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Drivers of inter-organizational product development: a case study in a project manufacturing company

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Abstract

There is already a wide acceptance on the importance of involving suppliers and customers in product development. Decent understanding prevails on the relationship-oriented approach to product development including various collaboration forms. However, there is less research on the factors explaining the decision of attending to joint product development. In addition, less studies have examined the integrated role of both suppliers and customers in product development initiatives. This study searches answers to the following research questions: 1. What is the role of different actors in product development initiatives? 2. What factors motivate suppliers and end customers to participate in product development? The research is carried out as an in-depth qualitative single case study in a large project manufacturing company. It takes the perspective of a purchaser company striving for product improvements. The first part of the empirical study consists of 14 semi-structured interviews. The second part includes two discursive workshops and builds upon the results of the interviews. This study contributes to the existing research by explaining the challenges and conditions facilitating joint product development with supplier and purchaser companies. The results highlight the role of end customers in improving the effectiveness of product development. As a practical contribution, the paper reports the application of workshop method as a facilitator of collaboration between supplier, purchaser and end customer companies.

Keywords: collaboration, supplier involvement, customer involvement, product development, purchasing, supply management

Intended track: Special Track on Logistics and distribution channel relationships

Paper type: competitive paper

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INTRODUCTION

The importance of collaboration in product development has been acknowledged for a long time. Development of complex products often requires collaboration crossing organizational boundaries enabling the use of complementary knowledge and resources (Lin and Germain, 2004; Ylimäki, 2014). There is already a lot of literature on involving both suppliers (e.g. Lakemond et al., 2001; Schiele, 2010) and customers (e.g. Lagrosen, 2005; Lin and Germain, 2004) to product development. The literature of product development includes many factors promoting inter-organizational collaboration (Brown and Eisenhardt, 1995). The benefits of involving suppliers to product development include leveraging supplier knowledge to reduce costs and lead times of product development (Handfield and Bechtel, 2002), getting better access to supplier technology (Ragatz et al., 1997) and increased innovation outcomes due to resource pooling and complementary capabilities (Yeniyurt et al., 2014). In addition, customer involvement may have a positive impact on product success (Gruner and Homburg, 2000), understanding of customer needs (Lagrosen, 2005) and competitor moves (Svendsen et al., 2011); and generation of new ideas (Kaulio, 1998).

Earlier research has often considered how external partners for joint product development should be chosen (Ylimäki, 2014). Also the relationship-oriented approach to product development has gained increasing attention in the literature with the interest in the impact of relationship characteristics and relationship management on product development (e.g. Ritter and Walter, 2003; Stump et al., 2002). However, there is less research on factors explaining whether customer and supplier involvement in product development will take place or not (Lin and Germain, 2004; Svendsen et al., 2011). This is essential especially in the opening stages of product development often regarded as essential for the product development success, due to decisions regarding design teams and impacts on overall time and costs (Chien and Chen, 2010). In the early phases of product development, the time demands for customers or suppliers can be grater (Brockhoff, 2003), which potentially decreases the motivation for participating in the product development of a focal company typically owning the product rights.

An aspect of novelty (cf. Gosling and Naim, 2009; Gunasekaran and Ngai, 2004) in this study relates to its case context representing make-to-order industry with JIT (just-in-time) supplies (González-Benito, 2002; Gunasekaran and Ngai, 2004) consisting of tailored project offerings to the customer. In this context, flexibility and responsiveness of operations and supplies (Gunasekaran and Ngai, 2004), integration of design and manufacturing (Eriksson, 2010) and inter-organizational collaboration (Ahola et al., 2008; Eriksson and Westerberg, 2011) have been highlighted. End customer is an important actor (Gunasekaran and Ngai, 2004; Eriksson, 2010) affecting the whole supply chain. However, it has been found that engineering-oriented mindset highlighting sophisticated techniques instead of customer preferences is still perceivable in many companies providing customer customized offerings (Tollin, 2002).

This study highlights the increased effectiveness of product development as a result of collaboration across several companies; the focal company as the owner of product rights, its suppliers and customers. It aims to understand the drivers of inter-organizational collaboration in the opening stages of product development projects. More specifically, the study searches answers to the following research questions:

1. What is the role of different actors in product development initiatives?
2. What factors motivate suppliers and end customers to participate in product development?

The research applies an in-depth qualitative case study approach in a large project manufacturing company. As its main result, the paper highlights the importance of end customer in product development involved by the purchaser company and its suppliers. It also gives insights on product development in the collaboration between supplier, purchaser and end customer companies. The main unit of analysis in this study is a focal company owning the product rights and aiming at development of its products with the facilitation of its suppliers and end customer. Furthermore, the role of the case company in facilitating collaboration between suppliers and end customers is examined.

The literature review of the paper is divided into two main streams in the literature (cf. Ylimäki, 2014) supplier involvement and customer involvement in product development. The paper continues by presenting the methodology used in the empirical part. The empirical results are examined in line with the posed research questions. Finally, the discussion and concluding remarks are presented.

LITERATURE REVIEW

SUPPLIER INTEGRATION IN PRODUCT DEVELOPMENT

Earlier research suggests that suppliers are key stakeholders in product development, although empirical evidence has not always been unambiguous (Luzzini et al., 2015). Many potential benefits such as access to new technologies and novel capabilities have been identified in utilizing suppliers in product development (Azadegan and Dooley, 2010; Ylimäki, 2014). Lau (2011) remarks that as product components or modules are outsourced to suppliers, supplier involvement becomes more significant. Song and Di Benedetto (2008) add that when a highly innovative product is developed the manufacturer seeks information from suppliers in order to shorten product development time and to reduce the costly design changes. However, it has also been found that the positive outcomes of supplier involvement in product development are difficult to achieve (Wynstra et al., 2001; Wagner and Hoegl, 2006). As an example, the supplier might not be acquainted with the peculiarities of the developer company's operations processes and the particular technical requirements.

A starting point for inter-organizational collaboration in product development is the supplier's willingness to participate. According to Schiele (2012), all suppliers are not willing to cooperate with buying companies, which is why it becomes important to achieve preferred status among key suppliers. There can be several barriers to product development collaboration such as the resistance towards information exchange in fear of knowledge spillovers (Melander et al., 2014). The customer may fear that the suppliers might reveal something intentionally or unintentionally to customer's competitors while the supplier might fear inequitable treatment from the customer's side (Ragatz et al., 1997). Ragatz et al. (1997) further argue that these barriers can be overcome by structuring long-term relationships and by proper asset allocation.

Rowley et al. (2000) indicate that an inherent relationship with a customer motivates the supplier to use its own knowledge to develop innovations that meet the purchaser company's needs. Also Ellis et al. (2012) found that preferred customer status is positively associated with the willingness of suppliers to share new technology with the purchaser company. The results of the study by Wagner and Bode (2014) highlight that suppliers are more likely to share process innovations and are less hesitant to share product innovations with customers when the relationship-specific investments go along with long-term and strong purchaser-supplier collaboration. Koufteros et al. (2007) argue that to achieve the supplier's trust, purchaser

company can use supply base rationalization strategies to reduce the number of suppliers and to give a larger volume to the suppliers it chooses to closer collaboration.

Wynstra et al. (2001) defined conditions for successful supplier involvement: 1) Identifying specific processes and emission that need to be carried out, to support at the integration of product development and purchasing; 2) forming an organization that embraces the execution of such tasks; 3) having employees which have the right commercial, social and technical skills. Also the promise of shared value can motivate suppliers to product development collaboration. Smals and Smits (2012) identify three ways how customer companies can offer value to their suppliers: 1) financial payment for sales and product development, 2) increasing technological knowledge and 3) reputational benefits associated to doing business with well-known firm.

Traditionally, supplier innovations have been pulled by the purchaser company, while the need for independently pushed innovations has been widely acknowledged (Wagner and Bode, 2014). Lakemond et al. (2006) present three general types of organizing supplier involvement in product development which combine these two ways to supplier innovations. The first is an integrated way of working, where information is changed on a continual basis. The second is an ad hoc approach; the supplier is contacted when a problem occurs. The third is based on a more independent role of supplier.

The typology of Lakemond et al. (2006) is similar to typology presented by Petersen et al. (2005) who divided supplier involvement in product development into three different types. The first type is black-box development, in which the supplier's role is the most comprehensive. In black-box development, the supplier takes responsibility for developing the component or subassembly according the customer's requirements (Ylimäki, 2014). The second type of supplier involvement in product development is gray-box development where the supplier and the customer work alongside each other (Koufteros et al., 2007). Koufteros et al. (2007) continue that gray-box development allows the integration of supplier's processes in the design. The third form of collaboration is white-box development which is customer-driven and where the supplier's role is limited. In white-box development, the supplier contributes only by commenting on the customer's design. (Ylimäki, 2014). In this study, the desire of the case company is to find a way of collaborating in a continual basis meaning both pushed and pulled ideas for product development and the gray-box approach.

Olson et al. (1995) remark that product development projects need the participation of many functional specialists. Product development processes are often carried out by project teams (Lakemond et al., 2001). Schiele (2010) present that the professionals of purchasing should be included in development processes and new product development teams when the intention of company is to incorporate supplier innovations into company, while at the same time confirming the commercial viability. Luzzini et al. (2015) state that purchasing function has emerged as a pivotal interface and process owner of purchaser-supplier relationships. However, Lakemond et al. (2001) remark that the purchasing function does not need to coordinate all the contacts with suppliers. Other internal departments, such as manufacturing and R&D, may also have substantial knowledge on supplier markets and they can have an important role in coordinating the involved suppliers. It should be noted that product development teams may also involve participants from customers and suppliers.

CUSTOMER INTEGRATION IN PRODUCT DEVELOPMENT

A challenge in utilizing the innovation potential of suppliers is the lack of sufficient knowledge about end customer needs limiting the understanding of potential areas for innovating (Larsson et al., 2006). Hence, a purchaser company should also consider end customer in improving its

product development. Collaboration with customers has become a major component of the development efforts of many companies (Greer and Lei, 2012) which increasingly see customers as a source of knowledge. Companies learn from their customers and new technologies push forward open forms of innovation and cooperation with customers (Lichtenthaler, 2008). Product development can benefit from in-depth understanding of customers, their situation and needs (Lagrosen, 2005) supporting the achievement of ideal costs and time in production and reducing uncertainties related to environment and customer demand (Chien and Chen, 2010).

Customer involvement in product development requires active interaction with the customers (Svendsen et al., 2011). This interaction may take forms such as small group exercises and prototype testing (Kaulio, 1998), customer involvement in product development teams (Lagrosen, 2005) as well as more traditional forms such as opinion boxes or customer interviews (Chien and Chen, 2010). Lead user method has been presented as a means to specifically facilitate early insights into customer needs and solutions for satisfying such needs (Greer and Lei, 2012; Tollin, 2002).

While it is often beneficial to involve customers in product development of a supplier company, participation of customers to product development is not self-evident and customer companies should carefully consider the advantages and disadvantages involved. Required costs can be substantial, particularly with greater involvement (Brockhoff 2003). Many factors such as mutual commitment, mutual trust, mutual adaptations and mutual relationship management (Ritter and Walter, 2003; Svendsen et al., 2011) have been found to have a positive effect on the involvement of customers in product development. Customers are motivated to be involved in product development specifically when price reductions, exclusive rights to the products, extra service and warranties are sought for (Brockhoff 2003). Other factors motivating customers include financial compensations, expectations of better offerings and greater opportunity for choice (Greer and Lei, 2012).

In turn, strong brand of the supplier company may hamper the motivation of customers to involve in product development since customers may feel that they voluntarily participate in activities aiming at increasing the value of the supplier's brand. Also an intense competitor focus may demotivate customers to involve in product development due to perceived larger emphasis on competitors than on the customers. (Svendsen et al., 2011)

Customer involvement can occur in different phases of product development (Kaulio, 1998; Lagrosen, 2005) such as specification, concept development and prototyping (Kaulio, 1998). The depth of customer involvement may vary in different phases. Nambisan (2002) points out that customers can be involved not only in providing new ideas but also in co-creating them with suppliers, in testing finished products, providing product support, and continuous improvement. According to Kaulio (1998) the involvement of customer in product development can generally take the following three forms:

- “Design for” is an approach where products are designed on behalf of the customers based on gathered ideas and customer needs.
- “Design with”, where in addition to the above-mentioned, customers can react to different proposed design solutions.
- “Design by” refers to an approach where customers are actively involved and participate in the product design.

In this study, the approach where products are designed with customers is highlighted. In this phase product concept and solutions are jointly developed by customer and supplier companies.

The collaboration is characterized by on-going discussion between customer and supplier during the product development process (Kaulio, 1998). The emphasis of this study is especially in the initial stages of starting joint development efforts requiring initiatives and new ideas to be implemented. The collaborative design usually happens in the initial phases of product development (Greer and Lei, 2012).

SUMMARY OF THE LITERATURE

The reviewed literature points out that increasing attention has been paid to involving both suppliers and customers to product development. Suppliers are the most notable and acknowledged companion in product development efforts whereas customer involvement has more recently gained more attention. Despite the indisputable benefits involved, there are also risks and sacrifices involved concerning each of the participating actors. Therefore, it is important to study in-depth the role of each actor into joint product development. Many earlier studies stress the perspective of purchaser company while there are less studies simultaneously assessing several counterparts in the product development (Smals and Smits, 2012). In addition, many of the earlier studies have studied either supplier or customer involvement as separate perspectives to the issue. However, it has been found that the involvement of supplier and customer is highly integrated (Lau, 2011). When a company develops supplier involvement, it authenticates a good foundation for customer participation and vice versa. The empirical part of this study intends to shed more light on product development collaboration involving suppliers, purchaser and end customer companies through an embedded single case approach.

METHODOLOGY

The study was carried out as a qualitative single case study reflecting a critical case fitting to the posed research questions (Yin, 2009). The embedded case study highlights the perspective of the purchaser company (later case company) and its relationships between two suppliers and one of its customers. The case company is a global project manufacturing company which has around 12,000 employees. The purchasing function of the case company coordinates the collaboration with suppliers in the case company and was chosen as a facilitator of a program (later development program) aiming at improving both cross-functional and inter-organizational collaboration in product development. In the case company, the focus is specifically on redesign activities which are an important part of product development (Eppinger et al., 1994).

Four companies were involved in the empirical part of this study. The followings notation for the companies is used: case company, Customer, Supplier A and Supplier B. The Customer is a Finnish process industry company that operates in international markets. The offerings consist mainly of physical products that are sold further to other companies or directly to consumers. The Customer has also notable research and development operations and aim for radical technology innovations in its industry. The Supplier A is a global technology provider company. The offerings consist of products and technologies related to rotating equipment. Supplier B is a global company in the engineering industry. It provides tailored power industry-specific solutions.

The purchasing of the case company handles global operations and has an extensive supply chain. The total spend of direct purchases is around EUR 1-2 billion annually which is

purchased from thousands of suppliers in over 50 countries. Numerical details regarding case company's supplier base and purchasing are provided in Table 1.

Table 1 Key figures of purchasing and suppliers of the case company

Proportion of the purchasing spend of all costs	65 %
Supplier count	10,000
Share of purchased materials/service	80 % materials 20 % services

Figure 1 presents the units of analysis in this study. The study is carried out from the perspective of the case company with the emphasis in development of its products. The first unit of analysis relates to the involvement of suppliers to the product development of the case company. Second unit of analysis takes the perspective of involving customer to the product development in the case company. The third analysis unit examines the connection bypassing case company, i.e. product development relationship between supplier and end customer as well as end customer and supplier.

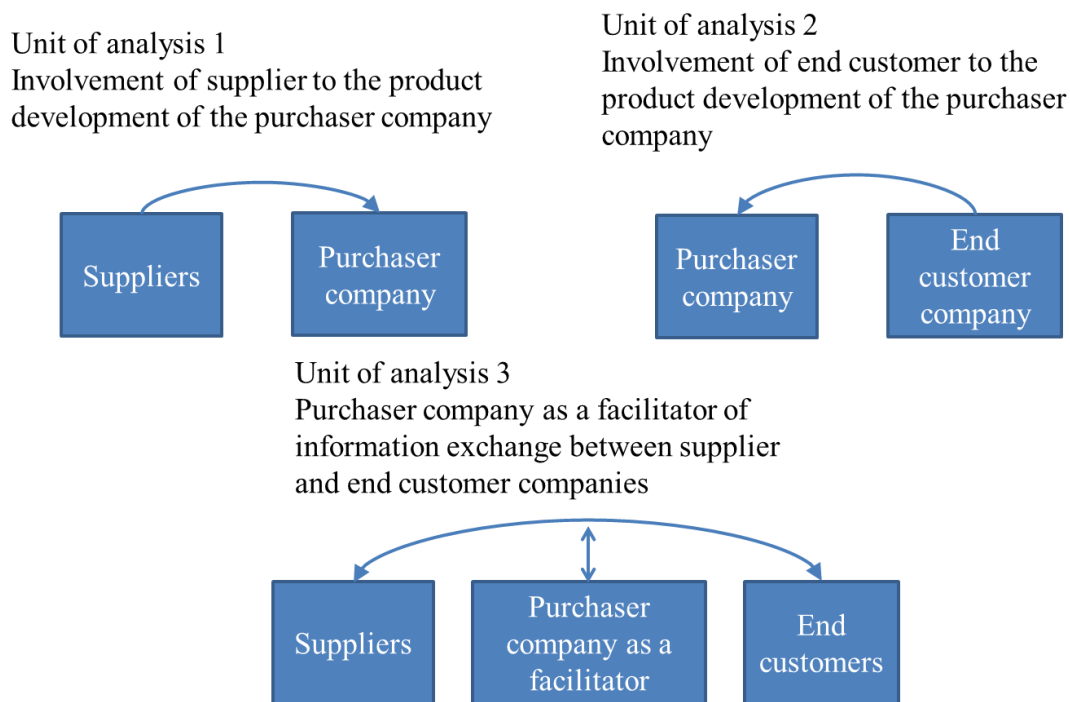


Figure 1 Units of analysis of the study

The applied research methods and their connections to the research questions and units of analysis are presented in Table 2. This study utilizes both interviews and discursive workshops as a source of empirical data. The directors of the development program of the case company proposed candidate interviewees representing purchasing function and two other functions regularly involved in product development, namely product development and manufacturing. Hence, the choice of interviewees followed the logic of theoretical sampling since the choice was driven by the anticipated high level of knowledge in light of the research questions (Flick, 2002). The final choice of 14 informants was made jointly between company representatives and the researchers with the emphasis on interviewees both on the mid-level (later referred to as managers) and top-level (later referred to as directors).

Table 2 research methods and informants

Research question	More specific theme	Unit of analysis	Research method	Informants
RQ1	Role of different actors in product development initiatives	1 and 2	Interview study	Case company 4 purchasing directors 2 purchasing category managers 5 product development directors 1 product development manager 2 production directors
RQ2	Factors perceived to motivate suppliers to product development	1		
RQ1	Initiation of product development between supplier and end customer	3	Workshop (WS) 1	Case company 2 purchasing directors 1 purchasing program director 2 purchasing category managers 1 product development director Supplier A 1 strategic account manager Supplier B 1 product director End customer company 1 purchasing category manager 1 maintenance manager
RQ2	Factors motivating each actors to joint product development	1 and 2		
RQ1	Implications findings of the WS1 (information flows, see figure 2)	3	Workshop (WS) 2	Case company 2 purchasing directors 1 purchasing program director 3 purchasing category managers 1 product development director 1 product development manager
RQ2	Review and confirmation of WS1 results	1, 2 and 3		

The 14 semi-structured interviews studied initiatives to product development and collaboration with suppliers in product development. Description of the interview themes is presented in Appendix. The interviews were conducted in May and June 2015. The duration of interviews was from 40 to 90 minutes. The interviews were audio-recorded and transcribed to an electrical document.

After the analysis of interview study findings, two informal meetings were organized with two representatives (a purchasing director and a development program director) of the case company. Since the significance of inter-organizational collaboration in product development was a key observation in the interview study, it was deemed important that a workshop attended by suppliers, case company and its customer is organized. A workshop with complementing personnel roles and organizational parties were seen as a valuable way to acquire in-depth information of relationships. According to Van de Ven and Delbecq (1971), interactive group

discussions often create more valuable information than their best member alone. Also Kim and Ahn (1999) present that increasing complexity of the contemporary environments makes it less possible for a single decision maker to consider all aspects of the problem. This study utilized the interactive group technique by applying semi-structured workshops with pre-defined discussion topics in line with the research questions.

Two workshops were organized. Most of the interviewees also participated in the workshops. The first workshop was organized in October 2015 and it lasted for three hours. In the first workshop, there were six representatives from the case company, two representatives from the end customer company and one representative from both supplier companies. There were also four representatives from a research group including three of the authors, who observed the discussions and facilitated the workshop events. The first workshop consisted of group conversations where the participants were divided into three smaller groups. Additionally, one research group member participated in each small group to document the discussion. At the end of each theme, all participants discussed the perceptions and different solutions together.

All eight participants of the second workshop were from the case company. Additionally, there were three representatives from research group (two of the authors) documenting the event. The second workshop was organized in December 2015 and it lasted three hours. Memos of the workshops were written down to an electrical document. The second workshop elaborated the results of the workshop one. In the beginning of the workshop two, the gathered data from the workshop one was presented to the case company with a slide show in order to get feedback and to ensure the correctness of the data. The more specific topic of the workshop was to investigate the information flows between the studied companies, possibly bypassing the case company.

The analysis of the results of both interview and workshops was carried out inductively according to the set research questions. The analysis was carried out by two of the authors first separately and then by comparing and combining the analysis. In addition, the validity of results as a reflection of true observations in practice was reviewed by the representatives of the case company.

EMPIRICAL RESULTS

OVERALL STATUS OF INTER-ORGANIZATIONAL PRODUCT DEVELOPMENT

A purchasing director described the transformation in the product development activities of the case company. For 10–20 years ago the company developed and manufactured many product components in-house. There was an instant internal contact between product development and manufacturing which facilitated specification changes during the project deliveries. However, the search for cost-effectiveness led the company to outsource the manufacturing of many parts of the products. This created challenges in handling changes in product designs caused by customer demands.

Most of the purchasing employees regarded that the early involvement of suppliers to product development projects is valuable especially when the focus of the development project is not merely in the own technology of the case company and there is a need for an extrinsic resource. The case company had encouraged suppliers to bring out divergent development ideas and this was also a part of its purchasing and supply chain strategy. Especially partner suppliers were invited to be a part of product development projects. Also the representative of Supplier A

commented that the case company was increasingly active in the early contacting regarding product development. However, the initiation of product development ideas was seen as a major challenge by the interviewees of the case company. A purchasing director explains:

“The challenge is that we have not managed to establish a reliable process for delivering supplier development ideas through our organization and ascertaining that feedback is provided to suppliers.”

The case company also acknowledged the importance of communicating with end customer in product development but this collaboration was only gradually receiving more attention. Some interviewees utilized a term “fit for purpose” meaning that production and product specifications need to be scaled by the customer needs. It was mentioned that customer needs are often culturally bounded. While in some areas customers appreciate long product life-cycles and usability of machines, in other areas customers are mostly interested in payment periods and prices of the offered machinery. Increasingly, it was deemed important that some features of products which are not valued by customers can be stripped off.

According to the end customer represented in workshop 1, there was still room for improvement in the case company’s understanding of customer needs. Also the representatives of suppliers commented that the case company pays perhaps too much attention to the prices of its products leaving maintenance costs for the customer with less attention. End customer stated that its improvement ideas regarding case company’s products did not seem to lead to concrete changes in the offerings. This was a contrasting viewpoint to the perceptions during the interviews of the case company reflecting the lack of supplier or customer ideas to product development.

INITIATORS TO JOINT PRODUCT DEVELOPMENT EFFORTS

According to the interviewees, the initiation to product development can come from three directions: from the employees of the case organization, suppliers and customers (see Table 3). When considering the case company itself, a purchasing category manager presented the next three options for the sources of initiatives:

“First, product-specific team, because they have the most detailed information on the products. Second, the top management giving a signal to improve price competitiveness. Third, a development team which have already understanding on a new manufacturing method or materials which could be benchmarked and applied more widely.”

Table 3 Initiators of product development

Research questions	Perspective to the research question		
	Supplier	Purchaser company (case company)	End customer
Initiation of product development efforts, RQ1	<ul style="list-style-type: none"> Ideas on unnecessary elements in product specifications presented in regular supplier-purchaser meetings Direct contact with end customers was desired 	Initiators <ul style="list-style-type: none"> product-specific team top management development team with understanding of a new manufacturing method Contact with suppliers <ul style="list-style-type: none"> transferring the messages of end customers supplier meetings for identifying incorrect product designs Customer analysis results <ul style="list-style-type: none"> past and expected needs 	<ul style="list-style-type: none"> Signaling on cost-competitiveness both directly and indirectly (lost bids)

When looking at the sources of initiatives outside the case company, one of the main initiators was reportedly end customers. According to several interviewees, customers are the most significant impulse to start product development. A purchasing director stated that end customer requirements have effects upstream in the supply chain and they may require redesign of suppliers' existing products or components. According to a product development director, end customers create a cost pressure for initiating product development projects:

“Customers indicate that you are too high-priced in that area, and we get a good conception that in what area we have challenges compared to the product cost of a competitor. It starts from the customers, in other words cost pressures are the practical initiative. [...] We strive to construct a product development project in such a way that there is a customer always involved in it, in order to obtain knowledge on what exactly to develop.”

According to a purchasing director, the initiative of the end customer can also lead to the discussion with suppliers in order to share the problem:

“We can indicate that we do not get sales and you [suppliers] cannot get the business either. So something needs to be figured out together.”

Some interviewees also stated that since the case company was a traditional engineering company there still was a culture where advanced technologies were valued instead of listening to the preferences of customers. However, customer needs from the past and expected needs for the near future were increasingly utilized in the starting point of new product development projects.

The third source for initiatives in product development is the suppliers. The suppliers can be active and give their ideas on how the product could be done better or if they have recognized something unnecessary in the product specifications. Sometimes the own product development

initiatives of the case company lead to the need to involve suppliers into the process. A purchasing director describes the situation:

“We demand from our suppliers that they inform us on the possibly incorrect product designs from the perspective of manufacturing techniques. [...] We work in a close collaboration in order to improve the cost competitiveness of our offerings. We have regular meetings with the supplier two times a year.”

The purchasing function of the case company was widely regarded as the main channel in the communication with suppliers which sometimes involved representatives of product development to the discussion on product changes.

A further area of investigation in this study was whether the initiation to product development could originate from the relationship between suppliers and end customers. Supplier A considered it important that it could bring its own ideas which could directly benefit the case company's customer (end customer), especially when the supplier has specific knowledge of the end customer's industry. At the present the suppliers' understanding about the end customer was weak. This comment was mentioned when the quality levels satisfying end customer needs was discussed. Supplier A was keen to know better the customer segments of the case company. In this discussion the concept of optimal quality was mentioned: provision of quality satisfying customer requirements but not over-quality. Both the Supplier A and the case company emphasized the same demand: there is a need for the development process where the case company's offerings respond to an end customer's product requirement standards. Also the end customer company representatives participating in the workshop agreed with the Supplier A on the idea of delivering optimal quality for the end customer.

In workshop 2 the representatives of the case company deemed it significant to recognize the characteristics of information flows when involving both end customers and suppliers in product development. There is always a risk of losing confidential information because all these counterparts impel their own interests. Figure 2 presents the desirable model of information exchange from the viewpoint of the case company.

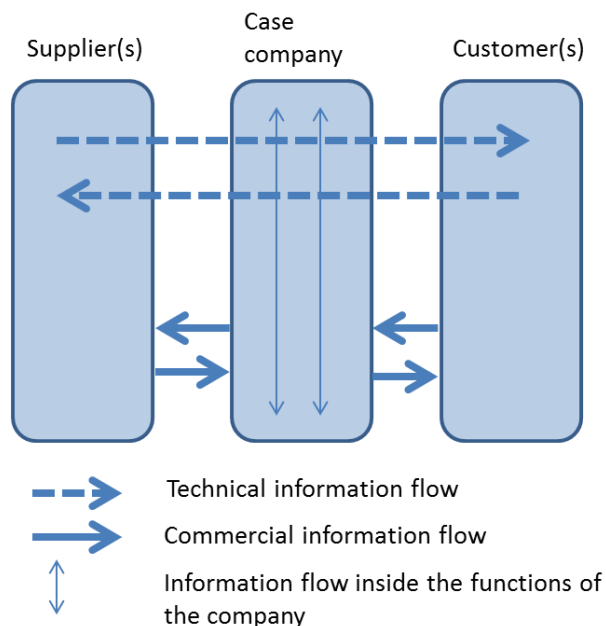


Figure 2 The information flows between the companies involving in product development

The technical information can flow from the suppliers to the customer and the other way round. Respectively, from the viewpoint of the case company, the commercial information has to be controlled by it to avoid direct commercial collaboration among suppliers and the customer. At the same time, the technical and commercial information flows go inside the different functions of the case company in order to avoid silos between business functions.

MOTIVATING FACTORS TO JOINT PRODUCT DEVELOPMENT EFFORTS

One factor motivating both purchaser and supplier companies to joint product development is naturally the success in business. Achievement of overall cost savings was a quite common answer among the interviewees of the case company. It was also deemed important that the obtained success could be shared with the suppliers in order to keep suppliers motivated.

Different actors and parties had also varying motivating factors to joint product development efforts. A purchasing director gave an example:

“Our suppliers value product changes which make their manufacturing processes more fluent. It improves their quality and delivery performance.”

Many interviewees stated that a respected subject among the suppliers is the ensuring of continuity of collaboration. A joint development project can be a guarantee of continuity for both sides. However, the promise of longer collaboration can also activate suppliers to product development initiatives. This is how a purchasing director described it:

“When we were more aggressive in bidding our suppliers they possibly felt that if they develop products together with us, we can still buy the next project from the competitors. What could then be the benefits for them of the product development with us?”

One of the interviewees (a purchasing director) also warned that too close relationships in product development may lead to supplier lock-ins. The interviewee continued that the desired starting point for joint product development is when it is genuinely a beneficial opportunity to both parties, both contribute with their own specific capabilities.

In the interviews, the necessity to activate and motivate suppliers to provide product development initiatives was widely stressed. Due to the complexity of products the case company cannot have competencies on the development of all the components and technologies (a product development director). According to a purchasing category manager, supplier with a good idea can radically accelerate project launches:

“We have had product development workshops together with this supplier and we have been able to reduce the manufacturing costs.”

The interviewees of the case company regarded it challenging to activate suppliers to introduce product development ideas. Many of the interviewees stated that there are only few good examples of it so far. This is how a purchasing director described it:

“We have tried to communicate a new kind of culture to our suppliers in order to facilitate their product development ideas but it is quite difficult to obtain the ideas. [...] It is our problem to introduce appropriate rewards and we also reward our suppliers by nominations and so on. [...] We have to consider very carefully what is the motivation for suppliers to involve in product development and what the concrete benefits for the suppliers are.”

Also the motivating of suppliers to involve to the product development projects of the case company was discussed. According to a purchasing director:

“The best way is to describe to suppliers what we are doing and why: what are the perceivable benefits, e.g. the percentual improvements in energy efficiency or production costs. Or we can communicate the expected increase in sales volumes or business areas.”

According to the interviewees of the case company, the subject that motivates suppliers to collaboration varies depending on the supplier. In a simple product manufacturing business, the main motivating factor is production volume. In contrast, some suppliers are eager to innovate and introduce new technologies regarding more complex offerings. A purchasing director describes the situation where supplier appreciates high technology:

“We are rather keen into development, and by that we are quite interesting customer to our suppliers. [...] Specially, when they [suppliers] want to test new products, they want to test them with us because we have highly demanding production process.”

The issue of factors motivating different parties to product development was further studied in group discussions of the first workshop. Table 4 presents a summary of factors motivating the case company, Customer, Supplier A and Supplier B to provide initiatives to product redesign process. Since the opinions of Supplier A and B merged in the joint discussion, they are presented in the same Table. Search for cost-effectiveness and overall success in business were clearly the motivating factors linking all the parties. This is how the representative of Supplier A commented it:

“The traditional means for cutting costs have already been used and that route leads to nowhere. Now we need to jointly identify means for cost savings. Small changes to products do not provide great production savings.”

Table 4 Factors motivating customers and suppliers to product development

Research questions	Perspective to the research question		
	Supplier	Purchaser company (case company)	End customer
Motivating factors to joint product development, RQ2	<ul style="list-style-type: none"> Increased production volume (specifically in standard operations) New innovations and testing of technologies facilitating supplier's own product development Continuity of collaboration Joint development projects bringing out supplier's expertise Global presence of the customer 	Collaboration with suppliers: <ul style="list-style-type: none"> accelerates project launches reveals unnecessary demands in product specifications reduces manufacturing costs 	<ul style="list-style-type: none"> Identified challenges in manufacturing Search for cost savings in case company's products Improving the appreciated features in case company's products
	<ul style="list-style-type: none"> Success in business Achievement of overall cost savings 		

The representatives of Customer clearly presented that the case company should have the active role in its own product development especially when cost savings are sought for. Too high

price is communicated indirectly by the customer through a lost tendering case. Customer is primarily active when there is a certain identified problem in an existing product or its delivery which requires solutions. However, Customer was keen to utilize a better feedback system in order to deliver information regarding desired product features. The representatives of Customer suggested that lost tendering cases should be carefully analyzed in order to learn for the future biddings. Customer representatives also doubted the ability of the case company to process the ideas given by them. They mentioned that product development engineers are often too far away from the field to which the construction has been designed.

Suppliers A and B presented that one of the main motivating factors to produce initiatives to product development is to demonstrate their own competence to the case company. This was considered to support in assuring continuity of the relationship. Suppliers also presented that significant cost improvement potential lies in the collaborative product design. For example, the supplier can suggest alternative material changes to the components. While the suppliers regarded the development of their own products as always desirable, it was regarded that certain aspects in customer such as global and strategic status and prospective potential of business give more motivation for customer-dedicated development work. The suppliers deemed that the case company can promote its supplier collaboration by contacting the supplier as soon as possible in the product development process and having an open conversation about product specifications. It is too late to start the discussion during the tendering phase. The collaboration in product development is the promise of business for suppliers and it was deemed to require mutual confidence between suppliers and the case company. The openness of product cost information was valued by the suppliers but at the same time the importance of strict confidence was acknowledged.

A joint area of discussion among all the parties involved in workshop one related to the balance of relationships. There was a common agreement that if the purchaser company has a too dominant role in collaboration, it can in the long term economically run down the supplier. Correspondingly, if the supplier has a too dominant role in the collaboration it may not have enthusiasm for joint product development projects. The three parties ended with a collective resolution: the relationship between the supplier and the purchaser company is balanced when both counterparts benefit from collaboration and neither counterpart feels exploited economically.

DISCUSSION

The findings of this study highlight specifically the importance of end customer in giving both direct and indirect signals for product development initiatives (market pull). The studied project manufacturing context requires close interaction between supplier, purchaser, and end customer companies since offerings are typically tailored to the customer (Gunasekaran and Ngai, 2004; Eriksson, 2010). This is proposed as a contributing factor for the perceived importance of customer involvement in product development. Customer initiatives can have both direct (communication of preferences) and indirect (e.g. lost tendering case, price pressure) forms while supplier is typically more explicit in its initiatives. Also more formally organized collaboration practices such as supplier meetings are applied. The case company was seemingly primarily searching for collaboration with the supplier while the possible co-operation with customer was only gradually gaining more attention.

Slightly varying factors motivate different actors to join product development while the common motivators included business success and obtained cost savings. Some of the

interviewees of the case company seemed to acknowledge the need to have longer supplier relationships when closer collaboration product development was sought for, as also suggested in the earlier literature (Svendsen et al., 2011). It is often meaningful to involve only carefully selected suppliers in product development (McElroy, 1995) and apply a supply based rationalization strategy (Koufteros et al., 2007). However, the case company generally had a tendency to short supplier contracts and continuous bidding. The means for motivating suppliers were more often sought from both financial and non-financial rewarding. According to Smals and Smits (2012), this kind of value for the supplier is necessary but it depends on the business network surrounding the focal purchaser–supplier dyad.

It is notable that the end customer behaved actively typically when certain deviations from desired demands both in terms of costs, product specifications or quality were identified. Hence, the results of this study reflect the study by Lagrosen (2005) indicating that the main problem should be to make the customers realize the value of participating in product development. Proactive contacting with lead customers is required from suppliers developing its products (Greer and Lei, 2012). Suppliers, in turn, were searching for continuity and new opportunities to develop their technologies and offerings, as also suggested in the earlier literature (Wagner and Bode, 2014). Suppliers can obtain spin-off effects of new knowledge and competencies and expand its customer portfolio (Smals and Smits, 2012). Although more active supplier collaboration was still sought for by the case company, there appeared to already exist more established practices for supplier collaboration in comparison to customer collaboration.

Earlier studies have identified risks in involving both suppliers (Ylimäki, 2014) and customer (Nambisan 2002; Tollin, 2002) in product development. The representatives of the case company did not stress the risks involved in dyadic collaboration with suppliers and customers. However, the findings of this study demonstrate the willingness of the purchaser company to control the direct information flows between suppliers and end customers in order to avoid too close commercial contribution between end customers and suppliers. Also the representatives of suppliers companies suggested that the case company should better coordinate the collaboration between the three parties and communicate the preferences of the end customers. This suggests that one company needs to take the responsible role in coordinating the joint product development. This can also be related to the suggestion of Munksgaard et al. (2012) paying attention to the focal company's need to strategize across inter-organizational level in order to obtain combined and complementary strategic intentions.

CONCLUSIONS

This study contributes to the existing research by explaining the conditions facilitating joint product development between supplier, purchaser and end customer companies in its initial phases. While the purchasing function intrinsically facilitates collaboration to the supplier side, it is suggested that this view should be complemented by the perspective of end customer. Many earlier studies recognize the significance of the collaboration with suppliers in the product development process (Wynstra et al. 2001; Dubois and Wynstra 2005; Song and Di Benedetto, 2008), but most existing studies do not pay any attention to the collaboration between the supplier, the purchaser company and the end customer (Lau, 2011; Lawson et al., 2009). This study also provides an interesting contextual setting for the study by emphasizing the transformation of product development in a project manufacturing company with engineering-oriented mindset. The importance of end customer in product development was

raised only during the progress of this study which led to the arrangement of joint workshops between suppliers, case company and end customer.

As a contribution to the managerial practice, this study presents how a workshop method can improve inter-organizational collaboration in product development. Joint discursive events where all the counterparts can present their improvement ideas concerning products were valued by all the actors in the workshop. The atmosphere in the workshop was open and constructive due to carefully selected and not competing parties. It appeared that especially the end customer was able to forward its message upstream. Workshops can provide a significant link between the requirements of the end customer and the capabilities of suppliers. When all the counterparts are in the same room, it is possible to discuss what components or functions are significant or insignificant in the terms of customer satisfaction.

This study has novelty value to the literature, due to its empirical access to all three different actors including supplier, purchaser and end customer. However, the study is limited to one case context which limits its external validity. The results and proposals of this study may be best applicable in similar project manufacturing environments and require more testing in the future. This study identified the importance of end customer perspective in product development and further study should emphasize this viewpoint more.

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APPENDIX: INTERVIEW THEMES

Background information of the respondent

Initiation to product development

- external and internal sources for product development ideas
- forms of product development initiatives

Collaboration with suppliers in product development

- current challenges in committing suppliers to product development
- factors motivating suppliers and the case company to joint objectives
- collaboration forms with the supplier