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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 building projects depends on how they are organized in accordance with the logistics context, which is determined by building contractors’ competitive priorities, product characteristics, and production process choices. Taking a configurations approach, the purpose of this paper is to describe 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 production process influences 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 description of the fit between building contractors’ logistics context and the organizing of logistics. For managerial practice, a logistics configuration profiling template was developed that can be used as a tool in the logistic strategy process.

Introduction
While recent studies on the organizing of logistics in construction indicate that reorganizing logistics can reduce material-flow-related problems in projects and increase operational efficiency (c.f., Sundquist et al. 2018, Dubois et al. 2019), there are few papers that address logistics strategically at the company level. The contemporary construction logistics body of literature predominately focuses 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 a 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 often 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 2022). However, the success of employing such logistics solutions depends on the way they are organized in accordance with product and process characteristics, which are 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 create 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 production process characteristics (Klaas and Delfmann 2005), which vary between traditional and industrialized housebuilders (Jonsson and Rudberg 2015). As such, production process choice and product characteristics

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create different conditions 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 resembles 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 in the market (Simu and Lidelow 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., Pfohl and Zöllner 1997, Klaas and Delfmann 2005). As such, building contractors need to organize logistics to match their product characteristics and production process choice.

In logistics research, competitive priorities, product characteristics, and production process choices 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, the 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 strategies, 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 contexts and organizational elements. Taking a configurational approach, the focus is on 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 accounts 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. Voordijk et al. 2006, Hofman et al. 2009, Sabri et al. 2020), 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, building contractors have a central role in increasing awareness and the use of logistics solutions (Janné and Rudberg 2022). 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 the organizing of logistics in building contractors. The purpose is to describe 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 (LCPT). Each case represents a building contractor, i.e. a company that undertakes residential and/or non-residential construction. The LCPT is used in two ways. Firstly, for within case analyses to describe the 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.

The scope is limited to two different sub-groups of building contractors: industrialized housebuilders that primarily pursue residential construction through
standardized products and off-site construction, and general-purpose contractors that pursue both residential and non-residential construction by the means of customized building designs and primarily on-site production. The latter includes both construction of multi-family residences and non-residential construction, such as the construction of schools, elderly homes, hotels, etc. More complex construction projects, such as industrial and infrastructure construction, are not considered in this paper due to their higher complexity and typically longer project lead times compared to building construction.

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 describing the strategic fit of building contractors’ organizing of logistics. In practice, the LCPT 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.

Conceptual research framework

The conceptual research framework proposed is developed based on the configurations approach to the 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 on 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.

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 Christopher (1986), Chow et al. (1995), and Klaas and Delfmann (2005): (1) competitive priorities, covering the external context, (2) production process choice, and (3) product characteristics, the latter two covering the internal context.

Competitive priorities in building contractor companies

Competitive priorities allow differentiating the building contractor’s external contexts. The competitive priorities, e.g. cost, delivery, quality, and flexibility, are 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 undertakes a wide array of building projects and sets up specific organizations for each project, with responsibility typically residing within the middle management (e.g. project managers) (Simu and Lidelow 2019). Competitive priorities for general-purpose contractors tend to be focussed 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 Lidelow 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 the production process choice (L1 in Figure 1) and product characteristics (L2 in Figure 1), which is further described in the two following sections.

Production process choice: degree of off-site assembly

The choice of production process affects the degree of centralization of decision-making (L3 in Figure 1), the appropriate supply network configuration (L4 in Figure 1), and specialization of work (L5 in Figure 1) (Miltenburg 2005). In housebuilding, the choice of the production process can be summarized in four generic production processes, based on the degree of off-site assembly (Gibb 2001, Jansson and Rudberg 2015), each with different requirements for 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 production process choice influences the extent to which detailed plans can be developed before their execution, i.e. the degree of formalization (L6 in Figure 1) (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 decentralized planning and control of on-site activities.

MB has the highest degree of off-site assembly because it involves the 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 the production system. MB processes thus allow for centralized planning approaches and systems.

**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 building contractors 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 before the customer-order decoupling point (CODP) is thus low and so is the
degree of product standardization. Therefore, product characteristics are 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 before the CODP in the same way stock of raw materials is 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 before when a customer order is received (typically combined with pure standardization).

The degree of pre-engineering influences the extent to which the organization possesses 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 (L7 in Figure 1) because the materials to be procured for a project are known before the production phase (Johnsson 2013). This primarily affects materials management of standard components and assemblies, which can be centralized (Moretto et al. 2022). Centralized supply and logistics are 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 determine whether it is known before a customer order has been received which type of transportation is used, how the 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). Product characteristics, therefore, influence the degree of formalization (L8 in Figure 1).

**Organizing of logistics**

Bowersox and Daugherty (1987) were among the first to classify logistics organizations as 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 study the organizing of logistics using structural variables. The literature reveals five structural variables that typically are used to classify logistics organizations: (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.

**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).
**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 consist 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 the 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 the site. Therefore, the physical structure of the construction supply chain heavily impacts the requirements of logistics management.

**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, increasing specialization, and construction workers can focus on production activities (Lindén and Josephson 2013). A low degree of specialization in administrative logistics tasks typically means 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 manages inventory levels, coordinate co-loading, and plans deliveries to the construction site (Dubois et al. 2019).

**Formalization**
Formalization indicates the extent to which logistics processes, policies, procedures, and strategies are documented (Daugherty et al. 2011). A lack of formalization often results in the project and/or site management using 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 subcontractors and suppliers adhere to the planning procedures (Janné and Rudberg 2022).

**Integration**
Chow et al. (1995) define 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 (L9 in Figure 1), 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.

**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. (2022), 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. The conceptual research framework is applied to four case studies in the following chapter.

**Method**
The research process was based on iterations between data collection and conceptual framework development, following the logic of abductive reasoning. A key concern in abductive reasoning is to identify deviations in the empirical material from prior theoretical knowledge to suggest hypotheses/propositions or to interpret existing phenomena through a new conceptual framework (Kovács and Spens 2005). The abductive research process in this study enabled the researchers to make meaningful interpretations of the empirical data from the case studies, while the
definitions and interpretations of the variables within the conceptual framework could be refined based on the case study findings. This process resulted in the LCPT (Figure 2), which was developed by combining the definitions of logistics context and organizing variables in the conceptual framework with the insights gained from the case studies.

The research process started with a review of the 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 building 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 refine the conceptual framework and develop the LCPT. The conceptual framework only considered the definition of fit between the logistics context and organization of logistics, while the case studies could deviate from such theoretically “ideal” situations. The cases thus provided new insights into the current practices among building contractors. For instance, the case studies revealed that it is important to distinguish between operational and strategic tasks when determining the degree of centralization. A building contractor’s organization of logistics can be considered decentralized despite having a central logistics department with responsibility for strategic logistics decisions if most operational logistics tasks are performed at the project level. Therefore, a low degree of off-site assembly does not imply that a building contractor should not centralize any logistics tasks, but that the contractor’s degree of centralization is expected to be lower than in the case of a higher degree of off-site assembly. Thereby, given the abductive approach of the study, the case studies played an important role in altering the definitions of, and links between, logistics context and organization variables.

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 building contractors with different competitive priorities, degrees of pre-engineering, and production process choices. The aim here was not to explain the use of the conceptual framework in a single case, but instead to investigate whether the conceptual framework assists in illustrating logistics context and logistics organizations in different sub-groups of building 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 describe 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 sub-groups of building contractors are expected to vary significantly, general-purpose contractors and industrialized housebuilders. 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 housebuilders. Three cases belong to the category of general-purpose contractors and one case belongs to the polar category of 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 production process choice. The motivation for having three cases in the group of general-purpose contractors is that their practices typically vary 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 (RBC) is included in the study but is considered representative of 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 were collected with the 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).

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 production process choice; (2) questions to provide an understanding of the structure of their logistics organization and how logistics were managed in their projects; and (3) questions related to background

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 | €36 million/400 (2019 figures) | R&D manager | 5            |

GC1: General-Purpose Contractor 1; GC2: General-Purpose Contractor 2; GC3: General-Purpose Contractor 3; RBC: Residential Building Contractor.
information about the case participants, a 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 Ph.D. 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 h. 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 has 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 modeling (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 the 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 configuration 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 LCPT derived from the review of the 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 into how to determine the level of fit between the two types of variables. 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 describing 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 refine the framework and decided to arrange three online workshops with the same case participants who were initially interviewed. Two workshops, lasting 2 h each, were conducted with the case participants from GC1, GC2, and GC3. A separate workshop was conducted with the participant from RBC, lasting 1 h, mainly due to problems with finding a suitable time for all four participants.

Having separate workshops created an opportunity to verify the 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 on 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 LCPT 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 whether they could be useful tools to initiate and guide logistics improvement programmes at a strategic level in their respective organizations. After the workshops, the authors compared the participants’ profiles to the authors’ profiles, listened to the recordings, and summarized the discussions before 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.

Results

Table 2 summarizes the key features of the case companies. The general-purpose 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 building 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 its 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 be 70–80%, which is a result of the use of 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 has more people (10) in their logistics function than GC2 and GC3 (1 respectively). Outside of the parent organization, the three have project logistics, but only GC2 has logistics development at the regional level. In contrast, RBC has gathered its logistics expertise with product development, purchasing, and production in its 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.

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 provides support regarding logistics in large and complex projects but does 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 utilize the CM&SA process.

GC2 prefers large and complex projects and competes primarily on its ability to handle variations between projects. Their challenge lies in 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

| 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 choice | 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 logistics | Logistics developers (regional), project logistics | Project logistics | 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 |
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 the 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 the 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.

**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 Figure 2 shows the companies’ logistics context profiles, whereas the lower part profile the organization of logistics. Both these areas are compared between the case companies in the following sub-sections. The cases are classified using ranges to enable a relative comparison of the different sub-groups of building contractors. The scale used in the LCPT ranges from 1 to 4, in which two cases that exhibit similar characteristics are classified in the same range. For instance, two cases that are classified as level 1 under “production process choice” indicates that they use CM&SA production processes. Levels 2 and 3 would indicate that they use either PF&SA or PF&PA, respectively, while level 4 corresponds to an MB production process.

**Logistics context**

Case GC1, GC2, and GC3 are identical in terms of competitive priorities, production 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 building contractors. The case participant from GC3 stated that they have a “react to the market” approach and prioritize 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 production 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 production 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).

**Organizing of logistics**

GC1, GC2, and GC3 have centralized logistics functions, but they are neither positioned near the upper hierarchical levels in the organization nor very large relative to the size of the companies. Most logistics decision-making takes place at the project level within these companies, which indicates that their logistics organization structures are decentralized. However, 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, corresponds to a configuration with PF&SA and ATO. Out of the four cases, RBC has the highest degree of centralization, which aligns with its 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 corresponds 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 takes 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 have 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 corresponds 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 organization. In contrast, RBC’s supply chain department accounts for approximately half of its 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 in a single unit in the parent organization. By integrating logistics within a cross-functional department, RBC facilitates 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.

**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 LCPT in Figure 2 illustrates the degree of fit in a building contractor’s logistics configuration. A 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. (2022) distinguish between project-oriented and product- and process-oriented contractors, which resemble general-purpose contractors and industrialized housebuilders, respectively. This indicates that there is no “one-size fits all” to organizing logistics for building contractors. In the following subsections, the relationships between context and organization variables are discussed as to what constitutes external and internal fit in a building contractor’s logistics configuration.

**External fit**

In a building contractor organization, external fit signifies their attempt to adapt their product offering to the 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 the 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 building contractors have a high level of fit between competitive priorities, production process choice (L1 in Figure 1), and product characteristics (L2 in Figure 1), 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 prioritize 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. 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 building 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 production process choice and product characteristics are seldom outlined in terms of explicit formulations of an operations strategy (Maylor et al. 2015). Production process choice and product characteristics are typically reactive rather than proactive responses 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&amp;SA process (Simu and Lidelow 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.

**Internal fit**

While the cases exhibited a high level of external fit, there were indications of misfits between the internal logistics context and the organizing of logistics. For instance, combining a single logistics unit with a low degree of off-site assembly (L3 in Figure 1) poses coordination challenges for logistics specialists. For the CM&amp;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 on 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 (L7 in Figure 1). 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 focussing 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 adaptations 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 decisions, and its prerequisites are primarily set by the building 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 possesses the formal decision-making authority and control over day-to-day logistics activities. However, case findings indicate that site management has the main responsibility for both setting the frame of reference for logistics processes and making local adaptations to the project. These building contractors are considered as “heavy decentralized” since both operational and strategic logistics (to some extent) are the responsibility of site management. On the other hand, RBC can be considered as “lightly centralized” due to its 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 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) suggest 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 resulting from a low degree of product standardization (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 (L8 in Figure 1).

Conclusions and implications

The purpose was to describe the fit between the logistics context and logistics organizing at a strategic level. To fulfill this purpose, relevant contextual and organizational variables were identified and used to create a conceptual research framework (Figure 1), which describes logistics configurations in building contractor companies. It summarizes the logistics context and organization variables identified in the literature, which were divided into three context variables and five organizational variables. To describe the fit between the logistics context and logistics organizing, the framework was applied to four cases by the means of the LCPT (Figure 2). Their degree of fit is illustrated using the LCPT. 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.

Research and managerial implications

The main contribution is to existing research on the 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. 2022), the findings suggest that a “one-size-fits-all” approach to the organizing of logistics in building contractors is unfeasible. In line with this, two research contributions are highlighted: (1) Production process choice influences the extent to which planning and logistics decision-making is 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 LCPT 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 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 decisions 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 LCPT (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.

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 employ large-scale surveys with profile deviation analysis to find ideal logistics configurations of high-performing
building contractors. Furthermore, while the LCPT is useful for illustrating relative differences, it does not indicate how to create fit in a logistics configuration. The LCPT considers the perspective “content of fit” as opposed to “patterns of interactions” (see Venkatraman and Camillius 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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