

CUSTOMER-DRIVEN PURCHASING

EMPIRICAL APPLICATIONS

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ABSTRACT

Purpose - The purpose of this paper is to illustrate application of a method for customer-driven purchasing.

Design/methodology/approach - A method for customer-driven purchasing was developed and applied within a research project using a combination of a multiple case study and focus groups. The research project involved six companies within different lines of trade and the method was applied to more than 20 products in the case companies. In this paper, the applications to four products at three companies are presented.

Findings - When applying the method, the case companies received several insights and direct results. All three companies found items that could be sourced either with focus on efficiency or responsiveness. Direct visible results were, for example, shortened supply lead time for customized items and reduced inventory levels for standard items.

Research limitations/implications (if applicable) - All the companies included in the study can be referred to as medium-sized or large companies where at least a fraction of the sales are customer-order driven and/or customized. Further research could therefore focus on applications at small manufacturers. Of further interest is also the method's applicability during product development projects.

Practical implications - The importance of establishing supplier relationships based on the order winners for sourced items, as opposed to based on cost per item has been identified. Additionally, the negative effects of long supply lead time for customized items have become evident.

Originality/value - This research incorporates knowledge about CODP-differentiated competitive priorities in the purchasing process.

Keywords: Purchasing, Customer-driven, CODP-differentiation, Method application, Supplier interaction.

1. INTRODUCTION

Today, when a product can be sourced from all over the world, customers will not settle for whatever companies are offering, they demand quality goods and services designed for their unique needs (van Weele, 2010). Not only standard items and raw materials, but also more complex and perhaps customized components and sub-assemblies are being purchased (Kroes and Ghosh, 2010). Due to the transparency of the market, customers also require a price and delivery lead time that is globally competitive (Schultz, 2009). Traditionally, purchasing at a manufacturer, here referred to as a focal actor, is executed by a purchase order to a supplier actor (van Weele, 2010). However, in order to pursue competitive purchasing, the traditional purchasing situation (a dyadic relation between the focal actor and the supplier actor) is extended to a triadic supply chain, including also the focal actor's customer, see Figure 1.

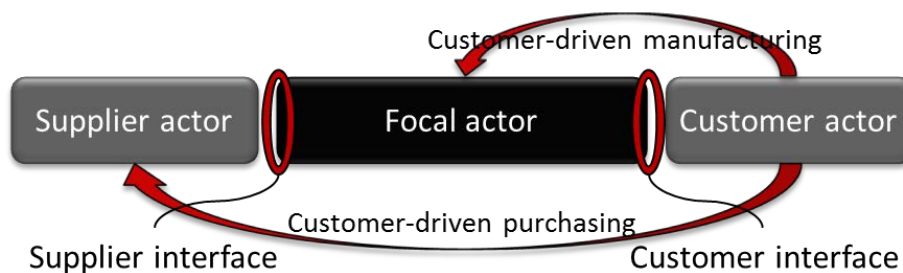


Figure 1. Customer-driven manufacturing and customer-driven purchasing

The requirements from the customer actor are handled at the customer interface. The customer requirements can be expressed as ‘competitive priorities’ (e.g. Leong *et al.*, 1990; Ahmad and Schroeder, 2011). Competitive priorities have long been identified in manufacturing strategy as the customer’s requirements that the focal actor’s manufacturing function needs to fulfill (Slack and Lewis, 2011). The most commonly referred to competitive priorities are quality, cost, delivery, flexibility, and innovativeness (e.g. Leong *et al.*, 1990; Ahmad and Schroeder, 2011).

How customer requirements are handled internally when the supply system only constitutes one actor is clearly stated in manufacturing strategy/management literature (e.g. Hill and Hill, 2009), and is here referred to as customer-driven manufacturing. However, there is less evidence of research regarding the situation when the supply system is divided into several suppliers in sequence (the focal actor and its suppliers) and thus how customer requirements can be transferred to requirements on the supplier in the supplier interface. When conceptualizing the customer-driven supply chain, previous authors have taken a clear stand point in the focal actor and focused on the internal alignment of production with demand and the integration of suppliers (e.g. Lyons *et al.*, 2012, p. 23). This is done with the underlying assumption that the whole manufacturing and supply chain needs a customer-driven one-piece-flow set-up. However, in this research the whole range of end-products offered by the focal actor is regarded, including all items from standard or customer-generic items kept in inventory to customer-order-unique items ordered once. These different types of items require different sourcing strategies and different levels of supplier interaction (Terpend *et al.*, 2011). In order for the interaction with the supplier to be competitive, the customer requirements from the customer interface should be communicated to the suppliers, here referred to as **customer-driven purchasing**, which is the focus of this research, see Figure 1.

A key knowledge when making a product in-house is the customer order. The point in the manufacturing flow when the customer order is received is referred to as the customer order decoupling point (CODP) (Hoekstra and Romme, 1992). The CODP separates the forecast-driven flow from the customer-order-driven flow in the supply chain. It also separates the competitive priorities into those relevant to pursue before the customer order is received and those relevant to pursue after (Olhager, 2003).

In manufacturing strategy, there is an understanding of how different types of products (e.g. standardized or customized) require different strategies (e.g. Make-to-Stock, Make-to-Order etc.) and of how different positions of the CODP affect, for example, process choice and planning principles (Hayes and Wheelwright, 1984; Hill, 2000). As early as in 1985, Buffa stressed the need for also purchasing and the supplier interaction to be aligned with manufacturing in order to support the appropriate competitive priority (Buffa, 1985). This notion was supported also by Watts *et al.* (1992). Recently, the need to extend the use of competitive priorities to also include the purchasing strategy has been highlighted (e.g. Krause *et al.*, 2001; González-Benito, 2007; Kroes and Ghosh, 2010).

To our knowledge, so far very limited research has been performed on incorporating knowledge about CODP-differentiated competitive priorities in the purchasing process. Mello *et al.* (2012) presented a framework, based on the work by Wikner and Rudberg (2005), integrating engineering, purchasing, and manufacturing but their framework is mainly an extended CODP typology. Also, there is limited support on how product customization can be combined with forecast-driven and customer-order-driven purchasing.

However, within a research project, involving the authors of this paper, a method for customer-driven purchasing (the CDP method) has been developed (Bäckstrand *et al.*, 2013), which facilitates the transfer of customer requirements, in the form of competitive priorities, to requirements on the supplier. The purpose of this paper is to illustrate application of the CDP method in three companies in order to show the potential with customer-driven purchasing.

Next, the methodology of this research is presented and thereafter, the CDP method will be described. Applications of the CDP method at three case companies are thereafter presented followed by discussion and conclusions.

2. METHODOLOGY

The CDP method was developed within a research project involving six companies in Sweden within different lines of trade. The companies were Combitech AB in Linköping, Ericsson AB in Borås, Fagerhult AB in Habo, Husqvarna AB in Huskvarna, Parker Hannifin AB in Trollhättan, and Siemens Turbomachinery AB in Finspång. During the research project, the CDP method was applied to more than 20 products in five of the case companies. The sixth company, Combitech AB in Linköping, is a consultancy company without its own manufacturing. Its role in the project was to provide the research project with knowledge from a wide range of consultancy assignments. In total, 36 individuals from the six companies have been involved in the research project. Table 1 shows the different roles of the individuals directly involved in the research project.

The main activities during the research project were workshops where researchers and representatives from the companies met. Other activities were meetings between the researchers and representatives from one company at a time. The research method can therefore be described as a combination of a multiple case study and focus groups.

Table 1. Roles of case company informants

Company	Role	Interview(s)	Workshop(s)
Combitech	Vice President Design & Logistics	X	X
	Business Developer	X	X
	Business Area Manager (2 informants)		X
	Logistics and Purchasing Consultant (2 informants)		X
	Consultant Manager		X
	Logistics and Purchasing Consultant		X
Ericsson	Manager Supplier Management (2 informants)	X	X
	Pre-CODP Commodity Manager	X	X
	Manager Planning & Short Term Dimensioning	X	X
	Post-CODP Commodity Manager		X
	Manager Process Management Logistics		X
Fagerhult	Project Manager SCM	X	
	Global Purchasing Director	X	X
	Supply Chain Director	X	
	Plant Manager Suzhou		X
	Trading and Outsourcing Manager		X
	Production Logistic Manager		X
	Business Developer, Supplier Development		X
	Supplier Developer		X
Husqvarna	Supply Chain Manager	X	X
	Project manager		X
	Purchaser		X
Parker	Manager Production Control	X	X
	Senior Buyer, Strategic purchase	X	X
	Trainee		X
	Division supply chain manager		X
	Supplier development		X
	Quality and Supplier development		X
Siemens	Process and Method Developer	X	X
	Purchasing Developer	X	
	Manager Demand and Supply Planning	X	X
	Supply Chain Developer (2 informants)		X

Since several companies were included and the same issue was treated at each company, the study can be described as a multiple case study with several contexts (i.e. line of business) according to Yin (2003, p. 40) with multiple units of analysis since purchasing strategy, manufacturing strategy, and the supplier relations were studied. The case can best be described as a company's process of transferring customer requirements, in the form of competitive priorities, to suppliers. A multiple case study allows cross-case comparison and the investigation of a particular phenomenon in diverse settings (Williamson, 2002, p. 115). In the multiple case study, the empirical data were collected through interviews, documentation and participant observations. Table 1 shows which informants have been interviewed. The interviews dealt with customization issues, supplier relationships, etc. Documents were collected in order to analyse product data, e.g. products structures and lead times. The participant observations involved that one of the researchers visited the companies several times to work together with representatives for the companies in order to develop and

apply the CDP method. No data have been collected from suppliers or customers. The focal actors, i.e. the case companies, could provide data about, for example, the customer requirements in the form of competitive priorities as well as the supplier actors' perspectives on level of customization of the supplied items.

During the workshops, the representatives from the companies interacted with each other and the researchers, based on the topic decided for each workshop, which is in line with the description of focus groups by Morgan (1997, p. 2). The workshops produced data and insights that had been difficult to access in other ways. All in all, eleven workshops were held during the period March 2009 – March 2013. Table 1 shows which informants participated at one or more workshops. Three of the workshops focused on the applications of the CDP method to products at the companies. The first of these workshops was held in November 2011, the second in May 2012, and the third in September 2012. Before the workshop in November 2011, an initial description of the CDP method together with an instruction of use were sent to the participating companies. The companies prepared the workshop by applying the method. During the workshop, each company presented the results of the application and discussed this together with the other companies and researchers. Due to that the companies found the last phase (steps 10-12) of the CDP method difficult to apply, the second workshop focused on these steps. The companies presented their results from applying the method to another product than the product presented at the first workshop. Also the third workshop focused on the last phase in order to discuss how to best apply these at the companies. At this workshop also several insights from applying the CDP method was presented and discussed.

In this paper, the applications at three companies are presented; Ericsson AB in Borås, Parker Hannifin AB in Trollhättan and Siemens Turbomachinery AB in Finspång. The applications are also discussed where a comparison is made between the purpose with the different phases and steps of the CDP method and how the companies applied these.

The three companies included are all manufacturing companies in Sweden. One of the companies, Parker Hannifin AB in Trollhättan, carries a full line of products ranging from catalog orders/standard to fully customized products and offers “engineer-to-order” customer-order-unique products. In the case study, however, the focus was on the products that were “adapt-to-order” i.e. where certain items in a “standard” product could be adapted to customer-order requirements. The products from Ericsson AB in Borås and Siemens Turbomachinery AB in Finspång were all customer-unique but both companies had a distinct customer order decoupling point, where the modules assembled before this point were customer-generic and after customer-unique or customer-order-unique.

3. THE CUSTOMER-DRIVEN PURCHASING METHOD

In Bäckstrand *et al.* (2013) the method for customer-driven purchasing is presented. The CDP method consists of twelve steps, divided into three phases. These three phases represent the corner stones of the method:

- Phase 1 – *Identify and differentiate items* consists of the core concepts and tools for lead time based investigation of customer-driven manufacturing.
- Phase 2 – *Analyze item characteristics* is based on the platform created by phase 1 and constitutes the link, in the method, between manufacturing and purchasing.
- Phase 3 – *Analyze and implement supplier interaction* is the final phase where the details of customer-driven purchasing are established.

These phases are now further elaborated.

3.1. Phase 1 – Identify and differentiate items

The objective of phase 1 is to distinguish purchased items that are supposed to be subject to the analysis performed in phase 2.

- **Step 1: Identify product (family) and bill-of-materials (BoM)**
The point of departure of the method is to select a product or a product family to be investigated. Initially, the complete product structure is identified. The key information at this stage is the constituent items the product is made up of.
- **Step 2: Identify supply lead time for each item**
Each identified item from step 1 is here complemented with the manufacturing lead time or the purchasing lead time, depending on whether it is a make or buy item. The cumulative lead time, i.e. the total supply lead time, can then be calculated for each product, see Figure 2. The supply lead time is the total time it takes to replenish a product = external purchasing lead time + internal manufacturing lead time. To increase the understanding of the situation, a time-phased product structure is created, see Figure 2.
- **Step 3: Differentiate forecast-driven items from customer-order-driven items**
Each item can be categorized in terms of level of certainty, as either being forecast-driven (FD) or customer-order-driven (CoD), see Figure 2. The categorization is based on the demand lead time in relation to the supply lead time (also known as the P:D relation, see e.g. Shingo (1981) and Mather (1984), here referred to as the S:D ratio).
- **Step 4: Differentiate generic items from unique items**
Each item can also be categorized in terms of different levels of customization. In this context this is referred to as properties on a scale from customer-generic (CG), via customer-unique (CU) to customer-order-unique (CoU), in line with Wikner and Bäckstrand (2012).
- **Step 5: Differentiate make items from buy items**
The initial four steps are generic in terms of make or buy items. This fifth step is however targeting the differentiation of buy items as a gateway to next phase that focuses on purchased items and supplier relationships. In Figure 2, the purchased items are indicated with bold lines.

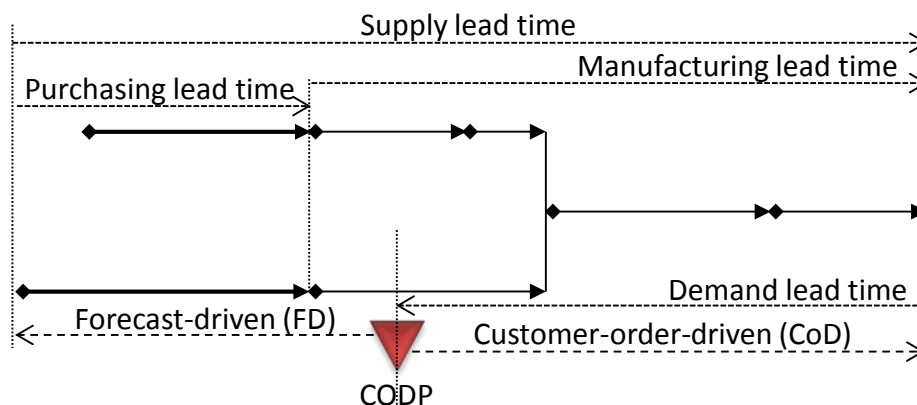


Figure 2. A time-phased product structure

As a result of Phase 1, a thorough lead time based analysis has been performed on the targeted product or product family, see Figure 2. All sub-items have been analyzed using a time-phased approach and combined with a make or buy categorization, all purchased items have been classified along the dimensions of level of certainty and level of customization.

3.2. Phase 2 – Analyze item characteristics

The objective of phase 2 is to identify the supplier relationships to focus on in the final phase, i.e. phase 3, of the method.

- **Step 6: Analyze items in the customization-perspective framework**

All items have some level of customization and this was investigated in Step 4. The analysis is here further detailed as the purchased items, that are in focus in phase 2, have a level of customization that depends on if the item is viewed from a focal actor’s perspective or from a supplier actor’s perspective, see Figure 3 (Wikner and Bäckstrand, 2012). The same item can, for example, be seen as generic by the focal actor, used in all their products within a product family, but seen as customer-unique by the supplier actor if the supplier actor only manufactures this item for the focal actor. This analysis provides further information related to e.g. how risk should be shared between the focal actor and the suppliers. For example, the three scenarios indicated with grey in Figure 3 point out scenarios with “counter-logic” flow of level of customization, i.e. where the supplier perceives a higher level of customization than the focal actor and thus assumes a higher risk for keeping inventory etc.

		Focal actor’s perspective		
		CG	CU	CoU
Supplier actor’s perspective	CoU			
	CU			
	CG			

CoU = Customer-order-unique
 CU = Customer-unique
 CG = Customer-generic

Figure 3. The customization-perspective framework

- **Step 7: Analyze items in the certainty-customization framework**

Up till now in the CDP method, the issues of certainty and customization have been analyzed separately. In this step, the two dimensions are combined in an integrated framework that allows simultaneous analysis. The framework provides information on purchased items with different combinations of level of certainty and level of customization, see Figure 4. Based on this information, items can be classified and less competitive combinations can be targeted for further analysis, such as forecast-driven customer-order-unique items, indicated in grey in Figure 4.

CoU		
CU		
CG		

FD CODP CoD

CoU = Customer-order-unique
 CU = Customer-unique
 CG = Customer-generic
 FD = Forecast-driven
 CoD = Customer-order-driven
 CODP = Customer order decoupling point

Figure 4. The certainty-customization framework

- **Step 8: Analyze items in the CAP matrix**

The analysis in the certainty-customization framework in step 7 results in six different item categories. For each category, an adapted version of the Kraljic matrix (Kraljic, 1983) is applied. Whereas the traditional Kraljic matrix is based on supply risk and profit impact, the adapted matrix differentiates items based on the dimensions of supply risk and competitive advantage and is thus referred to as the competitive advantage purchasing (CAP) matrix, see Figure 5. By focusing on competitive advantage instead of only profit impact, the strategic intent of the focal actor is more explicitly reflected in the categorization of each item.



Figure 5. The CAP matrix

- **Step 9: Select supplier relationships to analyze**

The previous steps were based on the categorization of items. This step takes the analysis further by recognizing the connection between item and supplier. This step hence constitutes the crucial link between item-based analysis and the management of supplier interaction. The output of this step is a list of supplier relationships to analyze and a prioritization of in what order to analyze them. A gross list of supplier relationships that might need further investigation is created based on the outcome of steps 6, 7, and 8. The prioritization of supplier relationships to analyze can be supported by the S:D-ratio (supply lead time divided by demand lead time), but this step puts more emphasis on qualitative aspects such as tacit knowledge and experience than on quantitative measurements.

Phase 2 of the method introduces a higher level of complexity in the analysis as the lead time based analysis of individual perspectives is extended to cover also intersections of different concepts and actors. Finally, a differentiated perspective of suppliers is obtained that provides a baseline for a more elaborate investigation of supplier interaction.

3.3. Phase 3 – Analyze and implement supplier interaction

The objective of this final phase is to extend the identification of requirements of different supplier relationships to become practical guidelines for how to appropriately manage supplier interactions in a context of customer-driven purchasing.

- **Step 10: Analyze the selected supplier relationships in the Interaction Framework**

The previous phases provided an overall differentiation of suppliers, using a combination of different types of lead time based analysis, perspective based analysis and CAP matrix based analysis. This step takes the analysis further by highlighting a set of factors that need to be considered in the supplier relationships selected in step 9. The gross set of potential affecting factors is huge but by using the output from the previous steps, a tailored set of appropriate factors to regard in the supplier interaction is distinguished. In

order to be able to consider several affecting factors in a supplier relationship, an Interaction Framework is used (Bäckstrand, 2007, 2012). The outcome is a detailed description of what to emphasize in each individual supplier interaction and whether a high or low level of interaction is most appropriate.

- **Step 11: Analyze controllability in the supplier interface**

The previous steps of the method have provided a thorough understanding for the supplier relationships of the focal actor. The method has also provided differentiation between the suppliers and highlighted key characteristics of each supplier relationship. At this stage, a subset of the suppliers has been identified for inclusion in the implementation in Step 12. In preparation for implementation a “plan for every item/supplier” approach is used. Key issues in this work is to identify the level of controllability for each item/supplier and then to define how to manage each individual item/supplier interaction. Controllability refers to the focal actor’s ability to control the supply system (Wikner *et al.*, 2009; Wikner and Bäckstrand, 2011).

- **Step 12: Implement customer-driven purchasing**

The implementation is formally performed in this step. As in many cases, the goal is the goal in itself and by performing the initial eleven steps, much of the implementation of customer-driven purchasing is performed. The formal implementation, represented by this step, usually involves a formal decision to measure and control the operational aspects of how to increase the use of the customer-driven purchasing.

Phase 3 involves the operationalization of the output of the previous two phases. The details of how to manage the supplier interaction was outlined also covering a “plan for every item/supplier” approach. The formal implementation then finalized the CDP method.

4. APPLICATIONS OF THE CUSTOMER-DRIVEN PURCHASING METHOD

In this chapter, the applications of the CDP method at the case companies Ericsson AB in Borås, Parker Hannifin AB in Trollhättan and Siemens Turbomachinery AB in Finspång will be described. Each description will start with a short presentation of the company and the product family that the CDP method was applied to. For each company, the description will focus on the activities which gave the main insights, i.e. the activities which drew attention to a problem or a difficulty and in some cases resulted in a change in the company’s way of working. This means that not all steps in the CDP method will be described for all three companies.

4.1. Ericsson AB

Ericsson AB is a world-leading provider of telecommunications equipment and related services to mobile and fixed network operators globally. This case study has been conducted at Ericsson AB in Borås, part of the business unit ‘Network’ and henceforth referred to as Ericsson. At Ericsson, the CDP method has been applied to the MINI-LINK. A MINI-LINK consists mainly of a radio transmitter, an indoor unit (modem), cables and an antenna. The CDP method has so far been applied to the radio transmitter, the antenna and six items within the MINI-LINK. In this example, the radio transmitter and the antenna are used.

Phase 1 of the CDP method, which mainly identifies and differentiates the current circumstances for the constituent items in a product, was applied at Ericsson in a rather straightforward manner. Figure 6 shows output from the application in the form of a time-phased product structure for the radio transmitter, with regard to CODP. The product structure

consisted of 18 items, whereof 14 were purchased. As can be seen in Figure 6, six items (items 10, 12, 13, 15, 17 and 18) were forecast-driven. All forecast-driven items were purchased. Ericsson regarded three items as customer-generic and two as customer-order-unique, the remaining 13 as customer-unique.

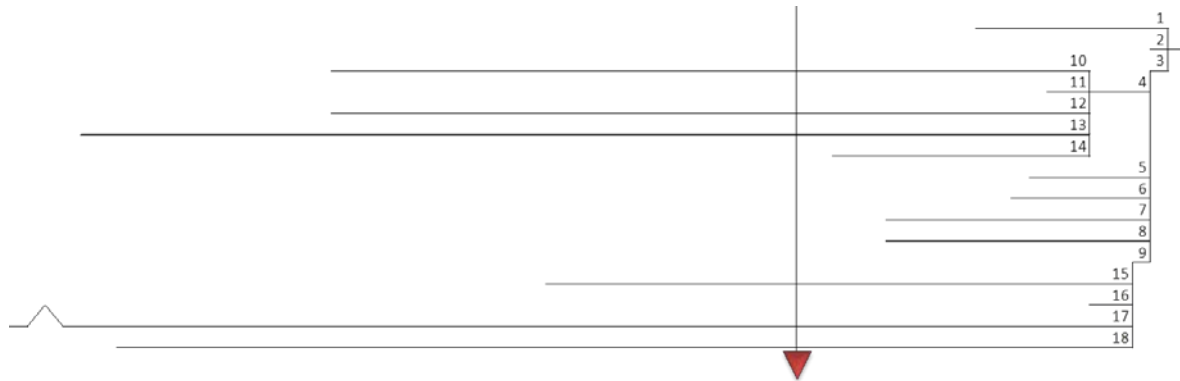


Figure 6. Time-phased product structure for the radio transmitter with regard to the CODP (indicated with the triangle)

During the application of phase 2, when analyzing items in the customization-perspective framework, a deeper analysis of the supplier actor's perspective revealed that there was a discrepancy between Ericsson's perspective and the supplier's perspective of the level of customization for two items in the radio transmitter. There was one item that Ericsson saw as customer-unique while the supplier saw it as generic and another item that Ericsson saw as customer-order-unique while the supplier saw it as customer-unique. These scenarios are however not "counter-logical" according to Figure 3 and do not imply an increased supply risk.

When analyzing items in the certainty-customization framework, several generic items were found to be needed after the CODP. Thus, for these items there was reduced supply risk and an option to either source them as forecast-driven items with efficient purchasing or customer-order-driven with focus on responsiveness.

In the CAP matrix, two customer-generic items in the radio transmitter were classified as bottleneck or strategic items according to Kraljic's definition, depending on the supplier, which implied a higher supply risk. When selecting supplier relationships to further analyze, the two suppliers delivering the strategic/bottleneck items were chosen to be analyzed due to their long lead times (high S:D-ratio). For the antenna, one supplier was selected based on its long lead time, and in order for comparison, its competitor with substantially shorter lead time was also selected.

In the Interaction Framework in phase 3, Ericsson analyzed the two alternative suppliers supplying the same item for the antenna. The result of this analysis was clearly favorable for the supplier with substantially shorter lead time, due to the customized nature of the item. Moreover, for this item Ericsson also analyzed the level of controllability in the supplier interface. This analysis was also favorable to the same supplier since it offered a higher level of controllability.

One of the main conclusions Ericsson made based on the application of the CDP method were regarding the whole supply chain set-up for the antenna. With the present set-up they had very low controllability, parts of the sourcing were regarded as 'black-box' i.e. no visibility at supplier. For the radio transmitter, the application revealed the extremely long supply lead

time for one of the items, which was due to supplier location and thus transportation lead time. It also became evident that supplier selection was based on cost for all items. Consequently, when applying the CDP method Ericsson reevaluated their selection of the antenna-supplier and phased out the original supplier. A supplier that better supported the competitive priority ‘lead time’ was selected.

4.2. Parker Hannifin AB

Parker Hannifin Corporation is a global leader in ‘Motion and Control Technologies’ working within eight operating groups which spans the core of motion technologies – electromechanical, hydraulic and pneumatic. This case description refers to the Trollhättan site of Parker Hannifin’s Pump and Motor Division in Sweden, henceforth referred to as Parker. At Parker, the CDP method has been applied to hydraulic motors within two out of the three production lines. A hydraulic motor in the fixed product line and within the product family ‘F12’ will be used as example here.

The steps in phase 1 were applied in a rather direct way. The time-phased product structure helped Parker to identify a situation in which the demand lead time and the supply lead time of a customer-order-unique item were equal. This situation was unfortunate since it could not be automatically handled by the ordering system – the ordering system often confused forecasts with actual customer orders. Furthermore, when differentiating make from buy items, it became apparent that customer-order-unique items were outsourced, which meant that Parker was completely dependent on their suppliers in order to deliver the products on time.

In phase 2, when analyzing items in the customization-perspective framework, it was disclosed that there was a discrepancy between Parker’s perspective and the supplier’s perspective for three items for F12, items 4, 11, and 14 in Figure 7. Moreover, two of these items (4, 11) were seen as generic by Parker, since they are used in all Parker’s hydraulic pumps, but seen as customer-unique by the supplier, i.e. the supplier only manufactured these items for Parker. This meant that the risk exposure was higher for the supplier but this was neglected by Parker due to the fact that the items were regarded generic at Parker. These items thus needed to be taken into consideration when selecting supplier relationships to further analyze.

		Parker’s perspective		
		CG	CU	CoU
Supplier Actor’s perspective	CoU			
	CU	4, 11	2, 3, 4	
	CG	8, 9, 10, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28 29, 30	14	

Figure 7. Customization-perspective framework for F12

When analyzing items in the certainty-customization framework, several generic items were found to be needed after the CODP. This provided Parker with an option to further analyze whether the generic items should be sourced as forecast-driven items with efficient purchasing or customer-order-driven items with focus on responsiveness. Moreover, it was

Furthermore, several items were classified as strategic and one as bottleneck in the CAP matrix. All these items had the same two suppliers and these suppliers were selected for further analysis. One of these suppliers supplied the two items with options mentioned above.

Siemens has not yet analyzed suppliers in the Interaction Framework. Siemens used single sourcing and perceived that the purpose with the Interaction Framework mainly was to compare suppliers. However, Siemens analyzed controllability in the interfaces between Siemens and the two suppliers selected. The result showed that Siemens had a low level of controllability with these suppliers and that it would be beneficial for Siemens to increase its controllability to reduce supply lead time and increase flexibility. This could be achieved by booking capacity at the supplier or perhaps by purchase (raw) material from the supplier's supplier to reduce the supplier's external lead time (and risk).

One of the main advantages for Siemens of applying the CDP method was to facilitate and increase internal communication. One example of this was that during a new product development project, the company representatives in the research project met with the designers of a new concept. By jointly carrying out steps 1 to 3 in the CDP method and thus visualizing the time-phased product structure with regard to the CODP, consensus was reached and the designers had an incentive for decreasing the supply lead time already at the blueprint. This resulted in a point of product differentiation being moved from before the CODP to after the CODP, thus reducing the need for buffers.

Another example where the CDP method pointed out the necessity of increased internal communication in order to support competitiveness is the two items with options that had to be ordered based on forecast mentioned previously. In order to avoid speculation on options, the supply lead time for these two items should be reduced until it was equal to the demand lead time, or less. There were alternative ways to reduce the supply lead time; the external purchasing lead time could be reduced, the internal manufacturing lead time could be reduced, or a combination of both. For Siemens, the internal manufacturing lead time constitutes the majority of the supply lead time. Thus, if the external lead time should bear the whole lead time reduction, this would imply a reduction with 17.6 % and 41.1 % respectively for the two items. On the other hand, if the internal lead time should bear the whole lead time reduction, this would imply a reduction with 7.9 % and 16.7 % respectively for the two items. In order to determine which way to go, purchasing and manufacturing had to have a functioning communication.

5. DISCUSSION AND CONCLUSIONS

In order for the interaction with the supplier to contribute to competitiveness, the customer requirements on the focal actor, in the form of competitive priorities, should be communicated to the suppliers, here referred to as customer-driven purchasing. In this paper, research on customer-driven purchasing is presented by applying the newly developed CDP method, which has been developed within a research project involving six companies. The method consists of twelve steps, divided into three phases; Phase 1 – *Identify and differentiate items*, Phase 2 – *Analyze item characteristics*, and Phase 3 – *Analyze and implement supplier interaction*.

In this paper, the applications of the CDP method to four products at three companies are presented; Ericsson, Parker and Siemens. The first phase was applied in a rather straightforward manner in all three companies. Although this phase is mainly intended as preparation, it gave several insights to the companies. Just mapping and agreeing on the time-phased product structure, which is one of the outputs from phase 1, was a fruitful exercise for the companies.

The analyses in the different frameworks in the second phase gave the companies a lot of suggestions on supplier interactions to further analyze and take actions upon. Both Ericsson and Parker found that there were discrepancies between their perspectives and the suppliers' perspectives of customization for several items. Moreover, at all three companies, generic items were found to be needed after the CODP. These items can either be sourced as forecast-driven items with efficient purchasing or customer-order-driven with focus on responsiveness. Also, the analyses in the CAP matrix challenged the companies' routine use of the Kraljic matrix.

Finally, phase 3 was perceived as complex by the companies, although two workshops within the research project focused on this. Only Ericsson formally analyzed supplier relationships in the Interaction Framework and only Siemens and Ericsson analyzed controllability in the supplier interface. However, all three companies altered their supplier selection based on the analyses in the CDP method in order to achieve a more customer-driven purchasing.

Based on the results from the applications of the CDP method, the method may be adjusted. The way the method is presented in Bäckstrand *et al.* (2013), focus is on going through each step in order to reach the final step 12 where customer-driven purchasing is implemented, although it also in Bäckstrand *et al.* (2013) is emphasized that "the road is the goal in itself and by performing the initial eleven steps also much of the implementation is performed". The results from the applications prove that several of the steps 1 to 11 are rewarding in themselves. None of the three companies applied all 12 steps of the CDP method but could nevertheless be regarded as, in a way, to have implemented customer-driven purchasing. It is therefore a bit misleading that step 12 is called "Implement customer-driven purchasing", indicating that steps 1 to 11 have to be finalized before reaching step 12 and implementing customer-driven purchasing. Moreover, also phase 1 may be more highlighted as achieving results itself, not only be regarded as a preparation phase.

The industrial relevance of this research has become evident during the research project, both from the case companies' genuine interest in dealing with this issue and from the statements from the company representatives during workshops. The applications of the CDP method have resulted in measurable and lasting results at the case companies.

All the companies included in the study can be referred to as medium-sized or large companies. However, the case companies operate in different industries and manufacture very different products (in terms of value, size, supply- and demand lead time etc.). They are also very different regarding their internal structure. Nevertheless, ever since the initial workshop of the research project, the companies have somewhat surprisingly discovered that their supplier-interaction-related problems were much alike. The suggested solution to their supplier-interaction-related problems, the CDP method, has so far been applied at five case companies and more than 20 products with beneficial results. The method is thus assumed to be generalizable and relevant to medium-sized or large manufacturing companies with a range of products where some items are customer-driven and customized. Further research could analyze the applicability of the CDP method to small manufacturing enterprises.

In this research, data collection and workshops have involved the focal actors, i.e. the case companies. Further research could include also those suppliers selected in step 9 in order to extend the customer-driven purchasing approach to them.

Another interesting area for further research is to use the results from Siemens that carried out steps 1 to 3 of the CDP method during a product development project. It could be investigated whether all steps could be used during product development projects and also when and how they could be applied during such a project.

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