) provided the basic assumptions of strategy configurations that was used to develop the conceptual model. This type of research provided input to the structure of the conceptual model and its type of fit to ensure that future studies can examine the relationships between variables with a feasible statistical method. The second type of articles (i.e., the logistics contingency research articles) were used to derive tentative conceptual definitions of logistics context, content, and performance variables. The identified logistics configuration variables were then used to build up the conceptual model. The third type of articles (i.e., the empirical research on logistics management in construction) were used to adapt the conceptual definitions to the building construction context.

3.2.2 The Multiple Case Study

In the multiple case study, the purpose was to explain the fit between the logistics context and the organizing of logistics at a strategic level, which addresses RQ1and RQ2 in this thesis. Study 1 followed the logic of abductive reasoning (Kovács and Spens, 2005), which can be used for either suggesting a new framework or an extension of a theory that matches the empirical context (Dubois and Gadde, 2002). This study falls into the latter category, i.e., the empirical material was used to adapt previous logistics contingency studies that did not focus on the building construction industry. Therefore, the research process began with a review of previous logistics contingency research to identify logistics context and content elements. This provided tentative logistics context and content that served two purposes in the early phase of the research: 1) to develop a conceptual framework that provided the basis for a logistics configuration profiling template, and 2) to structure early data collection.

The empirical data was collected using a multiple case study to adapt the logistics strategy context and content elements derived from literature to building construction. The multiple case study comprised a total of four cases: three general-purpose contractors and one industrialized housebuilder. The three general-purpose contractors resemble typical large construction companies with a focus on the Nordic countries. The industrial housebuilder mainly operates in Sweden. They produce building modules in a factory and their modules are standardized and can be combined into a limited number of variants.

The multiple case study design was selected to examine fit in different logistics strategy contexts, which Eisenhardt (1989) refers to as selecting cases for theoretical reasons. The reasons can be to replicate previous cases (literal replication), to fill theoretical categories (theoretical replication), or a combination of both. In this study, the cases were selected based on a combination of theoretical and literal replication. The reason for selecting cases based on theoretical replication was to identify building contractors with contrasting logistics strategy contexts, which were expected to differ significantly in terms of their organizational structure in industrialized housebuilders and general-purpose contractors. However, general-purpose contractors tend to exhibit different organizational structure across geographical regions and projects (Koch et al., 2015). Therefore, three general-purpose contractors were selected based on literal replication to test whether they exhibited similar characteristics due to their similar logistics contexts as expected or used different organizational structures for other reasons.

The data collection was guided by a case study protocol. It was used to develop themes in the interview guide to ensure that all the constructs in the conceptual framework had been covered. Semi-structured interviews were held with representatives from each company that worked in a logistics department or similar, or who had a broader role that included logistics. The semi-structured interview format ensured that the main topics had been covered, while retaining flexibility to unanticipated discussions of interest with the respondents. The interview guide derived from the case protocol contained three types of questions: 1) the logistics strategy context of the case company, 2) the structure of the logistics organization and/or who managed logistics in their projects; and 3) background information about the respondent, their company, and the company's level of awareness in logistics management.

All three themes had to be covered during the interviews, but not in a particular order. The interviews provided new insights into the tentative logistics context and content variables, which led to a new literature review with a narrower scope on papers using a configurational approach to logistics strategy. This led to the development of a logistics configuration profiling template that was used to analyze the interview data. The profiling template was based on the strategic profiling method, which is a method to illustrate the degree of fit between the strategy context and content, and is suitable when there are four or more variables considered (Hill and Brown, 2007). The interview data was used to make tentative profiles for each case, which was done through an interpretative approach (McCutcheon and Meredith, 1993). The tentative profiles were based on the researchers' interpretation of the participants responses. In line with the abductive approach used in the study, the researchers arranged three workshops with the case participants to verify the tentative profiles. This measure was taken to increase content validity (McCutcheon and Meredith, 1993), i.e., that the operationalization of the logistics context and organizing of logistics made sense to the case participants and in their company.

3.2.3 The Single Case Study

The single case study focused on the process of establishing fit/misfits between the logistics context and content, and addresses RQ2 in this thesis. The purpose was to examine how strategic choice influences the logistics strategy process. This was achieved by conducting a longitudinal single case study. Single case studies can be used for generalizing findings if they are atypical cases that deviate from the "average" case (Yin, 2018). The case selected was an atypical case due to the broad focus on several logistics aspects and that the logistics strategy process was initiated at a strategic level, which is uncommon in construction. Although the case company was a typical large contractor in the Swedish construction industry, few building contractors address logistics at a strategic level (Green et al., 2005, Thunberg and Fredriksson, 2018) and there were to the authors' best knowledge no similar cases of a deliberate logistics strategy process in the construction industry. Furthermore, the researchers had access to process data that covered 11 years (2008-2019) of the logistics strategy process. The case selection was thus motivated by the accessibility to appropriate data and by obtaining information on an atypical case (Flyvbjerg, 2006). The longitudinal design enabled investigation of how changes to the logistics context and strategic choices over time shape the outcome of the logistics strategy process, and thus how fit/misfit between the logistics strategy context and content is established.

The data collection methods and analysis techniques used in this study were inspired by the suggestions for studying the strategy process made by Van de Ven (1992) and Langley (1999). To study the strategy process, the overall research approach must accommodate for temporal sequences between activities, decisions, and events and how they influence strategic choices that lead to a fit/misfit (Van de Ven, 1992), which is in favour of collecting and analyzing process data. At the start of the study, the authors had already access to extensive documentation of the logistics strategy content, pilot projects where they tested the strategy, time plans for the strategy process, and implementation plans. However, the research process began with a literature review, in line with the recommendations by Voss et al. (2002) to establish a focus early in the research process. The literature review comprised literature from three distinct, but related areas: 1) organization design and strategy, 2) organization design and strategy in logistics management, and 3) logistics management in construction. Here the researchers identified a need to collect additional interview data to complement the archival data. The rationale for interviewing key persons involved in the strategy process was partly based on gathering additional information beyond the archival data, but also to triangulate data sources in order to increase construct validity (Yin, 2018). The researchers decided to interview one current logistics developer at the company and two key persons that were responsible for the strategy process.

The interviews were semi-structured to allow the respondents to give their view of the strategy process, while retaining a focus on identifying which decision, activity, and/or event that generated an outcome. The first interview was held with the current logistics developer at the company, who had spent one year analyzing the company's experiences from the strategy process. Although it did not reveal direct indications of what had led to the outcomes of the strategy process, the interview findings provided valuable input for the following interviews the key persons behind the logistics strategy. The key persons interviewed were the logistics manager who had the main responsibility of the strategy formulation, and the project manager who was primarily involved in testing the strategy through pilot projects and in the implementation phase. The interviewees gave their experiences from the years that they had been involved in the logistics strategy process, which provided useful information on the sequence of decisions, activities, and events, and what had generated the strategy process outcomes.

The data analysis was carried out in two steps: First, a visual map was created based on the interview and archival data that illustrated important decisions, activities, and events during the strategy process. Thereafter, the interview data was used to link the decisions, activities, and events to the logistics strategy process outcomes. This enabled the researchers to draw conclusions of what had caused a strategy component to be successfully implemented or why it had remained unrealized.

4. Summary of Papers

This section provides a summary of the three papers that this thesis is based on. The main findings and contributions of each paper are presented.

4.1 Summary of Paper 1

The purpose of Paper 1 was to develop a typology of ideal logistics configurations in construction. Furthermore, the paper includes a discussion of how to validate these ideal logistics configurations empirically. The purpose was achieved through a conceptual review of configurational approaches within organizational design research, logistics contingency studies, and contemporary construction logistics research. The literature constituted the basis for a conceptual model that was used to develop the typology. The conceptual model is illustrated in Figure 5 and links the logistics strategy content (i.e., structural components referred to as "organization of logistics activities") to the degree of pre-engineering and off-site assembly (the latter refers to the element "choice of production process" used in this thesis). The middle part of Figure 5 imply that each logistics strategy context has an ideal logistics configuration profile comprising logistics strategy context and content elements. By adhering to an ideal profile, a building contractor can achieve desirable logistics performance outputs that are in line with a cost/delivery or flexibility-oriented strategy. Building contractors that deviate from an ideal profile should exhibit lower performance across logistics performance categories.

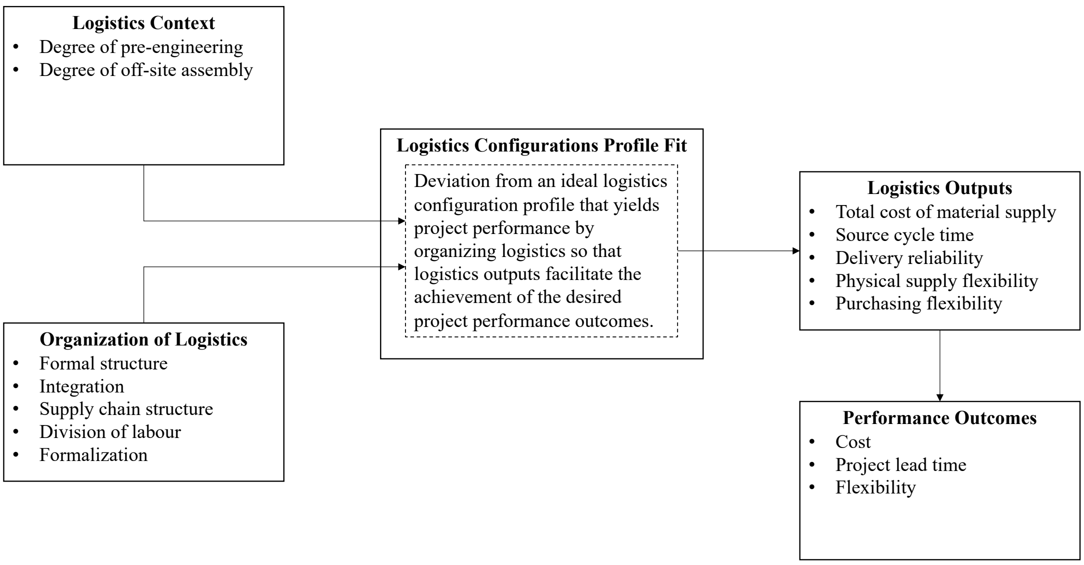

Figure 5 Conceptual model of logistics configurations in building construction (Haglund, 2021)

Based upon the conceptual model, a typology of two ideal logistics configurations was defined: the product/process-oriented configuration and the project-oriented configuration. These are two configurations positioned at the extremes of a continuum. By adhering to one of these two configurations, a building contractor should benefit from either low costs and short project lead times, or a flexibility in the building design and the ability to deliver a wide range of projects.

The product/process-oriented configuration achieves low costs and short project lead times through a geographically fixed supply chain structure combined with long-term relationships with materials suppliers. Logistics tasks are typically part of a central department. This enables short sourcing cycle times, high delivery reliability, and contributes to low administration and transportation costs. In contrast, the project-oriented configuration excels within flexibility related measures. They achieve this by designing their logistics system in a way that it can adapt to unanticipated changes to the demand of building materials. Administrative logistics tasks can be performed by a central department, but operational and physical tasks need to be managed at the regional and/or project level. This configuration works best for building contractors that have many temporary supply chains that are geographically dispersed. The main advantage is the high degree of physical supply and purchasing flexibility. Physical supply flexibility indicates that material suppliers and goods reception resources can respond to sudden changes in material flow characteristics and demand volatility. Purchasing flexibility indicates that the building contractor can source components from many different suppliers in varying batch sizes on a short notice.

The main contribution of Paper 1 to this thesis is the classification of ideal logistics configurations that highlight the trade-offs building contractors face when pursuing a certain logistics strategy configuration. This provides a starting point for further empirical research and can be used by managers to identify misfits in their company's logistics strategy.

4.2 Summary of Paper 2

The purpose of Paper 2 was to explain the fit between the logistics context and the organizing of logistics at a strategic level. This was achieved by identifying three logistics strategy context elements (upper part of Figure 6) and five content elements (lower part of Figure 6) in literature. These elements were used to develop a profiling template that could illustrate the degree of fit in building contractors' logistics strategy configurations. The profiling template was then applied to four building contractors using a multiple case study (see Figure 6, where a straight line indicates fit, and a dogleg indicates misfit). Three building contractors were classified as "general-purpose contractors" due to their broad range of clients and building projects. The fourth was classified as a "residential building contractor" to highlight that they focus on multi-family residences, producing low-cost housing for private clients.

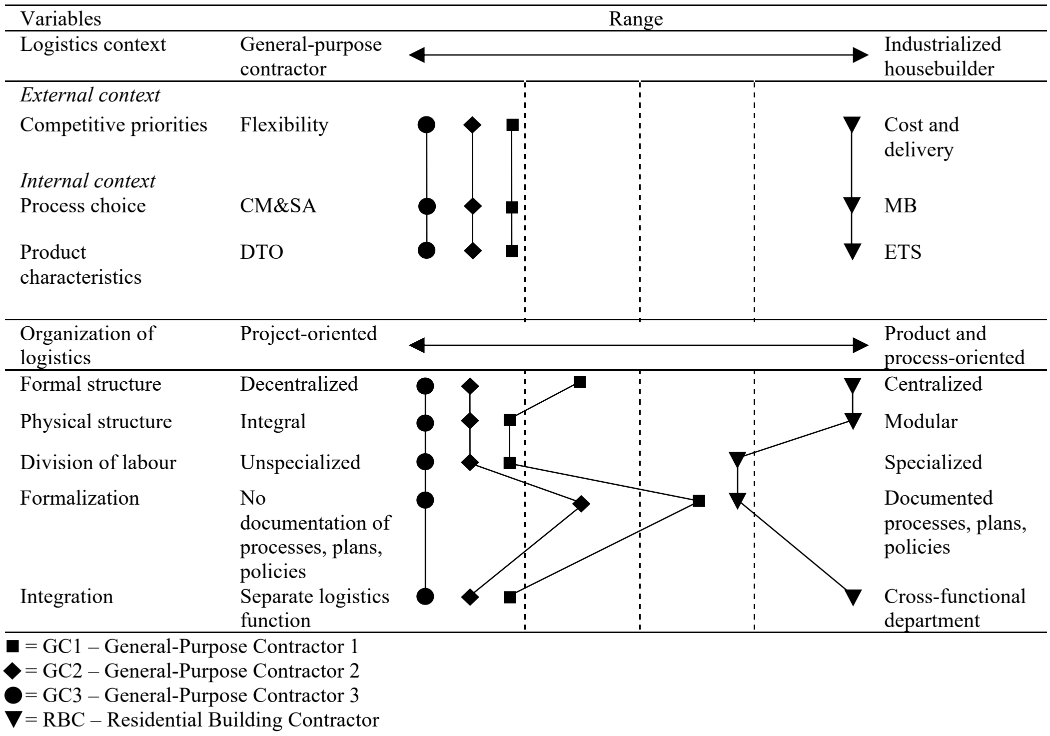

Figure 6 Logistics configuration profiling of the four case companies (Haglund et al., 2022)

The paper provided insights into typical characteristics of different logistics strategy configurations. Three logistics strategy context elements were identified: competitive priorities, process choice (i.e., the choice of production process), and product characteristics (i.e., the degree of pre-engineering), and five logistics strategy content elements: formal structure, physical structure, division of labour, formalization, and integration. The multiple case study indicated that the profiling template proved to be a useful tool in explaining the fit between the logistics strategy context and content.

The case studies indicated that general-purpose contractors (GC1, GC2, and GC3) need to distinguish between which logistics tasks that are aggregated into a central unit (i.e., centralized) and which are delegated to the project level (i.e., decentralized). Strategic logistics decisions need to be taken at a central level. This contrasted with the existing situation of the general-purpose contractors in the case study, which delegated these decisions to projects. Furthermore, it was found that both the general-purpose contractors and the industrialized housebuilder can benefit from formalizing logistics processes. Formal logistics processes, policies, and procedures developed by a central logistics department provide a frame of reference for logistics operations, while the execution of logistics tasks is performed at the project level.

Paper 2 describes relevant elements and their respective characteristics that can be used to determine the fit between the logistics strategy context and content. Furthermore, the paper highlights the need for a formalized logistics strategy to establish a fit between the logistics context and organizing of logistics. The multiple case study revealed that this might be uncommon in the Swedish construction industry and that there are substantial benefits in formalizing a logistics strategy rather than pursuing an *ad hoc* strategy.

4.3 Summary of Paper 3

Paper 3 focused on the process of establishing fit, which is the activities, decisions, and events that shape the ultimate outcome of the logistics strategy process. While fit can be observed at a point in time, the process behind establishing fit is often overlooked. This is problematic because the strategy process is typically unpredictable and characterized by managers' level of discretion in strategic decision making (i.e., strategic choice is highly affected by the manager's decision-making authority and background). The purpose of Paper 3 was thus to examine how strategic choice influences the logistics strategy process. This was achieved through a longitudinal single case study, which was carried out in retrospective of a large building contractors logistics strategy process. To fulfil the purpose, the following research questions were studied and answered:

RQ1. How does managerial discretion constrain logistics strategy formulation and implementation?

RQ2. How does strategic choice influence logistics strategy and structure in terms of fit?

The paper provided insights into the process of establishing fit between the logistics context and strategy in a building contractor organization. It revealed that the building contractor's previous endeavours in logistics, production, marketing, etc., can restrict their ability to pursue an ideal logistics configuration. This suggests that building contractors are prone to path-dependency when choosing among logistics strategy alternatives. Consequently, building contractors can take several routes to achieve a fit between the logistics strategy context and content: 1) the logistics strategy context can be adapted to the existing logistics strategy content (i.e., changing the degree of pre-engineering, production system, and/or the supply chain structure), 2) changing the logistics strategy content to the existing logistics strategy context (i.e., reorganize logistics tasks, decision-making authority, and logistics processes), and 3) a combination of 1) and 2). The most feasible alternative ultimately depends on the type of constraints managers face and whether these constraints mostly affect the implementation difficulty in the logistics strategy context or content.

Paper 3 contributes to this thesis by identifying and presenting the constraining factors to logistics strategy implementation, which are summarized in Table 3. These factors mediate the fit between the logistics strategy context and content of the building contractors. In particular, the paper highlights that a top-down strategy process model cannot be regarded a universal solution to formulating and implementing a logistics strategy in building construction. The initial conditions are never the same prior to the logistics strategy process, and the top-down strategy process model disregards that the logistics strategy is path-dependent and involves making choices that are influenced by internal company politics and conflicting priorities at different levels of a building contractor organization.

Table 3 Identified constraints to logistics strategy implementation (based on Haglund and Rudberg, 2022)

Logistics strategy dimension	*Intended outcome*	*Realized outcome*	*Identified constraints*	*Implications for fit*
Context	- Increased level of standardization - Long-term relationships with suppliers	- Low use of standard components - Mainly local suppliers	- Lack of cooperation between central purchasing department and project purchasers	- Low degree of logistics task predictability - Many logistics decision elements
Content	- Centralized logistics with regional planning units - Standardized administrative and operational logistics processes	- Centralized logistics development	- Lack of top management support - Low level of logistics expertise in the purchasing department - Lack of incentives to change among site managers	- In favour of customized logistics solutions for individual projects - Local adjustments to logistics processes based on project conditions resulting in ad hoc problem solving

5. Discussion

In this section, the two research questions are answered, followed by a discussion of the thesis' purpose.

5.1 Research Question 1

What elements of logistics strategy context and content can be used to assess the fit of building contractors' logistics strategies?

This thesis suggests nine elements that can be used to assess the fit between the logistics strategy context and content, four context and five content elements. The logistics strategy context elements are competitive priorities, the degree of pre-engineering, the choice of production process, and supply chain structure. The suggested logistics strategy content elements fall under two categories that are referred to as structure components (formal structure, integration, and division of labour) and process components (formalization and order-driven/speculative).

Competitive priorities determine the contractor's strategic orientation. They influence the logistics strategy content so that they are configured in a way that favours a cost/delivery or flexibility-oriented competitive strategy (Bowersox and Daugherty, 1995). The three internal context elements are the degree of pre-engineering, the choice of production process, and the supply chain structure. The degree of pre-engineering is primarily related to the predictability of logistics tasks. A high logistics task predictability (e.g., in an ETS situation) favours formalization of logistics processes in the form of standard policies, procedures, and goals (Persson, 1978). Industrialized housebuilders can therefore standardize their logistics processes to a further extent than general-purpose contractors. The choice of production process and supply chain structure were found to influence the degree of centralization in the logistics organization. For instance, an ETO situation requires a high level of flexibility in production and distribution (Klaas and Delfmann, 2005). In Paper 2 it was found that this needs to be supported by a combination of a centralized logistics function and decentralized control and execution.

In Paper 1, two distinct logistics strategy configurations were described: the product/process-oriented and the project-oriented configuration. The product/process-oriented configuration strive for economies of scale and long-term relationships with material and component suppliers. Building contractors that adopt this configuration exhibit high performance in primarily cost and delivery related measures. In contrast, the project-oriented configuration delivers superior performance in flexibility related measures. The logistics strategy is thus a means of supporting a strategic orientation (Bowersox and Daugherty, 1995). For instance, building contractors with a product/process-oriented configuration are typically industrialized housebuilders that can deliver building projects with short project lead times and at a low cost. The project-oriented configuration is typically a feasible alternative for general-purpose contractors that compete based on their ability to deliver a variety of building projects. These findings add further insights into the trade-off between productivity and flexibility-related capabilities in building contractors' production strategy highlighted by Jonsson and Rudberg (2015). The trade-offs are not only a consequence of the strengths and weaknesses of different production systems but are also determined by a configuration of the logistics organization structure, the supply chain structure, and characteristics of logistics processes. This means that the logistics strategy must exhibit a fit with the production and marketing strategies to support a cost/delivery or flexibility-oriented strategy.

However, there are risks involved with trying to combine the two configurations as this may lead to the situation of being "stuck in the middle" (Porter, 1996). Although concepts, such as mass-customization, is highlighted as a means of overcoming the productivity/flexibility trade-off in building construction (e.g., Bonev et al., 2015), it can be questioned whether these trade-offs really are eliminated. On the contrary, the thesis findings suggest that it is a compromise between the product/process and project-oriented configuration. Using the product/process matrix developed by Jonsson and Rudberg (2015), the mass customization strategies fall in the categories between the two extremes of pure product customization (ETO) and standardization (ETS). A mass customization production strategy resembles the ATO degree of pre-engineering, which in turn involves trade-offs. For instance, a building contractor with the product/process-oriented configuration that decides to move from ETS to ATO to allow for a more flexible building design will experience an increase in administrative costs. Furthermore, the added customization in the product increases variation in the production phase (da Rocha et al., 2016), leading to an increase in the number of logistics decision elements brought by an increased degree of pre-engineering. This incurs increased administrative costs because of increased information processing requirements to handle the reduced logistics tasks predictability and increased number of logistics decision elements (Persson, 1978, Pfohl and Zöllner, 1997).

5.2 Research Question 2

What leads to fit/misfit in building contractors' logistics strategies?

Paper 2 illustrate three building contractors with misfits and one building contractor exhibiting a fit. The strategic profiling template was used during the workshops as a basis for discussing the concept of fit, which indicated that fit was not a conscious choice mainly due to the lack of a central logistics department with responsibility for strategic decisions. This was apparent in the building contractor that had the highest degree of fit, which led to *ad hoc* logistics decision-making at the project level. Therefore, the logistics strategy process needs to be "owned" by a department or unit that is detached from the projects and is not constrained by the projects' time and budget.

The findings in Paper 3 provide insights into the logistics strategy process in a building contractor organization. Logistics strategy process models do not adequately explain the link between the logistics strategy process and its outcomes. This is because the logistics strategy alternatives available to a building contractor are constrained by prior investments, internal political influences, and incentive structures, to name a few. This is in line with contemporary construction logistics research that report other factors than the logistics context as the primary barriers towards implementing logistics solutions, such as a lack of widespread technology standards for sharing information in the supply chain (Elfving, 2021). Furthermore, the strong project-focus in construction is highlighted as a limiting factor for building contractors with the intention to centralize logistics and coordinate multiple projects and their supply chains (Dubois et al., 2019). Projects are limited by time and budget constraints, which indicate that strategic logistics decisions must be made at a company level. This includes the permanent part of contractor organizations that allocate resources and provide expert support to projects (Winch, 2014). A central logistics function is thus an important enabler for logistics strategy implementation.

The logistics strategy process was also found to be path dependent, where investments in, e.g., production technology or logistics infrastructure can generate lock-in effects that limit logistics strategy alternatives. Building contractors should consider different options to establish fit between their logistics strategy context and content and strive for the option with lowest implementation difficulty. This means that establishing fit is a continuous process, where the company must balance trade-offs rather than trying to find an optimal solution (Sandberg, 2017). Paper 3 outlines three alternatives that a building contractor can pursue to establish fit: 1) change the logistics strategy context (i.e., the degree of pre-engineering, the production system, or supply chain structure), 2) change the logistics strategy content (i.e., change the organizational structure and/or logistics processes), or 3) a combination of 1) and 2).

5.3 Purpose

The purpose of this licentiate thesis was *to investigate the fit between logistics strategy context and content for building contractors*. Fit has been extensively discussed, explicitly and implicitly, in logistics strategy research. By investigating the fit between the logistics strategy context and content, this thesis identifies the internal sources of complexity that influence a building contractor's logistics strategy content. Building contractors face similar internal sources of complexity as companies within other types of industries, and this thesis consider those that are logistically relevant, namely the number of logistics decision elements and the predictability of logistics tasks. These are determined by four logistics strategy context elements: competitive priorities, product, production process, and supply chain characteristics (Christopher, 1986, Klaas and Delfmann, 2005). In this thesis, they are adapted to the ETO type of production in building construction and defined as the contractor's competitive priorities, degree of pre-engineering, the choice of production process, and supply chain structure.

5.3.1 Logistics Strategy Context and Content

Building contractors need to apply the right measures to handle the number of logistics decision elements and predictability in logistics tasks. This is to ensure that the logistics organization and logistics processes are designed to handle the decision elements and the level of predictability generated by the logistics context. This thesis puts forward two distinct situations that represent general-purpose contractors and industrialized housebuilders:

(1) Building contractors with few logistics decision elements and predictable logistics tasks, such as industrialized housebuilders, can benefit from a central logistics department with a high division of labour. This tends to be combined with formalized rules, policies, and procedures for how to perform logistics tasks.

(2) Building contractors with many logistics decision elements and unpredictable logistics tasks, such as general-purpose contractors, can benefit from centralizing strategic and administrative logistics tasks, but they need decentralized control for operational logistics tasks. This favours a low division of labour and a low/moderate degree of formalization.

It should be noted that a central logistics department is suggested for both general-purpose contractors and industrialized housebuilders. In Paper 2 it was found that central logistics functions can serve different purposes in the two logistics contexts. Previous logistics strategy research has suggested that the project-structure is most feasible when logistics tasks are unpredictable (Pfohl and Zöllner, 1997). However, this thesis partially contradicts this notion. A central logistics function does not eliminate the possibility to manage day-to-day logistics operations at the project level. Strategic logistics tasks, such as strategy formulation and logistics development, should be centralized. The number of logistics decision elements and the predictability of logistics tasks then determine to what extent logistics needs to be decentralized to retain responsiveness to variation at the operational level (Abrahamsson et al., 2003). This indicates that building contractors' logistics strategies need to be adjusted to the contextual conditions of the company, and not just to the conditions at the construction site (Rudberg and Maxwell, 2019).

The most feasible option for building contractors' logistics organizations is thus a matrix structure to combine autonomous projects with a central logistics function (see Figure 7). The central logistics function is present in projects, albeit to varying extents depending on the logistics strategy context. A highly formalized logistics strategy that is executed by a central logistics function is thus a natural response to a standardized product, while a flexible product offering creates a need for a logistics strategy that facilitates reconfigurable solutions for each project (Rudberg and Maxwell, 2019). In general terms, the balance between a central function and the projects is determined by the diversity in products and the need for coordination between specialist functions to deliver projects (Galbraith, 1971). Project oriented matrix structures are preferred for organizations delivering complex projects, while functionally oriented matrix structures are suitable in for less complex projects (Slack and Lewis, 2017). Based on the findings in Paper 2, the following two paragraphs describe how a central logistics function can be incorporated into two types of building contractors, where the first situation represents an industrialized housebuilder and the second a general-purpose contractor (see Figure 7).

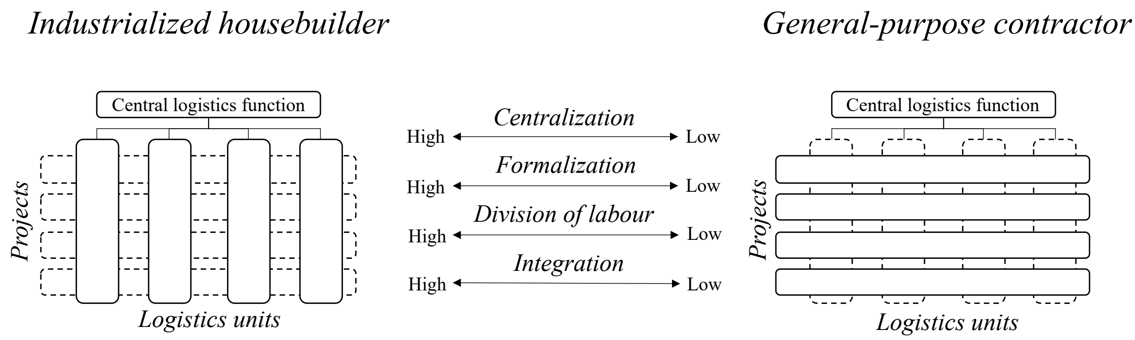

Figure 7 Continuum of logistics organization structures

In the situation of an industrialized housebuilder, the central logistics function has the role of a governing body. A logistics manager (or someone with a similar job title) has the primary responsibility for a central logistics function, which in turn contains one or more units. These units can be divided according to different logistics tasks, e.g., delivery planning, site logistics and material handling, pre-construction planning, coordination, etc. One unit can also comprise several of these tasks, e.g., one unit is responsible for site logistics and material handling. The logistics units are responsible for executing formalized logistics processes defined by the central logistics function, and they significantly influence logistics tasks in projects. This type of logistics organization is suitable for building contractors with a relatively low number of logistics decision elements and predictable logistics tasks. Therefore, building contractors with a high degree of repetition in projects (i.e., an MB production system, ETS, and a stable supply chain structure) will most likely employ this logistics organization structure. This situation is illustrated in the left part of Figure 7, where the solid lines represent the influence that logistics units have over projects.

In the situation of a general-purpose contractor, the central logistics function takes a more passive role as a support function. The projects take primary responsibility for logistics decisions and execution but can utilize the logistics units for expert advisory. This logistics organization is suitable for building contractors with a relatively high number of logistics decision elements and unpredictable logistics tasks. This is to retain responsiveness to the high number of logistics decision elements and unpredictability in operational logistics tasks. Consequently, there is a need for logistics expertise at or in vicinity to the project level in the form of project logisticians and/or regional planning units. This logistics organization structure is suitable for building contractors with an CM&SA production system, an ETO degree of pre-engineering, and temporary supply chains. This situation is illustrated in the right part of Figure 7, where the projects' solid lines represent their influence on the logistics units.

The two situations signify that there is not one best way to organize logistics, which is in line with the contingency stream of logistics strategy research (Christopher, 1986, Persson, 1978). The findings of Paper 1 strengthen the contingency approach to logistics strategy in building construction. It was found that the industrialized housebuilder's logistics organization, depicted in the left part of Figure 7, promote economies of scale, while the general-purpose contractor's logistics organization, depicted in the right part of Figure , facilitate responsiveness and flexibility. Yet, the matrix structure is deemed necessary in both cases due to the inherent project-based operations in building construction. It is not a matter of either a pure project-oriented logistics organization or a single central logistics function, but that different degrees of centralization, formalization, integration, and division of labour within the matrix structure are suitable for different logistics strategy contexts, as highlighted in Figure 7.

5.3.2 Logistics Strategy Process

The situations previously described are based on the content of fit perspective that is based on a cross-sectional view of fit. The cross-sectional view provides a snapshot of the fit between the logistics strategy context and content. However, establishing fit is an ongoing activity, which takes place continuously in construction projects and at a central level. This view implies a more dynamic view on fit than what is typically considered in logistics research (Sandberg, 2017, Zajac et al., 2000).

The organizing of logistics has received some attention in construction logistics research, but typically they focus on organizing logistics activities and resources in the supply chain (Dubois et al., 2019, Sundquist et al., 2018) or from the perspective of the building project (Le et al., 2020), but not from the perspective of the building contractor. As seen in Paper 3, the logistics strategy is influenced by strategic choice, where managerial discretion constrains the ability to establish fit between the logistics strategy context and content. Therefore, the permanent part of the building contractor organization poses additional constraints to logistics strategy formulation and implementation apart from the challenges towards implementing logistics solutions in projects, such as complex interdependencies between activities and actors (Dubois et al., 2019). Winch (2014) state the permanent part of the project-based organization possess the resources that are used to deliver projects. As such, the challenges towards formulating and implementing a logistics strategy at a central/strategic level should not be undermined because individual projects possess little time and resources for these undertakings. Paper 3 highlights this issue, in which the logistics strategy process was severely constrained due to insufficient support from top management at the central/strategic level and constrained time schedules and budgets at the project level.

The two variations of matrix structures for building contractors' logistics organizations in Figure 7 can potentially be means of overcoming the challenges related to scarce project resources and a lack of connection between strategic and operational level logistics. The central logistics function should take responsibility for formulating the logistics strategy. To firmly establish the logistics strategy throughout the organization, it needs to be translated into explicit guidelines for the project level (Rudberg and Maxwell, 2019). In the case of a typical industrialized housebuilder (left part of Figure 7), the logistics strategy can be implemented with less effort because the central logistics function is more involved in the day-to-day operations. However, a general-purpose contractor needs to put more effort into translating strategic level plans to the project level. This is due to the difficulties with maintaining knowledge of all logistics decision elements in situations with highly diverse product characteristics (Galbraith, 1971), such as in the case of general-purpose contractors (right part of Figure 7) that combine ETO with a CM&SA production system. However, in both situations, a better connection between the strategic and operational level can help mitigating many logistics-related problems in construction projects and in the construction supply chain (Thunberg and Fredriksson, 2018).

6. Conclusions, Contributions, and Further Research

In this section, conclusions, the thesis' contributions, and suggestions for further research are presented.

6.1 Conclusions

The purpose of this thesis was *to investigate the fit between logistics strategy context and content for building contractors.* This thesis provides the following conclusions on the fit between the logistics strategy context and content in building construction by answering two research questions:

RQ1. What elements of logistics strategy context and content can be used to assess the fit of building contractors' logistics strategies?

Competitive priorities, the degree of pre-engineering, the choice of production process, and supply chain structure were identified as the main logistics strategy context elements that determine the number of logistics decision elements and the predictability of logistics tasks for a building contractor. The number of logistics decision elements and the predictability of logistics tasks then determine the degree of centralization, formalization, integration, division of labour, and whether logistics processes are formalized and driven by order or speculation.

RQ2. What leads to fit/misfit in building contractors' logistics strategies?

The logistics strategy content needs to exhibit fit with the logistics strategy context to support a cost/delivery or flexibility-oriented strategy. A misfit between the logistics strategy context and content can hinder building contractors in pursuing a cost/delivery or flexibility-oriented strategy. However, the logistics strategy process is not a deliberate choice between logistics strategy alternatives but is a compromise between previous and future undertakings. Building contractors need to consider the constraining factors, such as limited authority among strategic decision-makers and previous investments, towards implementing a logistics strategy. Failing to address these constraints can lead to a misfit and they must choose the alternative that involves the least risk. This can be done by 1) adapting the logistics strategy context to the existing logistics strategy content 2) adapting the logistics strategy content to the existing logistics strategy context, or 3) a combination of 1) and 2).

6.2 Contributions

The main research contribution of this thesis is to the logistics strategy body of knowledge concerning the context, content, and process dimensions of logistics strategy within building construction. Previous logistics strategy literature has mainly focused on manufacturing industries (e.g., Harrison and van Hoek, 2008, Stock et al., 1998). This thesis provides descriptions of logistics strategy context and content elements that have been adapted to the building construction industry. Furthermore, the concept of fit has been investigated and highlights that building contractors need to pursue different logistics strategies for the logistics function to support their competitive strategy. The profiling template (Figure 6) and the suggested logistics organization structures (Figure 7) can be used by researchers and practitioners to pursue further studies of how to establish fit and as a tool to analyze and reconfigure a logistics strategy, respectively.

6.2.1 Research Contributions

The thesis shows that a configurational approach to logistics strategy context and content can be used to determine the trade-offs, where the fit between multiple interrelated logistics strategy context and content elements can either support a cost/delivery or flexibility-oriented strategy. Consequently, the main argument put forward in this thesis is that the different degrees of pre-engineering, type of production systems, and supply chain structures employed by building contractors need to exhibit a fit with the five logistics strategy content (degree of centralization, formalization, integration, division of labour, and whether logistics processes are order-driven/speculative). The identified logistics strategy context elements represent building contractors' internal sources of the number of logistics decision elements and the predictability of logistics tasks. The identified elements and the logistics configuration profiling template in Figure 6 can be used by researchers studying the fit between building contractors' logistics strategy context and content.

Furthermore, the insights related to the process dimension of logistics strategy suggest that the fit between the logistics strategy context and content is not the result of deliberate choice for efficiency/effectiveness reasons. The examples of constraints to logistics strategy formulation and implementation increases the understanding of how the fit between the logistics strategy context and content can be established. The research also shows that failing to address these constraints can lead to a misfit between the logistics strategy context and content, which is proposed to negatively affect the performance of building contractors' logistics operations.

6.2.2 Contributions to the Building Construction Industry

The configurational approach used in this thesis not only brings research contributions, but it highlights that the logistics strategy carry implications for other functional areas in building contractor organizations. The logistics configuration profiling template in Figure 6 can serve as a managerial tool to assess the fit of their current logistics strategy and/or evaluate the consequences of changing the degree of pre-engineering or the production system on the logistics strategy. For instance, a building contractor that aims at reducing their degree of pre-engineering to offer more customization for the client will need to address the consequences this has on their logistics strategy. In the situation where a contractor wants to increase the degree of off-site assembly, e.g., by moving more value-adding activities to an off-site factory, this will change the characteristics of the materials and components that need to be delivered to the construction site for the final assembly. Both these two changes determine whether logistics processes can be formalized and the degree to which they need to be centrally managed, respectively.

The research process that led to this thesis started out with the ambition to describe how building contractors currently work with logistics strategies. However, it was discovered early in the process that logistics strategies in the building construction industry are more or less non-existent, if one refers to systematically developed strategic plans for how to manage logistics. This thesis does not provide an explicit managerial framework that outlines in detail what a logistics strategy should contain and step-by-step guidelines for how a building contractor should formulate and implement a logistics strategy. It does however provide more general advice in the form of the identified logistics strategy context elements, the structure and process components, and challenges to logistics strategy implementation that needs to be addressed. Furthermore, the thesis highlights the need for a central logistics function among building contractors, although their role can differ depending on the need for decentralized planning and execution. These findings can promote a more strategic approach to logistics in which building contractors consider logistics as an important functional area that increases the likelihood of delivering successful building projects.

6.3 Further Research

As mentioned in section 6.2.2, this research does not provide explicit guidelines of what a logistics strategy should contain in terms of structure and process components. Paper 1 and 2 focus on structure components, while Paper 3 comprises both structure and process components. However, the process components identified in Paper 3 are derived from analyzing one case and need to be further investigated to provide more explicit guidelines.

In addition, the thesis does not provide a set of performance measures to evaluate the effects of a logistics strategy. A logistics strategy should prescribe performance measures that enable building contractors to evaluate the performance on process level outputs rather than on firm level outputs. Process-level performance should provide a less distorted view on how “healthy” their logistics strategy is since other factors that contribute to performance are not considered. Furthermore, process-level performance measures can be used to identify the effects of deviating from an ideal logistics strategy configuration.

The effects of company size and geographical market segmentation of building projects have not been investigated in this thesis. Size and geographical market segmentation can potentially influence the structure of the logistics organization, but this was left out to direct the initial focus on large building contractors with projects that are geographically dispersed. However, future research should consider small and medium-sized contractors with concentrated geographical market segments. In terms of absolute numbers, small and medium-sized contractors dominate the Swedish construction industry, and their smaller size and low degree of geographical dispersion can favour more centralized planning and control of material flows. Further research on this avenue can benefit both construction logistics research and the construction industry by providing insights for a common, but overlooked, type of building contractor in construction logistics research.

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Paper 1

Logistics Strategy, Structure, and Performance: A Typology of Logistics Configurations in Construction

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Logistics Strategy, Structure, and Performance: A Typology of Logistics Configurations in Construction

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Abstract

Building contractors need to understand their operational context to manage logistics efficiently and effectively. However, we know little about the choices regarding organization of logistics in building contractors and its relationship to performance. Thus, the purpose of this paper is to develop a typology of ideal logistics configurations and to discuss the strengths and weaknesses of the fit as profile deviation perspective for logistics configuration studies in construction. The typology is based on a critical review of stand-alone contingency studies within the logistics and construction management research domains. Two logistics configurations positioned at the extremes of a spectrum are identified. The first is the product-process oriented configuration resembling to the way industrialized housebuilders organize and manage logistics. The second is the project-oriented configuration, which resemble to how logistics is managed when operations are characterized by a high degree of on-site construction and project-specific engineering designs. The product-process oriented configuration typically generates low total costs of material supply and short and reliable lead times, while the project-oriented configuration has a flexible material supply process to support the high degree of variability in on-site operations and in the supply chain. Thus, these two configurations will perform better within different performance categories (project lead time, cost, and flexibility). Furthermore, the fit as profile deviation perspective is a promising approach to empirically assess the two configurations. For managerial practice, the typology can guide building contractors and consultants in evaluating existing logistics configurations and how to maintain ideal configurations when new logistics roles emerge.

Keywords: Building Contractors, Configuration Research, Logistics Strategy

1 Introduction

During the last decade, new specialized logistics-related roles have emerged in construction companies. The new roles include logistics managers, coordinators, and specialists that are responsible for setting up the site layout, managing the material flow process, delivery planning, materials handling on-site, etc. (Dubois *et al.* 2019). Previous studies indicate that the organization of logistics, including these new roles, influence the performance of construction projects. For instance, on-site productivity is positively affected by specialization of logistics tasks (Sundquist *et al.* 2018) and companies can achieve economies of scale by using joint logistics resources across several projects (Dubois *et al.* 2019). Thus, the matter of how to organize logistics tasks has become increasingly important at the strategic level of building contractors.

Building contractors are a diverse group which consist of large general contractors, industrialized housebuilders, residential builders, etc. (Simu and Lidelöw 2019). Therefore, to manage logistics efficiently (i.e., achieve intended logistics outputs) and effectively (i.e., to achieve intended performance outcomes), contractors need to understand their type of operations and how it influences organization of logistics. The role of logistics differs across the spectrum of production systems, which in turn requires contractors to organize and manage logistics in a way that it supports their operations (Klaas and Delfmann 2005). Yet, so far, most research on organization of logistics in construction has focused on adapting logistics principles to construction with limited consideration of building contractors' operational characteristics.

Contingency theory is a common approach to organization of logistics, which contends that an alignment between the context and organization structure lead to better performance. However, logistics researchers have argued that contingency factors provide only a partial explanation to the strategy-structure-performance links (Klaas and Delfmann 2005). Configuration theory suggests an alternative approach and combines an array of contingency variables derived from stand-alone logistics contingency studies. This is a holistic approach that account for the strategy-structure-performance relationships more comprehensively than individual contingency studies do (Ketchen Jr *et al.* 1993). When applied to logistics, configuration theory suggests that a high degree of fit between several logistics context and organization structure variables should lead to certain performance outcomes (Klaas and Delfmann 2005; Pfohl and Zöllner 1997).

The challenge in studying logistics configurations comes from the plethora of analysis methods resulting from different perspectives to the fit of a sample configuration profile. Each perspective thus have different implications for how to approach, interpret, and empirically evaluate the effects of configurations on performance outcomes. Venkatraman (1989) proposes six different perspectives that form the basis for configuration studies that focus on the fit between constitutive elements: *fit as moderation*, *fit as mediation*, *fit as profile deviation*, *fit as gestalts*, *fit as covariation*, and *fit as matching*. Each of these perspectives differ in scope of and level of detail, which means that the perspective that is selected need to suit the phenomena being studied. The most common perspective for studying the effects of a configuration's fit on performance is from the perspective of fit as profile deviation. Here, fit indicates an adherence to a sample configuration of an ideal configuration. In other words, a deviation from the ideal profile is negatively related to performance, while exhibiting a high degree of fit to an ideal profile is positively related to performance. Thus, the purpose of this paper is to develop a typology of ideal logistics configurations in construction and discuss the strengths and weaknesses as to how fit as profile deviation can be used to study the relationship between logistics configurations and performance in construction.

2 Logistics Configurations

Configuration theory postulates relationships between strategy, structure, and performance, which require consideration of multiple interrelated variables. Central to the configurations approach to logistics is the concept of fit between two groups of variables: the *logistics context* and the *organization of logistics* (Klaas and Delfmann 2005). Furthermore, it requires consideration of two elements: verbal statements (i.e., conceptual definitions) and operationalization of its constructs that enable empirical analysis (Venkatraman 1989). Both these two elements are necessary in theory building research using the configurations approach. The former ensures that the constituents of a particular configuration are rigorously defined, and the latter is the means needed to measure the constructs (Wacker 1998). Drawing on previous configuration studies and stand-alone contingency studies, the following sub-sections focus on defining conceptual definitions of logistics context and organization variables.

2.1 Logistics Context

Logistics literature provides a plethora of logistics context variables, such as strategy, environmental uncertainty and heterogeneity, importance of logistics, and information technology (Chow *et al.* 1995). However, Sousa and Voss (2008) argue that contingency based studies must identify a limited set of variables that best account for different contexts. Many logistics context variables proposed by logistics researchers have several resembling labels and conceptualizations and there are no general exact definitions. This partly stems from the broad range of fields in which they have been applied. Thus, it is necessary to define domain-specific logistics context variables for construction. As such, based on previous work on logistics-related contingency research in manufacturing (e.g., Chow *et al.* (1995), Pfohl and Zöllner (1997), Klaas and Delfmann (2005)) and construction (e.g., Jonsson and Rudberg (2015)), the logistics context of building contractors can be reduced to two variables. The first context variable is *the degree of pre-engineering* to account for the product-related contingency effects. The second is *the degree of off-site assembly* and addresses what typically is considered as process choice or technology in the manufacturing industry.

The reason for choosing the degree of pre-engineering is that it captures the product characteristics that differentiate between different housebuilders. In general, product characteristics is a broad concept that subsumes several other underlying concepts, such as product design, value density, product range, bill of materials (BOM) structure, etc. (Pfohl and Zöllner 1997). Housebuilding is engineer-to-order (ETO) production and thus, production is entirely order-driven with inventories consisting of only raw materials and components, if any (Johnsson 2013). As such, the degree of pre-engineering provides a useful distinction between different ETO situations and denotes to what extent the building specifications can be adapted according to client input (Schoenwitz *et al.* 2012). In other words, the degree of pre-engineering accounts for the extent to which design and engineering activities are performed prior to the customer-order decoupling point (CODP) (Wikner and Rudberg 2005). Table 1 describes the three groups of ETO products that represent different degrees of pre-engineering.

Table 1. Degrees of Pre-Engineering in Housebuilding (based on Wikner and Rudberg 2005; Jonsson and Rudberg 2015).

Pre-engineering	**Value adding prior to CODP**	**Product Standardization**	**Customizable BOM levels**	**Client input**
Design-to-Order (DTO)	None	Pure customization	6<	High choice of building design
Adapt-to-Order (ATO)	Standard parts, components, and sub-assemblies	Customized or tailored standardization	3-6	Limited choice of predetermined options
Engineer-to-Stock (ETS)	Standard buildings or building modules	Segmented or pure standardization	0-2	Limited/no choice of building design

For process choice, the *degree of off-site assembly* represents different production processes in housebuilding. Process choice has been rigorously defined in operations strategy literature via the product-process matrix (Hayes and Wheelwright 1979). Jonsson and Rudberg (2015) proposes a product-process matrix for the housebuilding context comprising of two dimensions: the degree of product standardization and degree of off-site assembly. The degree of off-site assembly is used to denote to which extent a building is prefabricated in an off-site factory. Production is still driven by customer orders, but building components and modules are produce in a controlled environment and assembled on site. However, an off-site factory is typically feasible when is combined with relatively high degree of standardization to reach sufficiently high production volumes (Gibb and Isack 2003; Jonsson and Rudberg 2014). The feasible degree of off-site assembly thereby corresponds to the degree of pre-engineering; as customization increases, more production activities become feasible to perform at the construction site. Table 2 describes four generic production systems in housebuilding.

Table 2. Process Choices in Housebuilding (based on Gibb and Isack 2003; Jonsson and Rudberg 2015).

Process Choice	Prefabrication	Site Assembly
Component Manufacture & Sub-Assembly (CM&SA)	Raw materials/components	Entire building
Prefabrication & Sub-Assembly (PF&SA)	Panel elements	Windows, doors, façade, non-load carrying elements
Prefabrication & Pre-Assembly (PF&PA)	Panel elements with pre-assemblies	Non-load carrying elements
Modular Building (MB)	Volumetric modules	Volume module assembly

2.2 *Organization of Logistics*

While logistics context variables lack consensus in literature, organizational variables are more consistent across domains. Nonetheless, there are some contingency variables that are unique to logistics, besides those commonly used in contingency studies, such as centralization and formalization (Meyer *et al.* 1993). Table 3 presents the five variables for organization of logistics identified in this study with their respective conceptual definition.

Table 3. Conceptual Definitions of Organization of Logistics Variables.

Variable	Conceptual Definition	Key Authors
Formal Structure	The degree to which logistics decision-making is concentrated to a single unit and their proximity to top management.	Chow *et al.* (1995), Pfohl and Zöllner (1997), Moretto *et al.* (2020)
Integration	The degree to which logistics tasks are coordinated with other functional areas within the firm.	Chow *et al.* (1995)
Supply Chain Structure	Geographic dispersion of suppliers, distribution network, and construction sites. Channel governance in terms of vertical integration and supplier relationships.	Klaas and Delfmann (2005), Voordijk *et al.* (2006), Hofman *et al.* (2009), Stock *et al.* (2000)
Division of Labour	The degree of specialization in physical (transportation, material handling, goods reception) and administrative (order processing, delivery planning, inventory management) logistics tasks.	Dubois *et al.* (2019), Klaas and Delfmann (2005), Lindén and Josephson (2013)
Formalization	The degree to which logistics processes, policies, procedures, and strategy are documented.	Chow *et al.* (1995)

Formal structure indicates the degree to which logistics tasks are concentrated to a single unit and the proximity of this unit to top management within the organization (Chow *et al.* 1995). Typically, this is referred to as the degree of centralization in the (logistics) organization structure. As centralization in logistics tasks increases, it typically follows a reduction in its ability to handle variation at the operational (project) level (Pfohl and Zöllner 1997). Centralization reduces the organization's information processing capabilities and when paired with production task variability, it creates a misfit between the information processing requirement and capacity (Galbraith 1974; Luo and Donaldson 2013). For instance, when purchasing and material flow processes are aggregated at the company level which limits the ability to cope with rush orders and changes in production schedules (Moretto *et al.* 2020). Furthermore, a high degree of centralization in the formal structure tends to be followed by a high degree of integration between different functional departments (Chow *et al.* 1995).

The supply chain structure constitutes of two elements and denotes the physical arrangement and governance structure of supply chain members (Klaas and Delfmann 2005). The physical element specifies the geographical dispersion of production facilities, suppliers, and customers (Stock *et al.* 2000). The governance structure indicates the buyer-supplier relationship, which subsequently is characterized by two dimensions: 1) the degree of vertical integration and 2) the strength of relationships between supply chain members (Voordijk *et al.* 2006). Based on the two dimensions, the governance structure can vary from integrated hierarchical structures with close buyer-supplier relationships to disintegrated market structures with loose buyer-supplier relationships. Furthermore, a third mode of channel governance, the network structure, is positioned between markets and hierarchies. The network structure denotes vertically disintegrated organizations but with close buyer-supplier relationships (Stock *et al.* 2000). These buyer-supplier relationships can be either short-term (project) or a long-term (strategic supplier) depending on the type of building material supplier (Voordijk *et al.* 2006).

The division of labour denotes the specialization in administrative and physical logistics tasks (Klaas and Delfmann 2005). An example of specialization in administrative logistics tasks is the use of logistics specialists in projects that have taken over material flow-related tasks from site management (e.g., site layout planning, delivery planning, etc.) (Dubois *et al.* 2019). Physical task specialization is typically achieved by purchasing carry-in services from a third party (Lindén and Josephson 2013). Furthermore, formalization is typically coupled with specialized and indicates to what extent decisions, tasks, and supplier relationships are governed by formalized processes, rules, and operating procedures (Chow *et al.* 1995).

3 Defining Fit - A Typology of Ideal Logistics Configurations

Fit is the common denominator that enables a distinction between different configurations. According to configuration theory, a fit between the individual variables correspond to a certain configuration where different compositions of variables form configurations with distinctive characteristics (Meyer *et al.* 1993; Venkatraman 1989). Configurations can be either conceptually or empirically derived, i.e., defined with typologies or taxonomies respectively. However, Meyer *et al.* (1993) view the dichotomy of typology and taxonomy-based configurations as artificial. Typologies are based on synthesis of stand-alone empirically driven contingency studies. On the other hand, all taxonomies are theoretically based since the forming of empirically driven configurations rely on organization theory. Thus, they should be viewed as complementary when describing configurations and it is instead the replicability of a configuration that is important (Miller 1996). Typology and taxonomy-based configurations do however require different methodological approaches. For instance, taxonomies can require cluster analysis to identify the configurations while typology-based configurations are identified through conceptual modelling (Venkatraman 1989).

Logistics configurations are typically typology-based, i.e., they synthesize stand-alone logistics contingency studies (Klaas and Delfmann 2005). This enables formation of configurations that represent a fit between a set of multiple interrelated logistics context and organization variables. In construction, two distinctive configurations have emerged via the distinction between *product-process oriented* firms and *project-oriented* firms (Lessing *et al.* 2015; Simu and Lidelöw 2019). Although these types of contractors are not the outcome of explicit configurations studies, their definitions closely resemble to that of the logistics context in logistics configuration research (c.f., Chow *et al.* 1995; Klaas and Delfmann 2005; Pfohl and Zöllner 1997). Therefore, two logistics configurations can be distinguished via their process choice and product characteristics. The *product-process oriented* configuration are typically industrialized housebuilders that produce highly standardized products via a high degree of off-site assembly. On the other hand, the project-oriented configuration tends to produce highly customized products via a low degree of off-site assembly (Jonsson and Rudberg 2015).

Based the contextual and structural differences between product-process and project-oriented configurations, they produce distinctive logistics outputs and subsequently produce different performance outcomes (Klaas and Delfmann 2005). Here, it is important to note that the strategy-structure-performance links in configurations studies differs from that of bivariate contingency studies. In configurational studies, it is the fit between multiple interrelated variables that relate to certain performance outcomes. Hence, the performance outcomes are a result of adhering to an ideal configuration profile rather than the features of individual constructs, such as centralization and formalization (Venkatraman 1989). This indicates that different compositions of multiple interrelated contextual and organizational variables will result in different logistics outputs. Figure 1 builds on the logic established by Vorhies and Morgan (2003) and illustrates the postulated relationships between logistics configuration profile fit, logistics outputs, and performance outcomes. For each ideal type of logistics configuration, there are certain logistics outputs that are specific for the type of configuration (Klaas and Delfmann 2005; Pfohl and Zöllner 1997).

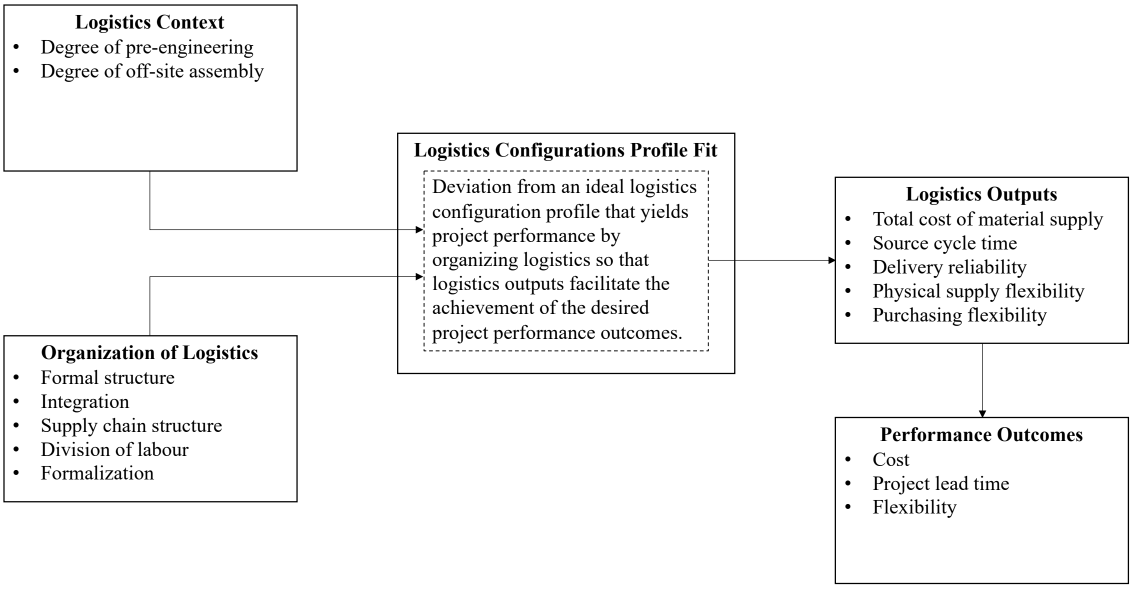

Figure 1. Logistics configuration profile fit, logistics outputs, and performance outcomes.

3.1 The Product-Process Oriented Configuration

Product-process oriented firms typically strive for low project costs and short project lead times combined with a high delivery precision by specializing in producing residential buildings for a narrow target market in an off-site factory (Jonsson and Rudberg 2015). The logistics context is thus characterized by a high degree of off-site assembly (MB) and a high degree of pre-engineering (ETS). This configuration's organization of logistics is characterized by centralization in logistics tasks. Centralized planning and control are typically feasible when there are only a few organizations' material and information flows that need to be coordinated (Rudberg and Olhager 2003). Product-process oriented firms can thus have formal operating procedures which are performed by a specialized planning function that coordinate material and information flows to and between multiple projects (Dubois *et al.* 2019). The supply chain structure that is characterized by geographical concentration, tight buyer-supplier relationships, and a high degree of vertical integration (Voordijk *et al.* 2006). Consequently, most value-adding is concentrated in an off-site factory with central inventories of finished volume modules and direct distribution to the construction site. This enables the product-process oriented firm to pursue a push-logic in inbound and production logistics in the off-site factory and thus optimization of both order-sizes of material components, production lot-sizes, and inventory of finished volume modules. However, final assembly still takes place at geographically dispersed locations. Hence, the material flows from the off-site factory to the construction site follow a pull-logic which needs to be synchronized with off-site factory takt time and volume module deliveries (Arashpour *et al.* 2017).

The logistics outputs of this configuration are mainly cost and lead time related. Centralized planning and control of material and information flows with formalized procedures enable contractors that adopt this configuration to exploit company-wide resources better than project-oriented configurations (Dubois *et al.* 2019). Furthermore, a centralized supply organization that engage in long-term relationships with material suppliers for standardized components facilitate short sourcing cycle times, high delivery reliability, and low administrative and physical distribution costs (Bildsten 2014).

3.2 The Project-Oriented Configuration

The project-oriented configuration can typically not match product-process oriented configuration's performance in terms of project lead time and cost level but strive to deliver a wider range of projects according to different customer requirements (Jonsson and Rudberg 2015). Due to the small production volumes of each product variant and variations in the production process, the formal structure of the logistics organization is typically decentralized with less formalization and specialization than the product-process oriented configuration (Klaas and Delfmann 2005). The project-oriented configuration's supply chain is highly dispersed since the suppliers differ from project to project and are typically procured locally. Logistic tasks are decentralized and instead there is a reliance on the project organization to coordinate material flows in individual project's supply chains (Simu and Lidelöw 2019). This gives rise to a high number of converging material flows to the construction site which leads to a temporary and geographically dispersed supply chain. As such, logistics integration is limited to activities and firms within the project, which restricts cross-functional integration at the company level.

The low degree of centralization, specialization, and formalization facilitates logistics flexibility, which is the ability of logistics system to manage both anticipated and unexpected in material supply that require rapid changes in the logistics system (Jafari 2015; Sandberg 2021; Zhang *et al.* 2005). Zhang *et al.* (2005) points out four elements of logistics flexibility, of which two are relevant to building contractors: 1) physical supply flexibility indicates that material deliveries and inbound supply resources can be adjusted in response to production requirements, and 2) purchasing flexibility denotes the ability to source different materials and components in different batch sizes on a short notice. A project-oriented configuration is thus characterized by a high degree of logistics flexibility, but it comes with precondition that flexibility does not entail a relatively large increase in total costs.

4 Findings and Discussion

The product-process and project-oriented configurations identified in this study represent the two extremes in the typology, and there is potential to identify further configurations that are positioned in between (see e.g., Jonsson and Rudberg 2015). Most configuration studies are however taxonomy-based and combine cluster analysis to derive ideal configurations empirically with profile deviation to compare the degree of fit in the sample to that of the ideal configuration (e.g., Kristensen and Nielsen 2020; Tomas *et al.* 2007; Vorhies and Morgan 2003). It is generally more difficult to define ideal profiles in typology-based configuration studies as the ideal configuration needs to be theoretically derived (Venkatraman 1989). On the other hand, Ketchen Jr *et al.* (1993) argue that taxonomy-based configurations provide little ground for studying the configuration – performance relationship and are better suited for describing configurations per se. The typology-based approach is however the more feasible alternative when the aim is to analyze the relationship between logistics configurations, their respective logistics outputs, and performance outcomes.

The typology and taxonomy-based approaches does however share the problem of being cross-sectional and only providing a static perspective to configurations. This is a potential issue for research on logistics configurations within construction since cross-sectional configuration studies can produce conflicting results (Venkatraman 1989). Logistics management in construction is still regarded as immature (Janné and Rudberg 2020) albeit the developments during the recent decade. A cross-sectional logistics configuration study in the construction domain may therefore risk of being overly conservative (particularly taxonomy-based studies) or idealistic (particularly typology-based studies). Additionally, the concept of fit is in its infancy in construction compared to manufacturing, which may indicate that fit is not a conscious choice among building contractors. For researchers, it is thus important to determine what constitutes fit in an ideal logistics configuration profile. This calls for both taxonomy and typology-based approaches as they are mutually reinforcing in the theory-building process (Ketchen Jr *et al.* 1993; Meyer *et al.* 1993; Venkatraman 1989).

Cross-sectional approaches are most likely the most feasible approach regardless of them being empirically or theoretically based. However, as new construction logistics practices, roles, actors, and organizations evolve, dynamic approaches will be needed to capture what is happening beyond the cross-sectional configuration samples (Venkatraman 1989). A potential venue for studies adopting the dynamic approach is to apply organizational information processing theory. Longitudinal studies can reveal how construction companies manage mismatches between organizational processing requirements and capacity over time (Galbraith 1974; Luo and Donaldson 2013). This has the potential to inform both theory and practice in terms of the process of arriving at fit.

5 Conclusions and Further Research

The purpose of this paper was to develop formal conceptual definitions of the constitutive elements of logistics configurations in building contractor firms and to define what characterizes ideal logistics configurations. The two logistics context variables and five organizational variables defined in this paper provided the basis for a typology of ideal logistics configurations in construction: the product-process oriented configuration and project-oriented configuration. This typology can be used to study determine the respective strengths and weaknesses of different logistics configurations in and their logistics outputs and performance outcomes. Fit as profile deviation is regarded a suitable analysis method to take in consideration both the configuration's profile deviation from that of an ideal configuration, and its effect on logistics outputs and subsequent performance outcomes. Taxonomy-based configurations are more suitable whenever there is uncertainty of what characterizes an ideal configuration and when the configuration – performance relationship is beyond the scope of the inquiry. This is due to the lower degree of generalizability among taxonomies, which limits them in comparing performance across different configurations. For managerial practice, the typology can guide building contractors and consultants in evaluating their existing logistics configurations and how to maintain ideal configurations when new logistics roles emerge.

The main limitation of this study is that it remains to empirically test the typology presented in this study. As such, empirical investigations can reveal the configurations positioned in between the two extremes to capture the entire spectrum of logistics configurations. Lastly, configurations can be studied at different points in time and levels of analyses. This study focused on the individual building contractor's configuration, but future studies can pursue longitudinal research designs and attempt to identify logistics configurations at the project/programme level through a multi-stakeholder perspective.

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Paper 2

Organizing Logistics to Achieve Strategic Fit in Building Contractors: A Configurations Approach

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Organizing Logistics to Achieve Strategic Fit in Building Contractors: A Configurations Approach

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Abstract

Previous research indicates that the success of logistics solutions in projects depend on how they are organized in accordance with the logistics context, which is determined by competitive priorities, product characteristics, and process choice. Taking a configurations approach, the purpose of this paper is to explain the fit between the logistics context and the organizing of logistics at a strategic level. A conceptual research framework is derived from literature postulating an influence of the logistics context on the organizing of logistics. The framework is applied to four cases by the means of strategic profiling, which provides a snapshot of the fit in the cases' logistics configurations. The findings indicate that the type of process influence the degree to which logistics decisions should be made centrally, and that the degree of standardization and pre-engineering influence the degree to which logistics processes should be formalized. The main contributions are the identification of logistics configuration variables and the explanation of fit between the logistics context and organizing of logistics. For managerial practice, the profiling template can be used as a tool in the logistic strategy process.

Keywords: construction logistics, case study, strategic fit, logistics strategy

1 Introduction

While recent studies on organizing of logistics in construction indicate that reorganizing logistics can reduce material-flow related problems in projects and increase operational efficiency (c.f., Dubois et al., 2019, Sundquist et al., 2018), there are few papers that address logistics strategically at the company level. The contemporary construction logistics body of literature predominately focus on operational logistics, but there is little known about the long-term strategic decisions that create the prerequisites for logistics management in building contractors' construction projects. In this context, a logistics strategy is the long-term plan that guides logistics activities at the operational level (Autry et al., 2008).

By neglecting the strategic level, construction logistics research does not explicitly consider that some logistics solutions are invalid under certain circumstances. Contractors have begun using different logistics solutions, such as: carry-in services to avoid disturbances to production tasks, terminals for inventory buffers, checkpoints to ensure timeliness of direct deliveries, and collaborative planning systems for materials deliveries (Janné and Rudberg, 2020). However, the success of employing such logistics solutions depends on the way they are organized in accordance with product and process characteristics, which is typically determined in the logistics strategy (Chow et al., 1995). For example, a recent study by Sezer and Fredriksson (2021) reveals that the type of project and building method creates different prerequisites for planning and controlling material flows to and from the construction site. Likewise, Ying et al. (2014) concluded that the planning and control methods used for order-driven materials are unfeasible for generic materials.

For planning and control of material flows, feasible methods are limited by the planning environment (i.e., demand, product, and production characteristics) (Jonsson and Mattsson, 2003). Similarly, physical logistics tasks are limited by vehicle size, package size, and site constraints (Sezer and Fredriksson, 2021). The organizing of administrative and physical logistics tasks is thus influenced by product and process characteristics (Klaas and Delfmann, 2005), which vary between traditional and industrialized housebuilders (Jonsson and Rudberg, 2015). As such, process choice and product characteristics create different preconditions for logistics management in construction (Faniran et al., 1994). Industrialized housebuilders typically have off-site production facilities in which they produce standardized building modules with a stable organization that resemble more to that of a manufacturing company. On the other hand, general-purpose contractors can produce a variety of projects, typically by limiting investments in fixed resources to reduce overhead costs and maintain flexibility towards the market (Simu and Lidelöw, 2019). Although both types of contractors are within the same sub-industry, their preconditions for planning and executing logistics tasks differ. This indicates that a "one-size fits all" approach to logistics organizing is unfeasible (c.f., Pfhol and Zöllner, 1997; Klaas and Delfmann, 2005). As such, building contractors need to organize logistics to match their product characteristics and process choice.

In logistics research, competitive priorities, product characteristics, and process choice constitute typical elements of the logistics context (Chow et al., 1995; Klaas and Delfmann, 2005). The organizing of logistics resources needs to match the logistics context to produce efficient (low resource utilization) and effective (strategically aligned) outcomes (Klaas and Delfmann, 2005). This match between a building contractor's logistics organization and logistics context is described using the concept of "fit". Fit emanates from organization theory and denotes the alignment between the organization, its internal context which is typically reflected by its strategy, and its external context, which is characterized by market position, market structures, product lifecycles, etc. (Venkatraman and Camillus, 1984). When applied to logistics, a fit between the logistics context and organizing of logistics tend to produce better outcomes in terms of cost, quality, delivery, and/or flexibility (Stock et al., 2000). However, fit must not be mistaken for the correlation between two variables but can be achieved from different initial states and through many potential means and indicates a coherency between several strategy, structure, and process elements (Meyer et al., 1993). A common approach to determining the level of fit between context and organization is by the means of the configurations approach. It is a way of classifying typical organizational archetypes with similar characteristics in terms of their composition and fit between several context and organizational elements. Taking a configurational approach, the researcher emphasizes a broad set of commonly co-occurring organizational and/or strategic characteristics rather than the correlation between two organization variables (Meyer et al., 1993). Thus, a configuration approach to logistics account for a fit between several aspects of the logistics or supply chain context and the structure of supply chains or logistics systems (Klaas and Delfmann, 2005).

In construction, the configurations approach has been used to study construction supply chain configurations (e.g., Hofman et al., 2009, Sabri et al., 2020, Voordijk et al., 2006), but there has been less emphasis on the fit between the logistics context and logistics organizing at the strategic company-level. At this level of analysis, the configurations approach determines whether the logistics organization structure and resources match with the type of production process and outputs (Pfohl and Zöllner, 1997). This issue of organizing logistics has become increasingly important for building contractors over the past decade as they increase the use of logistics solutions in projects (Ekeskär and Rudberg, 2016). Furthermore, contractors have a central role in increasing awareness and the use of logistics solutions (Janné and Rudberg, 2020). Thus, the configurations approach enables an analysis of logistics organizing at the company-level to find ideal configurations (i.e., a high level of fit) of the logistics context and organizing of logistics of different types of building contractors. Therefore, in this paper, the configurations approach to logistics is adopted to examine organizing of logistics in building contractors. The purpose is to explain the fit between the logistics context and the organizing of logistics at a strategic level. This includes the characteristics of ideal logistics configurations of building contractors regarding different competitive priorities, product characteristics and production processes.

To address the purpose of this study, a conceptual research framework is developed based on literature within the fields of organization research, operations strategy, and construction logistics. The framework is then applied to four cases in a multiple case study approach to develop a logistics configuration profiling template. The profiling template is used in two ways. Firstly, for within case analyses to explain fit between the logistics context and logistics organization at the company level. Secondly, for a cross-case comparison to illustrate the differences between ideal configurations in different logistics contexts. This paper contributes to logistics in construction by addressing logistics at the strategic level by the means of the configurations approach. It adds to the contemporary construction logistics body of knowledge by identifying relevant logistics context and organizing variables, and by explaining strategic fit of building contractors' organizing of logistics. For practice, the profiling template contributes in terms of being a tool that can be used by strategists, logistics managers, and operations developers to initiate logistics improvement programmes at the strategic level.

2 Conceptual research framework

The conceptual research framework is based on the configurations approach to organizing of logistics (Klaas and Delfmann, 2005), focusing on the fit between two parts: the logistics context and the organizing of logistics. The emphasis is the consistency between logistics context variables and organization variables at the strategic level. Project-specific context and organization variables are therefore only considered at an aggregate company level. In the following, the two parts of the research framework are explained in more detail, starting with the logistics context followed by the organizing of logistics.

2.1 Logistics context

Sousa and Voss (2008) highlight the value of identifying a limited set of variables that best distinguish between different contexts. As such, we propose three broad context variables in this study, partly based on the works of Chow et al. (1995), Christopher (1986), and Klaas and Delfmann (2005): 1) competitive priorities, covering the external context, 2) process choice and 3) product characteristics, the latter two covering the internal context.

2.1.1 Competitive priorities in contractor companies

Competitive priorities allow to differentiate the contractor's external contexts. The competitive priorities, e.g., cost, delivery, quality, flexibility, is a part of a company's operations strategy (Slack and Lewis, 2017). Two general types of operations strategies in housebuilding companies have emerged as a response to different contexts. The first type is the general-purpose contractor that undertake a wide array of building projects and set up specific organizations for each project, with responsibility typically residing within the middle-management (e.g., project managers) (Simu and Lidelöw, 2019). Competitive priorities for general-purpose contractors tend to be focused on flexibility in the delivery of products and adjustment of the production process (Jonsson and Rudberg, 2017). The second type of operations strategy is the industrialized housebuilder. They aim to reduce complexity and uncertainty in projects by standardizing products, thereby increasing repetition in production (Jansson et al., 2014). For them, projects are typically managed by a fixed organization that resides at the company-level (Simu and Lidelöw, 2019), and the competitive priorities for industrialized housebuilders tend to focus more on cost and lead time performance (Jonsson and Rudberg, 2017). To support competitive priorities, a company must choose the appropriate production process for its products (Hill and Hill, 2009). Hence, competitive priorities have a direct influence on process choice, which is further described in the following section.

2.1.2 Process choice: Degree of off-site assembly

The choice of production process affects the degree of centralization of decision-making and specialization of work (Miltenburg, 2005). In housebuilding, process choice can be summarized in four generic production processes, based on the degree of off-site assembly (Gibb, 2001, Jonsson and Rudberg, 2015), each with different requirements on the planning and execution of logistics tasks:

- *Component manufacture and sub-assembly (CM&SA)*: the traditional approach to housebuilding in which most production is carried out on-site.
- *Pre-fabrication and sub-assembly (PF&SA):* components are prefabricated, and assembly works are performed on-site.
- *Pre-fabrication and pre-assembly (PF&PA)*: the degree of pre-fabrication is similar to *PF&SA* but has more pre-assembly (e.g., window assembly off-site).
- *Modular building (MB)*: volumetric modules are prefabricated in a factory and assembled on-site.

The process choice influences the extent to which detailed plans can be developed prior to their execution (Tenhiälä, 2011). A configurations approach implies that the choice of production process determines the level of detail and the hierarchical level at which plans are developed and executed (Tenhiälä, 2011). In this context, Bankvall et al. (2010) highlight the reciprocal interdependencies between planning levels and Thunberg and Fredriksson (2018) promote pre-construction planning at the company-level (strategic and tactical) to reduce the many problems at the operational level.

CM&SA has the lowest degree of off-site assembly leading to low levels of standardization and repetition, which entails a higher degree of uncertainty in the production system. Thus, it needs to be supported by a decentralized planning and control of on-site activities. MB has the highest degree of off-site assembly because it involves prefabrication of volumetric modules in an off-site factory. MB is associated with standardization and repetition of activities, which entails a lower degree of uncertainty in production system. MB processes thus allows for centralized planning approaches and systems.

2.1.3 Product characteristics: Degree of product standardization and pre-engineering

Housebuilding typically involves highly customized products. However, differences exist within housebuilding and Jonsson and Rudberg (2015) exemplify this using Lampel and Mintzberg (1996) five categories of product standardization: pure standardization, segmented standardization, customized standardization, tailored customization, and pure customization. Within this spectrum, general-purpose contractors tend to produce more customized products, while industrialized housebuilders tend to produce more standardized products (Jonsson and Rudberg, 2014).

However, classifying housebuilders based on product standardization alone only captures the actual product dimension but fails to recognize how the product was engineered. Housebuilding is engineer-to-order (ETO) production (Gosling et al., 2017) and the level of value-adding prior to the customer-order decoupling point (CODP) is thus low and so is the degree of product standardization. Therefore, product characteristics is heavily influenced by the degree of pre-engineering (Johnsson, 2013).

Wikner and Rudberg (2005) suggest that ETO production is a special case of make-to-order (MTO) production, where design and engineering activities are driven by customer orders. To differentiate between ETO and MTO, they propose three subsets of ETO, which includes the product and engineering dimension. The engineering dimension denotes the "stock" of engineering work performed prior to the CODP in the same way stock of raw materials are held in the physical flow of goods (Gosling et al., 2017). The amount of value-adding through design and engineering activities carried out before the CODP is determined by the degree of pre-engineering, and is categorized into three main groups (Wikner and Rudberg, 2005):

- *Design-to-order* (DTO): design is predetermined to a limited extent or not at all (typically combined with *pure customization*).
- *Adapt-to-order* (ATO): building components are pre-engineered and used to adapt the design to each project (typically combined with *segmented*, *customized*, and/or *tailored customization*).
- *Engineer-to-stock* (ETS): the entire building is pre-engineered prior to when a customer order is received (typically combined with *pure standardization*).

The degree of pre-engineering influences the extent to which the organization possess information about the final product and its constitutive parts and assemblies through standardization. A high or medium degree of pre-engineering (ETS or ATO) facilitates a centralized supply and logistics organization because the materials to be procured for a project are known prior to the production phase (Johnsson, 2013). This primarily affects materials management of standard components and assemblies, which can be centralized (Moretto et al., 2020). Centralized supply and logistics is however also achievable for DTO, but at the risk of invoking conflicts between the central organization and site management (Johnsson, 2013). From a logistics perspective, product characteristics thereby determine the type of transportation used, how material is to be handled, storage requirements, packaging, the overall capacity for logistics tasks, and whether common logistics resources and capabilities can be used for these tasks (Pfohl and Zöllner, 1997).

2.2 Organizing of logistics

Bowersox and Daugherty (1987) were among the first to classify logistics organizations in companies. Their classification was based on clustering companies' logistics activities into three strategic orientations: process, market, and information. However, they concluded that a classification based on activities alone was inadequate since companies can pursue different activities regardless of their logistics organization structure. Thereby, they suggest researchers to study organizing of logistics using structural variables. The literature reveals five structural variables that typically are used to classify logistics organisations: 1) degree of centralization in the formal organization (Pfohl and Zöllner, 1997), 2) physical structure of the supply chain (Klaas and Delfmann, 2005), 3) division of labour in logistics tasks (Pfohl and Zöllner, 1997), 4) the degree of formalization in logistics tasks (common set of rules, policies, procedures, strategy, etc.) (Daugherty et al., 2011), and 5) degree of cross-functional integration (Chow et al., 1995). These are explained in further detail in the following sub-sections.

2.2.1 Formal structure

The coordination mechanisms in the organizing of logistics typically include purchasing, production planning and control, order-to-delivery process, distribution planning, and post-delivery services (Jonsson and Mattsson, 2016). The complexity and variability in these tasks determine to what extent logistics tasks, activities, and responsibilities can be aggregated into a centralized unit or group of specialists (Pfohl and Zöllner, 1997). In housebuilding, Dubois et al. (2019) suggest that decentralizing administrative processes typically leads to low levels of coordination of inbound material flows to the construction site. On the other hand, centralized administrative processes, typically carried out by logistics specialists, facilitate increased coordination of material flows between the supply chain and the construction site. Hence, the formal organization structure determines if logistics is concentrated in a single unit or distributed in the organization, and also where in the organizational structure the logistics function is positioned (Chow et al., 1995, Klaas and Delfmann, 2005).

2.2.2 Physical structure

Physical structure determines the structure of the supply chain, including the physical dispersion of warehouses, production sites, and distribution network nodes (Klaas and Delfmann, 2005), which has also been denoted "supply chain modularity" (Voordijk et al. (2006). For instance, in *MB*, the factory and the construction site are decoupled in time and space. Material flows between the factory and the construction site consists mainly of building modules. Hence, high coordination requirements reside in the factory, and between the factory and the site, but are lower at the construction site due to the fewer value-adding activities at site. In *CM&SA*, on the other hand, most production activities are carried out at the construction site leading to a lot of materials delivered to the construction site, and thus high coordination requirements on the many deliveries to site. Therefore, the physical structure of the construction supply chain heavily impacts the requirements on the logistics management.

2.2.3 Division of labour

The division of labour signifies the degree of specialization in physical logistics tasks (e.g., transportation, material handling, and goods reception) and administrative logistics tasks (e.g., order processing, delivery planning, and inventory management) (Klaas and Delfmann, 2005). In housebuilding, physical logistics tasks are typically unspecialized and handled by construction workers that alternate between production activities and material handling. Outsourcing on-site logistics to a third-party logistics provider, or having dedicated materials handling workers on site, increases specialization and construction workers can focus on production activities (Lindén and Josephson, 2013). A low degree of specialization in administrative logistics tasks typically mean that planning and coordination are carried out by site-management. Administrative logistics tasks are specialized when carried out by logistics specialists or outsourced to a third-party logistics provider that manage inventory levels, coordinate co-loading, and plan deliveries to the construction site (Dubois et al., 2019).

2.2.4 Formalization

Formalization indicates the extent to which logistics process, policies, procedures, and strategy are documented (Daugherty et al., 2011). A lack of formalization often results in that project and/or site management use different procedures for logistics activities. This can for instance lead to conflicts regarding delivery schedules, unplanned deliveries, poor goods reception, and inefficient vehicle loading (Ying et al., 2014). These effects are reduced by standardizing planning procedures for logistics but require that sub-contractors and suppliers adhere to the planning procedures (Janné and Rudberg, 2020).

2.2.5 Integration

Chow et al. (1995) defines logistics integration as "the degree to which logistics task and activities within the firm and across the supply chain are managed in a coordinated fashion" (Chow et al., 1995, p. 291). They argue that the degree to which logistics is integrated with other functional areas is determined by the organizational structure, such as whether logistics is a separate function or part of a larger cross-functional department. Integration is most likely to occur when logistics tasks are specialized, formalized, and centralized (Abrahamsson et al., 2003). Hence, the degree of cross-functional integration is partly determined by the configuration of, and coordination with, the other logistics organizational variables.

2.3 Synthesis

Figure 1 presents the conceptual research framework, which is based on the configurations approach to logistics organizing. This approach suggests that logistics organizing is contingent upon its strategy, and that a fit between context and organization will lead to better performance (Klaas and Delfmann, 2005). As recommended by Moretto et al. (2020), both external and internal context variables are considered to account for the degree of the fit between the organizing of logistics and its market characteristics and operations strategy.

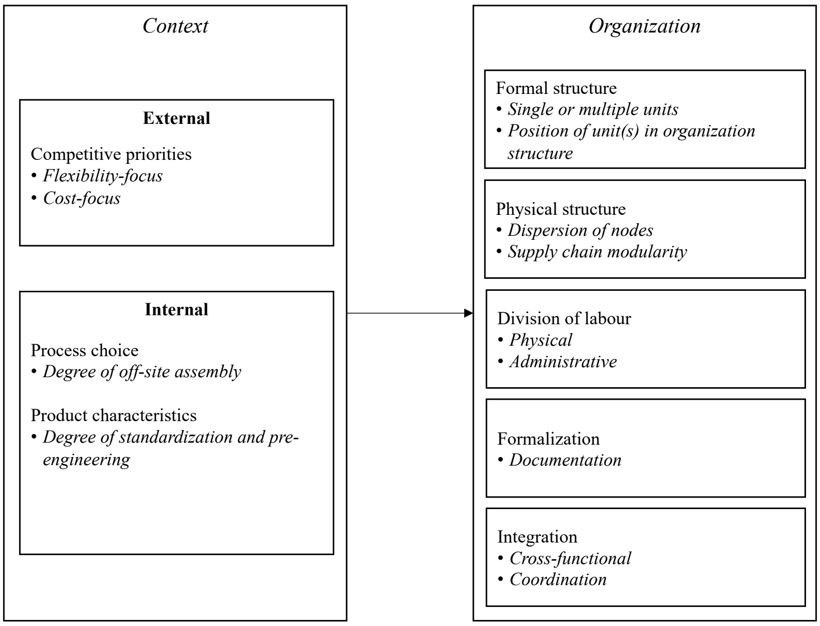

Figure 1. Conceptual research framework.

3 Method

The research process was based on iterations between data collection and conceptual framework development, following the logic of abductive reasoning (Kovács and Spens, 2005). The research process started with a review of literature to identify logistics context and organization variables. A scoping review (Jesson et al., 2011) was conducted in this stage with a focus on identifying ways for classifying how contractors organize logistics at the company level. The searches were conducted using Google Scholar and the university library's own database which includes Business Source Premier, Web of Science, and Scopus. The search words included *logistics organization and contingency*, *organizing logistics*, and *construction*. The identified articles were from both the logistics and the construction domains. The review of literature informed about potential logistics context and organization variables, which were used to develop a conceptual framework and structure early data collection.

A multiple case study approach was used to test the conceptual framework and develop the logistics configuration profiling template. Case research is suitable for studying a phenomenon in its context and when the boundary between the phenomenon and context is blurred (Yin, 2018), which is in line with the configurations approach used in this research. The organizing of logistics is expected to vary between contractors with different competitive priorities, degree of pre-engineering, and process choice. The aim here was not to explain the use of the conceptual framework on a single case, but instead to investigate whether the conceptual framework assists in illustrating logistics context and logistics organization of different contractors. Therefore, a multiple case study approach was chosen where the case selection was based on perceived similarities and differences in the logistics context.

When using multiple case studies in theory development, Eisenhardt (1989) argues that cases should be selected based on theoretical reasoning. In this study, the purpose is to explain the fit between the logistics context and logistics organizing at a strategic level which includes the characteristics of ideal logistics configurations of building contractors regarding different competitive priorities, product characteristics and production processes. Considering these, two types of contractors are expected to vary significantly, general-purpose contractors and industrialized contractors. General-purpose contractors typically have a more project-oriented operations strategy than industrialized housebuilders (Simu and Lidelöw, 2019). Therefore, theory suggests that general-purpose contractors have lower degrees of standardization, pre-engineering, and off-site assembly than industrialized housebuilders (Jonsson and Rudberg, 2014).

Consequently, cases were selected based on their belonging to the theoretical category, i.e., general-purpose contractors or industrialized housebuilder. Three cases belong to the category general-purpose contractors and one case belong to the polar category industrialized housebuilder (see Table 1, providing an overview of the companies and case participants). The two groups of cases were selected based on the grounds of theoretical replication to produce different results, but for expected reasons (Yin, 2018). The two groups were expected to differ due to its differences in competitive priorities, degree of pre-engineering, and process choice. The motivation for having three cases in the group of general-purpose contractors is that their practices typically varies due to that their operations strategies to a larger extent can be influenced by external factors, e.g., from suppliers and clients (Koch and Friis, 2015). Industrialized housebuilders, on the other hand, typically have a narrow market focus, which means that their operations strategy will most likely not differ significantly across cases and that they typically have more control over its production system and supply chain (Lessing and Brege, 2015). Therefore, the three general-purpose contractors were selected to account for potential differences due to the external influences on their operations strategy. The three cases included are also the three largest general-purpose contractors in Sweden and are therefore considered to represent large contractors in the general-purpose group. Only one industrialized housebuilder is included in the study but is considered representative for its theoretical category since the group of industrialized housebuilders is smaller and more uniform than the group of general-purpose contractors.

Within the cases, data was collected with use of different methods (semi-structured interviews, workshops, and secondary data), increasing construct validity by corroborating findings from different data sources (Yin, 2018). Secondary data sources were mainly used for gathering additional information about the companies, and included public information (websites, annual reports, newspapers, and trade magazines), and internal documents from the companies (presentations, checklists, and databases).

Table 1. Overview of case companies and participants.

Company	**Type of company**	**Industry**	**Approximate turnover/employees (2020 Swedish market)**	**Profession of case participant**	**Years in role**
GC1	Large general contractor	Construction and engineering	€3,2 billion (building division)/7200	Logistics specialist	13
GC2	Large general contractor	Construction and engineering	€1,3 billion (building division)/6500	Logistics developer	5
GC3	Large general contractor	Construction and engineering	€2 billion (building division)/3600	Logistics developer	3
RBC	Industrialized housebuilder	Residential housebuilding	€38 million/400 (2019 figures)	R&D manager	5

Data collection in the cases was initiated through four semi-structured interviews which were used to revise the set of logistics context and organization variables from the conceptual research framework. An interview guide was used, which was based on a case study protocol divided into three categories that were identified in the literature review: (1) questions used to gain an understanding of the companies' respective logistics context, which included the types of clients, competitive priorities, product characteristics, and process choice; (2) questions to provide an understanding of the structure of their logistics organization and how logistics was managed in their projects; and (3) questions related to background information about the case participants, brief history about the company, and previous efforts within logistics. One representative from each company working directly with, or in proximity to, the logistics function was interviewed. The representatives from GC1, GC2, and RBC all have many years of experience in working with logistics in construction and the representative from GC3 has a PhD in construction logistics and has been working 3 years as a logistics developer at the company. The interviews were conducted in online video meetings and recorded to facilitate transcription and analysis. Each interview lasted around 1,5-2 hours. Interview questions were based on the three categories of case study questions. For the analysis, the authors listened to the recordings and used meeting notes to link interview data to the questions in the case protocol, followed by a cross-case comparison to identify similarities and differences between the cases.

Based on the input from the interviews, a new literature review was carried out with a narrowed focus on the configurations approach to logistics organization. Classifications are thereby based on a set of variables that are derived from logistics contingency research that have accumulated over time. This provided a more comprehensive view that may be of better practical use than only studying the dyadic relationship between two variables (Klaas and Delfmann, 2005). Conceptual modelling (McCutcheon and Meredith, 1993) was used to categorize logistics context and design variables and to provide dimensions for classifying the variables. This resulted in the conceptual research framework, which provided the relevant variables used for classifying the case companies' logistics configurations. The cases were classified using strategic profiling methodology, which is a suitable method for illustrating the degree of fit in a configuration involving four or more variables (Hill and Brown, 2007). Each case was given its own logistics configurations profile based on the case findings. The profiling was done through an interpretative approach (McCutcheon and Meredith, 1993) by visualizing the case data using the profiling template derived from the review of literature. This resulted in four visual profiles illustrating the degree of fit in the cases' logistics configurations.

The interviews provided data on the case companies' logistics context and organization variables but lacked insight in how to determine the level of fit between the two types of variables (RQ2). Furthermore, since an interpretive approach was used to profile the cases, the researchers had to ensure content validity, i.e., that the variables were accurately measured (McCutcheon and Meredith, 1993). Thus, to address the purpose of explaining fit, the researchers identified a need for further data collection. Dubois and Gadde (2002) refer to this process as “systematic combining” in abductive case research, which emphasizes the search for theoretical concepts or constructs that explain empirical phenomena and vice versa. As part of the matching process between the conceptual research framework, and data collection and analysis, the authors identified a need to empirically verify the framework and decided to arrange three online workshops with the same case participants who were initially interviewed. Two workshops, lasting 2 hours each, were conducted with the case participants from GC1, GC2, and GC3. A separate workshop was conducted with the participant from RBC, lasting 1 hour, mainly due to problems with finding a suitable time for all 4 participants.

Having separate workshops created an opportunity to verify applicability of the framework to the two different groups in more detail. Each workshop was recorded, and two researchers attended each workshop, where one was responsible for moderating the workshops and the other had a more passive role in listening to and commenting the discussion. During the workshops, the case participants were first introduced to the notion of logistics configurations. Thereafter, they were given a task to classify their own companies using the logistics profiling template and to discuss whether they agreed with the researchers’ interpretation or not. The discussions revealed issues with how the logistics context and organization variables were related and what determined a fit between them. The workshop participants also discussed the possible applicability of the framework and the profiling in their organizations and weather they could be useful tools to initiate and guide logistics improvement programmes at a strategic level in their respective organisations. After the workshops, the authors compared the participants’ profiles to the authors’ profiles, listened to the recordings, and summarized the discussions prior to and after the participants had conducted the logistics profiling task. These steps served two purposes: 1) to verify the authors’ profiling of the cases which had been done using an interpretative approach, and 2) to revise conceptual definitions since the workshops revealed some ambiguity about the organizing of logistics variables.

4 Results

Table 2 summarizes the key features of the case companies. The general contractors GC1, GC2, and GC3 pursue extensive design and engineering activities in the pre-construction phase, which indicates that they have a DTO pre-engineering strategy. Furthermore, these contractors perform most value-adding activities on the construction site, which resemble the traditional on-site construction process CM&SA. The residential building contractor, RBC, is an industrialized housebuilder that has established a product development unit in their supply chain department. Building designs are based on five pre-engineering building modules that are produced in their factory or sourced from one of their suppliers. The degree of value-adding activities in the factory is estimated to 70-80 percent, which is a result of that they use the MB production process.

GC1, GC2, and GC3 have organized logistics tasks in similar ways; they have central logistics support functions and logistics developers in the parent organization. However, GC1 have more people (10) in their logistics function than GC2 and GC3 (1 respectively). Outside of the parent organization, the three have project logisticians, but only GC2 has logistics development at the regional level. In contrast, RBC has gathered their logistics expertise with product development, purchasing, and production in their supply chain department.

Regarding documentation, the cases indicate that formal documents are related to operational aspects of logistics. Coordination activities (i.e., at which point logistics is involved in the building process) are mainly carried out in the pre-construction phase in GC1, GC2, and GC3. In RBC, coordinating logistics with product development and production is considered a day-to-day activity. Each case is analyzed in further detail in the following section.

Table 2. Summary of the cases' key characteristics.

Characteristic	GC1	GC2	GC3	RBC
Design and engineering	DTO, pure customization	DTO, pure customization	DTO, pure customization	ETS, segmented standardization
Production process	CM&SA	CM&SA	CM&SA	MB
Parent organization	Central logistics support function (10 people)	Central logistics support function (1 person)	Central logistics development (1 person)	Supply chain department
Regional divisions and projects	Project logisticians	Logistics developers (regional), project logisticians	Project logisticians	None
Documentation	Logistics plan template	Delivery calendar, checklists	Delivery schedules, site layout plans in information system	Policies and procedures for logistics planners
Coordination	Pre-construction, production phase	Experience feedback across divisions, pre-construction phase	Production phase	Product development, module production and site assembly

4.1 Within-case analysis

The challenge for GC1 is to involve the central logistics group in their projects. As of now, there are risks involved in using a centrally developed logistics plan with decentralized execution, especially since the logistics group is relatively small in comparison to the size of the company. The group currently provide support regarding logistics in large and complex projects, but do not specify explicit logistics policies, procedures, and rules. In other words, the level of support from the logistics group differs between projects as it is up to site management to execute and update logistics plans. Projects that do not reach a certain threshold for contract value and technical complexity do not receive support from the logistics group, although these projects typically are DTO and utilizes the CM&SA process.

GC2 prefers large and complex projects and compete primarily on their ability to handle variations between projects. Their challenge lies with coordination between regions to achieve economies of scale and to disseminate experiences from one region to the others. As of now, logistics development resides both within the parent organization and in the regional divisions. In the parent organization, they are working on a development project focusing on digitalizing the project purchasing process, which includes logistics, albeit to a low degree. Instead, regional divisions take the main responsibility for logistics development, and the intensity of such activities varies between divisions. Thus, some regions have come further than other regions in developing and implementing logistics tools, guidelines, policies, and procedures.

GC3's organizing of logistics is characterized by delegating logistics tasks to the projects, which suits their relatively low degree of production standardization, pre-engineering, and off-site assembly. Thus, project specific logistics plans can be developed concurrently with design and engineering in the pre-construction phase but are typically not considered before the production phase. The logistics developer in the parent organization questions whether it is feasible to delegate all logistics tasks to the projects because the logistics tasks do not change drastically, regardless of the projects being unique and "one-off". Such distributed authority to site managers to make logistics-related decisions, involves a risk of "reinventing the wheel" without learning from previous projects.

RBC's challenges lie with integrating a centralized logistics organization with on-site assembly of volumetric modules. Although their logistics organization is centralized and specialized relative to the general-purpose contractors, the completion phase of their projects includes assembly works, on-site materials handling, and remaining works after module assembly resemble traditional on-site construction. Thus, because their production system has two parts, one off-site factory and one on-site module assembly, their logistics planners need to consider both industrial production process and traditional construction process logistics. This is of particular importance for RBC since they need to reduce production lead times as much as possible to compensate for the lower degree of flexibility in their production system and products.

4.2 Cross-case comparison

Figure 2 denotes the cases' logistics configuration profiles and is based on the framework in Figure 1 populated with data from the case study results. The upper part of the Figure 2 shows the companies' logistics context profiles, wheras the lower part profile the organisation of logistics. Both these areas are compared between the case companies in the following sub-sections.

4.2.1 Logistics context

Case GC1, GC2, and GC3 are identical in terms of competitive priorities, process choice, and product characteristics. During the interviews in cases GC1 and GC2, it was explicitly stated that they prefer large and complex projects, and they viewed their sheer size as an advantage over smaller housebuilding contractors. The case participant from GC3 stated that they have a "react to the market" approach and prioritizes flexibility in their projects and products to stay responsive to client requirements. Therefore, GC1, GC2, and GC3's competitive priorities are flexibility and innovativeness. Regarding their process choice, most value-adding activities are performed on-site, and therefore, their degree of off-site assembly is CM&SA. They carry out design and engineering activities from scratch in the pre-construction phase, which indicates that their degree of product standardization and pre-engineering is DTO. RBC prioritizes cost and lead time and has the highest degree of off-site assembly due to their process choice being MB, in which they produce volumetric modules that are assembled at the construction site. The modules are standardized and combined into complete buildings. Therefore, RBC has a high degree of pre-engineering (ETS).

4.2.2 Organizing of logistics

GC1, GC2, and GC3 have centralized logistics functions, but GC1's group of logistics specialists is larger than GC2 and GC3's. Therefore, GC1's degree of centralization, with centralized logistics development and decentralized execution, correspond to a configuration with PF&SA and ATO. Out of the four cases RBC, has the highest degree of centralization, which aligns with their high degree of product standardization, pre-engineering, and off-site assembly.

In GC1 and GC3, logistics tasks at the project-level are primarily performed by unspecialized labour, while logistics development is performed at the company-level. In GC2, although a logistics developer worked in the central organization, it is primarily the regional departments that carry out logistics development while the projects are responsible for execution. The degree of specialization (i.e., division of labour) therefore correspond to their more product- and process-oriented operations strategy. In RBC, it is primarily administrative logistics tasks that are carried out by logistics specialists, but site management take over when building modules leave the factory and are delivered to the construction site. The degree of specialization in RBC is therefore lower than expected for the MB process and ETS pre-engineering strategy.

In terms of formalization, GC1 and RBC have formalized logistics tasks (e.g., logistics plan template used in GC1), but has not formulated strategies at the company-level. Instead, formalized policies and procedures were primarily intended for the project-level, which is why their degree of formalization is considered to be mainly product- and process-oriented. Furthermore, GC2 utilizes logistics guidelines of other tools for delivery planning, but these are not as extensive as those of GC1 and RBC, which indicates their degree of formalization correspond to a more project-oriented approach. GC3 has not formalized logistics activities, policies, procedures, or a strategy, indicating a low degree of formalization intended for a logistics context characterized by CM&SA and DTO, i.e., purely project-oriented.

GC1, GC2, and GC3's organizing of logistics entails that logistics is detached from design and engineering, implying a low degree of integration at the company-level. Instead, GC1, GC2, and GC3 integrate logistics with design and engineering activities in the pre-construction or production phase due to the DTO pre-engineering strategy. Moreover, their respective logistics units are relatively small in relation to the size of the whole organizations. In contrast, RBC's supply chain department accounts for approximately half of their organization, in which the logistics unit is in proximity to the product development and production unit. RBC's logistics organization therefore has the highest degree of integration, which is a result of the logistics function being concentrated to a single unit in the parent organization. By integrating logistics within a cross-functional department, RBC facilitate cross-functional coordination between logistics, production, and product development. A supply chain manager is responsible for logistics, production, and product development, which indicates that logistics is positioned in proximity to top management in RBC.

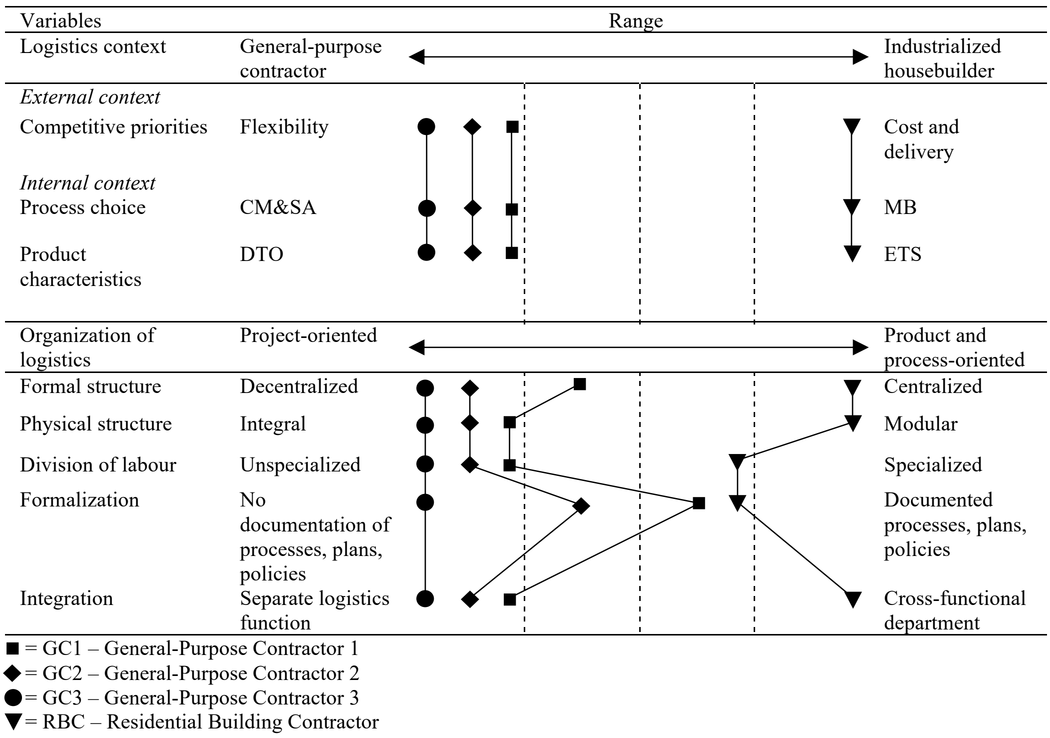

Figure 2. Logistics configuration profiles.

5 Discussion

Pfohl and Zöllner (1997) argue that the organizing of logistics is a response to market characteristics, product characteristics, and the type of production process. The conceptual framework in Figure 1 shows one external and two internal logistics context variables that influence building contractors' organizing of logistics. Building on this framework, the profiling template in Figure 2 illustrates the degree of fit in a building contractor's logistics configuration. The profiling template is a descriptive tool, which does not provide deeper explanations of the *whys* and *hows* but can be used to illustrate relative differences between configurations or changes in a configuration over time.

Based on the logistics configuration profiles of the four cases, two polar logistics configurations are identified in this study, corresponding to the distinction between general-purpose contractors and industrialized housebuilders (Simu and Lidelöw, 2019). Similarly, Moretto et al. (2020) distinguish between project-oriented and product- and process-oriented contractors, which resemble to general-purpose contractors and industrialized housebuilder respectively. This indicates that there is no "one-size fits all" to organizing of logistics for building contractors. In the following sub-sections, the relationships between context and organization variables are discussed as to what constitutes external and internal fit in a building contractor's logistics configuration.

5.1 External fit

In a building contractor organization, external fit signifies their attempt to adapt its product offering to client's requirements (Jonsson and Rudberg, 2014). Therefore, external fit does not directly relate to the organizing of logistics. However, competitive priorities influence the choice of production process and product characteristics, which in turn influence the organizing of logistics. Thus, the fit between the external and internal context is necessary to account for the external fit in a logistics configuration.

The case studies indicate that the contractors have a high level of fit between competitive priorities, product characteristics, and subsequently process choice which is represented in Figure 2 by the straight profiles under logistics context. The case findings align with the suggestions of Jonsson and Rudberg (2015) that industrialized housebuilders typically prioritizes cost and delivery over flexibility. The industrialized housebuilder RBC utilizes a high degree of pre-engineering, product standardization, and off-site assembly, allowing them to reduce lead-time and costs. The general-purpose contractors are positioned at the other end of the spectrum with flexibility as their main competitive priority. Their low degree of pre-engineering, product standardization, and off-site assembly enable them to produce a variety of buildings without incurring added costs.

It is important to note however that the competitive priorities in the case studies are the case participants interpretations of which their respective strengths and weaknesses are. Whether or not their interpretations coincide with that of their clients' is not revealed in the cases, which may hide potential external misfits between the contractors' and their clients' competitive priorities (Maylor et al., 2015). A logistics configuration's level of external fit should therefore not only be considered from the contractor's point of view, but by the degree to which the contractor's competitive priorities are reconciled with the priorities of their target market.

Furthermore, a building contractor's process choice and product characteristics are seldom outlined in terms of explicit formulations of an operations strategy (Maylor et al., 2015). Process choice and product characteristics are typically a reactive rather than proactive response to the external context. In general-purpose contractors, the operating strategy is a result of pursuing a flexibility-oriented operations strategy with a DTO pre-engineering strategy and a CM&SA process (Simu and Lidelöw, 2019) rather than a deliberate commitment at the strategic level. This encourages project-specific design and engineering solutions, variations in production technology and process layout, which lack coherence throughout the organization.

5.2 Internal fit

While the cases exhibited a high level of external fit, there were indications of misfits between the internal logistics context and organizing of logistics. For instance, combining a single logistics unit with a low degree of off-site assembly poses coordination challenges for the logistics specialists. For the CM&SA process, the low degree of off-site assembly involves many components that are to be delivered to the construction site from different suppliers. A centralized logistics support function is thereby difficult to pursue due to the need for coordinating numerous suppliers, including the sub-contractors' suppliers (Dubois et al., 2019). This is illustrated in case GC1 in which logistics specialists from the central logistics unit need to be consulted in projects. This suggests that the degree of off-site assembly influences the degree of centralization in the formal structure, i.e., the extent to which planning is carried out by a central logistics unit.

Furthermore, previous research indicates that product characteristics influence the degree of centralization. When products are standardized, logistics tasks may be predetermined correspondingly, which is typically carried out by a central logistics unit (Pfohl and Zöllner, 1997). However, the construction supply chain poses coordination challenges due to the temporary production sites and supply chains. This is in line with the case findings, which suggest that operational logistics tasks need decentralized support. Both the general-purpose contractors' and the industrialized housebuilder's organizing of logistics must be able to handle variability in projects, albeit at different degrees, which implies decentralization of operational logistics tasks. Nonetheless, the case findings do not postulate it as being contradictory to having a central logistics unit focusing on logistics development and long-term issues. Thus, a distinction should be made between the organization of operational and strategic logistics. Operational logistics concerns making local adaptions while strategic logistics involves setting a frame of reference for logistics processes and how logistics is organized (Abrahamsson et al., 2003, Sandberg, 2021). These two do not have to be organized in the same way, i.e., operational logistics can be decentrally managed while a central logistics unit sets the frame of reference for logistics processes. A central logistics unit can be assumed to be responsible for strategic logistics decision, and its prerequisites are primarily set by the contractor's operations strategy. On the other hand, projects must make local adjustments to account for the site location and its surroundings, local suppliers and sub-contractors, and the type of construction method used where it can differ between projects.

GC1 and GC2 have adopted this approach to some extent with standardized logistics plan templates and guidelines developed by logistics specialists in the central organization. The logistics specialists provide support in projects, but site management possess the formal decision-making authority and control over day-to-day logistics activities. However, case findings indicate that site management have the main responsibility for both setting the frame of reference for logistics processes and making local adaptions to the project. These contractors are considered as "heavy decentralized" since both operational and strategic logistics (to some extent) are in the responsibility of site management. On the other hand, RBC can be considered as "lightly centralized" due to their combination of central planning and decentralized execution.

The distinction between strategic and operational logistics can be related to the degree of formalization. In line with Abrahamsson et al. (2003), the cases indicate that formalized logistics processes need not to be centrally executed, but they have to be centrally designed and managed. The central entity thus set the frame of reference for logistics processes, which in turn are executed by logistics specialists at the project level. Daugherty et al. (2011) suggests that formalizing logistics processes, policies, and procedures signals a commitment to activities that are perceived as particularly important, even in a logistics context characterized by variability and complexity. As a result, both general-purpose contractors and industrialized housebuilders can benefit from formalizing logistics processes, policies, and procedures. However, a low degree of formalization is a common reaction to variability and complexity (Chow et al., 1995), such as that of a general-purpose contractor. Therefore, the degree of standardization and pre-engineering is proposed to influence the degree of formalization.

6 Conclusions and implications

The purpose was to explain the fit between the logistics context and logistics organizing at a strategic level. To fulfil this purpose, relevant contextual and organizational variables were identified and used to create a conceptual research framework (Figure 1), which describe logistics configurations in building contractor companies. It summarizes the logistics context and organization variables identified in literature, which were divided into three context variables and five organizational variables. To explain the fit between the logistics context and logistics organizing, the framework was applied to four cases by the means of a logistics configuration profiling template (Figure 2). Their degree of fit is illustrated using the logistics configuration profiling template. The findings from the case studies are consistent with the configurations approach in that there is no one best way to organize logistics in the context of a building contractor company, but rather that it is contingent upon the logistics context.

6.1 Research and managerial implications

The main contribution is to existing research on organizing of logistics in construction through the identification of logistics context and organization variables relevant in the housebuilding context. In line with recent contingency studies in the field of logistics and supply chain management (e.g., Bals et al., 2018, Moretto et al., 2020), the findings suggest that a "one-size-fits-all" approach to organizing of logistics in building contractors is unfeasible. In line with this, two research contributions are highlighted: 1) Process choice influence the extent to which planning and logistics decision-making are centralized (i.e., the degree of centralization), and 2) in contrast to previous configuration studies within the logistics domain, formalization can provide benefits in a logistics context characterized by complexity and variability, such as those of general-purpose contractors. However, it is expected that general-purpose contractors have a lower degree of formalization compared to industrialized housebuilders.

The profiling template can be used as a managerial tool to reflect upon the level of fit between the logistics context and organizing of logistics, for example by investigating which degree of centralization and formalization that is reasonable. Therefore, the main implication for construction logistics practice is that logistics should be organized to match the preconditions set by the degree of pre-engineering and the type of production system. By simultaneously addressing both product, process, and logistics aspects, it creates a composition of logistics resources and processes that are aligned with the type and characteristics of production tasks, which in turn lead to shorter project lead times, less disturbances, lower total costs of material supply, etc. However, the findings indicate that management should carefully consider centralizing decision regarding strategic logistics issues and formalization of logistics processes, policies, and procedures. A centralized entity can be responsible for setting the frame of reference for logistics, while operational logistics tasks are executed by logisticians at the project-level. General-purpose contractors will need to delegate operational control to the project-level, but they could benefit from using standardized logistics tools and guidelines (e.g., logistics plan templates) and logistics specialists support in the pre-construction phase. Additionally, none of the building contractors had a deliberate logistics strategy, which is recommended to signal commitment to logistics tasks in building projects. For developing a logistics strategy, the conceptual framework (Figure 1) and the profiling template (Figure 2) can be used by building contractors and consultants in the initiation phase of the strategy process for analysis and early development of logistics strategy contents.

6.2 Limitations and further research

One limitation of this research is that the proposed relationships between logistics context and organization variables require further empirical investigation. Thus, the authors recommend future studies to employ large scale surveys with profile deviation analysis to find ideal logistics configurations of high performing building contractors. Furthermore, while the profiling template is useful for illustrating relative differences, it does not indicate how to create fit in a logistics configuration. The profiling template considers the perspective "content of fit" as opposed to "patterns of interactions" (see Venkatraman and Camillus, 1984). Future research should consider which decisions that need to be made to create internal and external fit by addressing decision areas and the process of formulating and implementing a logistics strategy in a building contractor company. The authors recommend in-depth case studies to gain a better understanding of how to create fit in a building contractor organization.

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Paper 3

Logistics Strategy Implementation in Construction: The Influence of Strategic Choice

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Under review in the International Journal of Logistics Management

Logistics Strategy Implementation in Construction: The Influence of Strategic Choice

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Abstract

Purpose – The purpose of this paper is to examine how strategic choice influences the logistics strategy process. The research evaluates the role of strategic choice in the process of establishing fit between the logistics context and strategy in a building contractor organization.

Study design/methodology/approach – A large Swedish building contractor's logistics strategy process is analyzed through a longitudinal single case study for a period of 11 years (2008-2019).

Findings – The case study reveals three main constraints to logistics strategy implementation: a dominant purchasing organization, a lack of incentives, and deviating top management priorities. This suggests that a fit between the logistics context and logistics strategy components is not a conscious choice but is influenced by the level of discretion among decision-makers.

Research limitations/implications – Establishing fit is a continuous cycle of regaining fit between the logistics context and logistics strategy components. Fit can be achieved by a change to the logistics context or to logistics strategy components.

Originality/value – This paper adopts a longitudinal case design to study the fit between the logistics context and strategy, adding to the body of knowledge within organizational design and strategy in logistics and supply chain management.

Keywords: Construction logistics, Strategy process, Strategic fit, Organizational structure, Project-based organizations

1 Introduction

This paper addresses the logistics strategy process in building contractor organizations. Building contractors are project-based organizations and are typically decentralized where projects are managed locally with little connection to the permanent organization (Dubois and Gadde, 2002). Consequently, activities at the operational level seldom follow strategies formulated at the corporate level (Miterev et al., 2017) and there is typically little connection between logistics plans at these levels (Elfving, 2021), which in turn causes material-flow related problems at the operational level (Thunberg and Fredriksson, 2018). However, a corporate/company level logistics plan (i.e., a logistics strategy) can be a means of improving efficiency at the project level by reorganizing logistics activities that lead to better resource utilization and labour productivity (Dubois et al., 2019). Addressing the issue of formulating and implementing a logistics strategy in a building contractor organization can thus yield insights into how to establish the necessary prerequisites for managing logistics in building projects.

In comparison to production systems and supply chains in manufacturing, construction has more complex interdependencies between production and supply activities (Bankvall et al., 2010). There is also a lack of adequate planning and control of materials and information flows that lead to poor coordination between contractors and sub-contractors, which give rise to material flow issues (Thunberg et al., 2017). Previous studies indicate that better planned material flows in construction projects can lead to reductions in total project costs by increasing efficiency in transportation, material handling, and production tasks on site (e.g., Janné and Rudberg, 2022). However, logistics is rarely addressed holistically in projects and instead the main contractor and sub-contractors manage their own material flows (Dubois et al., 2019). One effect of this is that planning methods are misaligned with material flow characteristics, leading to congestion on the site and poor resource utilization (Sezer and Fredriksson, 2021). There is thus a need to consider contextual aspects that influence how logistics is organized, i.e., a contingency approach to logistics (Marchesini and Alcântara, 2016). The main contractor is typically highlighted to be in the position to address these planning-related issues (Vrijhoef and Koskela, 2000), but it requires that logistics is addressed at a strategic level (Thunberg and Fredriksson, 2018).

Despite the existing research on logistics and supply chain strategy and structure (e.g., Feizabadi et al., 2021, Sabri, 2019), the process of establishing the logistics strategy and structure is seldom addressed. A central concept within logistics and supply chain strategy is "fit", which refers to aligning strategy and structure elements with internal and external contingencies, such as market and operations characteristics, respectively (Chow et al., 1995). The concept of fit in logistics and supply chain research is typically considered from a content perspective (e.g., Feizabadi et al., 2021, Nakano, 2015, Sabri, 2019), but this disregards how fit (and misfit) is generated. Mintzberg (1979) argues that strategy and structure cannot be endowed solely to its constituent elements because they do not represent the strategy as it is pursued. Therefore, to understand how fit is established, one must look beyond strategic and structural elements to capture the process behind the realization of the strategy.

Strategic choice is an alternative perspective to the content of fit perspectives that acknowledges the difficulties in establishing fit (Venkatraman and Camillus, 1984). It suggests that fit is the outcome of an unpredictable process characterized by internal and external pressures that are involved in reshaping the organization and its strategy (Child, 1972). The existing organizational structure and strategy, as well as political processes, can constrain managerial discretion in creating fit between strategy, structure, and context (Montanari, 1978), for instance, during strategy formulation and implementation. In the case of construction, logistics practices are characterized by low maturity and an absence of a strategic approach to logistics (Janné and Rudberg, 2022), despite the emergence of new methods, tools, and organizational forms for managing logistics in construction projects (Dubois et al., 2019). This indicates that the development and deployment of logistics practices are not necessarily a conscious choice determined solely by their fit with the logistical context, which is postulated by the content of fit perspective. In short, strategic choice seemingly constrains the development and deployment of logistics strategy in building contractor organizations. Therefore, the purpose is to examine how strategic choice influences the logistics strategy process, addressing the following research questions.

RQ1. How does managerial discretion constrain logistics strategy formulation and implementation?

RQ2. How does strategic choice influence logistics strategy and structure in terms of fit?

The study is based on a longitudinal case study of a large contractor's logistics strategy process and on the conceptual foundation in Child's (1972) strategic choice theory. The case is, to the authors knowledge, one of few deliberate logistics strategy processes in construction, where a wide range of strategy contents are addressed. In contrast, most logistics initiatives in construction are limited to one or a few logistics strategy components with an emphasis on the operational level. The longitudinal case design used in this study thereby provide unique insights into the role of strategic choice in a large building contractor's logistics strategy process and its outcomes in terms of fit.

The paper contributes to research within organizational design and strategy in logistics and supply chain management. In particular, the study illustrates how managerial discretion during the logistics strategy process influences outcomes in terms of fit in a large construction company. Project-based production is rarely considered in studies of functional strategies, such as logistics strategies. The paper also highlights managerial factors, and their potential influence on the strategy process, that must be considered to create necessary prerequisites for managing logistics in construction projects.

The paper is structured as follows: First a theoretical background to strategic choice and fit is presented. After this, the research design and method are described. This is followed by a case description and analysis of the case. The paper ends with a discussion and conclusions, including the limitations of the study and suggestions for further research.

2 Theoretical framework

A logistics strategy is defined as "Strategic directives formulated at the corporate level … used to guide … logistics activities at the operational level of the organization." (Autry *et al.*, 2008, p. 29). These strategic directives refer to how logistics is organized, the order and sequence of logistics activities, and the supply chain structure. The strategic directives are commonly referred to as strategy components and can be divided into structure components and process components. Structure components refer to strategic decisions regarding the logistics organization structure and supply chain structure, and process components relate to decisions regarding administrative and operational logistics processes (Klaas and Delfmann, 2005).

To establish an efficient and effective logistics system, companies' must also create a fit between the logistics strategy components and contextual factors (Klaas and Delfmann, 2005). A contingency approach entails that the logistics strategy context directly influences the logistics strategy components (Chow *et al.*, 1995). However, this assumes that the strategy context directly influences strategy components and neglects the presence of other influences. In contrast, strategic choice theory posits that strategic decisions, and subsequently the strategy components, are constrained by managerial discretion and predispositions of managers (Child, 1972). Here the contingency argument falls short in explaining high performance in organizations with a moderate degree of fit (Doty *et al.*, 1993). The fit between logistics strategy context and components can thus not only be accounted to the content of fit but need to be examined based on how fit is established.

The following sub-sections describe the logistics strategy process and its outcomes through the lens of strategic choice and fit. Beginning with strategic choice, it provides an explanation of how the strategy process is influenced by constraints to managerial discretion in formulating and implementing the strategy. The next sub-section describes the notion of fit along with construction-specific contextual factors and logistics strategy components. The details of this description of fit are summarized in the left and middle part of Table 3 (see page 14).

2.1 Strategic choice: Managerial discretion and predispositions of managers

The content of fit perspective concerns the structure and content of organization and strategy, respectively. It places less emphasis to what is happening within the structure and how strategies unfold and are realized (Mintzberg, 1979). In contrast, strategic choice takes the perspective of the process of arriving at fit, where the causal effect of context on strategy is influential rather than a sole determinant of strategy and structure, as assumed from the content of fit perspective (Venkatraman and Camillus, 1984). The organizational structure and strategy is thereby the result of strategic choices made by managers that are *influenced* by context, but where managerial factors codetermine the choice of strategy and structure (Montanari, 1979).

Child (1972) was the first to suggest that managerial factors, besides context, influence strategy and structure. However, he did not explicate the factors that strategic choice consists of. Montanari (1978) identified this lack of an explicit definition of strategic choice and proposed two underlying factors that characterize how strategic choice influences organizational structure and strategy: managerial discretion and predisposition of managers. Managerial discretion denotes the position managers are in to make changes to strategy and structure, i.e., their decision-making authority. Previous investments in technology, human resources, changes to the organizational structure, etc., can substantially constrain the manager's mandate to formulate and implement a new strategy. Thus, managers must evaluate the conditions for the new strategy and its implementation so that they have sufficient authority and the necessary prerequisites to realize strategic plans. Furthermore, strategic choice implies that strategic implementation is prone to path dependency, i.e., the organization's previous strategic endeavours, which constrain managerial discretion. This includes the organization's prior performance outputs that inform future strategic decision-making by feeding performance objective fulfilment back to managers.

Beside managerial discretion, Montanari (1978) suggest that the managers' personality, educational and professional background, functional orientation, etc., lead to certain preferences in the strategic decision-making processes. Therefore, managerial discretion in strategic choice is also influenced by the predisposition of managers. These managerial factors are typically disregarded in cross-sectional studies, where it is assumed that the organization naturally strives for a fit between its strategy, structure, and context (Miles *et al.*, 1978). As such, applications of the content of fit perspective in operations management studies have produced simple representations of contingency effects on operational strategies, but fail to explain why misfits occur (Sousa and Voss, 2008). This is also apparent in construction logistics research, which have revealed other reasons than contextual factors for the selection and adoption of logistics practices. For instance, Elfving (2021) mention timing, maturity and availability, market factors, and top management priorities as both restricting and promoting in developing and deploying logistics practices in construction companies.

2.2 Establishing fit between contextual factors and logistics strategy components

Managerial discretion and predisposition of managers captures the managerial decision-making process, but does not acknowledge the outcomes of the strategy process in terms of fit (Krabberød, 2015). Ruffini *et al.* (2000) argues that the strategy process is not important *per se*; it is the process of arriving at an outcome that fulfils stakeholder requirements by creating fit. Fit is defined as the match between information processing (IP) requirements with IP capacity (Galbraith, 1974). However, the IP theory needs to be adapted to the construction environment and terminology (Koskela and Ballard, 2012).

In logistics research, uncertainty stems from the material and information flows characteristics, which are determined by; demand characteristics, product characteristics, the design of production system, the supply chain structure, and formalization (c.f., Christopher, 1986, Chow *et al.*, 1995, Klaas and Delfmann, 2005). These are determinants of IP requirements. IP capacity is determined by the organizational structure and the need to match the level of IP requirements to achieve fit (Galbraith, 1974). The following paragraphs define the sources of IP requirements and capacity, starting with the contextual factors (demand characteristics, the degree of pre-engineering, and the production system), to be followed by the logistics strategy components (structure and process).

Demand characteristics relate to the heterogeneity among clients, determining what types of buildings to produce. The target market(s) requirements are typically described using competitive priorities (cost, quality, flexibility, and delivery) (Maylor *et al.*, 2015).

The *degree of pre-engineering* refer to the degree of standardization in the product offering, reflecting the demands from clients, which is operationalized by the contractors competitive priorities (Jonsson and Rudberg, 2015). A flexible product offering typically entails an increase in bill-of-materials levels, which in turn increases the complexity for inventory management and delivery planning (Flynn and Flynn, 1999). In engineer-to-order situations, product standardization is mainly determined by the amount of engineering work that is performed prior to customer order, which can be divided into three categories (Wikner and Rudberg, 2005):

- Engineer-to-stock (ETS): The product is designed prior to customer order.
- Adapt-to-order (ATO): An existing product design is modified according to customer order.

- Engineer-to-order (ETO): The product is engineered from scratch offering broad customizability.

The *production system* characteristics determines how the product is to be produced, i.e., the type of production process and production technology that is to be used. For a building contractor, this entails choosing a suitable production system, which produce outcomes in congruence with competitive priorities (Jonsson and Rudberg, 2015). In general, the lower the degree of pre-engineering (e.g., ETO), the higher the coordination needs to handle the complexity from non-routine engineering tasks (Shurrab *et al.*, 2020). This influences both upstream and downstream processes in terms of their degree of task interdependency (pooled, sequential, and reciprocal), task predictability, and problem analyzability (Miles *et al.*, 1978, Cannas *et al.*, 2019). The degree of pre-engineering is thus associated with the choice of production system, which must accommodate for the type of product (Cannas *et al.*, 2019). Jonsson and Rudberg (2015) classify four different production systems in housebuilding:

- Component Manufacture and Sub-Assembly (CM&SA): Production activities are carried out on-site with a flexible sequence of operations and reciprocally interdependent activities leading to a high level of process time and flow variability.
- Prefabrication and Sub-Assembly (PF&SA): Prefabricated panel elements that are assembled on site along with other sub-assemblies. Contains a flexible sequence of operations and reciprocally interdependent activities leading to a high to medium level of process time and flow variability.
- Prefabrication and Pre-Assembly (PF&PA): Sub-assemblies are pre-assembled to prefabricated panel elements leading to fewer materials to be deliver to the site and fewer operations. Contains a flexible sequence of operations and reciprocally interdependent activities leading to a medium level of process time and flow variability.
- Modular building (MB): Volumetric modules are prefabricated in an off-site factory which has a production line or batch flow layout. Remaining assemblies on-site are reduced but still have a flexible sequence of operations and reciprocally interdependent activities.

Structure components include the logistics organization structure and the supply chain structure. The logistics organization structure determines the level of IP capacity, where centralization is the degree to which logistics decision-making authority is concentrated to a single unit (Pfohl and Zöllner, 1997). Supply chain structure refers to the geographical dispersion and relationships with suppliers (Voordijk *et al.*, 2006). The supply chain structure has implications for the complexity of production and logistics tasks. In particular, the number of and type of relationships with suppliers influence the uncertainty in delivery reliability and quality (Flynn and Flynn, 1999). Construction logistics centres can be used to reduce the number of deliveries to the construction site or as short-term storage for just-in-time deliveries (Janné and Fredriksson, 2022). Moreover, the contractor can engage in long-term relationships with suppliers that enable better alignment between logistics solutions and on-site production (Bildsten, 2014).

Process components refers to the administrative and operational logistics processes (Klaas and Delfmann, 2005). Administrative logistics processes are associated with information processing, coordination, reporting, and control (e.g., order processing) and operational logistics processes are associated with executing of logistics tasks (e.g., transportation and material handling). IP requirements are reduced by formalizing administrative and operational process, i.e., when processes and procedures for performing logistics activities are explicitly formulated (Chow *et al.*, 1995).

2.3 Conceptual research framework

Figure 1 depicts contextual factors and strategic choice as co-determinants of fit. Fit is represented by the dashed arrow and indicates a congruence between the IP requirements generated from contextual factors and IP capacity generated from logistics strategy components, where strategic choice is proposed to have a mediating effect on fit. Demand characteristics determines the heterogeneity and characteristics of clients. The degree of pre-engineering and the production system determines IP requirements. Fit ensures that logistics contributes to the business strategy (Heskett, 1977) and enable efficiency in on-site operations and in the supply chain (Dubois *et al.*, 2019) by aligning the logistics strategy with demand, product, and process characteristics of the organization (Christopher, 1986).

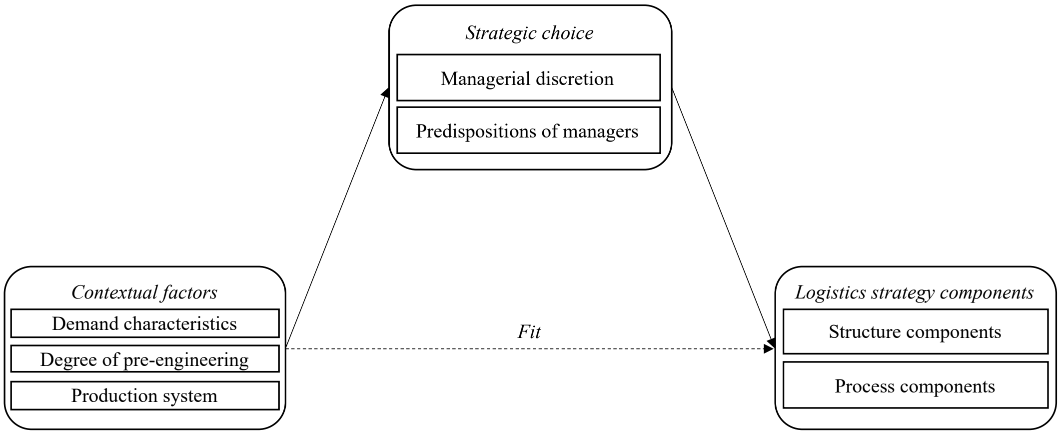

Figure 1. Conceptual research framework.

3 Research design and method

3.1 Research design

To study logistics strategy from the perspective of the process of arriving at fit, the overall research approach needed to accommodate for temporal sequences between events and how they lead to the strategy process outcomes. The research was based on a literature review and a single case study. The literature review focused on three literature areas: 1) organizational design and strategic management literature, 2) organizational design in operations management, and 3) logistics management in construction. This was done in line with the recommendations by Voss *et al.* (2002) to establish a focus early in the research process, whereby the researchers can identify constructs and their presumed relationships. The empirical part of this study was a single case study of a large Swedish construction company's logistics strategy process. The single case design was selected to examine the company's logistics strategy process over a period of 11 years, thus making it possible to study the case over time as a longitudinal study (Yin, 2018). In 2008 the company initiated a project to develop a logistics strategy and tested the strategy through a total of 8 pilot projects split up in three phases. Phase 1 involved one project, phase 2 involved 6 projects, and phase 3 involved one project. The project spanned over 7 years and was discontinued in the middle of 2016, but the research study also includes the years 2016-2019 to cover the possible outcomes of the project after its termination.

3.2 Case selection

The case selection is motivated by the accessibility to the company and by obtaining information on an unusual case (Flyvbjerg, 2006). The authors had access to extensive documentation and key agents in the logistics strategy process. This contributed with rich information covering a long period, which enabled the longitudinal case design. Furthermore, while the building contractor was regarded a typical large general contractor in Sweden, a deliberate effort to address logistics holistically at the corporate level among these types of contractors is uncommon. It was thus the logistics strategy process that makes the case unusual, and not the contractor's general characteristics. The case was however selected for theoretical reasons (Eisenhardt, 1989) based on the contractor's general characteristics in terms of size (large), target market (broad/local), production system (CM&SA), and degree of pre-engineering (ETO). Therefore, in line with the recommendations by Ketokivi and

Choi (2014), regarding using cases as theory elaboration, the case's characteristics and empirical data provided a basis for analytical generalization. Finally, the phenomenon of the strategy process and the process of arriving at fit is favourably studied by analyzing process data (Van de Ven, 1992, Langley, 1999). Therefore, the third reason behind the case selection was the access to process data that described the decisions, activities, and events that recognize the unpredictable process of establishing fit.

3.3 Data collection

The data included both primary and secondary data (see Table 1). The primary data was of two types. The first is the passive participation of one of the researchers throughout the whole strategy process, including notes and meeting minutes that was taken. The second type is the interviews with key persons involved in the strategy process that was conducted in retrospect of the strategy process. For these interviews, a pilot interview was conducted with the current logistics developer at the company, providing insights into the company's experience from the project. The insights from the pilot interview were used as input for the interview guide that was used to interview the former logistics manager and the project manager, which were the key persons behind the company's logistics strategy and the pilot projects. The secondary data comprised internal documentation containing summaries of the pilot projects, descriptions of the logistics strategy, records, and presentation from strategy meetings, implementation plans, and formal directives that were developed for central purchasing and logistics. This documentation was provided to one of the researchers who observed the strategy process from start to finish but did not take active part in formulating and implementing the strategy. The documentation covered the project from its initiation in 2008 to a final report issued in 2014. Besides internal documentation, publicly available information, such as reports, trade magazines, annual reports, and thesis works, were used for background information to establish a sense of when and in what sequence certain activities in the strategy process took place. In total, the interviews, documentation, and publicly available information covered decisions, activities, and events from 2008 to 2019.

Table 1. Data sources and case area.

Data sources	**Case area**			**Comment**
	Managerial factors	**Strategy process timeline**	**Outcomes**	
Interviews with logistics developer (2 à 1,5h each)	X		X	Employed 2018.
Interview with logistics manager (1 à 1,5h)	X	X	X	Retired 2016.
Interview with project manager (1 à 1,5h)	X	X	X	Resigned 2013.
Internal project documentation	X	X	X	Reports continuously issued over 2008-2014 and one report in 2019.
Publicly available information: Annual reports, theses work and reports, trade magazines		X		Financial measures, comments from top management, and details regarding pilot projects.

Researcher observation, note taking and documentation 2008-2016.		X	X	Passive participation during strategy process by one of the researchers.

3.4 Analysis

This study adopted a two-step approach for the analysis. The first step concerned data reduction, where the activities, events, and decisions present in the documentation was structured in the form of a preliminary visual map representing the sequence and timeliness of events in the strategy process. To ensure that the activities, events, and decision had been mapped correctly and to complement the information provided in the documentation, the researchers transcribed and coded the interviews with the logistics developer, logistics manager, and project manager. The result was a visual map of critical events that occurred between 2008 and 2019 (Figure 2). Langley (1999) recommends this approach for the "sense-making" part of process studies to overcome the extensiveness that characterize process data. The visual mapping approach is suitable as an intermediary analysis technique and enables researchers to retain strategy process data as a sequence of events. These events then provide grounds for explaining underlying causes for strategy process outcomes (Van de Ven, 1992). For instance, a particular decision by top-management was related to the implementation phase while the managers' predispositions were related to the strategy formulation. The visual map was thus used to describe the strategy process as it unfolded, including the decisions, activities, and events that influenced strategic choice during strategy implementation.

Having mapped at which point in time the events occurred, the second step in the analysis concerned connecting these events to strategy process outcomes, which explained to what extent each event contributed to the strategy being realized or unrealized as intended. Finally, the building contractor's initial state, expected outcomes, and actual outcomes were compared, which enable the researchers to infer the influence of strategic choice on strategy process outcomes (see Table 2 and 3).

4 Case study description

The company is a large contractor operating in the Nordic countries with a focus on the Swedish construction industry. The logistics strategy process is illustrated in Figure 2, and includes important decisions, activities, events, and reports. The following paragraphs summarize the logistics strategy process in chronological order.

As a response to the low productivity levels and growth in the construction industry, the company's logistics manager sent out a survey to site managers in the beginning of 2008 to map how much time was spent on purchasing and logistics-related tasks in projects. The survey indicated that the company had substantial potential in reducing waste in these activities. This convinced the logistics manager to develop a logistics strategy for the company. The logistics manager contacted a consultancy firm the same year that produced a first draft of the logistics strategy. In 2009, the logistics manager planned the first pilot project to further explore the potential benefits of a corporate-level logistics strategy. Towards the end of 2009, they initiated pilot 1, which had a narrow focus on transportation and material handling of make-to-order materials. Pilot 1 was completed in the end of 2010.

A project manager was hired in the fall of 2010 and became responsible of planning and executing pilot 2. The pilot, which comprised of seven projects, started in 2011 and was finished in 2013. The purpose of pilot 2 was more in line with the first draft of the logistics strategy developed by the consultancy firm, addressing how to supply multiple projects using the same logistics operations platform, how to organize logistics to achieve scale economies, and the potential benefits of increased standardization and centralization of logistics tasks. However, at this time the company experienced declining profitability in their housebuilding business unit. Consequently, top management decided that they would reduce overhead costs by downsizing the central organization. So, as pilot 2 progressed as expected and was finished with promising results, the project manager who had only been employed for 2 years was in the risk of being dismissed, leading to that he resigned voluntarily in the end of 2013.

Pilot 3 begun in the fall of 2013 with the former project manager now working as a consultant. Until this point in time, the strategy process seemed to be progressing well. However, the Chief Purchasing Officer (CPO) had been sceptical towards some of the investments proposed by the logistics manager and the, now former, project manager. For instance, the CPO and the logistics manager could not agree upon which ERP-system to purchase, which resulted in that they did not purchase an ERP-system at all. Instead, the former project manager had to manually make material requirements plans, delivery plans, and produce packing, labelling, and unloading instructions for suppliers and haulage contractors. Therefore, they could not use the learnings from the pilot in future projects. Furthermore, while pilot 3 was undergoing, the CPO resigned in the first half of 2015. The CPO had been an important spokesperson for the logistics strategy in the top management team, but his and the project manager's resignation meant that the strategy work was losing ground in the company. A new CPO was hired in the end of 2015, who was positive towards the logistics strategy. However, the CPO had not been involved and the logistics manager was approaching retirement at this time. The logistics strategy had already lost support throughout the organization, and the process came to an end when the logistics manager to retired in 2016.

In 2017, although the logistics manager and the project manager were no longer working at the company, the new CPO established a central logistics unit, which belonged to the central purchasing department. Despite there being no plan of developing a logistics strategy on the same scale as intended by the logistics manager, the new CPO hired several people to continue developing methods, tools, and processes at a central level, one of them being the logistics developer. The logistics developer was hired in the beginning of 2018 and begun gathering information on what had been done previously in terms of logistics development. In the beginning of 2019, the logistics developer produced a report summarizing the logistics strategy process from 2008 and onwards. Apart from a summary, the report included recommendations of which areas of logistics to focus on in the short- and long-term. However, central logistics was closed in 2019 when the CPO resigned. The logistics developer was then relocated to a support function focusing on technical support to projects.

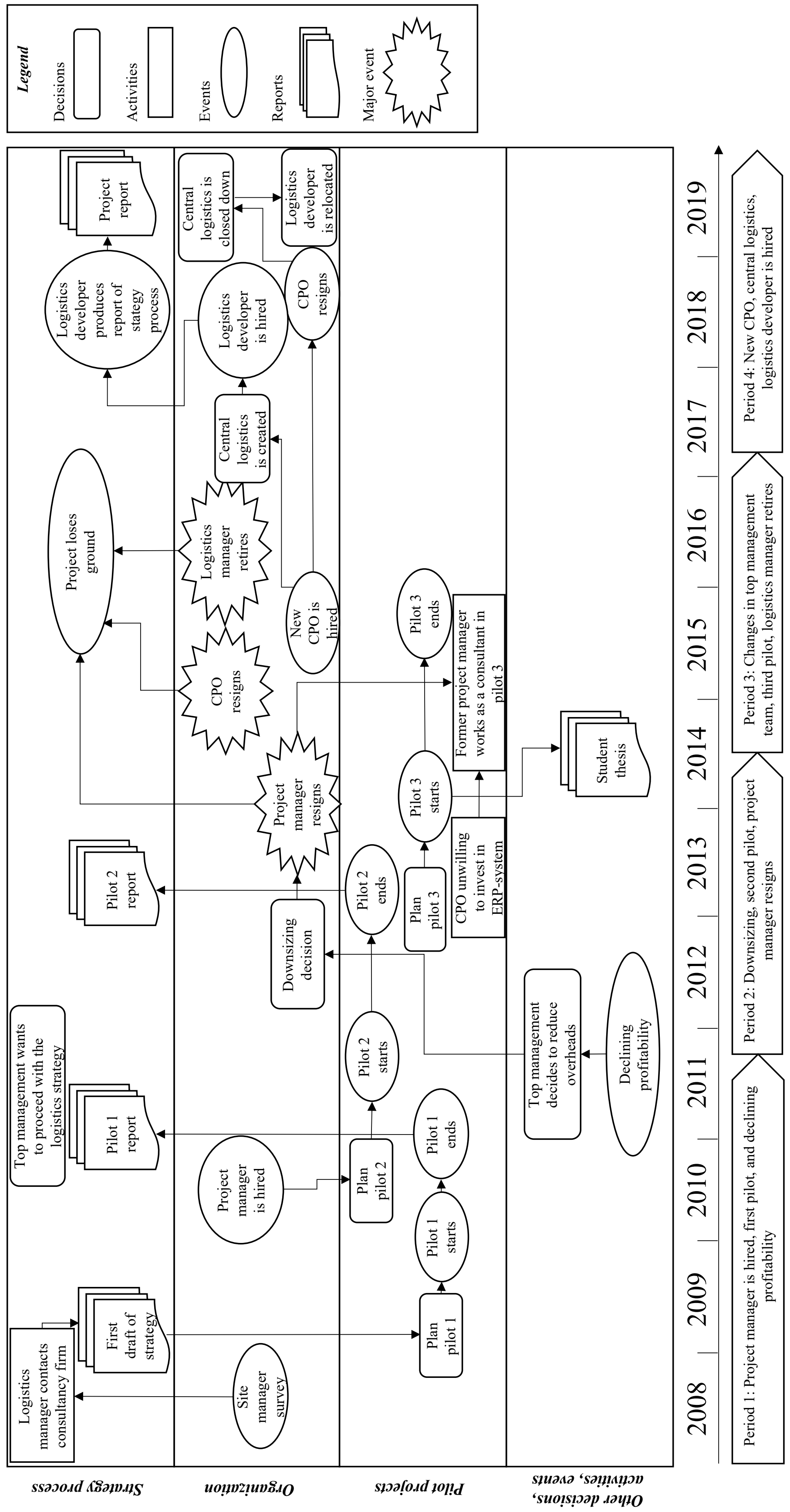

Figure 2. Visual map of the logistics strategy process between 2008-2019.

5 Case study findings

5.1 Constraints to managerial discretion

This section addresses RQ1: *"How does managerial discretion constrain logistics strategy formulation and implementation?"*. The interviews and the internal project documentation reveal several issues that constrained the implementation of the logistics strategy. The constraints to managerial discretion are detailed in Table 2. The three most predominant issues constraining managerial discretion can be summarized as: 1) lack of a formal logistics organization and thus formal authority of the logistics manager, 2) lack of incentives to change among internal stakeholders, and 3) deviations in top management priorities.

Regarding the first issue, the logistics manager stated that *"the biggest problem was that we (logistics) belonged to purchasing"*. The central purchasing organization lacked fundamental logistics expertise, e.g., of the total cost concept, lot sizing, and transport planning. Consequently, site managers were reluctant to use framework agreements from central purchasing since they caused problems for transports and on-site logistics. The logistics manager added that purchasers were not aware of what was happening in projects, even though they had a company policy that required purchasing to evaluate supplier performance after project completion.

Besides purchasing, the interviewees indicate that site managers were not reluctant to the strategy per se, but they lacked incentives to use centrally developed logistics solutions. For instance, the site managers' bonuses were based on project performance (i.e., time, budget, and quality), which entailed that they did not want to bear additional costs for material handling and marking and labelling of goods. Thus, there were no incentives for site managers to pay for distribution terminals and the ERP-system because it was perceived as an additional risk to the project's budget. In addition, the project manager believed that they lacked an internal business model for how to allocate investment costs between the central organization and projects. The project manager suggested that the central organization should have taken the investments costs and that projects would pay a license fee, e.g., for using the ERP-system.

Deviating top management priorities manifested itself in several ways, but it was most prominent between 2013-2016. Top management had in fact been positive towards the strategy in the first couple of years, but changes in the team's composition led to a more sceptical attitude. For instance, the CPO's resignation entailed that the logistics manager had to find a new way to gain top management support. After pilot 2 was completed in 2013, the CPO did little to gain the support from the rest of the top management team, which the logistics and project manager perceived to originate from a lack of logistics expertise. For instance, the project manager stated: *"we always needed to go via purchasing ... and when you have a CPO in the top management team that does not understand this (logistics), there will not be any change"*. The project manager also raised the need for a supply chain manager, or a supply chain department, who knows what logistics means for operations and who could explain this to top executives.

Table 2. Relative influence of managerial factors on strategy process outcomes.

Identified logistics strategy components	**Expected outcomes**	**Realized outcome**	**Identified constraints to managerial discretion during the strategy process (Data source within parentheses: D = Documentation, LM = Logistics Manager, PM = Project Manager, LD = Logistics Developer)**
Structure components			
Centralized logistics	Centralized development of logistics operations platform	Existed between 2016-2019.	New purchasing manager left (started in 2016) (LM), Top management did not understand the strategy (PM), Logistics was part of the purchasing organization (D, LM, PM, LD)
Regional planning units	Aggregation of materials and distribution planning (MTS materials)	Not realized	Top management did not understand the strategy (PM), Regional managers were not committed to change current way of working (LM)
ERP-system	Connecting central/regional and project planning levels	Not realized	Central organization was reluctant to carry initial investment costs (LM, PM), Top management did not understand the strategy (PM)
Distribution terminals	Inventory buffers of MTS materials in each region to increase flexibility, minimize number of deliveries, achieve economies of scale.	Not realized	Site managers only experienced the incurred cost of distribution terminals (PM), Central organization was reluctant to carry initial investment costs (LM, PM)
Process components			
Design and engineering	Routines to improve planning, supplier selection, and accuracy of information.	Not realized	Top management did not understand the strategy (PM), Low degree of standardization in design and engineering solutions (D, LM)
Site logistics	Site disposition plan, roles and responsibilities, delivery planning, goods reception.	Not realized	Material handling on site was not considered logistics (PM), Purchasers were not aware of material flow problems on site (LM, PM)
Marking and labelling of goods	Ensure correct and informative packaging labels.	Not realized	Site managers only experienced the purchasing cost but not the savings of labelling goods (PM), Lack of scale perceived by suppliers (PM)
Delivery planning and transports	Increased control of delivery times and reduce disturbances on production activities.	Not realized	Logistics was part of the purchasing organization (D, LM, PM), transport costs were not visible to project purchasers (included in purchasing costs) (D, LM)
Supplier development policies	Continuous improvements to supply logistics	Not realized	Insufficient logistics capabilities within purchasing organization (D, LM, PM), Long-term supply agreements were not used by project purchasers (PM), Purchasing organization's incentives drove focus on purchasing costs over total costs (D, LM, PM), Logistics was part of the purchasing organization (D, LM, PM)

5.2 The influence of strategic choice on fit

This section addresses RQ2: *"How does strategic choice influence logistics strategy and structure in terms of fit?"*. The implications of strategic logistics decisions identified in the literature were compared with the case study findings to investigate how strategic choice influence fit (Table 3). This comparison revealed that the logistics manager and project manager had not attempted to make significant changes that would lead to a change in demand characteristics. However, there were attempts to increase the degree of pre-engineering and to move towards a PF&SA production system, but this remained unchanged. The predominant use of the CM&SA production system in projects thus entailed high IP requirements, which subsequently must be matched with IP capacity to establish fit.

The analysis of the structural components reveals that the organizational structure generates high levels of IP capacity since the central logistics department and regional planning units were unrealized. The contractor's logistics was thus managed in a decentralized organizational structure with low division of labour, and thus it generated a high level of IP capacity. This corresponds to the high degree of production and supply variability generated by the degree of pre-engineering, the production system, and the supply chain. The high IP capacity generated from the organizational structure therefore matches the high IP requirements, which indicates a fit between the contextual factors and the structure components.

However, the analysis of the process components indicates that the company had an underfit logistics strategy (i.e., that IP requirements exceeded IP capacity). None of the logistics strategy process components were realized (Table 2), which was in favour of ad hoc problem solving by site management and construction workers without formalized administrative and operational logistics processes. The low degree of formalization in the administrative and operational logistics processes thus generate high IP requirements in addition to what was generated from the degree of pre-engineering, the production system, and the supply chain structure. In other words, the lack of formalized routines in the five process components (Table 2) generate uncertainty and complexity in addition to the low degree of pre-engineering, the CM&SA production system, and the geographically dispersed supply chain structure. The low degree of formalization is apparent in pilot 3, where the former project manager worked as a consultant to manually solve administrative logistics tasks.

Table 3. Strategy process outcomes and its implications on fit.

Contextual factors and logistics strategy components	**Description**	**Literature findings**		**Case study findings**	
		Implications for fit	**Key references**	**Realized outcome**	**Implications for fit**
Contextual factors					
Demand characteristics	Number, size, knowledge, behaviour, and heterogeneity among clients	Determines suitable degree of product standardization and pre-engineering through competitive priorities	Shurrab et al. (2020), Maylor et al. (2015)	Remained unchanged. Projects were of local character with a high heterogeneity among clients.	Products and productions system were adaptable to each client's requirements and the company mainly competes with smaller local actors.
Degree of pre-engineering	No. product variants, BOM structure complexity (depth and breadth), and amount engineering work performed prior to customer order impacting production and supply variability	IP requirements are generated from the late design changes.	Cannas et al. (2019), Shurrab et al. (2020), Wikner and Rudberg (2005), Flynn and Flynn (1999), Christopher (1986)	Low use of standardized products and pre-engineered components. BOM structure changes from project to project.	High level of IP requirements due to low amount of information possessed prior to task execution (DTO: low degree of pre-engineering).
Production system	Degree of off-site assembly (CM&SA, PF&SA, PF&PA, or MB) impacting production and supply variability	IP requirements are generated from production variability (process time and flow variability).	Shurrab et al. (2020), Cannas et al. (2019), Jonsson and Rudberg (2015), Wikner and Rudberg (2005), Christopher (1986)	Mainly CM&SA production systems with high levels of production variability in projects.	High level of IP requirements due to due to low amount of information possessed prior to task execution (high level of production variability).
Structure components					
Organizational structure	• Centralization: logistics tasks are either concentrated to a single unit or	Determines level of IP capacity of logistics organization during task performance.	Galbraith (1974), Klaas and Delfmann (2005), Flynn and Flynn (1999), Chow et al. (1995), Christopher (1986)	• Centralization: Site management had control over logistics tasks. No involvement from	High level of IP capacity generated from decentralized organizational structure. IP requirements reduced

	distributed in the organization • Division of labour: administrative and physical logistics tasks performed by general-purpose or specialized personnel			a central unit in projects. • Division of labour: site management mainly administered purchasing, call-offs, deliveries, goods reception, and invoicing. Material handling was mainly carried out by construction workers.	due to reduced division of labour.
Supply chain structure	Number of suppliers and supplier relationships impacting delivery reliability and quality	IP requirements are generated from supply variability.	Janné and Rudberg (2022), Bildsten (2014), Klaas and Delfmann (2005)	Mainly arms-length relationships with local suppliers of building materials. Direct deliveries to construction sites from materials suppliers.	High level of IP requirements generated from short-term, market-based supplier relationships. Direct deliveries from many suppliers to construction sites.
Process components					
Administrative processes	Formalized procedures for information processing, coordination, and control activities, e.g.: demand management, inventory and order management, order processing, distribution and transportation planning.	Determines level of IP requirements generated from level of formalization.	Autry et al. (2008), Klaas and Delfmann (2005)	Formalized logistics processes were never implemented, and logistics tasks were handled in a problem-solving manner. Administrative processes were seldom considered by site management.	High level of IP requirements due to low amount of information possessed prior to task execution (lack of administrative routines and information system).

Operational processes	Formalized procedures for physical activities, e.g.: on-site material handling, transportation, warehouse operations.	Determines level of IP requirements generated from level of formalization.	Autry et al. (2008), Klaas and Delfmann (2005)	Formalized logistics processes were never implemented, and logistics tasks were handled in a problem-solving manner. Construction workers and supervisor typically carried out goods reception and material handling.	High level of IP requirements due to low amount of information possessed prior to task execution (absence of established material handling and goods reception procedures).

6 Discussion

Supply chain fit and logistics strategy literature emphasizes the fit between strategy components and contextual factors (c.f. Klaas and Delfmann, 2005, Sabri, 2019). However, the case study findings reveal that fit is not necessarily a conscious choice but is codetermined by contextual factors and strategic choice. Subsequently, managerial discretion is constrained by several factors, such as top-management support, incentives in the line organization, the educational and professional background of internal stakeholders, and company politics. This contrasts with cross-sectional studies of logistics strategy and supply chain fit that focus on outcomes over the process of establishing fit. The case study findings are more in line with the suggestions of Ruffini *et al.* (2000) that strategy and structure are codetermined by contextual factors and the level of discretion decision-makers have to establish fit. The main thesis in this paper is that contextual factors do not directly determine the logistics strategy and structure. The authors propose that strategic choice mediates the fit between contextual factors and logistics strategy structure and process components. The mediation by strategic choice is characterized by managerial discretion and predisposition of managers. This suggests that a perfect fit is seldom achieved and that building contractors should aim for a satisfactory fit where the strategic decision-maker must identify slack in the demands of influential stakeholders internally and externally of the firm (see Ruffini *et al.*, 2000).

Howard *et al.* (2007) present similar findings in a case study of the implementation of supply practices at an engine plant, where the implementation plans received inadequate attention from top management and where unfortunate timing halted the process. Likewise, the case study findings here reveal that the downsizing decision at the building contractor unfortunately coincided with the intended implementation period starting in 2012. In a study of a similar building contractor, Elfving (2021) highlight timing as a critical determinant in the implementation of standardized logistics solutions. Here, the financial crisis triggered a downsizing decision at the building contractor, which led to that only one logistics solution remained. Furthermore, Elfving (2021) discusses other aspects related to timing, such as the importance of the maturity of a company and to ensure that top management priorities align with the intended strategy process outcomes to enable implementation of the strategy. In the case study, top management were initially supportive of the logistics strategy, but it lost ground when the CPO resigned. Although there is no concrete evidence in the case study findings of what triggered the downsizing decision, the reluctancy to invest in an ERP-system and to make changes to the organizational structure coincide timewise with the decision to cut overhead costs. However, this situation could have been avoided had the logistics manager, the project manager, and the CPO been able to agree upon a satisfactory ERP-system. Research on strategic consensus highlight this issue and indicate that common reasoning and consistency in decision-making over time are important parts of the strategy process (Mirzaei *et al.*, 2016). In the case study, the logistics manager had to negotiate with stakeholders at a variety of hierarchical levels, including top management, regional managers, and site managers. Reaching strategic consensus between all these levels requires time, timing, and consistency in decision-making (c.f. Ruffini *et al.*, 2000, Mirzaei *et al.*, 2016, Elfving, 2021).

Furthermore, the process of establishing fit can take different routes depending on whether a change is made to contextual factors or to logistics strategy components. Zajac *et al.* (2000) propose four possible scenarios in the process of establishing fit based on whether strategic change is required to regain fit and whether strategic change occurs. These two possibilities are not mutually exclusive, meaning that strategic change can be necessary, but it never occurs. On the contrary, strategic change can occur while it is unnecessary, which creates a misfit. The former scenario is more in line with the case study findings. Strategic change was necessary to compensate for an underfit strategy where IP requirements exceeded IP capacity, but the change never occurred. This indicates that the contextual factors' influence on logistics strategy structure and process components is not unidirectional, as postulated in the conceptual research framework (Figure 1), but bidirectional. A bidirectional relationship implies that the logistics strategy structure and process components do not need to be changed to obtain fit, but fit can be achieved by modifying demand characteristics, the degree of pre-engineering, and/or the production system.

In a wider context, the logistics strategy process in a building contractor company cannot only be a means of changing the organizational structure to cope for uncertainty (lack of IP capacity) or establish formalized processes (reduce IP requirements). It needs to encompass the contextual factors, including demand characteristics (e.g., by changing project selection strategy), the degree of pre-engineering (i.e., moving the customer order decoupling point), and the choice of production system. This is in line with previous research on logistics strategy, which highlight the need to establish fit between product and process characteristics and the logistics strategy and structure. For instance, Christopher (1986) argues that different positions in the product/process matrix require different ways of organizing logistics activities, and thus the product/process characteristics determines the feasibility of a particular logistics strategy. A configuration of logistics strategy structure and process components can therefore be integrated with Jonsson and Rudberg's (2015) version of the product/process matrix, which is adapted to the project-based production of housebuilding. Different positions in the matrix represents variations in product and process characteristics and each position has an ideal configuration of logistics strategy structure and process components. This entails that in general there are three ways of establishing fit: 1) the logistics strategy can be adjusted to suit the demand characteristics, the degree of pre-engineering, and the production system, 2) demand characteristics, the degree of pre-engineering, and the production system can be adjusted to the logistics strategy, and 3) a combination of 1) and 2).

7 Conclusions

The purpose of this paper was to examine how strategic choice influences the logistics strategy process. The paper contributes to the body of knowledge within organizational design and strategy in logistics and supply chain management. The first research question is answered through the identification of the nine logistics strategy components and the constraints to their implementation (Table 2). The second research question is answered by inferring the level of managerial discretion to the logistics strategy outcomes in terms of fit (Table 3). The study thus adds on to cross-sectional studies within this research area by elaborating on the process of establishing fit. The following sub-sections provides the research implications, the limitations of the study, and suggestions for further research.

7.1 Research implications

Previous research emphasize that fit creates superior performance, where fit is defined as adhering to ideal configurations of logistics strategy components. However, this would assume that a building contractor's external and internal context remains stable over time with limited need for strategic change, which is seldom the case even in industries with low clockspeeds, such as construction. Add to this that strategic decision-makers do not always possess sufficient decision-making authority to pursue an ideal configuration, such as in the case with the building contractor's logistics manager. Contextual factors are thus important to consider, but logistics strategy implementation in construction is primarily determined/guided by the level of managerial discretion. This is not to de-emphasize the importance of fit; different combinations of product and process characteristics have different ideal configurations of logistics strategy components.

The authors argue that contextual factors (demand characteristics, the degree of pre-engineering, and the production system) are not static over time, which implies that there will be a process of regaining fit, in which the outcome (fit/misfit) is dependent on strategic choice. This line of reasoning falls into the notion of dynamic fit put forward by Zajac et al. (2000) who treat fit as an ongoing process of regaining fit, either by making modifications to contextual factors, strategy, or both. In other words, the logistics strategy process can be driven by a change in demand and production characteristics requiring an increase/reduction in the degree of pre-engineering and a change of production system (reduction/increase in IP requirements) and/or logistics driven by reconfiguring logistics strategy components (reduction/increase in IP capacity). The former is driven by the logistics strategy, in which logistics is a source of competitive advantage. The logistics strategy triggers a change to demand, product, and/or process characteristics, which resembles to the inside-out approach. In the latter, the logistics strategy is a means of pursuing the corporate/business strategy, which resembles the outside-in approach.

7.2 Limitations and further research

The contextual factors and logistics strategy components are specific to construction and cannot be directly generalized to other industries. The peculiarities of construction, such as fixed position, temporary production systems, and temporary project organizing imply that the principles from other industries cannot be adopted without consideration of these peculiarities because the sources of uncertainty are different from manufacturing. However, future studies of logistics strategy implementation in other project-driven industries (e.g., ETO manufacturing) are interesting for comparing the role of strategic choice.

The single case design poses some limitations to generalizability. The logistics strategy components (Table 2) are specific for the building contractor in the case study. Further studies of other types of building contractors (e.g., industrialized housebuilders) and ETO contexts are needed to define generic logistics strategy components for ETO companies. In addition, the case study findings indicate that the middle management levels of building contractors may be overlooked in the construction logistics research domain. Regional and area managers have a high level of authority and oversee multiple projects simultaneously. The case study findings indicates that they were a constraining factor to logistics strategy implementation, but this needs to be investigated further.

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