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Strategies for achieving customer order flexibility – supplier perspective

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Abstract

Purpose – The purpose of this study is to develop a framework of strategies to achieving customer order flexibility in and related to the order-to-delivery (OTD) process. The purpose is also to investigate how companies prioritize various strategies to achieve customer order flexibility.

Design/methodology/approach – Based on a literature review, pre-tests and conceptual reasoning, a conceptual framework of strategies related to the order-to-delivery process was developed. The strategies were linked to the order quantity and delivery lead-time flexibility dimensions. This structure resulted in six groups covering enabling as well as remedial strategies. An empirical interview study of ten customer–supplier relationships was conducted.

Findings – The interviews identified additional strategies, thereby expanding the framework. The enabling strategies with the highest median values were "have continuous contact with the customer's purchaser" and "use safety stock of raw materials/semi-finished products". The remedial strategy with the highest median was "re-plan/re-prioritize the order backlog". In the delivery sub-process, it was more common to apply remedial strategies for delivery lead-time than for order quantities.

Research limitations/implications – The developed framework is a contribution to the literature on operational flexibility in and related to the OTD process. It complements existing knowledge by taking a supplier perspective.

Practical implications – Suppliers can use the framework as a tool to understand and systematically achieve better customer order flexibility in and related to the OTD process. Customers can use the framework as a checklist for supplier evaluation and supplier development.

Originality/value – Few identified studies include empirical data on customer order flexibility.

Keywords Customer order flexibility, Order-to-delivery process, Enabling strategies

Paper type Research paper

1. Introduction and purpose

Flexibility—the ability to adapt to volatile customer demands—is an ever-important customer service element (Üstündag and Ungan, 2020; Kumar and Singh, 2020; Mishra, 2020; Eyers *et al.*, 2018; Manders *et al.*, 2017). Flexibility is a broad term with little consensus as to its definition (e.g. Mishra, 2020). This is related to that it can reflect different organizational levels and different types – defined as sets of situations for which flexibility is required

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(Abdelilah *et al.*, 2018). Therefore, flexibility should be studied in a precise way (Engelhardt-Nowitzki, 2012). Flexibility can be found on different levels; reflecting long-term, systematic changes in customers' aggregated demand on a strategic level, or reflecting stochastic, unpredictable, short-term changes on an operational level (Kumar and Singh, 2020). Liao (2020) claims that flexibility often is understood as linked to processes on an operational level. On an operational level, customers directly experience supplier flexibility related to orders in the order-to-delivery (OTD) process (Forslund *et al.*, 2021). As compared to manufacturing processes, OTD processes have received little research attention, given their relation to customers' purchasing experience (Brabazon and McCarthy, 2017).

An increased dependence on suppliers, typically representing 60–80% of manufacturers' total cost (Üstündag and Ungan, 2020), shows the impact of supplier flexibility (Kumar and Singh, 2020; Gligor, 2018). Flexibility research is therefore required to address different types of flexibility and to broaden the scope from internal to inter-organizational (Gligor, 2018; Bag *et al.*, 2018; Mishra *et al.*, 2018; Kuo *et al.*, 2016). However, according to e.g. Mishra (2020) such studies are in their infancy and are often based on simulation methodologies (Kuo *et al.*, 2016). The lack of empirical studies in operations management in general was pointed out by Säfsten and Johansson (2020), Mishra *et al.* (2018) and Tachizawa and Gimenez (2010). The lack of empirical studies of flexibility was recently pointed out by Mishra (2020) and Mishra *et al.* (2018). A recent survey study of customers' (purchasing managers in manufacturing companies) perspectives on supplier flexibility in the OTD process (Forslund *et al.*, 2021) found that manufacturing customers perceive insufficient supplier flexibility from their most important suppliers. Similarly, the study of customer–supplier flexibility fit by Gligor (2018) claimed that studies often stress customers benefits of flexibility, without considering how that impacts the supplier. As customers and suppliers have a complex interplay in the inter-organizational OTD process, these results raise questions about the suppliers' actions to achieve flexibility. By adopting a supplier perspective on the OTD process, complementary knowledge can be achieved. To stress the operational order-related character of the OTD process, this is referred to as customer order flexibility.

So, how and with what strategies can customer order flexibility be achieved? The term "strategy," as a set of managerial practices, has been largely used in operations management literature (Tachizawa and Gimenez, 2010). The term practice (Mishra, 2016; Boyle and Scherrer-Rathje, 2009) can also be used. Flexibility strategies are composed of ways and actions that manufacturers have at their disposal when trying to respond to changing demand conditions (Ketokivi, 2006). Mishra (2020) and Mishra *et al.* (2018) argued that few studies exist on how to achieve flexibility for manufacturers. The study of Forslund *et al.* (2021) resulted in a conceptual framework of supplier flexibility variables in the OTD process. According to Listou and Flygansvaer (2021), that framework is a tool to gain a better understanding of supplier flexibility. As that framework was developed from a customer perspective, it did not deal with ways to achieve flexibility. In fact, no identified study has provided a framework of how to achieve customer order flexibility in the OTD process. The OTD process is one of the most important processes to manage from a logistics viewpoint (Forslund *et al.*, 2021; Brabazon and McCarthy, 2017). It is therefore of interest to investigate what strategies for achieving customer order flexibility can be related to the OTD process. In that way, a complementing tool for understanding customer order flexibility from a supplier perspective (in line with Listou and Flygansvaer, 2021) could be the result.

The main purpose of this study is to develop a framework of strategies to achieving customer order flexibility in and related to the order-to-delivery process. Given that recent studies (Forslund *et al.*, 2021; Gligor, 2018) have found that customers perceive insufficient supplier flexibility, one reason may be that suppliers lack a comprehensive overview of more or less common strategies to apply in certain situations. The framework is expected to improve the understanding of and illustrate how to select appropriate strategies to increase

customer order flexibility. Accordingly, it can enable practical use and application. Practical tests of the framework can also validate, add or delete strategies, which further develops the framework. In line with that, an additional purpose of the present study is to investigate how companies prioritize various strategies to achieve customer order flexibility.

The study concerns customer orders in make-to-order (MTO) and assemble-to-order (ATO) types of operations. MTO and ATO are increasingly common, and as this type of operation implies large uncertainties in customer demand (Mishra, 2020), flexibility is particularly important (Kuo *et al.*, 2016). This study hence does not include cases in which customer orders are delivered from stock (MTS) or include engineering (ETO).

The rest of the paper is structured according to the development process of the conceptual framework, consisting of three main phases. During the first phase, a preliminary framework was developed based upon a literature review, conceptual reasoning and pre-testing (Sections 2–3). In the second phase, interviews were used to complement theory with empirically identified strategies, but also to understand how suppliers prioritize among strategies (Sections 4–5.2). The third phase consisted of additional conceptual reasoning of the theoretical and empirical framework into a final framework, which is the result of the study (Section 5.3).

2. Customer order flexiblity in the literature

In order to lay a foundation for a framework of strategies for achieving customer order flexibility in and related to the OTD process, a literature review was conducted. It is initiated with an overview of focused flexibility types in and related to the OTD process.

A large number of flexibility types exist, with differing meanings, as specified in the introduction. Searching for the concept "customer order flexibility" generated no articles in OneSearch and just a few articles in Google Scholar. Interestingly, these articles mention the concept without defining it (see e.g. Weng and Fujimura, 2012). Encouraged by the call for studying flexibility in a precise and specified way (Engelhardt-Nowitzki, 2012), it is a surprise that so little research interest has been directed towards studying such a core aspect of flexibility as the dyadic interplay and relations of customers and suppliers between order and delivery. Supplier flexibility in and related to the OTD process has though been studied out of customers' perspective. Supplier flexibility should however also be investigated from suppliers' perspective.

Conceptual unclarities within supplier flexibility have been discovered. Overall, two different approaches to defining supplier flexibility can be found, where the first point at the internal relation between manufacturing and the purchasing department. Examples are purchasing flexibility (Zhang *et al.*, 2002, p. 571), defined as "the ability of the organization to provide the variety of materials and supplies needed by manufacturing quickly and performance-effectively through corporative relationships with suppliers". Supply flexibility (Tachizawa and Gimenez, 2010, p. 1116) was defined as "the ability of the purchasing function to respond in a timely and cost-effective manner to changing requirements of purchasing components in terms of volume, mix and delivery date". Supplier flexibility (Lao *et al.*, 2010, p. 8) was defined by as "the extent of responsive abilities through the use of supplier-specific capabilities". These definitions do not reflect the intended inter-organizational flexibility from suppliers. The second approach to defining supplier flexibility however does that. Kumar (2020) defined supplier flexibility as the assessment of suppliers' ability to accommodate respondents' requests and changes efficiently and meet emergency orders. If "customers" replace "respondents", that definition has the intended order-related view. Forslund *et al.* (2021) defined supplier flexibility in the OTD process as suppliers' ability to fulfil short-term changes in customer demand. With the changed perspective, customer order flexibility can be defined as the suppliers' ability to adapt to short-term changes in customer orders.

3. Development of a preliminary framework

The development of the preliminary framework built upon a continued literature review, complemented with conceptual reasoning within the research team at every development step. Together with the literature review and conceptual reasoning, pre-tests were important. Pre-tests and discussions were applied at every step by four researchers – the authors plus two other researchers in operations management/logistics. Furthermore, two experienced practitioners (one purchasing manager and one customer support professional) were involved to ensure practical usefulness, as detailed below. The pre-tests implied iteration between the researchers' suggestions and the practitioners' reactions. Continuous pre-testing is an example of a co-creative research approach, where researchers conduct research together with practitioners, as encouraged by Säfsten and Johansson (2020). The framework of strategies for customer order flexibility was developed in the following steps: (1) adapting flexibility dimensions, (2) relating customer order flexibility to the OTD process, (3) identifying potential flexibility strategies, (4) structuring and characterizing flexibility strategies and (5) visualizing the framework. In the text, key components of the framework are *italicized*.

3.1 Adapting flexibility dimensions

Following the traditions of earlier flexibility research, e.g. the widely known study of Slack (1987), flexibility is broken down into product flexibility, mix flexibility, volume flexibility, delivery flexibility and quality flexibility. Product flexibility is defined as "the ability to introduce novel products, or to modify existing ones," mix flexibility as "the ability to change the range of products made within a given time period," volume flexibility as "the ability to change the level of aggregated output," delivery flexibility as "the ability to change planned or assumed delivery dates," and quality flexibility as "the ability to change planned product quality levels" (Slack, 1987, p. 38). While Slack's study had a manufacturing perspective, the current study has a logistics perspective on customer orders in the OTD process. This implies that flexibility dimensions have to be adapted and prioritized (Mishra, 2020).

Flexibility dimensions in the OTD process were investigated in Forslund *et al.* (2021). As this process basically concerns how much to order and when to deliver, volume flexibility and delivery flexibility were found to be the most obvious dimensions to include. These dimensions are therefore kept in the current study. Volume flexibility was found by Liao (2020) and Abdelilah *et al.* (2018) to be the ability of a company to operate at various production output levels, a dimension similar to Slack's (1987), in that volume is seen on an aggregated, long-term level. According to Forslund *et al.* (2021), the volume flexibility dimension in the order-to-delivery process is defined as the ability to change volumes or quantities. The established dimension volume flexibility includes both the ability to adapt volumes long-term and short-term. The term *order quantity flexibility* instead implies an adaptation of volume flexibility taking place in an OTD process. It is defined as the ability to adapt order quantities on customer demand.

Delivery flexibility was defined as the capability of the company to adapt lead-times to customers' requirements (Abdelilah *et al.*, 2018), while Liao (2020) defined delivery flexibility as the ability of a company to deliver products to customers in response to uncertainties in e.g. delivery dates. Forslund *et al.* (2021) defined the delivery flexibility dimension in the order-to-delivery process as the ability to change delivery dates. All these views on the delivery flexibility dimension fit well into customer order flexibility. To refer to the dimension as delivery flexibility can be misleading, as a delivery includes aspects of both volume and lead-time, in line with the definition of Liao (2020). For better clarity, we refer to this dimension of customer order flexibility as *delivery lead-time flexibility* henceforth. It is defined as the ability to adapt delivery lead-time on customer demand (in line with Kuo *et al.*, 2016). Customer order flexibility can now be defined as the ability of the supplier to adapt customer orders according to the demanded order quantities and delivery lead-times.

3.2 Relating customer order flexibility to the order-to-delivery process

Flexibility strategies can be applied to specific customer orders in different parts or sub-processes in the OTD process. Forslund *et al.* (2021) studied supplier flexibility in the OTD process and addressed two sub-processes. The *ordering sub-process* takes place from request for quotation to order confirmation. The *delivery sub-process* takes place from order confirmation to delivery. As also the current study focuses on the OTD process, however shifting the perspective from the customers' to the suppliers', this choice is followed.

It is acknowledged that several flexibility strategies must be applied before specific customer orders arrive. Accordingly, these strategies are considered to be related to the OTD process. It will therefore be distinguished between strategies *in* and *related to* the OTD process.

3.3 Identifying potential flexibility strategies

Szwejczewski and Cousens (2007) studied how companies achieve mainly volume flexibility. Their studied companies used at least three strategies at the same time, and displayed large differences in used strategies. It was also found that strategies that worked well in one company could not be copied in another company, even if the companies seemed similar. Similar findings were found in Mishra (2016).

Forslund and Jonsson (2007) studied strategies for providing customer service such as flexibility, and a number of strategies that fit with MTO and ATO situations were found. The use of safety stock in raw material inventories (also suggested as a flexibility strategy by Tachizawa and Gimenez, 2010) was identified as the most common strategy, and was defined as stock kept as a reserve to guard against material shortage because of uncertainties in supply, demand and lead-time. In this study, it can be complemented by safety stock of semi-finished products, as identified by conceptual reasoning and in line with Kuo *et al.* (2016). Safety lead-time is defined by APICS (2013) as "an element of time added to the normal lead-time to protect against fluctuations in lead-time so that an order can be completed before its real need date." Forslund and Jonsson (2007) defined safety capacity as the reservation of extra capacity—i.e. capacity beyond that needed to cover average demand—and suggested the assumption of low-capacity utilization to protect against unforeseen events. Ketokivi (2006) suggested excess capacity to handle rush orders. This was elaborated by Cheng *et al.* (1997) as follows. Maximum capacity is often assessed based merely on available resources such as equipment and labor; however, it also must deal with competing demand. Adding more capacity is necessary to be able to compete and survive in the market; thus, it becomes more of safety capacity (Cheng *et al.*, 1997).

Further strategies fitted to MTO and ATO situations were mentioned by Forslund and Jonsson (2007). One of these was split deliveries, defined as smaller batches in production or delivery than what was ordered. Re-scheduling or re-planning was also suggested by Szwejczewski and Cousens (2007) and Ketokivi (2006). Subcontracting—temporary or short-term use of external suppliers—was beyond being found to be the least used strategy by Forslund and Jonsson (2007), also suggested by Szwejczewski and Cousens (2007) and, particularly for volume flexibility, by Ketokivi (2006). The use of overtime (also Mishra, 2016) was the second-most common flexibility strategy found in the study by Szwejczewski and Cousens (2007). Express transports were suggested by Forslund and Jonsson (2007). Similarly, Tachizawa and Gimenez (2010) suggested the use of alternative transportation modes. The most common flexibility strategy was to use multiskilled or cross-trained staff who can be moved between production lines or tasks (Szwejczewski and Cousens, 2007). This strategy was also mentioned by Ketokivi (2006), Mishra (2016) and Mishra *et al.* (2018). Mishra *et al.* (2018) and Mishra (2016) suggested reduced setup times.

Similarly, Szwejczewski and Cousens (2007) suggested SMED: single minute exchange of dies. The importance of reduced setup times was demonstrated by Yao and Paik (2016), enabling smaller lot sizes with shorter throughput times in order to achieve delivery flexibility. Through conceptual reasoning, also other order-specific costs that hinder customized order quantities could be reduced. Ketokivi (2006) and Mishra (2016) added the strategy of cooperating and having continuous contact with customers regarding, e.g. forecasts and delivery schedules. Additionally, the customer order decoupling point (CODP) is relevant. The CODP is the point in the material flow that permanently separates decisions concerning customer orders based on speculation or uncertainty from those made with certainty (Rudberg and Wikner, 2004). Moving the CODP downstream shortens lead-time. Another way of shortening delivery lead-time can be, even in MTO/ATO situations, to occasionally begin production of non-stocked items on speculation, based upon advance demand information. Advance order information implies that customers place orders, or give other demand information, in advance of their needs (Gallego and Ozer, 2001). This is however done without moving the CODP.

3.4 Structuring and characterizing flexibility strategies

Flexibility strategies in general are often structured as proactive/reactive (e.g. Mishra *et al.*, 2018), preventive/corrective (e.g. Forslund and Jonsson, 2007) or preventive/defensive (Gerwin, 1993). As the idea of preventing flexibility is misleading and creates a negative impression, a better label is "enabling" flexibility. *Enabling strategies* are here defined as proactive arrangements carried out to be able to more flexibly handle customers' request for quotations and customer orders. They enable flexibility in both dimensions (smaller order quantities and shorter delivery lead-times) and are general prerequisites that make it possible to achieve flexibility for all customers. Also the term defensive strategies give a negative impression. The label "remedial strategies" is used henceforth. *Remedial strategies* are defined as arrangements related to individual customer orders that allow the acceptance of order quantities and delivery lead-times that deviate from normal. Remedial strategies are applied as appropriate for important or prioritized customers and/or under special circumstances for individual customer orders. The core of the concept lies in applying enabling strategies before, and independently of, individual customer orders. Therefore, enabling strategies cannot reasonably be related to sub-processes in the OTD process (ordering sub-process respective delivery sub-process). They therefore hold a particular position in the framework, related to the OTD process but outside or before the sub-processes. Remedial strategies applied in the ordering sub-process can plausibly also be applied in the delivery sub-process, but as they can be prioritized and used in different ways, they are included under both sub-processes. In that way, the framework becomes more complete. This approach was appreciated in empirical pre-tests.

Customer order flexibility can now be defined as order quantity flexibility and delivery lead-time flexibility in MTO and ATO types of operations that take place before and in the ordering and delivery sub-processes of the OTD process. This implies six groups of strategies, where each strategy has an identification code. Enabling strategies (E) are related to order quantity flexibility (Q) and the delivery lead-time flexibility (L) dimensions, respectively, in two groups, EQ and EL. Remedial strategies (R) are similarly built upon the four flexibility groups of dimension (Q and L) and sub-process (O and D). For example, RQO implies remedial strategies for achieving order quantity flexibility in the ordering sub-process. The last position is an individual strategy number (see Table 1).

The enabling strategies "reduce setup time/order-specific costs", "use safety capacity in production", "use safety stock of raw materials/semi-finished products", "have access to temporary subcontractors", "have multiskilled staff" and "have continuous contact with the customer's purchaser" are all influencing customer order quantity flexibility without being

	Order quantity flexibility	Delivery lead-time flexibility
Enabling strategies related to the OTD process	*EQ. Enabling customized order quantity*	*EL. Enabling customized delivery lead-time*
	EQ1. Reduce setup time/order specific costs	EL1. Add a safety lead-time
	EQ2. Use safety capacity in production	EL2. Use safety capacity in production
	EQ3. Use safety stock of raw materials/ semi-finished products	EL3. Move the customer order decoupling point (CODP) downstream in the supply chain
	EQ4. Have access to temporary subcontractors	EL4. Have access to temporary subcontractors
	EQ5. Have multiskilled staff	EL5. Have multiskilled staff
	EQ6. Have continuous contacts with the customer's purchaser	EL6. Reduce throughput times in production
		EL7. Start production of non-stocked items on speculation
		EL8. Have continuous contact with the customer's purchaser
Remedial strategies in the OTD ordering sub-process	*RQO. Demanded order quantity*	*RLO. Demanded lead-time*
	RQO1. Apply split deliveries	RLO1. Apply split deliveries
	RQO2. Re-plan/re-prioritize the order backlog	RLO2. Re-plan/re-prioritize the order backlog
	RQO3. Use overtime in production	RLO3. Use overtime in production
		RLO4. Use faster modes of transport
Remedial strategies in the OTD delivery sub-process	*RQD. Demanded quantity change after order confirmation*	*RLD. Demanded delivery earlier than confirmed*
	RQD1. Apply split deliveries	RLD1. Apply split deliveries
	RQD2. Re-plan/re-prioritize the order backlog	RLD2. Re-plan/re-prioritize the order backlog
	RQD3. Use overtime in production	RLD3. Use overtime in production
		RLD4. Use faster modes of transport

Table 1.
Preliminary framework of strategies for achieving customer order flexibility

related to individual customer orders. Correspondingly, the enabling strategies "add a safety lead-time", "use safety capacity in production", "move the customer order decoupling point (CODP) downstream", "have access to temporary subcontractors", "have multiskilled staff", "reduce throughput times in production", "start production of non-stocked items on speculation" and "have continuous contacts with the customer's purchaser" influence customer order delivery lead-time flexibility without being related to individual customer orders.

The remedial strategies taking place in both sub-processes in the OTD process; "apply split deliveries", "re-plan/re-prioritize the order backlog" and "use overtime in production" are characterized by directly influencing customer order quantity flexibility as well as customer order lead-time flexibility, while "use of faster modes of transport" only influences customer order lead-time flexibility.

3.5 Visualizing the framework

The final pre-test led to clarified and streamlined formulations, resulting in the following preliminary framework of supplier strategies, aimed at achieving order quantity and delivery lead-time flexibility before and in the ordering and delivery sub-processes of the OTD process.

4. Methodology for the empirical study

In the second phase, an empirical study was carried out to illustrate how companies prioritize various strategies to achieve customer order flexibility and, furthermore, to look for

complementing strategies. The study built on studying customer order flexibility in specific customer–supplier relations, which were studied from the supplier perspective. Therefore, a specific sampling strategy had to be applied. The starting point was three large manufacturing customer companies, partners in an ongoing Swedish research project on capacity planning and flexibility. The customers were all part of international company groups and represented MTO and ATO production of complex components to construction projects. Their purchasing or supply chain managers selected each at least three important material suppliers. One of the important sampling criteria was that the suppliers should represent ATO and MTO types of operations, i.e. where customer orders are made with delivery lead-time. The sampling was therefore of non-probability character and an indirect form of convenience sampling known as snowball sampling (Bryman and Bell, 2007).

The study built upon empirical data collection from suppliers. Companies and respondents were granted confidentiality. The suppliers were all medium-sized or large manufacturers, located in Europe. This sampling strategy complemented the study of Mishra (2016) who addressed SMEs. They belonged to different industries and delivered such as metal, electromechanical or electronic components. All suppliers had a long-term (more than five years) relationship with the customer, and in most cases the customer was extremely important. The most knowledgeable respondent regarding this customer at each supplier was sought. As can be seen in Table 2, the respondents held different positions. Some suppliers took a long time finding the right respondent, as marketing/sales managers may have limited knowledge about production and logistics strategies and therefore chose to have more than one respondent (like K2) or talked with other respondents before the interviews (shown within brackets in Table 2, e.g., for L1).

The respondents were interviewed personally by video meeting or telephone, using an interview guide based on the framework in Table 1 (see Appendix). The interview concerned to what extent the supplier used the various strategies to achieve flexibility toward the specific customer. The extent of use of these strategies was assessed on a Likert scale from 1 = "not at all" to 5 = "to a very large extent" (Bryman and Bell, 2007). This approach was similar to the study of Szwejczewski and Cousens (2007). Each quantitative answer was complemented by a qualitative discussion to exemplify, clarify and explain the use of the strategy. Each interview lasted around 60 min. The interviews were followed up with all respondents reading, adjusting and confirming their answers via email. The respondents had between three and 30 years of experience with the customer. This, together with the impression that they demonstrated understanding of the questions, increased the validity of the study (Bryman and Bell, 2007). Median values for strategies were presented as measures of central tendency, while min-max, or range, were presented as measures of dispersion (Bryman and Bell, 2007). Aggregated medians of groups of observations were also presented.

Customer	Supplier	Respondents' position
K	K1	Key account manager
	K2	Key account manager, operations manager (planner)
	K3	CEO
L	L1	Marketing/sales manager (logistics manager, supply chain manager)
	L2	Operations manager
	L3	Export manager
	L4	Head of global planning
M	M1	Key account manager
	M2	Site manager
	M3	Sales manager

Table 2.
Studied companies and respondents

The empirical results provided an overview of the use of different enabling and remedial strategies to achieve customer order flexibility. As a third phase, further conceptual reasoning was carried out. It was based on responses and discussions during the interviews and revealed some additional patterns in the framework. A final framework was presented.

5. Findings and conceptual reasoning

In Section 5.1 a description is provided of how the suppliers in the sample achieve customer order flexibility in and related to the OTD process. Section 5.2 contains the expansion of the framework with empirically identified strategies for achieving customer order flexibility. In these two sections, some detailed study results are discussed in relation to previous studies. In 5.3, additional conceptual reasoning is carried out and a final framework is presented.

5.1 How suppliers achieve customer order flexibility

Quantitative data is presented in Table 3. Median values for the six groups of strategies are shown in *italic text* at the bottom of each box.

Among the enabling strategies, the highest median value was found for "use safety stock of raw materials/semi-finished products"(EQ3) and "have continuous contacts with the customer's purchaser" (EQ6, EL8). Suppliers K1, L2 and M1 stated that customer contact is done daily, while supplier K2 reported several contacts per week. One example of how this is done was explained by the key account manager at M1: "We work with the customer to improve the forecast, as we need to use our lead-time well. With the current one week's lead-time, every day is valuable." The enabling strategy with the lowest median was EL4, "have access to temporary subcontractors". This finding still accords to the findings of Forslund and Jonsson (2007).

Among the remedial strategies, the most popular, with a median of 5, is "re-plan/re-prioritize the order backlog" (RQO2) in the ordering sub-process for achieving demanded order quantity. "Re-plan/re-prioritize the order backlog" has high median (4) as remedial strategy also for achieving delivery earlier than confirmed. Its use is illustrated by the export manager at L3: "All customers claim to have stoppages in their production and want us to prioritize them, so we call them in order to understand the true situation before we re-plan." The remedial strategies for achieving changed order quantity after order confirmation with the lowest median were RQD1, "apply split deliveries" and RQD2, "use overtime in production" both with median values of 2. An illustrating example came from the production manager at L2: "Our owners tell us not to use overtime; we have to protect our employees' health." This contradicts the findings of Szwejczewski and Cousens (2007), who found use of overtime to be among the most common flexibility strategies. Quite the opposite, the use of overtime in the current study had a median value of 4 when applied to achieve delivery earlier than confirmed, corresponding more closely to the findings of Szwejczewski and Cousens (2007). K1's key account manager stated that "overtime is only used in crises, and then the customer has to pay for it." The "use of faster modes of transport" is a frequently used remedial strategy in the delivery sub-process for achieving delivery earlier than confirmed (median of 4). Both K1 and M1 mention that they have their own truck adapted to their customers' needs, even though they are both located in the same city as their customers.

The dispersion of responses within the same strategy varies highly. Of the 14 enabling strategies, six have a range from 1 to 5. The enabling strategy with the smallest dispersion, EQ6 "have continuous contact with the customer's purchaser", has a range from 4 to 5. Many remedial strategies have ranges from 1 to 5. The remedial strategies with the smallest dispersion are RQO2/RLO2/RLD2 "re-plan/re-prioritize the order backlog" with a range from 3 to 5. The use of strategies per supplier is also calculated with median, ranging from 2.5 (L3) to 5 (L2). Interestingly, suppliers for the same customer display quite different uses of

	Order quantity flexibility		Delivery lead-time flexibility	
Enabling strategies related to the OTD process	*EQ. Enabling customized order quantity*	*Median (min-max)*	*EL. Enabling customized delivery lead-time*	*Median (min-max)*
	EQ1. Reduce setup time/ order specific costs	4 (1–5)	EL1. Add a safety lead-time	3 (1–4)
	EQ2. Use safety capacity in production	3 (1–5)	EL2. Use safety capacity in production	3 (1–5)
	EQ3. Use safety stock of raw materials/semi-finished products	5 (3–5)	EL3. Move the customer order decoupling point (CODP) downstream in the supply chain	3 (1–4)
	EQ4. Have access to temporary subcontractors	2 (1–4)	EL4. Have access to temporary subcontractors	2 (1–4)
	EQ5. Have multiskilled staff	4 (1–5)	EL5. Have multiskilled staff	4 (1–5)
	EQ6. Have continuous contact with the customer's purchaser	5 (4–5)	EL6. Reduce throughput times in production	4 (2–5)
	EQ	*4*	EL7. Start production of non-stocked items on speculation	3 (1–5)
			EL8. Have continuous contact with the customer's purchaser	5 (3–5)
			EL	*3*
Remedial strategies in the OTD ordering sub-process	*RQO. Demanded order quantity*		*RLO. Demanded lead-time*	
	RQO1. Apply split deliveries	3 (1–5)	RLO1. Apply split deliveries	4 (1–5)
	RQO2. Re-plan/re-prioritize the order backlog	5 (3–5)	RLO2. Re-plan/re-prioritize the order backlog	4 (3–5)
	RQO3. Use overtime in production	3 (2–5)	RLO3. Use overtime in production	4 (1–5)
	RQO	*4*	RLO4. Use faster modes of transport	3 (1–5)
			RLO	*4*
Remedial strategies in the OTD delivery sub-process	*RQD. Demanded quantity change after order confirmation*		*RLD. Demanded delivery earlier than confirmed*	
	RQD1. Apply split deliveries	2 (1–5)	RLD1. Apply split deliveries	3 (1–5)
	RQD2. Re-plan/re-prioritize the order backlog	3 (1–5)	RLD2. Re-plan/re-prioritize the order backlog	4 (3–5)
	RQD3. Use overtime in production	2 (1–4)	RLD3. Use overtime in production	4 (1–5)
	RQD	*2*	RLD4. Use faster modes of transport	4 (1–5)
			RLD	*4*

Table 3. Framework of customer order flexibility strategies with empirical data

flexibility strategies. This accords with the vastly differing uses of flexibility strategies in the study of Szwejczewski and Cousens (2007), who found large differences, even between similar companies, in how flexibility strategies are used.

It can be seen that there is a difference in flexibility dimensions where enabling strategies have a higher median (4) for EQ-customized order quantity than for EL-customized delivery lead-time (3). The largest differences exist in the delivery sub-process. The median for remedial strategies is 2 for RQD demanded quantity change after order confirmation, while it is 4 for RLD demanded delivery earlier than confirmed. This difference is interpreted as it is easier to apply remedial strategies for delivery lead-time (such as using faster modes of transportation) than to apply remedial strategies for order quantities (such as re-planning order quantities during production). Even if the same remedial strategies are included in the framework in the order and delivery sub-process, the empirical data reveals that the strategies are applied to different extent.

5.2 Complementing the framework with empirically identified strategies

Some suppliers provided additional enabling and remedial strategies than the ones in the framework. As an enabling strategy for EQ customized order quantity, the key account manager at K1 suggested maintaining continuous contact with the assembly manager at the customer's site: "K allows their customers to make very late changes, but their purchasers are not always experienced enough to remember to update order information. Therefore, we bypass purchasing and make direct contact with assembly; they have complete information. We are sort of spying." This strategy was also mentioned by K1 as an enabling strategy for EL customized delivery lead-time and as a remedial strategy for RQD demanded quantity change after order confirmation. Enabling for RLO customer-demanded lead-time by having contact with the customer's engineering staff was suggested by the marketing and sales manager at L1: "By talking to engineering, we get more accurate order information than from purchasing, who has too aggregated forecasts." To consider these observations, the original strategy "have continuous contact with the customer's purchaser" is here expanded into "have access to advance demand information from the customer". These examples illustrate that advance demand information can be found at purchasing or at other functions. In line with Boyle and Scherrer-Rathje (2009), such an enabling strategy has the potential of reducing variation and hence the need for customer order flexibility. The use of these strategies is expected to differ between companies, in line with the findings of Szwejczewski and Cousens (2007).

Another enabling strategy for EQ was suggested by the export manager at L3: "We make agreements of holding dedicated, customer-specific safety stock, either at the plant or in a stock hotel." This safety stock consists of certain dimensions of metal sheets or certain alloys demanded by the customer. Three suppliers, all of them to K, suggested to "use temporary staff from agencies". K1 suggested this strategy for all four remedial flexibility groups; K3 mentioned it for the groups RQO, RLO and RLD. All these suppliers marked the use of this strategy with 5 on a 1–5 scale, hence it is a frequently used flexibility strategy. These numbers can be compared to the lowest median of 2 for "use overtime in production". As remedial strategy for RLD, K2 applies specific goods marking: "It enables that our products get priority in the large goods reception of K," says the operations manager at K2. In line with this strategy, "prioritized goods marking" can also be applied in the supplier's goods dispatch area to avoid unnecessary waiting time. In the final framework, the empirically identified strategies are added to the preliminary, marked with *italic text* (Table 4). Some strategies are valid in more than one of the flexibility groups. They are repeated since this study strived for a complete "strategy list" for each group.

5.3 A final framework based on additional conceptual reasoning

In studying the final framework in Table 4, some patterns can be seen. There are dimension-general and dimension-specific strategies. Dimension-general strategies can be used in both flexibility dimensions, to achieve both order quantity flexibility and delivery lead-time flexibility. One example of a dimension-general strategy is "use safety capacity in production". A dimension-specific strategy is only valid in one flexibility dimension. One example of a dimension-specific strategy for delivery lead-time flexibility is "add a safety lead-time." Similarly, there are sub-process general and sub-process specific strategies. One example of a sub-process general strategy, valid in both the order and the delivery sub-process, is "apply split deliveries". One example of a sub-process specific strategy is "use faster modes of transport", that is only valid in the delivery sub-process.

A complementary method of conceptually structuring the strategies emerged. Customer general strategies often overlapped enabling strategies, and customer-specific flexibility strategies often overlapped remedial strategies. The "use of safety stock" and "use of safety capacity" are examples of enabling and customer general strategies. However, a dedicated safety stock was empirically identified (strategy EQ7 in Table 4) as an enabling and

	Order quantity flexibility	Delivery lead-time flexibility
Enabling strategies related to the OTD process	*EQ. Enabling customized order quantity* EQ1. Reduce setup time/order specific costs EQ2. Use safety capacity in production EQ3. Use safety stock of raw materials/ semi-finished products EQ4. Have access to temporary subcontractors EQ5. Have multiskilled staff *EQ6. Have access to advance demand information from the customer* *EQ7. Make agreements with the customer about dedicated safety stock*	*EL. Enabling customized delivery lead-time* EL1. Add a safety lead-time (which can be negotiated down) EL2. Use safety capacity in production EL3. Move the customer order decoupling point (CODP) downstream in the supply chain EL4. Have access to temporary subcontractors EL5. Have multiskilled staff EL6. Reduce throughput times in production EL7. Start production of non-stocked items on speculation EL8. *Have access to advance demand information from the customer*
Remedial strategies in the OTD ordering sub-process	*RQO. Demanded order quantity* RQO1. Apply split deliveries RQO2. Re-plan/re-prioritize the order backlog RQO3. Use overtime in production *RQO4. Use temporary staff from agencies*	*RLO. Demanded lead-time* RLO1. Apply split deliveries RLO2. Re-plan/re-prioritize the order backlog RLO3. Use overtime in production RLO4. Use faster modes of transport *RLO5. Use temporary staff from agencies*
Remedial strategies in the OTD delivery sub-process	*RQD. Demanded quantity change after order confirmation* RQD1. Apply split deliveries RQD2. Re-plan/re-prioritize the order backlog RQD3. Use overtime in production *RQD4. Use temporary staff from agencies*	*RLD. Demanded delivery earlier than confirmed* RLD1. Apply split deliveries RLD2. Re-plan/re-prioritize the order backlog RLD3. Use overtime in production RLD4. Use faster modes of transport *RLD5. Use temporary staff from agencies* *RLD6. Use prioritized goods marking*

Table 4. Final framework of strategies for achieving customer order flexibility in and related to the OTD process

customer-specific strategy. Such a strategy is applied for all customer orders from that customer. Another example of enabling and customer specific strategies is "use of subcontractors". Remedial strategies are customer specific. Even if they have the potential to be used for every customer, they are in practice selectively applied to customers or customer orders. Letting a customer benefit from a remedial customer specific strategy is an issue of whether the customer, or the customer order, is considered important enough. Letting a customer order benefit from a remedial customer order specific strategy, even if the customer is not considered prioritized, could potentially be under the condition of accepting an added cost. A complete classification of customer general and customer specific flexibility strategies is presented in the final framework in Table 4. Underlined strategies can be applied generally to affect flexibility toward all customers but are mainly applied selectively for prioritized customers or customer orders.

6. Discussion

This section discusses the overall study results in relation to previous studies, highlighting the contributions to literature and the practical implications. It also describes the study limitations.

6.1 Contributions to literature

Customer order flexibility is a concern in and related to the OTD process in every type of company in customer–supplier relations. It was a surprise to find so little literature about it.

Therefore, the study has several contributions to literature, where existing knowledge is complemented and developed. It should however be acknowledged that the study, as any study, has limitations. A limitation can be the non-probability, convenience sampling method used. However, the framework in itself, being developed mainly based upon literature, has potential to be valid and generalizable within order-to-delivery processes in manufacturing companies.

First, this study focused on the operational OTD process, one of the most important processes in managing from a logistics viewpoint (Forslund *et al.*, 2021; Brabazon and McCarthy, 2017). It consequently contrasts to and complements the long-term, systematic, aggregated view on flexibility, as pointed out by e.g. Abdelilah *et al.* (2018), with the customer order flexibility view, instead addressing the short-term, stochastic view on flexibility. Second, in terms of perspective, the study provides contributions to literature on flexibility in and related to the OTD process by addressing the less often studied supplier perspective, in line with the encouragement of Gligor (2018) and Bag *et al.* (2018). Having knowledge from both actors' perspective enables a supply chain perspective, a more holistic view, stronger understanding and new insights about the interplay between suppliers and customers in strive for flexibility in and related to the OTD process.

A third contribution was derived from addressing another gap in previous knowledge. The study responds to recent calls for empirical studies as pointed out by e.g. Säfsten and Johansson (2020), Mishra (2020) and Mishra *et al.* (2018). The empirically adapted framework, and the knowledge about how some suppliers prioritize among strategies, contributes to a deeper understanding of flexibility strategies used in practice in certain buyer–supplier relations. The input from practitioners in the empirical study has a confirmatory value that increases the relevance of the framework. By that, the theoretical knowledge is expanded. Finally, the final framework of strategies for achieving customer order flexibility in and related to the OTD process is a contribution in itself, as no such framework were found. It collects and captures already known flexibility strategies in a different way than before, with its strong focus on providing a structure related to a specific and practical decision-making situation, as called for by Listou and Flygansvaer (2021) and e.g. Mishra (2020). This contribution bridges a gap between theoretical and practical implications.

6.2 Practical implications

There is practical relevance in providing a framework for enabling and remedial strategies for customer order flexibility in and related to the OTD process. The framework captures already known customer order flexibility strategies in a different way and with a different structure than before. The structure is based upon a practical situation for a decision-making manager; handling flexibility in the common and central OTD process. Viewing strategies as enabling and remedial has the potential advantage to make practitioners to switch to using enabling strategies that can be applied instead of "firefighting". Viewing separate strategies for achieving delivery lead-time flexibility and order quantity flexibility respectively, has learning implications as decision-makers can use adequate strategies for specific situations. Furthermore, viewing that depending on situations in specific sub-processes of the OTD process, different setups of strategies are available. Even late in the OTD process, after order confirmation, certain strategies exist.

Suppliers can hence use the framework as systematic input on how to achieve different dimensions of flexibility related to and in different sub-processes of the OTD process. The framework can also be used as a checklist for customers conducting supplier evaluations and supplier development. The findings of the empirical study, in the shape of to what extent certain strategies are applied by the studied companies, display similarities with the corresponding findings of Szwejczewski and Cousens (2007) in that there are substantial differences between companies in the way they use flexibility strategies. The non-probability,

convenience sampling method used implies that the possibilities of generalizing the empirical numbers shown in Table 3 are limited. Practitioners should therefore use the framework to compare themselves over time, or to their own suppliers, rather than comparing themselves to the empirical findings from this study.

7. Conclusion and further research

The main purpose of this study was to develop a framework of strategies to achieving customer order flexibility in and related to the important OTD process. The framework was developed in five steps based on literature reviews, conceptual reasoning and continuous pre-tests. The five steps were (1) adapting flexibility dimensions, (2) relating customer order flexibility to the order-to-delivery process, (3) identifying potential flexibility strategies, (4) structuring and characterizing flexibility strategies and (5) visualizing the framework. The framework is structured around two flexibility dimensions: order quantity flexibility and delivery lead-time flexibility; it covers enabling strategies related to the OTD process and remedial strategies in the ordering and delivery sub-processes in the OTD process.

An additional purpose was to investigate how companies prioritize various strategies to achieve customer order flexibility. In order to create the desired understanding for customer order flexibility, as acknowledged by Listou and Flygansvaer (2021), and to enable practical application, an empirical investigation of ten suppliers was carried out in response to research gaps pointed out by, e.g. Säfsten and Johansson (2020) and Mishra (2020). The sample illustrated how the companies prioritize the various customer order flexibility strategies related to and in the OTD process. The enabling strategies with the highest median value were "have continuous contact with the customer's purchaser" and "use safety stock of raw materials/semi-finished products". The remedial strategy with the highest median was "re-plan/re-prioritize the order backlog". In the delivery sub-process, it was more common to apply remedial strategies for delivery lead-time than for order quantities. The use of a handful of additional enabling and remedial strategies was empirically identified. One example is to have continuous contact with functions in the customer company other than purchasing, such as construction and assembly. Several suppliers indicated that purchasing is not always the most reliable and timely source for accurate order information. The strategy is therefore expanded to "have access to advance demand information from the customer".

Some suggestions for further research can be derived from the study. One interesting avenue would be to study what makes supplying companies prioritize certain flexibility strategies. Could this be related to customer demands, to the company's competitive strategies, to their customer base consisting of a few or many important customers, or to competitors' actions? The design of this study makes it possible to further study specific customer–supplier relations and to collect data also from customers. It would also be relevant to investigate the preference for using enabling over remedial strategies, or vice versa, as well as whether order quantity flexibility or delivery lead-time flexibility is the most prioritized when selecting strategies to apply. Are there cost aspects that favor enabling strategies vs remedial strategies? Boyle and Scherrer-Rathje (2009) even suggested to avoid or reduce the need for flexibility by more enabling strategies. Some strategies in the framework are related to each other and may even overlap to some extent. Analyzing these relations is a complex task that would require further conceptual reasoning. This is another potential path for further research.

The interview guide applied used a Likert scale ranging from 1 = "not at all" to 5 = "to a very large extent". A potential development of that scale could contain a precise description of every single level. What characterizes each scale level, and consequently what is the difference between for example answering 3 or 4 to the question what extent a certain strategy is used. This could increase the precision in the answers and is another suggestion for further research. A final suggestion with managerial relevance would be to continue

developing the framework into guidance on how to apply the strategies in the most effective way. This could include guiding managers as to which strategies are suitable, i.e. to identify strategies that absolutely should or should not be used in certain situations. It should also be pointed out that the empirical study here has a more illustrative purpose and is conducted within the frame of an existing research project. To be able to describe the applications of different flexibility strategies more broadly, a broader survey using a probability sampling method is needed.

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Further reading

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Appendix
Interview guide

For each of the possible strategies mentioned in the interview guide, the extent of use towards the specific customer was assessed on a Likert scale from 1 = "not at all" to 5 = "to a very large extent".

Order quantity flexibility

Enabling strategies related to the OTD process: customized order quantity

(1) We reduce setup time and other order specific costs
(2) We use safety capacity in production
(3) We use extra large safety stock of raw materials and semi-finished products
(4) We ensure access to temporary subcontractors
(5) We strive toward having a flexible staff
(6) We prepare by having continuous contacts with the buyer's purchaser
(7) Other strategy namely

Remedial strategies in the OTD ordering sub-process: Demanded order quantity

(1) We apply split deliveries
(2) We are re-planning/re-prioritizing the order backlog
(3) We use overtime in production
(4) Other strategy namely

Remedial strategies in the OTD delivery sub-process: Demanded quantity change

(1) We apply split deliveries
(2) We are re-planning/re-prioritizing the order backlog
(3) We use overtime in production
(4) Other strategy namely

Delivery lead-time flexibility

Enabling strategies related to the OTD process: customized delivery lead-time

(1) We add a lead-time to the normally applied lead-time, which can be lowered
(2) We use safety capacity in production
(3) We move the customer order decoupling point higher in the product structure
(4) We ensure access to temporary subcontractors
(5) We strive towards having a flexible staff
(6) We reduce throughput times in production
(7) We start production of non-stocked items on speculation
(8) We prepare by having continuous contacts with the buyer's purchaser
(9) Other strategy namely

Remedial strategies in the OTD ordering sub-process: Demanded lead-time

(1) We apply split deliveries
(2) We are re-planning/re-prioritizing the order backlog
(3) We use overtime in production
(4) Use faster modes of transport
(5) Other strategy namely

Remedial strategies in the OTD delivery sub-process: Delivery earlier than confirmed

(1) We apply split deliveries
(2) We are re-planning/re-prioritizing the order backlog
(3) We use overtime in production
(4) Use faster modes of transport
(5) Other strategy namely

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