

DISCONTINUOUS INNOVATION, PURCHASING AND SUPPLIER RELATIONSHIP DEVELOPMENT: A LEAP OF FAITH

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ABSTRACT

This paper explores an emerging field of research within purchasing that concerns the challenges and changing role of purchasing when companies embark on discontinuous innovation projects. Based on an in-depth case study of a product innovation project in the passenger ship rescue equipment industry, the paper seeks to shed light on the challenges this poses for purchasing, especially related to sourcing of new technologies and the accelerated process of supplier relationship development, which appears to circumvent the usual supplier qualification process and require a leap of faith by the two actors.

Keywords: Purchasing, sourcing, supplier relationship development, discontinuous innovation, case study

COMPETITIVE PAPER

INTRODUCTION

As companies rely on complementary technologies and competencies from their suppliers, they need to ensure that they can access and source these effectively. Where traditionally Research & Development (R&D) has assumed control of technology development and sourcing, some companies now realize that purchasing can play an important role in sourcing of new technology, yet this is not a role that falls within the usual sphere of responsibility and competence of most purchasing departments: it requires a new 'dual' role of purchasing (Schiele, 2010).

One of the current challenges for the purchasing function in many companies is therefore to contribute effectively to innovation projects, especially those that represent radical departures from existing practices. Where previous research has examined purchasing involvement in new product development (NPD) projects (e.g. Hillebrand and Biemans, 2004; Lakemond et al., 2001; Wynstra et al., 1999, 2003) the majority of extant research tends to focus on NPD projects that represent relatively incremental, or continuous, technological change. Recent research focuses on technology access and sourcing issues in the context of radical or discontinuous innovations (e.g. Bessant et al., 2005; Cousins et al., 2011; Datta et al., 2013), occasionally from a purchasing perspective (Phillips et al., 2006) but rarely from an IMP interaction perspective.

Although IMP researchers have studied technology development in networks (e.g. Håkansson, 1987; Håkansson and Waluszewski, 2002), the specific implications for the role of purchasing in the sourcing process are rarely considered. However, the IMP Interaction Model (Håkansson, 1982; 1987) does suggest that technological innovation happens through customer-supplier collaboration, facilitated by a gradual relationship development process where the actors slowly adapt to each other and build up the requisite trust and mutual commitment (Ford, 1980; Lee and Johnsen, 2012). The need for supplier relationship development and adaptation is also emphasized in research on early supplier involvement (ESI) in NPD (Ragatz et al., 1997; LaBahn and Krapfel, 2000; Walter, 2003) some of which focuses on conditions of technological newness, that is, discontinuous innovation (Song and Benedetto, 2008).

In this paper we seek to shed light on the challenges that discontinuous innovation poses for purchasing, especially related to sourcing of new technologies and the process of supplier relationship development. In particular we ask: *how can the purchasing function deal with the challenges posed by discontinuous innovation projects and what are the implications for sourcing and supplier relationship development?*

We have conducted an in-depth case study exploring these challenges, revealing interesting insights into how a discontinuous innovation project in the ship construction industry required a different approach to existing supplier involvement practices including a new role for the sourcing function and its relationship with R&D. Our results therefore point to a need for a fresh look at the role of purchasing in innovation projects characterized by high technological newness and discontinuity.

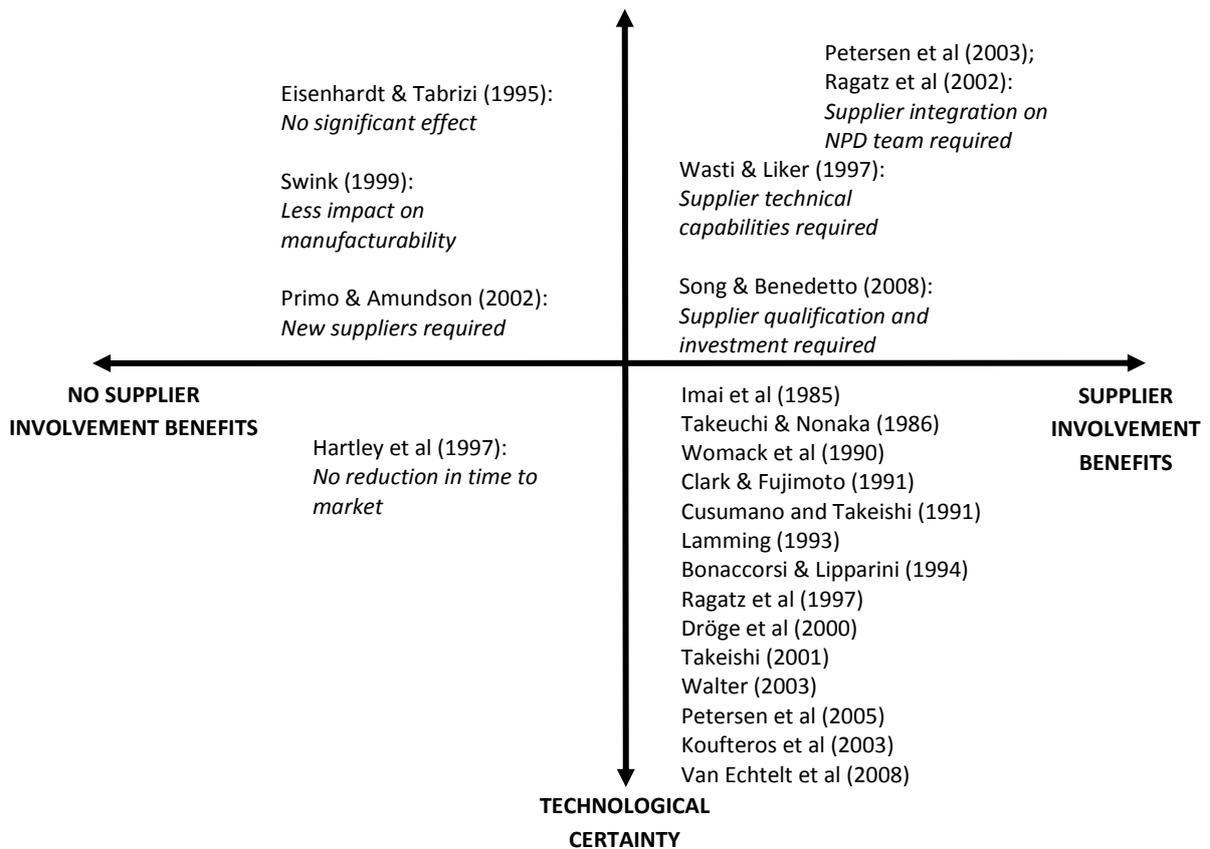
The paper is structured as follows: the next section provides a brief review of the literature on supplier involvement in NPD seeking to provide an overview of what extant research tells us about the effect of conditions of high technology uncertainty/newness and discontinuity. We also briefly summarize how existing research considers the role of purchasing in this process. We explore sourcing and supplier relationship issues as part of this review. An explanation of the case study methodology is provided before we report on the case study and draw initial observations and conclusions.

LITERATURE REVIEW

Definitions of supplier involvement in NPD (Johnsen, 2009) revolve around the integration of the capabilities that suppliers can contribute to NPD projects (Dowlatshahi, 1998), the tasks they are able to carry out on behalf of the customer, and the responsibilities they assume for the development of a part, process or service (Van Echtelt et al., 2008, p. 182). The acronym ESI adds a particular focus on the timing of supplier involvement (Bidault et al., 1998; Swink, 1999), which usually refers to involvement of key suppliers, such as black box suppliers (Clark and Fujimoto, 1991), at the concept stage or during early feasibility studies.

Research began to analyze the modifying effect of technological uncertainty or radical innovation in the late 1990s and this has been a continuing theme (e.g. Song and Parry, 1999; Ragatz et al., 2002; Song and Benedetto, 2008). Johnsen's (2009) systematic literature review, which tracked the supplier involvement research to its beginnings, reported conflicting findings regarding this effect. Where, for example, Petersen et al. (2005) found that technological uncertainty may further necessitate the need for supplier participation on the customer's NPD team, others found (e.g. Primo and Amundson, 2002) that existing suppliers may be less important than new suppliers. Figure 1 provides a synthesis of supplier involvement benefits in relation to levels of technological uncertainty.

Figure 1. Synthesis of Supplier Involvement Benefits and Level of Technological Uncertainty



Source: Johnsen, T.E. (2009), Supplier involvement in product development and innovation – taking stock and looking to the future. *Journal of Purchasing & Supply Management*, 15 (3), p. 196.

Although by 2009 the overwhelming evidence pointed in favour of supplier involvement in conditions of low technological uncertainty, research in conditions of high technological uncertainty was divided. In particular, we note the findings of Primo and Amundson (2002) suggesting existing suppliers may be less important than new suppliers in conditions of technology uncertainty, although as identified by other research (Wasti and Liker, 1997; Song and Benedetto, 2008) technological uncertainty may not require new suppliers but more careful supplier qualification with more emphasis on the supplier's technical capabilities. Recent research on the role of suppliers in *discontinuous* innovation (high technological uncertainty) supports the idea that existing suppliers may be less important than new suppliers, because new complementary capabilities and technologies from outside the existing supply chain are required (Phillips et al., 2006). Whether we frame innovations involving high technological uncertainty and newness as discontinuous, radical or disruptive, a key characteristic is that these types of innovation involve a paradigm shift (Kassicieh et al., 2002) and tend to be competence-destroying (Tushman and Anderson, 1986). Logically, in order to access such new technology and knowledge new suppliers from outside the firm's usual search space (Nicholas et al., 2013), may be required as existing suppliers would be more unlikely to provide new technology or knowledge of sufficient competence-destroying newness. Research in innovation and strategy, not surprisingly, has a more established record of research into technology searching from outside the firm's usual search space, for example, focusing on breakthrough scanning (Cousins et al., 2011), exterior sourcing (Datta and Jessup, 2013), boundary-spanning and exploration (Rosenkopf and Nerkar, 2001). However, although this has, potentially, important implications for purchasing and sourcing, far less research has examined these issues from a purchasing perspective.

The need for different ways of managing discontinuous innovations (innovations involving a high degree of technological uncertainty) and continuous, or incremental, innovations (involving low degree of technological uncertainty) resembles the classic *exploration - exploitation* paradox (March, 1991). Logically, discontinuous innovation calls for exploration of new ideas, technologies and relationships, whereas incremental innovation requires exploitation, or reliance and reinforcement of existing technologies and relationships. This duality is often viewed as a challenge of ambidexterity, which may require a structural separation of exploration and exploitation activities that clearly divides the different tasks (Benner and Tushman 2003; O'Reilly and Tushman (2011)). We should note here that some innovation researchers (Gibson and Birkinshaw, 2004) have argued that structural separation is not the best way forward and as it may lead to harmful isolation; instead ambidexterity should be present in the mind of each employee.

Although a few scattered contributions appeared since the 1980s it was not until the late 1990s that research into purchasing's involvement in NPD took form. Wynstra et al.'s (1999; 2003) research led to several frameworks for managing purchasing involvement in NPD, focused around a four categories of activities (development management, interface management, project management and product management), later re-organized into two broader 'management arenas' (Van Echtelt et al., 2008). Focusing more on purchasing organization issues, Lakemond et al. (2001) identified various configurations for involving purchasing in NPD based around project complexity (including the number and newness of technologies and size). Other noteworthy contributions have included e.g. Le Dain et al.'s (2010) work conceptualizing different supplier roles around the degree of responsibility delegated to the supplier and the overall risk of supplied components. Schiele (2010) found that most of the firms he studied had separated purchasing into advanced sourcing and life-cycle (or strategic) sourcing: advanced sourcing took the lead during the NPD process and life-cycle sourcing took over once a product had entered production. Advanced sourcing

would typically consist of engineers or purchasers with a strong technical background while life-cycle or strategic sourcing staff would have a more commercial background. Although not focusing on discontinuous innovation, Schiele (2010) suggests that methods such as purchasing scouts dedicated to scanning the supply market for new and unknown components appear to be particularly relevant for discontinuous innovation.

The IMP literature lends support to the idea that long-term relationships are required for joint innovation between industrial actors such as manufacturers and suppliers (e.g. Håkansson and Eriksson, 1993). As relationships develop over time from exploratory, developing and finally a stable relationship (or ultimately relationship dissolution) (Ford, 1980; Dwyer et al., 1987) the actors gradually build up mutual commitment and trust. Also, trust takes different forms at the different stages of relationship development i.e. initially contractual trust develops, followed by competence trust and eventually goodwill trust may develop (Sako, 1992; Lee and Johnsen, 2012).

The idea of gradually developing relationships in which the most stable and mature relationships form the backbone of joint innovation activity is consistent with most of the literature on supplier involvement in NPD and innovation (Johnsen, 2009). However, the strength of weak ties (Granovetter, 1973) and the need for ‘dancing’ with new potential business partners (Wilkinson et al., 1994) are not completely novel ideas and suggest a need for exploring new potential supplier relationships instead of relying solely on exploiting existing partnerships. The importance of weak ties has also been researched in the strategy and technology transfer literature (e.g. Hansen, 1999). Nevertheless, this is rarely considered in the context of purchasing and sourcing.

METHODOLOGY

This research project adopts an in-depth single case study strategy, which is motivated by the focus of the research topic on complex intra- and inter-organizational issues and an ambition to gain deep and rich explanations. Relying on an abductive approach (Dubois and Gadde, 2002) we seek to *elaborate* on theory (Ketokivi and Choi, 2014) within the two principal domains of purchasing and innovation. Following this approach, our case study is not guided by tightly formulated propositions but by relatively open research questions.

The single in-depth case study is based on interviews with multiple respondents both within the focal company of our study and with a supplier of new technology. We have no ambition to generalize from the empirical findings from a single case study but instead we aim to provide initial analytical generalization (Dubois and Araujo, 2007). Applying a moderate constructionist perspective (Järvensivu and Törnroos, 2010), we have sought to capture the perceptions of different respondents from across several company functions as well as the perceptions of the supplier involved in the project in order to uncover both local and more widely shared perceptions of reality.

The in-depth case study focuses on a Scandinavian company, here called ‘Alpha’, which has recently developed a completely new product for its customers in the ship construction industry: an NPD project involving discontinuous innovation. Forming our unit of analysis, the Alpha raft project involved sourcing and applying technology and competencies, which were completely new to the company. The Alpha raft project created a sense in the company of a need to involve its sourcing function from an early stage in the development process and to collaborate internally with R&D in managing the ESI process. This forced the company to reconsider its internal processes for managing NPD projects and the traditional organizational

responsibilities and roles. The project was undergoing final testing and nearing launch at the time of data collection. In sum, these project and company characteristics were an ideal fit for our research project.

Nine semi-structured interviews were conducted covering three departments within Alpha; Strategic Sourcing & Engineering, R&D and Marketing. Further interviews included top management and the supplier responsible for a technology, which has never before been used in the industry and is set to transform product performance. A semi-structured interview guide was used, adapted for different types of respondents. The main themes covered included: company background including NPD and innovation management processes and organization and overall company strategy; organization and characteristics of the sourcing function; sourcing involvement in innovation and collaboration with other functions especially R&D; sourcing strategy and space. In a few interviews we also asked a set of structured questions to evaluate the level of innovation of the Alpha Raft project.

All interviews were fully transcribed, coded and categorized into themes (Miles et al., 2014). The manual open coding process (Corbin and Strauss, 2008) was initially data-driven (Ryan and Bernard, 2003) with some codes defined a priori and others as they emerged from the raw data (data-driven) (DeCuir-Gunby et al., 2011). The second step was to import the raw interview text into a scheme or matrix linked to each code and functional department. This part of the analysis was conducted by one of the authors singlehandedly. Hereafter the codes were categorized and consolidated into meaningful themes through a dialog between the authors. Meaningful emerging themes were e.g. “strategic sourcing and innovation”, “challenges in NPD”, “initial contact”, “risk, trust and relationship management”, and “innovation challenges in Alpha Raft project”. A further step was to synthesize the clustered raw text from the interviews into shorter statements and text within each theme to gain a comprehensive overview of departmental perceptions and the discrepancies identified. Finally, we checked for errors and aligned the authors’ understanding and interpretations of the content of the themes (DeCuir-Gunby et al., 2011).

Consistent with the moderate constructionist approach (Järvensivu and Törnroos, 2010), we used role-ordered matrices (Miles et al., 2014) as tools to emphasize the different constructions (or perceptions) of the different groups of respondents i.e. the main communities involved. Tables 1-3 therefore show the different perceptions in relation to, for example, the nature and extent of innovation represented by the Alpha Raft project; it was for this reason that we thought it pertinent to interview not only purchasing and R&D employees but also marketing to get a better sense of the potential market impact.

The results were presented at a meeting with Alpha including senior management, and the heads of strategic sourcing and R&D. This served as an opportunity to validate the interpretations of the findings and discuss the emerging themes and conclusions (Eisenhardt, 1989). Thus, as recommended by Järvensivu and Törnroos (2010, p. 107), we exposed our interpretations and the ideas we were generating from the case analysis for scrutiny of the communities to which the ideas were brought (i.e. in particular the R&D, purchasing and top management respondents). The fact that these supported our interpretations and feedback enhanced our confidence in our results.

CASE STUDY FINDINGS: THE ALPHA RAFT PROJECT

In this section we first introduce the background of the company to gain an understanding of the context of the case. This includes the market the company operates within and how it traditionally manages NPD/innovation projects and the organization of purchasing (called

sourcing). This is followed by an introduction to the Alpha Raft project and the new sourcing process developed for this project. The major findings from the case study on these themes are summarized in Table 1, 2 and 3.

Company background

Founded in 1960, company Alpha is today a market leader in maritime and fire safety. Privately held and headquartered in Denmark the company today employs approximately 2000 employees worldwide. One significant customer segment for the company is maritime safety for passenger and cargo ships. A significant product within the passenger safety market consists of self-inflatable rescue life rafts. All passenger ships are required to carry lifesaving rescue equipment on board in case of an emergency. Regulations demands that 75% of the rescue capacity must be self-propelled lifesaving boats and 25% can be floating life rafts. In addition, regulations demand 25% rescue overcapacity, which may include life rafts. With its current product portfolio, Alpha therefore potentially targets 40% (25+25 of 125%) of passenger ship lifesaving rescue capacity.

The market

Table 1 captures interviewee perceptions of some of the contextual characteristics focusing on the company, the market and the company’s innovation challenges. The interviewee perceptions show an internal consensus that the market for maritime lifesaving equipment is heavily cost driven. Compared to the passenger ship market the cargo ship market is the more cost focused of the two. Alpha is market leader in the passenger ship market. But the market is undergoing a process of consolidation increasing the market competition. However, due to the nature of the product, and not least the end user, the market is very conservative and governed by strict rules and regulation. One respondent nailed it down to: *“it is the life or death of people we deal with every day”*. Safety is therefore the primary driver in the market. Due to the focus on safety and regulations the market cannot be characterized as innovation or technology driven. What is also important to compete in this marketplace is the product-service package and network. As products, due to regulations, require servicing every 12 months, customers demand that suppliers be able to handle this on a global scale. Two major customers, including their subsidiaries, capture approximately 80–90% of the market, while the two major suppliers (with Alpha as market leader) in total supplies 2/3 of the life rafts on the passenger market. Though efficiency and speed are coined as priorities by top management, middle management points at the many products, and the conflicting priorities as major company challenges. In sum, the market is driven by “safety first” i.e. regulations, and cost; due to consolidation among the suppliers, competition is expected to increase.

Table 1. Perceptions of context – company, market and innovation challenges

Themes	Management	Strategic Sourcing & Engineering	R&D	Marketing
<i>Market & drivers</i>	Market consolidation Price, cost and regulation driven More differentiation on cruise and passenger ships Network important for servicing	Company is customer and regulation driven	Safety and cost are drivers Customer specify 'makers list' to ship builders Services are important: "sell once, service 20 times" Duopoly	Marketing is different when few customers: duopoly Company largest on passenger market
<i>Company challenges</i>	Efficiency and speed are priorities	Many products, also in pipeline	Many products and development priorities	Many products Lacks prioritizing

		Low volume, complex products	Offshore market competitors	
<i>Purchasing challenges</i>	Purchasing refers to COO, Engineering refers to Strategic Sourcing Purchasing has traditional approach, not innovation focused Need for new competences e.g. for innovation projects	Purchasing is aligned with strategic focus Customized products and complex processes Competence development Purchasing not working on same speed, operational day-to-day focus Purchasing divided into strategic sourcing and supply/logistics Strategic purchasing creates framework and has supplier responsibility	Purchasing involvement can slow process down but important for cost reduction	Purchasing can be very 'square'

Traditional innovation and purchasing organization in Alpha

Alpha divides R&D and engineering into two departments. The engineering department is responsible for incremental cost-oriented development projects on rafts that have already been launched. Engineering refers to the head of strategic sourcing. Thus, the responsibility for strategic sourcing and on-going cost optimization lie in the hand of one person and goes hand in hand. NPD and more radical product innovations are the responsibility of R&D; ideas undergo a qualification process and subsequently enter a traditional stage-gate process. In the current NPD management model, sourcing for new technology is R&D controlled and due to the nature of the products and countless rules and regulations the NPD process is heavily driven by frequent and stringent tests, including full-scale tests; every new development must be fully documented to persuade customers and official authorities. However, numbers are insufficient to convince customers, hence a 1:1 prototype is necessary as a showcase for customers; *"... you can show the customer as many numbers, technical calculations and documents you want ...but showing and trying a full-scale prototype in the harbour, seeing that it works – that convinced them"*. Even though some ideas may come from customers and other external relationships, the current process can be characterized as mainly closed and internally focused and the traditional process is surrounded by much secrecy as the company seeks to protect from knowledge diffusion to competitors e.g. through mutual suppliers.

As mentioned, the head of strategic sourcing is responsible for incremental cost-oriented product development. However, in terms of NPD the strategic sourcing department is mostly involved only after components and suppliers are determined by R&D. Likewise, it is still R&D that takes the major decisions on innovations and is responsible for scouting for new innovations and technologies. The sourcing department would like to be more involved, but daily operational tasks leave limited time for taking part in the NPD process. Another challenge for the sourcing department is the heritage of being a cost-oriented department that has to change to a more mature value-oriented department. New and more complex tasks require new competences that the department needs to develop in order to be more involved in NPD and to challenge R&D. This process is in progress, e.g. by employing people with higher education, such as engineers and MBA graduates. Lately, strategic sourcing has become involved earlier in the process and R&D sees both pros and cons in inviting strategic sourcing and suppliers into the NPD process at an earlier stage. Especially now that the supplier base has moved from mostly local to more international, R&D believes that the strategic sourcing department imposes challenges and limitations for the NPD process in terms of time for coordination and frequently questions technically sound solutions: *"... I think that some [colleagues] find that it take away time from the projects and slows them*

down". On the other hand, R&D recognizes that involving strategic sourcing and suppliers at an earlier stage also gives the opportunity to cost-optimize the product up front.

Referring to the COO, the strategic sourcing department employs 10 people, with six in Denmark, two in Thailand and two in China. The employees in Asia are mostly engaged in finding and developing new low cost suppliers. Operational purchasing and inventory management are the responsibility of the logistics department. When finding new suppliers Alpha impose a traditional sourcing and supplier selection process based on price/cost, quality, delivery reliability and flexibility, and technical capability. But, when it comes to suppliers outside the current supply base, strategic sourcing has little involvement.

The supply market is characterized by few suppliers for Alpha. Alpha has approximately 300 suppliers and has what it defines as partnerships or close collaboration with approximately 10% of these. There have been attempts to develop ESI in NPD projects yet so far this has only been done with a few suppliers and is not very advanced or structured.

NPD project "Alpha Raft": a discontinuous innovation

In 2009 the company came up with an idea that had the potential to change completely the rules and competitive dynamics of the market. The project is the largest innovation project in the history of Alpha. "The Alpha Raft" combines the best features from lifeboats and life rafts in one. The new product doubles the rescue capacity in terms of the number of people on board compared to traditional applications and have increased focus on children and disabled passengers. By increasing rescue capacity, combined with less demand for space, the Alpha Raft enables ship-owners to utilize space better and e.g. have more cabins with sea view, and hereby charge a premium price.

The product also increases the safety level on board, building on the core value of Alpha as "*... a reliable supplier*". The product may not in itself create a new market, but has the potential for the company to not only capture market shares from current life raft competitors, but also to substitute other maritime lifesaving passenger products on board, such as traditional lifeboats. In other words, the Alpha raft has the potential to gain entry into the 60% of the market consisting of rescue boats, which is today out of reach with Alpha's current product range. Being more space efficient than lifeboats, the Alpha raft again enables ship-owners to have more cabins with sea view and increasing revenue.

The key innovation, and potentially a shift in paradigm within the industry, is the ability for the Alpha Raft to self-propel and steer away from the ship by the application and adaptation of a known technology in a new context. Steering away from the ship and sailing by own means is normally only a traditional lifeboat capability, while traditional life rafts have neither self-propelling nor steering equipment, but is designed simply to float.

Despite the overall agreement within Alpha that this project was a breakthrough for the company, Table 2 shows the diverging perceptions on how innovative the project truly is and the source of the innovation. While top management and Marketing perceive the innovation as a paradigmatic shift and indeed a discontinuous innovation, the R&D department, although acknowledging the embedded newness to the world and market potential, describes it as known technology and "*still just a raft with an engine...*". Marketing, in comparison, focuses on the innovation having the potential to change the way that the company position itself and hereby the way the company perceives its own role in the market. So, where top management sees the project as a lever for new markets and earnings, and Marketing sees the project as a changer of the self-perception of the company, R&D focuses more on it being an application

of a known technology although with major implications. The novelty of an innovation truly lies in the eyes of the beholder (Rogers, 1995).

Table 2. Perceptions of Project Alpha raft Innovation

	Management	Strategic Sourcing & Engineering	R&D	Marketing
<i>Open/closed innovation & responsibilities</i>		Mostly closed process	First project born in R&D Closed process, becoming more open Process driven by tests due to regulations – can be difficult to convince authorities and shipping companies Mainly shipping companies as development partners, not ship builders Incremental innovations managed by Engineering, part of strategic sourcing	Innovation during production managed by Engineering but difficult to determine if R&D or Engineering Company not very innovative: conservation industry, secrecy
<i>Degree of innovation</i>	Breaks in several areas with existing market; new to the world & paradigm shift	Revolutionary: does not currently exist	Smaller and frees up valuable space in front of passenger windows Eliminates need for rescue boats New to the world although still just a raft with an engine New competition	Potentially paradigm shifting if managed correctly Radical change
<i>New market</i>	Creates new customer relations also because customers are involved in project New market without existing competitors		New market for company but not for market Can capture some of rescue market	Company is market leader Not new customers but closer relationships
<i>Fit with existing customer values</i>	Higher safety level than existing systems but same purpose Need is already existent		Need is existent but company has also created the need through customer interaction	Potential to capture higher market share of existing market
<i>Technological innovation</i>	The largest innovation project for company. Expect 2-4 years jump ahead of competition Technological paradigm shift	Not paradigm shift – known technology	Paradigm shift for company: Enables double capacity and focus on disabled and children Not technological paradigm shift, new functionality and operational benefits	
<i>Performance change</i>	Radical/stepwise performance improvement in safety and space utilization		In functionality and operation	
<i>New competences & technology</i>	New core technology and competence in propulsion and steering	Requires new competences, sourced externally from supplies and consultants	In motors and steering, to develop internally or acquire adaptation of existing technology	

From a sourcing perspective, the most important implication of the innovativeness of the Alpha Raft project is that it required new technology, which was unfamiliar to the company and which did not exist within its existing supply base. The company was therefore forced to look outside the known supply base for inspiration. The application of new technology also required Alpha to source for knowledge about the steering and control system of the self-

propelling equipment. In other words, Alpha required building up internal knowledge and competences about a new core technology.

Sourcing and relationship development for the Alpha Raft project

The sourcing process for the Alpha Raft was very different from the traditional process, both when it comes to identifying and engaging with potential suppliers and involving the strategic sourcing department. In the Alpha Raft project R&D and strategic sourcing worked much closer than in traditional NPD projects and the traditional procedures and formalized processes for sourcing and supplier selection were short cut: *“The process was rather ad-hoc, even if the supplier may be characterized as a rather critical supplier for Alpha”*. With its traditional more reactive role in NPD, the sourcing department was not involved from the beginning of the project, but earlier than normally. Very early in the beginning of the project the R&D department produced a short list of suppliers for the self-propelling part. Hereafter, strategic sourcing became involved and, together with the steering committee, they decided to go for one supplier: here referred to as “Tango”. The most important considerations in this decision were the product and its technical capability, the experience and reliability of the supplier, and to a lesser extent the price of the product. As Tango has traditionally been a player in the commercial small boat market and not in the B2B large ship market, this was a concern for Alpha. Alpha needed to trust Tango to be a reliable partner but also needed to persuade the supplier of the potential for entering this new market as the actors had no prior knowledge of each other or the respective markets of their new potential partner. The initial contact was very informal with Alpha contacting the sales manager from Tango on a boat show. With no prior history with Alpha, Tango was initially sceptical, as it needed to invest own sales and R&D resources into the potential business and the relationship with Alpha. Also, the fact that Tango is a high volume manufacturer and Alpha focuses on manufacturing of low volume projects was of concern for Tango. Thus, Alpha is a very different kind of customer for Tango.

When Alpha first introduced the idea of using the Tango technology, much secrecy surrounded the interaction. Trust from both sides was an issue and needed to be built up front in order to proceed from the initial interactions. However, Tango demonstrated its up front trust and commitment to Alpha by sponsoring the first order with a 50% discount and Alpha gained trust in Tango through references from other Tango customers. However, after the first interaction and order, Tango did not hear anything from Alpha for approximately four month until suddenly Alpha came back and everything had to speed up in a very short time as Alpha was under pressure in the project. This was challenging for Tango as resources were allocated elsewhere due to the long silence. Alpha has experience with ESI, but as mentioned by the company, and shown by this case, relies on a fairly unstructured process.

Table 3. Perceptions of sourcing challenges and supplier relationship changes

Themes	Management	Strategic Sourcing & Engineering	R&D	Supplier Tango
<i>Strategic sourcing dept. and role</i>	No formalized role to source-/search for new technology/-innovation Decisions still with R&D Sourcing manager is engineering responsible for (cost) optimizing products after launch	Traditionally a rather reactive role. Not sourcing that identifies new technology/innovations Happens mostly in R&D, while sourcing dept. is more reactive and follows R&D Sourcing manager is engineering responsible when product are in	Sourcing earlier involved in NPD in this project Normally sourcing involved after specs and suppliers are settled Ideas for new technology/-innovation mostly born in R&D. No codified procedure for new technology/innovation	NIL

		operation/launched.	sourcing	
<i>Intra-organizational collaboration</i>	Need to integrate with and challenge R&D Large potential for increased internal collaboration Tango identified by R&D and sourcing involved afterwards	Sourcing dept. can be a pebble in the shoe. However conflicts are sharpening the edge. Internal collaboration increased over time Sourcing involved earlier in the process	Projects begin in R&D, but sourcing relatively early involved. Often both sourcing and R&D are together with supplier for solving issues Collaboration developed from bottom up and top down	NIL
<i>Sourcing process and supplier selection</i>	Same process used. No formal qualification process of supplier for Alpha raft. More ad-hoc. Idea fostered in R&D. Normally look inside current supplier base if possible and potentially develop supplier. But not the case for Tango as technology is far from supply base core	Similar process used for innovations But Tango is a short cut of standard process Tango ahead of their peers why short process for identifying supplier without evaluating others Sourcing involved all the way from start in Alpha project Price not so much in focus, as technical capability, product and reliability R&D's choice Sourcing responsible for risk assessment, agreements, contracts, supplier relations and interactions In case of Tango, corporate management involved, due to importance.	Different process than normally as very new technology for Alpha Different sourcing market. Choice of Tango in agreement between sourcing and R&D. First time R&D is so involved in customer discussions on needs identification and scoping	Initially approached very informal by Alpha at a boat show No prior contact with Alpha. Very different customer from different market. Very different customer requirements (OEM) Sees not just the potential business but the experience engaging with an OEM. Tango sponsored 50% of first order From first order, nothing heard for four to five months. And suddenly everything had to speed up
<i>Supplier relationship building and development</i>	Alpha engages in a set of relations which is trust-based and mutual dependent. Not many actors on the supply market. Dalliances not a common phenomenon in Alpha. More focused on long term. Partnerships with app. 10% of suppliers Suppliers often focused on "what's in it for me" Trust in Tango created through Tango network references	Especially in the beginning Tango was sceptical as the collaboration would significantly increase turnover. Close and good cooperation, but not a partnership-no long term contract. Alpha engages in ESI with a few suppliers, however rather unsophisticated/unstructured. Tango is an innovation supplier.	Tango traditionally operates on the commercial market and not on B2B. Tango now much more aware of required characteristics and functionality of their product	Sceptical in the beginning, double checking the market potential. Dedicated relation specific resources allocated to Alpha. Close collaboration between Tango sales and R&D and Alpha. Top management commitment from Tango. No contract besides a NDA Trust and good personal relations are essential. Trust was built up fast between the two actors. Sees the relationship as a partnership.
<i>Risk Management</i>	A new product demands all failure potentials identified. This includes suppliers.	A large competitor. Ensure that no knowledge is transferred to competitors from mutual suppliers. Challenge of lock-in effect.	For ship-owners Alpha Raft entails a risk as it is new product to the world. For Alpha to operate, someone has to take that risk. Not always to know how the projects are received in market. Needs to prove increased safety. IPR may also be a risk. Alpha Raft is risky business for	Always a risk in entering a new business and market. Therefore working so close with Alpha.

The CEO of Tango had sufficient confidence in the business potential and decided to invest in the project, including technical and sales coordination resources. Tango management acknowledged that engaging with an OEM required a totally different interaction pattern, which could not be achieved with their traditional one-to-one customer interaction business model. Now both Tango sales, R&D and top management interact with Alpha thus creating a much wider interface. Alpha describes the relationship with Tango as a good and close relationship based on mutual trust. Tango in turn describes the relationship as a partnership,

but in the eyes of Alpha the relationship is not yet a partnership, as no long-term agreement has been signed; due to the relatively low volume, Tango is classified as a 'B supplier' within Alpha. Table 3 shows the different perceptions of interviewees within Alpha and Tango, focusing on sourcing and relationship development challenges.

DISCUSSION AND CONCLUSIONS

Seeking to address a gap in existing research on the role of purchasing in discontinuous innovation (DI), this paper asked two research questions: *a) how can the purchasing function deal with the challenges posed by discontinuous innovation projects and b) what are the implications for sourcing and supplier relationship development?*

We have used a single in-depth case study of a DI project within a company in the passenger ship rescue equipment industry based on multiple internal interviews with managers and operational personnel representing different organizational functions; these include purchasing, internally called 'strategic sourcing', R&D, marketing and top management. In addition, we interviewed a supplier of a new technology, which was key to the innovation in Project Alpha Raft, gaining the supplier's perceptions of how the company i.e. its customer involved the supplier in the project. The case study explored how the purchasing function deals with the challenges posed by a DI project and the implications for sourcing and supplier relationship development; interviewing people from different functions and the supplier involved enabled us to gain the different perceptions or 'local truths' (Järvensivu and Törnroos, 2010) that indeed turned out to differ significantly in some respects, for example, around the extent of innovation represented by the Alpha Raft project.

The findings showed that Project Alpha Raft presented a number of challenges for Alpha. One critical challenge was the need for purchasing to become involved in the NPD process much earlier than in previous projects and to collaborate more closely with the R&D function, which is usually in charge of such projects. Alpha decided to involve its strategic sourcing function much earlier than usually in this project because the company realized that technology decisions, in particular technology sourcing, could not be left largely to R&D as per normal practice. Becoming involved in a DI project presented a challenge for the Alpha sourcing function as this was outside its usual comfort zone. Alpha recognized the need for it to develop competences within sourcing to enable it to better collaborate with, and understand the technical demands of, R&D. This suggests that early purchasing involvement (EPI) in DI projects requires a mature purchasing organization that possesses the right competences especially to be able to interact effectively with R&D.

Related to the challenge of purchasing becoming involved early in a DI project is the need to manage what Schiele (2010) refers to as the dual challenges of advanced and lifecycle sourcing tasks. Our case provides an example of exactly such a structural division, although the advanced sourcing function in Alpha has traditionally been controlled by the R&D department with little involvement of the sourcing department. Our case further illustrates how a DI project, which clearly requires advanced sourcing, is beginning to make one company reflect on its advanced sourcing organization, seeking to involve its sourcing department more closely in this process if not quite allowing it to control this process.

The sourcing criteria differed for the Alpha Raft project, being far less concerned with cost, and the usual supplier qualification process was circumvented due to the need for a rapid process. This appears to echo the recommendations of Wasti and Liker (1997) that technical capabilities should dominate supplier selection criteria but in fact contradicts Song and

Benedetto's (2008) advice to ensure a more careful supplier qualification process under conditions of high technological newness.

The case study also demonstrated how a company (Alpha) decided to source from a new and unknown supplier, Tango, which belongs to a related yet very different industry, thus in line with Phillips et al. (2006) and Primo and Amundsen (2002). We observed the concerns this raised within Alpha not least due to the fact that the industry is heavily driven by safety regulations, which means that any new unproven technology supplied by a new supplier presents a high level of risk. Indeed, Alpha saw a need to speed up the relationship development process it usually required before engaging in supplier collaboration. The supplier of the new technology in turn also saw this opportunity as more than simply a short-term relationship, realizing the need to adapt its practices, resources and expectations, as it was facing significant change in its business model as an outcome of the Alpha Raft project. This bears some resemblance to what Phillips et al. (2006) refer to as 'strategic dalliance' although in this case the ambition on both sides seemed to be to develop the relationship into a long-term collaboration rather than a short-term dalliance. But, the willingness of the two actors to circumvent the usual relationship development process and simply take a leap of faith contradicts most of the extant research into supplier involvement and, more widely, customer-supplier interaction in NPD and innovation.

Conceptual contributions

This paper has sought to contribute to research in early supplier involvement (ESI) in NPD, in particular the thin branch within this body of literature that now focuses on early purchasing involvement (EPI) (Schiele, 2010). The case study of the Alpha Raft project is a case study of EPI but a project characterized by discontinuous innovation (DI). Although some ESI research has investigated NPD under conditions of radical technological change (e.g. Primo and Amundson, 2002; Song and Benedetto, 2008) little research to date has empirically investigated EPI especially under conditions of DI. This paper has contributed a single in-depth case study on the phenomena, gaining insights from several internal functions as well as the supplier's perceptions.

In particular, we have focused on the sourcing process in an EPI DI project and the challenges of interacting with a new unknown supplier. Resembling a strategic dalliance (Phillips et al, 2006), but with the potential to evolve into a long-term relationship, the case study indicated a need to circumvent the normal supplier qualification process and for the two actors to take a leap of faith rather than wait for the relationship to mature and for trust to develop slowly. We highlight here that the idea of circumventing the normal supplier qualification process contradicts the advice of other research, notably Song and Benedetto (2008), to ensure a more careful supplier qualification process under conditions of high technological newness. In our view a plausible explanation for this is the need for DI projects a) to accelerate the innovation process and therefore also the mobilization of actors and b) to source new complementary technology from outside the firm's existing supply base, developing a tactical rather than, at least initially, a strategic collaboration with a trusted existing partner. Using Sako's (1992) trust typology, we suggest that this ties in with our observation that such collaboration requires a certain amount of initial competence and goodwill trust without first establishing the contractual trust that is normally assumed as the starting point for collaboration.

Although the exploit-explore dilemma in innovation is well-known (March, 1991) and the need to develop different routines for different types of innovation (e.g. O'Relli and Tushman, 2011; Bessant et al., 2014), very little research to date has investigated this challenge from a purchasing perspective. Where some existing research has considered challenges related to

search and selection (Rosenkopf and Nerkar, 2001:), little research to date has examined what this means for the purchasing function and structure although Phillips et al. (2006) is a rare contribution that explores implications for buyer-supplier relationships yet not for the purchasing function. In fact, it seems to be the assumption in existing research that search and selection of new technology is predominantly an R&D responsibility (e.g. Rosenkopf and Nerkar, 2001). Our paper indicates that this may no longer be the case and that there are considerable benefits but also challenges of involving purchasing in the (discontinuous) innovation process. Therefore, our paper makes a conceptual contribution to advance this agenda and we hope that our research can help to elucidate the role and challenges of purchasing in DI.

Managerial implications

From a single in-depth case study we are not in a position to generalize major managerial implications. However, taking our findings together with the consensus from existing literature, we are confident that companies would be wise to ensure close and early involvement of purchasing (EPI) in product innovation projects, working closely with R&D, especially in new technology sourcing or breakthrough scanning. In turn, this may require competence development, for example to boost the technical skills of purchasing or sourcing people.

Furthermore, we suggest organizational restructuring of the purchasing function, (Schiele, 2010) to divide purchasing into two sourcing groups: a) an advanced sourcing group, whose responsibility is primarily future technology sourcing and interaction with R&D and b) a lifecycle sourcing group, whose main responsibility is sourcing during the product lifecycle. In order to successfully capitalize from EPI projects we firmly believe that purchasing maturation is required to ensure a purchasing function that is truly in strategic alignment with overall corporate strategy.

Inspired by Phillips et al. (2006), Schiele (2010), and Bessant et al. (2014), we propose a set of contrasting sourcing practices for different innovation contexts i.e. low technological newness (incremental or continuous innovation) and high technological newness (radical or discontinuous innovation). The need to manage these two types of innovation challenges in a different way but at the same time is also emphasized by Tidd and Bessant (2009) and suggest an ambidextrous organization that incorporates both exploration and exploitation activities (O'Reilly and Tushman, 2011) although they do not focus on purchasing or sourcing. In other words, we do not suggest that companies switch from one practice or routine to another but that they seek to develop both ways of working - as parallel routines - at the same time.

Table 4. Contrasting Sourcing for Incremental and Discontinuous Innovation

	Low Technological Newness (Continuous)	High Technological Newness (Discontinuous)
<i>Sourcing function</i>	Lifecycle sourcing: for products/services already in operation and/or representing low innovation Purchasing responsibility	Advanced sourcing: for future products/services Joint R&D and purchasing responsibility
<i>Sourcing market</i>	Search within existing supply network: Reinforce relationships in which parties have adapted to each other and trust has been created over a long period of time	Search/scout outside existing supply network: Explore new potential relationships Explore suppliers from other industries with complementary technology

	Strong ties	Weak ties
<i>Supplier relationships</i>	Reinforce and develop existing suppliers e.g. through adaptation: strategic collaboration	Explore or “dance” with new partners: tactical collaboration
<i>Trust and commitment</i>	Long-term supplier relationships with trust, demonstrated by sharing of sensitive information	Short-term supplier relationships, limited to duration of project Limited sensitive information shared Easy to break off relationships
<i>Key sourcing criteria</i>	Cost, quality and delivery always critical supplier capabilities	Innovative capabilities of suppliers are particularly important; challenge of attracting suppliers with innovative capabilities
<i>Supplier approval as part of NPD process</i>	Existing preferred suppliers should continuously be evaluated and approved on efficiency and ESI contributions	New suppliers should circumvent the standard supplier approval process in order to fast track their involvement

Future research avenues

There are several potential avenues of research that follow from this study. One concerns the challenge of attracting suppliers from another industry (Song and Benedetto, 2008). A second related avenue concerns the challenges of collaborating with an unknown supplier and the problems of applying unknown technology especially within industries in which safety regulations are critical e.g. aerospace. A third avenue to pursue is to further investigate the required ambidextrous capability (O’Reilly and Tushman, 2011) to simultaneously explore and exploit in the context of purchasing and how this is related to company performance. Finally, the emerging concept of EPI warrants more development.

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