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**Integrated solutions from a service-centered perspective:
applicability and limitations in the capital goods industry**

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Abstract

Although advanced services, or so called integrated solutions, have increasingly received attention in the literature, no coherent body of literature exists, and the relational dimensions and consequences of integrated solutions are not explored in detail. Based on the emerging literature, we develop a framework identifying four different categories of integrated solutions: rental, maintenance, operational and performance offerings. We also compare and contrast the service- and the goods-centered logics with the logic of integrated solutions, and thereby show how the reciprocal interdependencies increase between customers and suppliers. We explore these interdependencies further in three case studies of firms experimenting with integrated solutions, and identify dependencies related to process knowledge, process optimization, and process operations. The paper shows that rather than moving along a linear continuum from goods to services, firms developing integrated solutions need to balance elements of both goods- and service-logics, as well as manage the increased customer-supplier interdependencies that integrated solutions entail.

KEYWORDS: integrated solutions, goods, services, customer-supplier interdependency, capital goods industry

Introduction

A number of marketing scholars argue for a new dominant logic of marketing, where service provision, rather than goods, is fundamental to economic exchange, and the logic of which is applicable to any type of organization, industry and sector (e.g. Edvardsson, et al., 2005; Edvardsson, et al., 2000; Gronroos, 1994; Gummesson, 1994; Normann, 2000; Vargo & Lusch, 2004). As a consequence, manufacturing firms have been urged to reposition themselves as service organizations and focus on a new set of issues, including the development of customized offerings, increased customer involvement, and even co-production (Gummesson, 1994; Normann, 2000; Vargo & Lusch, 2004). Instead of short-term transactions, long-term relationships with customers are in focus in these ‘new’ interactions (Gronroos, 1994).

Despite increased emphasis on services in both literature and practice, questions remain about the applicability of findings when it comes to manufacturing firms in the capital goods industry (Grove, et al., 2003; Stauss, 2005). The literature on service development focuses on the services sector and tends to underexpose the goods-manufacturing industry; in addition, most services marketing research focuses on consumer markets rather than industrial markets (Jackson, et al., 1995; Lovelock & Gummesson, 2004). As a result, scholars emphasize the differences between managing firms producing tangible goods and intangible services (Bowen & Ford, 2002; de Brentani, 1989; Vargo & Lusch, 2004), and often overlook a more integrated perspective which may better apply to the capital goods industry. Therefore, insight into how products and services could and

should be integrated in the capital goods industry, the challenges connected to this integration, the extent of the service offering, and the factors to consider when deciding on the product-service mix in the capital goods industry is scarce (Grove, et al., 2003; Oliva & Kallenberg, 2003). How the manufacturing firms in the capital goods industry operate in the so called service-dominant logic remains an open question.

In this paper, we explore the concept of integrated solutions and its relational consequences, specifically focusing on the capital goods industry. With integrated solutions, a combination of physical products or services, or both, plus knowledge are used to provide a specific outcome fulfilling the customers' needs. In a fully-fledged integrated solution, the supplier retains ownership of the equipment and increases the value for the customer (fulfils the customer's need) by reducing the customer's costs and/or enabling the customer to create new and more competitive offerings (Windahl, 2007). The buyer pays according to the level of usage or in relation to obtained cost savings, and thus the integrated solution becomes a running expense for the buyer rather than an investment (Soderstrom, 2003).

Drawing upon the relatively sparse literature on integrated solutions in the capital goods industry, the first objective of the paper is to create an understanding of different types of integrated solutions. The second objective of the paper is to develop a framework that deals with relational dimensions and consequences of developing integrated solutions in the capital goods industry. More specifically, we address two research questions: (a) how

can the concept of integrated solutions be operationalized, and (b) how do integrated solutions change the interdependencies between suppliers and customers?

Perspectives on integrated solutions in the capital goods industry: how can the concept be operationalized?

A review of existing literature

For firms in the capital goods industry, supplying integrated solutions differ from the traditional and established way of supplying products, spare parts and basic services. The literature describes the change in the offering in numerous ways: from less complete to more complete (Penttinen & Palmer, 2007), from unbundled to bundled (Stremersch, et al., 2001), from system to solution (Davies, et al., 2007), from standardized to customized offering (Matthyssens & Vandenbempt, 1998), and from product oriented to process oriented (Oliva & Kallenberg, 2003). The offering is usually connected to an increase in value for customers, and a focus on the customers' specific business rather than on technological needs (Shepherd & Ahmed, 2000).

An emergent stream of researchers from various backgrounds contributes towards an understanding of the opportunities and obstacles involved with supplying integrated solutions. Two main points of departure may be distinguished in this emerging literature: some authors discuss integrated solutions as the most advanced service offerings to the installed base (e.g. Gebauer, et al., 2005; Kumar & Kumar, 2004; Mathieu, 2001a; Oliva & Kallenberg, 2003; Stremersch, et al., 2001); other authors discuss integrated solutions

as a change of strategy and emphasize the need for organizational changes and for the firm to reposition itself within the value chain (e.g. Davies, 2004; Foote, et al., 2001; Galbraith, 2002a; Hax & Wilde 1999; Phillips, et al., 1999; Shepherd & Ahmed, 2000; Wise & Baumgartner, 1999).

So far however, there is no coherent body of literature on integrated solutions and a variety of different concepts are used. These include product service (Mathieu, 2001a; b; Phillips, et al., 1999), full service (Stremersch, et al., 2001), functional products (Kumar & Kumar, 2004), solution (Galbraith, 2002a), and integrated solutions (Davies, 2003; Wise & Baumgartner, 1999) (see Table 1). With only a few exceptions, the definitions are rather vague, include both consumer and capital goods, and omit further specifications of ‘customer need’, and fail to give real-life examples of integrated solutions. This complicates the process of comparing and contrasting findings and conclusions.

Therefore, drawing upon previous research, this section develops a descriptive framework for categorizing integrated solutions in the capital goods industry. In Table 1 we summarize important contributions from the integrated solutions literature specifically focusing on manufacturing and the capital goods industry. The contributions marked in grey are considered to have a main installed base focus. The unmarked contributions discuss integrated solutions from a perspective of changed strategies and organizational designs. In the next two sections, we further discuss these two perspectives.

Place Table 1 here

Integrated solutions: extending the offering to the installed product base

Some scholars describe the move towards integrated solutions as a sequential process where firms in the capital goods industry extend and enhance service offerings to their installed base. In this view, the relative importance of services increases and the relative importance of tangible goods decreases when firms move along the product-service continuum. Firms thus move from being product manufacturers to becoming service providers.

Oliva and Kallenberg (2003) provide a useful description of the expansion of the installed-base service offerings in the capital goods industry. They describe changes taking place in two dimensions: services change from being *product* oriented to end-user's *process* oriented and the customer interactions change from *transactional* to *relational*. Using these two dimensions, they identify four categories of services in the capital goods sector: basic installed, maintenance, professional and operational services. According to Oliva and Kallenberg (2003) advancing in the two dimensions towards operational services yields the 'pure service organization' – one that assumes operating risk and takes entire responsibility for the end-user's process. They argue that this move is to be taken only after the organization has established itself in the maintenance and service market; and since many firms are still in a current state of being early service

providers, Oliva and Kallenberg do not expect an extensive transition towards operational services. Oliva and Kallenberg's study does not however include any firms that actually provide operational services.

Kumar and Kumar (2004) extend the scope of operational services. They discuss functional product contracts as a level of service which provides customers with access to a technology, rather than with the ownership of the equipment. Hence, the product manufacturers are responsible for operations and maintenance, and provide the customers with the opportunity to focus on their core business processes (e.g. production) and avoid expensive investments in operations and maintenance. However, Kumar and Kumar do not give any examples of functional products and they do not discuss challenges and hurdles for applying such a strategy.

Even though Stremersch, et al. (2001, p. 2) have an installed base focus, they also build further on including the product in the offering, and define full service as “a comprehensive bundle of products and/or services that fully satisfies the needs and wants of a customer related to a specific event or problem”. In their framework for identifying full service, they include the dimensions of bundling (including both services and products) and extension in customer needs. The full-service concept, developed by Stremersch et al., approaches that of a more integrated, strategic perspective on integrated solutions.

Integrated solutions: changing strategies and organizational structures

Authors who use a strategic perspective emphasize that competitive advantage is not only about providing services, but also about combining products and services, changing business models and becoming customer centric (e.g. Foote, et al., 2001; Galbraith, 2005; Hax & Wilde, 1999; Quinn, 1992; Slywotzky & Morrisson, 1997; Wise & Baumgartner, 1999). This move represents a radical departure from a manufacturing firm's established strategy; it involves a change in expertise and attitudes and challenges conventional ways of thinking (Davies, 2003; Matthyssens & Vandenbempt, 1998). Penttinen and Palmer (2007) describe the move towards integrated solutions as a new strategic positioning which involves a change in the company's offering, from less complete towards more complete, and in the company's relations with its customers, from transactional to relational.

When firms move towards integrated solutions, the boundaries of activities performed by suppliers, customers and partners in the value stream change. Davies (2004) uses Womack and Jones' (1996) definition of the value stream to identify the value-adding activities involved in making, delivering, and using a product to provide services to the end-customers. In this, they include the entire set of value-adding activities in the life cycle of a specific product or service. The firms need to develop competencies within system integration (to design and integrate systems composed of hardware, software and services) and operational services (to maintain, operate and renovate a product throughout its operational life cycle), and sometimes business consulting and financing services (Davies et al., 2003).

In addition, the firms need to change organizational structures to cope with the new integrated-solution business. Galbraith (2005) argues that the firms need to create a ‘front/back’ organizational model, where the front-end is focused on market segments, and the back-end on products and technologies. Davies, et al. (2007) show that firms offering integrated solutions develop a variety of organizational structures that lie between the two ideal types of systems selling and systems integration.

Creating a framework for categorizing integrated solutions

Based on the literature review, we use ownership of equipment and product- vs. process-oriented offerings as attributes to identify different types of integrated solutions discussed in the literature, see Figure 1 below.

Scholars that view integrated solutions as an extended offering to the installed base, assume that integrated solutions are provided only after the product has been handed over to customers. As a result, they omit the connection between manufacturing and services, and instead argue for isolating service operations and personnel from the manufacturing and product placement operations. Using our framework, most of these scholars base their findings on studies of firms developing maintenance offerings, and to a certain extent operational offerings. For example, even though Oliva and Kallenberg (2003) discuss implications for operational offerings, they have not studied any such offerings; rather they base their findings on studies of enhanced service agreements, i.e. maintenance offerings in Figure 1.

In contrast, the scholars that emphasize changing strategies and organizations have mainly studied operational offerings and a few performance offerings (e.g. Penttinen and Palmer's (2007, p. 556) case study of SKF – “guaranteeing the bearings rolling in the customer's machines”). These scholars have a more integrated perspective, include the product in the definition and emphasize the importance of the R&D department.

Our definition of a fully-fledged integrated solution is related to service scholars proposing non-ownership as the basis for a new rental/access paradigm (Hill, 1999; Lovelock & Gummesson, 2004). These scholars refer back to Judd's (1964) and Rathmell's (1966) definitions of services and argue that transactions that do not involve a transfer of ownership are different from those that do. Using this paradigm would imply a need for attending to new issues, according to Lovelock and Gummesson (2004): in which manufactured goods form the basis for services, new thinking on service pricing, and services offer opportunities for resource sharing.

Despite similarities between a fully-fledged integrated solution and the proposed rental/access paradigm, the decisions about ownership are not straightforward in the capital goods sector. Integrated solutions are likely to form part of larger and complex customer systems, some of the equipment might therefore be owned by the customers and some by the supplier. The suppliers become part of the customers' processes when supplying fully-fledged integrated solutions and even though, from the customer's perspective, integrated solutions could be related to outsourcing, the solution often forms such an integrated part of the customer's process that close collaboration and risk sharing

are necessary (Windahl, 2007). Moreover, delivering these fully-fledged integrated solutions might not necessarily be the strategic aim of a manufacturing company in the capital goods sector. Instead, the suppliers seem to experiment with different degrees and perhaps even categories of integrated solutions.

In an effort to clarify the concept of integrated solutions, Figure 1 categorizes the different types of integrated solutions discussed in the literature. The framework addresses our first research question; it can be used for identifying integrated solutions in the capital goods industry, and for comparing and contrasting findings and conclusions. A categorization also facilitates the effort to devise more specific recommendations for managing the business of integrated solutions. In the next section, we use this categorization when discussing integrated solutions, the move towards a service-dominant logic and the consequences for interactions between suppliers and customers. The framework is also used to provide empirical illustrations of different integrated solutions offerings and analyze and explore the specific characteristics of our case studies.

Place Figure 1 Here

**Integrated solutions and the move towards a service-dominant logic:
how do integrated solutions change the interdependencies between
suppliers and customers?**

In all of the proposed categories of integrated solutions, the literature emphasizes the importance of addressing the customers' needs and to change the customer relationship from being transactional to relational. This transition implies long-term relationships built on trust (Brady, et al., 2005). Some of the literature also emphasizes the need for increased focus on relationships with partners and suppliers (Davies, 2004; Galbraith, 2002a; b) and the relationships in the business network (Windahl & Lakemond, 2006). These conclusions have strong links to service scholars arguing that "the new focus in service research today is not on the differences between goods and services, but on differences in how we want to portray value creation with customers (and other stakeholders) where the customer's perspective is emphasized" (Edvardsson, et al., 2005, p. 118).

A number of services scholars argue that manufacturers have to shift focus from goods, technology and manufacturing to services, intangible resources, co-creation of value and relationships (Gronroos, 1994; Gummesson, 1994; Lovelock & Wirtz, 2004; Normann, 2000; Vargo & Lusch, 2004). This shift in focus has been expressed in numerous ways, such as: from 'scientific management' to 'service management' (Gronroos, 1994), from a 'manufacturing paradigm' to a 'service paradigm' (Gummesson, 1994), and from a 'good-centered logic' to a 'service-centered logic' (Vargo & Lusch, 2004).

In this dichotomous view of goods and services, the focus on goods equals a focus on mass production and standardization (without customer involvement), whereas the focus on services is strongly connected to customization. It could be questioned whether this dichotomy is valid for firms in the capital goods industry. Classifications of both goods and services show that the degree of interaction with customers and the degree of customization vary within different types of services (Schmenner, 2004) and different types of goods (Hobday, 1998). For example, service providers, such as fast food restaurants, call centers and providers of financial services, are in the mass-services business where customization plays a minor role. However, capital goods manufacturers, especially those producing complex and expensive machines, usually have a long tradition of involving customers in product design and production (Davies, 2003; Hobday, 1998; Webster, 1984).

Prahalad and Bettis (1986) emphasize the importance of distinguishing between the need of changing dominant logics – which is what occurs when the strategic variety changes the nature of the core business significantly, and the need of coping with multiple dominant logics – which occurs when the new business is dissimilar. Firms in the capital goods industry build upon and use their core business when supplying integrated solutions. This includes a more complex process than ‘just’ moving from one logic to another. In addition, firms need to manage this new business of integrated solutions alongside their established business based on goods and support services, which is often

still important and profitable, a complication that has not been explored in previous research.

Arguably, it is too simplistic to suggest that firms in the capital goods industry need to move from one logic to another (Stauss, 2005). Rather, there seems to be a need to balance elements from both goods- and service-logics when developing and commercializing integrated solutions in the capital goods industry (Day in Bolton, et al., 2004). It is important to take this more complex reality into account when devising recommendations for managing the business of integrated solutions.

Offering – managing parallel focus on goods and services

In the following sections, we consider the change in logic entailed by integrated solutions related to Vargo and Lusch's (2004) service-dominant logic. More specifically, we discuss the elements of the offering and the interactions between the supplier and the customer. Table 2 summarizes the discussion.

In a goods-centered logic, goods are to be sold with the highest possible margin while services mainly repair the good in case of defects. In a service-centered logic, services are considered as core to the offering while goods are seen as appliances that might be needed in order to offer services; and the design of the goods should be customer- rather than technology-focused (Edvardsson, 1997; Vargo & Lusch, 2004). In integrated solutions however, goods and services have the same purpose – exchanges focus on increasing the customers' performance and/or cost savings. The supplier keeps the

ownership of the goods and internalizes the services. Interdependencies increase as the customer outsources some of their processes and makes the supplier a more important partner in their ongoing operations. Therefore, the focus on customers and their businesses is stronger than in the goods-centered view, but at the same time, the focus on goods and technology is stronger than in the service-centered view. The solution is dependent on the good itself, to an even higher degree than is the case with a support service which actually could benefit from a non-functioning good, see Table 2.

Therefore, for firms supplying integrated solutions in the capital goods industry, it is not enough to let the design of physical and technical resources be customer-focused and business-, instead of technology-run (c.f. Edvardsson, 1997). Even though the success of the offering depends on achieved cost savings for customers, the key to obtaining these savings relies on the development of the good itself, and also on the development and use of new technology (Penttinen & Palmer, 2007). The parallel focus on goods within the firm could, if used and managed wisely, be an advantage for firms developing and supplying integrated solutions in the capital goods industry.

Customer and supplier interaction – managing increased interdependencies

With integrated solutions, and explicitly with operational and performance offerings (see Figure 1), the supplier becomes part of the customers' processes to a larger extent than before. As shown in the previous section, this does not necessarily imply an active or co-producing customer, which a service-centered logic emphasizes. Rather, the interaction between the supplier and the customer changes from transactions (in the goods-centered

logic) to increased dependency (in the integrated-solutions centered logic). The role of the customers changes from receiving a good (in the goods-centered logic) to outsourcing parts of their operations (in the ‘integrated-solutions-centered logic’).

When supplying integrated solutions, value is determined using the customers’ perspectives and, as in the service-centered logic, the customers need to perceive and determine the value of the offering. However, suppliers also play an important part in determining the meaning of value; they need to propose, show and even educate the customers. The success of value creation is dependent on both the customers’ and the suppliers’ ability to perceive and determine value. The development of integrated solutions hence affects the relational value production and involves an ability to create trust and commitment between partners (Moller, 2006). The source of economic growth changes in particular for the supplier, who now becomes dependent on the performance and the cost savings at the customers’ plants.

Place Table 2 Here

Drawing upon the previous discussion in order to address research question two, we can see that the interdependency between suppliers and customers increases with integrated solutions offerings. Studying integrated solutions therefore provides an opportunity to explore more complex and intertwined customer-supplier relationships. In all of our four

categories of integrated solutions, the interdependency between the supplier and the customer plays an important role (compared to traditional sales of goods). However, the customer's dependency on the supplier, and the supplier's dependency on the customer is likely to increase in ascending order: rental offerings, maintenance offerings, operational offerings and performance offerings, see Figure 2. This is in line with Forsstrom and Tornroos (2005, p. 6) who argue that "with increased interdependence the potential for value co-creation increases."

Drawing upon Borys and Jemison's (1989) discussion on value creation and interdependencies, integrated solutions increasingly involve reciprocally interdependencies, i.e. dependencies "in which partners exchange outputs between each other and need to learn from each other" (p. 241). In a more recent article, Gulati and Sytch (2007) explore and exemplify interdependencies further, they use the term "joint interdependence" and argue that in contrast to literature discussing dependence asymmetries through the logic of power, joint interdependence is "governed by the logic of embeddedness. The logic of embeddedness, in turn, entails reduced transaction costs, greater resilience in the face of relational hazards, and increased opportunities for value creation." The authors identify *joint action* and the *quality of information exchange* as important mediating factors for the performance effect of joint dependence. Joint actions include activities such as dyadic cooperation and coordination across organizations, and also involve the development of solutions to relational and operational problems. The quality of the information exchange is linked to its detail, accuracy, and timeliness. Even though Gulati and Sytch (2007) provide a useful framework for exploring

interdependencies further, their analysis was conducted in a setting of sequential rather than reciprocally interdependencies (c.f. Thompson, 1967); and the authors do emphasize the need to expand the discussion towards more complex, reciprocal interdependencies.

Despite the emphasis of current research on the need to move from transactional to relational customer relationships, the reciprocal interdependencies between customers and suppliers, their consequences, and potential for value creation have not been as extensively explored (Forsstrom & Tornroos, 2005; Gulati & Sytch, 2007; Tuli, et al., 2007). Scholars seem to agree upon that the potential for value creation exists, but as argued by Forsstrom & Tornroos (2005, p. 6): “how the potential is exploited and realized is another story. There obviously is no simple formula for how the cooperation and interaction between the parties should be carried out in practice”. Moller (2006, p. 914) argues that “there is a clear need for research that explores inter-organizational collaboration in value-production where the traditional roles of suppliers and customers are becoming more complex and intertwined, and where the players have to be able to develop new collaborative competences”.

In the following sections, we explore the relational consequences of integrated solutions further; more specifically, our cases concern the situations with the highest degrees of dependencies, i.e. operational and performance offerings shown in Figure 2. Avoiding the general statement of ‘increased interdependencies’, we focus specifically on identifying important dimensions and consequences of reciprocal interdependencies.

Place Figure 2 Here

Managing integrated-solution initiatives: three examples from the capital goods industry

Method

The empirical part of this paper concerns three case studies of firms in the capital goods industry that are experimenting with integrated solutions. The studies were part of an explorative research project on firms experimenting with integrated solutions, conducted during 2001-2007¹. This paper draws upon an in-depth study at Alpha, the ‘Sludge case’, complemented with two smaller case studies at Beta, the ‘Air case’, and Gamma, the ‘Power case’. Through the in-depth study of the Sludge case, we obtained a rich and full understanding of the context and the underlying dynamics of phenomena that play out over time (Siggelkow, 2007); and through the smaller and complementary case studies of the Air case and Power case, we could contrast our findings and carry out complementary and synergistic data gathering case studies (Leonard-Barton, 1990).

In order to increase the possibility to explore variation in the cases, the cases were carefully selected according to the context they operate in (Dubois & Gadde, 2002). Our

three case companies, Alpha, Beta and Gamma are large international players operating in the capital goods industry. All three companies have a long history (about 100 years) in product manufacturing and development. They still have a strong product focus and have traditionally provided reactive rather than proactive services. Over the last few years, however, the after-sales market has increased in importance and today makes up a substantial part of the turnover (approaching half of the turnover).

In addition, new possibilities within control and optimization technologies have given opportunities to further increase their responsibility for the after-sales market. Alpha, Beta and Gamma have all developed different types of service agreements/contracts ranging from more basic reactive maintenance agreements to more preventive and proactive support agreements where risk and rewards are shared. This has created new possibilities to service customers in market segments with a high focus on availability, reliability and process control, such as dewatering plants, power plants and the oil and gas industry.

The three firms have also experimented with different types of integrated solutions where instead of ‘only’ providing extended service agreements, they actually become more or less part of their customers’ operations and base their business models on product performance and output and in some cases even keep the ownership of the products themselves. Although all three companies predict a growth in the sales of these more

¹ A more thorough description of the research project is available in Windahl (2007) and findings of the earlier development stages of the Sludge case have been published in Windahl, et al. (2004) and Windahl and Lakemond (2006). This paper includes new data gathered from the later implementation stages of the Sludge case, as well as the ‘new’ Air and Power cases.

advanced integrated solutions, i.e. operational and performance offerings, so far they only concern a minor proportion of the business; and there are several hurdles and challenges to overcome before these initiatives will, if ever, form a substantial part of the businesses.

An industrial reference group linked to the project met 12 times (from December 2001 to December 2004), and was an important forum for discussing important issues and complications with integrated solutions. Alpha and Gamma participated from the start; Beta attended two meetings in 2004. All three firms attended a one-day workshop on integrated solutions in February 2005. The reference group meetings provided us with a broad and deep understanding of the complex and ambiguous processes connected to integrated solutions over time and across varying locations.

Through the in-depth longitudinal study of Alpha² and the reference group meetings including all three companies, we gained an important understanding of the companies' contexts and integrated solutions offerings during a period of several years. The extensive study at Alpha also made it possible to focus the data gathering for the two cases at Gamma and Beta. These two latter cases contrast the 'Sludge case' as they concern different degrees of ownership of the equipment part of the offering; in this way we have used theoretical replication (Eisenhardt, 1989), i.e. we have explored and compared the specific characteristics of integrated solutions and the consequences for supplier-customer interdependencies on the spectrum of process-oriented offerings. These

² In connection to the longitudinal study of the 'Sludge case' at Alpha, carried out during the period 2001-2007, 65 people were interviewed, including customers, partners and suppliers of complementing products. The research design alternated participant observation, interview rounds and reference group meetings.

offerings demand radical changes in expertise and attitudes (Davies, 2003; Matthysens & Vandenbempt, 1998).

For the specific purpose of this paper, six interviews concerning the Sludge case, four interviews concerning the Power case and two interviews concerning the Air case were selected for in-depth analysis. The interviews, of 1.5 to 2 hours each, were conducted in a semi-structured manner with open-ended questions; they were recorded and later transcribed. During data gathering, notes were taken concerning the impression of the interview and the respondent. Findings and results of the studies were checked and discussed with the interviewees on several occasions.

The sequential selection of the case studies with the purpose to address more ‘extreme’ cases of operational offerings in order to contrast the findings in the Sludge case (c.f. Yin, 1994) resulted in a diminishing number of interviews performed. However, our pre-understanding of the companies and the cases through the recurrent reference group meetings made it possible access the cases rapidly and accurately and focus our interviews on the most important issues. Despite this, a limitation of our study is the predominant focus on the Sludge case, Alpha and its industry. In the conclusions, we discuss some of the implications with this limitation.

The analysis was an iterative process with recurrent analysis and intervention phases, comparable to what Dubois and Gadde (2002) call ‘systematic combining’. For each case a within case analysis was performed. The transcripts of the interviews were analyzed

based on categories connected to the interview questionnaire. The overall categories were linked to e.g. aspects of the offering/integrated solutions developed, the organizational structure, the role of the customer, and the role of the supplier. During the analysis, it was aimed to clearly distinguish between the respondent's explanation of facts and description of facts, as suggested by Miles and Huberman (1994). In addition, since the data gathering was performed in a real-time process, we located the data and change in past, present and future time (Pettigrew, 1997). The analysis of each case resulted in detailed case descriptions. These were compared in a cross-case analysis.

Throughout the study, we adopted a number of methods for improving the quality of the research (c.f. Lincoln & Guba's (1985) criteria). Credibility was achieved by following the developments at the three companies over time, using multiple as well as different sources of information, checking interpretations with respondents, and discussing findings and conclusions with academic colleagues as well as industrial partners. The issue of dependability was addressed by accounting in detail for the research process, choices made and methods used. Finally, transferability was improved by the rich and thick descriptions of the case studies, comparison of the cases, and the specificities of the cases, all concerning firms in the capital goods sector supplying machinery and equipment required for production.

Case descriptions

This section contains a short description of the Sludge, Air and Power case. Table 3 provides a summary of the three cases.

Alpha and the Sludge case

Alpha is an international specialist in centrifugal separation, heat exchange and fluid handling, and manufactures a range of products such as high-speed separators, decanters (centrifuges) and heat exchangers. The Sludge case concerns the development and launch of an intelligent decanter control system which optimizes the sludge treatment process and significantly cuts the customers' costs associated with the wastewater treatment process. Instead of selling components, spare parts and services separately, based on the new technology Alpha decided to license solutions to customers, and to create business offerings based on incentive contracts and performance optimization of customer processes. Recognizing that this represented a radical departure from its traditional business model, it established an internal corporate venture to launch the new technology and business concept.

During the first three years of the launch, the venture team has focused on Alpha's installed base and targeted large customers with high potential for cost savings. The customers go through an initial testing period where two decanters are run in parallel (only one with the new technology), in order to prove the cost savings. This test period has varied from 6 months to 2–3 years. The customers pay a fixed installation fee and can choose whether to have a fixed or varying (following the cost savings) annual fee. The 'sludge system' is currently (2006) installed at 14 plants, of which ten have signed contracts and four are running tests.

Beta and the Air case

Our second company, Beta, is a manufacturer of a wide range of air compressors used in industrial applications. Similar to Alpha, but with a slightly different approach, Beta has developed intelligent new technology that optimizes their customers' use of compressed air. A number of different 'products' are available, such as air scanning, monitoring and optimizing. Initially, these products were sold directly to the customers, but since they provide opportunities for increasing efficiency and optimizing the compressed air supply, the new strategy is to only include them in more comprehensive service contracts.

In 2004, the first 'Air contract' was signed. Beta is responsible for the production of compressed air over a five-year period, and the customer pays a fixed monthly fee based on their consumption. Beta bought the customers' old equipment (it will be used as back-up) and installed new equipment that will be used to run the plant. Therefore it is Beta that takes the risk if the costs increase. If the costs decrease, Beta and the customer will share the savings.

The Air case is organized as a project organization that buys services and new equipment internally through the use of an internal bank. The project manager is part of the new sales organization. In 2006, another Air contract was signed; this contract will run for 10 years. About five more contracts are in the pipeline, and Beta's aim is to achieve at least one contract per year.

Gamma and the Power case

Our third firm, Gamma, is a manufacturer of steam and gas turbines for power generation and mechanical drive applications. As with our other case firms, Gamma's focus on services and even on solutions has increased during the last years. The firm describes service in its corporate strategy as the 'profit machine (and future growth)', whereas the product divisions are described as the 'Competence machine' and the systems/solutions divisions are described as the 'Growth machine (and future profit)'.

In 2000, during the construction of a new power plant, Gamma signed its first operations and maintenance contract which means that, over a six-year period, Gamma is responsible for running the plant and delivering power to the national grid, and steam and power to a particular paper mill. The customer pays a fixed monthly fee, plus a variable fee based on operational uptime. In addition, the contract operates under a wide range of performance guarantees, and all site personnel are included in the contract. The management of the plant is kept internally and Gamma uses a sub-supplier for the operational competence. Gamma has decided to offer these types of contracts only to new customers, to whom they also deliver new equipment.

Place Table 3 Here

Analysis

The three cases illustrate some important challenges, which arise when developing integrated solutions in the capital goods industry, and which can be used to explore our research questions further. Below, we analyze the challenges related to the offering and the supplier-customer relationship. I.e. exploring research questions (a) how can the concept of integrated solutions be operationalized? and (b) how do integrated solutions change the interdependencies between suppliers and customer? In all three cases, the firms develop new technology and products, and outline new business models and offerings to customers. In addition, they increase the responsibility for, and hence the dependency on, the customers' processes – this requires new types of customer relationships.

Integrating products and services in integrated solutions - categorizing the cases

The firms under study use new technology that enables them to create competitive integrated solution offerings which change business models and logics – services and goods are used to increase performance and/ or cost savings for the customers. The suppliers build on established process and product knowledge, and add new software competence in order to be able to offer integrated solutions. System integration capabilities seem to be of utmost importance in this creation of integrated solutions (Davies et al., 2006; 2007; Davies & Hobday, 2005). Instead of the suppliers being dependent on selling as many products and services as possible, and the customers being dependent on buying these services and products as cheaply as possible, wealth is created for both suppliers and customers through achieving cost savings/ increased process performance. Our three case studies show that the source of economic wealth for the

integrated solutions clearly differs from the goods-centered and service-centered logics, where the control and production of goods, and the application of specialized knowledge and skills of the supplier are in focus respectively (cf. Table 2).

This view of value creation (reducing the customers' cost and enabling the customers to create new and more competitive offerings) supports Normann's (2001) discussion on the firm as an organizer of value creation and would make integrated solutions part of the paradigm that Normann calls 'the reconfiguration of the value-creating system'. Instead of making either goods or services the core of the offering (Gummesson, 1994), the value creation becomes core and to a certain extent, both services and goods become peripheral, in line with our depiction of the integrated-solution centered logic in Table 2.

In all our cases, the integrated solution offerings are process oriented, i.e. represent either performance offerings or operational offerings as shown in Figure 3. In the Air case, the supplier retains the ownership of the equipment. Hence, the Air case provides an example of a performance offering or a fully-fledged integrated solution. In the Power case, the customer buys the equipment but the supplier gets the responsibility for operation and maintenance, providing the customer with the opportunity to avoid expensive investments (Kumar & Kumar, 2004). The offering may be concerned as an example of an operational offering. In the Sludge case, the customer owns the core equipment (the decanter) whereas the supplier keeps the ownership of the optimizing equipment (the computer and software). Thereby, the equipment is partly owned by the customer and

partly owned by the supplier and the offering contains elements of a performance as well as an operational offering.

Despite the three cases being examples of process-oriented integrated solutions, there are significant differences between the types of customer process they are oriented towards.

This emphasizes the necessity to organize the integrated solution around customer specific needs (cf. Philips, et al., 1999). The supply of compressed air is a support process to the customer's core process. The optimization of the sludge dewatering process is not crucial to the customer's core process of wastewater treatment, but is becoming an increasingly integrated process and is even considered a core process at many modern wastewater treatment plants. The production of power and heat is the customer's core process. Therefore, it seems that customers may be inclined to retain a higher degree of ownership of equipment when the integrated solution is oriented to processes that are concerned more core to the firm. This may also have consequences for the supplier-customer interdependencies which will be explored in the next section.

Place Figure 3 Here

Exploring the dimensions of interdependency

For the customers in the capital goods sector, buying integrated solutions decreases the customers' control over processes often crucial for their operations. For the suppliers of

integrated solutions, supplying integrated solutions make them part of the customers' operations to a larger extent than before, when they were supplying equipment, services and spare parts separately. The customers and suppliers exchange outputs between each other and need to learn from each other – the interdependencies become increasingly reciprocal (Thompson, 1967). In the following paragraphs, we analyze the change in interdependencies in each of our three cases. In line with Borys and Jemison (1989) the analysis shows that the reciprocal interdependencies identified in the integrated solutions offerings call for a fit between a range of partner operations.

In the **Air case**, we identify several reciprocal interdependencies – in which the outputs of each become inputs for the others (Thompson, 1967). The customers increase the dependency on the supplier's (Beta's) operations, i.e. they become dependent on Beta for the supply of compressed air both in terms of equipment and operations. Hence, they become increasingly dependent on the supplier in terms of process performance. Consequently, the customers are exposed to the risk of losing their internal knowledge about the compressed air process, hence increasing their dependency on Beta's process knowledge. The customers see an increased risk of losing both their internal knowledge and the control of the supply of compressed air. They are worried about a future where there is a lack of the compressed air which is crucial for their production process and a situation where they cannot retain the responsibility in-house. The customers' core process performance becomes increasingly dependent on Beta.

In turn, Beta becomes increasingly part of the customers' processes: the customers' need for compressed air increases with the performance of their production processes, i.e. the more the customers produce, the more compressed air they need. Beta increases the dependency on the performance of the customer's core process. In contrast, once delivered, the more 'pure' equipment sale is independent from the customers' process; and Beta benefits from the fact that the equipment needs maintenance and service. The interdependency in this traditional sale is sequential rather than reciprocal, i.e. "one partner 'hands off' to another" (Borjesson & Jemison, 1989, p. 241) and the output of one activity is the input to another activity (Hakansson & Persson, 2004). Arguably, with the integrated-solution offering, Beta loses out on selling the equipment³. Hence, with the integrated-solution offering, the interdependencies change from having been sequential to becoming increasingly reciprocal; something which calls for fit between a wider range of partner operations (Borjesson & Jemison, 1989).

In the **Sludge case**, the customers increase their dependence on Alpha in terms of the performance of the optimization of the sludge dewatering process. In contrast to the Air case however, the customers' sludge dewatering processes do not become totally dependent on Alpha, only the optimization of the process. The customers can still run the process but lose the optimization-process knowledge. Before, people on site carried out the optimization, but with the new offering, Alpha is taking it over. In terms of equipment, once again although the customers do increasingly depend on Alpha for the optimization since they still own the decanter, they do not completely depend on them.

³ Since Beta has created an internal bank, the sales department still gets to sell the equipment internally however.

To what extent the offering affects the customers' dependency on Alpha in terms of the core process is somewhat complex. Even though the wastewater treatment process could be considered the customers' core process, the sludge dewatering has increasingly become an integrated and important part of the main process. With new legislation in many countries, there is a high cost associated with the sludge dewatering process and it has increasingly become part of the core process. Arguably, with the new integrated-solution offering, the customers' core process performance becomes increasingly dependent on Alpha.

In a similar way to the Air case, in the Sludge case there is also a reciprocal process interdependency between the customer and the supplier. Alpha is dependent on the customer's process: the amount of inflowing wastewater as well as the quality of the sludge affects the optimization of the dewatering process. As seen above, the Sludge case does not involve reciprocal interdependencies to the same degree as the Air case: Alpha supplies the core equipment (the decanter) even if the customer does not want the integrated solution/ the optimization. In this way, the offering involves a sequential interdependency and Alpha is only partly dependent on the performance of the customer's core process.

The **Power case** somewhat differs from the other two cases. The customers outsource their core process to Gamma. Consequently, on the one hand they increase their dependency on Gamma's process knowledge and performance. On the other hand, they are somewhat less dependent, or rather less intertwined (Moller, 2006), with the supplier;

i.e., since the customers still own the equipment and the whole plant, they do have the option of terminating the contract and either take over the operations themselves or contract to another firm.

When it comes to the supplier's dependency on the customer, the Power case once again differs from the other two cases. Even though Gamma becomes increasingly dependent on the performance of the customer's process, Gamma's dependency on its customer and the customer's involvement decreases rather than increases since Gamma takes over the complete operation of the plant. Even though the process interdependency increases also in the case of Gamma, its nature seems to be sequential rather than reciprocal. The case of Gamma hence involves less complex interdependencies (Gulati & Sytch, 2007); at least once the contract has been signed. In order to be awarded the contract, however, Gamma depends on the customer's process knowledge and involvement since the supplier needs to outline the contract and performance guarantees. This customer process knowledge dimension is specifically highlighted by the Gamma case, since it represents a case where the supplier takes over the whole process. However, the customers' process knowledge and sharing of process parameters are of utmost importance also in the cases of Beta and Alpha, both when outlining the new agreements but also during the actual operations.

In all our three cases, the customers' dependencies on the suppliers increase with the integrated-solution offerings. Our analysis suggests that there are more reciprocal interdependencies associated with a performance offering (the Air case) than with an

operational offering (the Power case). It also shows that with an operational offering, the customers keep some independency since they still own the equipment, and the interdependency is sequential rather than reciprocal. However, as discussed in the previous section, it is also important to consider what type of process the offering is directed towards when comparing the cases. The customers become more dependent on the suppliers if the offering is strongly related to their core process, as in the Power case for example. The increase in interdependencies and more specifically reciprocal interdependencies between supplier and customer has consequences for how to cooperate and coordinate across organizations. In the next section, we extend the discussion and identify managerial implications, such as the need for joint action and quality of information exchange (Gulati & Sytch, 2007).

Below, Table 4 summarizes the analysis, and Figure 4 illustrates how the increase in reciprocal dependencies differs between our three cases. The Power case is an example of an operational offering where the supplier takes over the customer's core process, i.e. production of power and heat. The Air case is an example of a performance offering, if compared to the Power case, is not as much part of the customer's core process. The Sludge case contains elements of both a performance and an operational offering, which if compared to the Power case and the Air case is less part of the customer's core process. One limitation of our identified dependency dimensions is that we have not weighted them, i.e. they are likely to be of varied importance, and therefore Figure 4 provides an estimate of the differences in interdependencies between the cases. More research is needed in order to attribute importance/ weighting the dimensions. In addition, we do not

claim to be exhaustive in identifying the dependency dimensions. Instead, we have explored some dimensions and provided a framework which can be tested and possibly extended by other scholars. The last section discusses further limitations of our findings and suggests avenues for further research.

Place Table 4 Here

Place Figure 4 Here

Implications for integrated solutions in the capital goods industry

Advanced services, or so called integrated solutions, have been discussed rather vividly in the service literature. It is more difficult to find empirical studies focusing on the capital goods industry. This paper addresses this gap by reviewing the literature on integrated solutions, discussing its applicability for the capital goods sector and taking further steps in operationalizing the concept of integrated solutions. Furthermore, we provide three empirical examples of different integrated solution offerings and discuss their relational consequences in terms of interdependencies between suppliers and customers. Below, we discuss the implications of our study.

Balancing elements from both goods- and service-logics

Since firms in the capital goods industry operate to a large extent within the goods-dominated logic, established ways of thinking and acting need to be overturned when developing integrated solutions. It is difficult to create this focus, and understanding of integrated solutions in the overall goods-focused organization. Instead solutions might be considered as a means to sell goods and thus prevent 'true' integrated solutions from taking form. This is in line with the strategic perspective on integrated solutions emphasizing the need for changing business models, organizational structures, competencies and conventional ways of thinking (e.g. Davies, 2003; Foote, et al., 2001; Galbraith, 2005; Hax & Wilde, 1999; Matthysens & Vandenbempt, 1998; Quinn, 1992; Slywotzky & Morrisson, 1997; Wise & Baumgartner, 1999).

So, on the one hand, the 'goods-dominated' attitudes need to be overturned. If companies focus on cutting the costs and increasing the value for customers, these companies might find that products or technologies other than the established ones are more efficient and suitable to use. Integrated solutions create an opportunity for radical and 'out of the box' innovations. On the other hand, as we have seen in our cases, established thinking and established departments, such as service and R&D, greatly contribute to the creation of integrated solutions. Service engineers influence the design of new equipment and hence create better conditions for effective service. The R&D department provides invaluable knowledge on how to increase the efficiency of the goods, both through improving the good itself but also through adding new technology, substantially improving the product's performance. Therefore, although the strategic perspective on integrated

solutions is applicable and useful to understand the consequences of integrated solutions, it must be complemented with a focus on the need to integrate integrated solutions with the existing business which it is highly dependent upon.

A strong focus on the creation of a separate organizational unit for integrated solutions may have several advantages and creates a necessary focus on this activity within this specific unit. However, besides the necessity to create internal focus in order to develop integrated solutions, there is also a need to create mechanisms for interaction and integration with other organizational parts of the company in order to sustain the integrated solution and make it part of the company's business (cf. Davies, et al., 2007; Lakemond & Berggren, 2006). It is therefore important to create a structure for integrated solutions that can co-exist with established organizational structures.

In addition, firms in the capital goods industry need to be able to both explore the business of integrated solutions and exploit the existing business of goods and services concurrently. In our cases, the business of integrated solutions still only contains a minor part of the total turnover, reinforcing the need to balance the need for radical departure from the manufacturing firms' traditional strategy and the integration of elements of traditional business and a new strategic positioning as described by Penttinen and Palmer (2007).

Consequently, it is rather problematic to describe the emergence of integrated solutions as the shift from a traditional goods-centered logic to a service-centered logic (e.g. Vargo

& Lusch, 2004). Indeed, when supplying integrated solutions, the firms seem to operate from a service-centered perspective where ‘the tangible goods serve as appliances for service provision rather than ends in themselves’ and where there are opportunities for these firms to retain ownership of the goods and charge a user fee, thereby to focus on the total process of consumption and use (Vargo & Lusch, 2004, p. 13). However, the current view of a service-centered logic needs to be somewhat revised to also incorporate the reality of firms in the capital goods industry that are offering integrated solutions. We argue that, in the proposed integrated solution logic (see Table 2), the interdependency increases between the suppliers and the customers. The suppliers become more part of the customers’ processes, and the meaning of value and the source of economic growth are determined from the customers’ perspectives. The role of *both* the service and the good is to increase performance and/or cost savings for customers. In our cases, the focus on goods and new technology, i.e. software for controlling and optimizing the equipment, seems to be a prerequisite for achieving cost benefits and making the integrated-solution offering viable for both supplier and their customers. These findings support Penttinen and Palmér (2007, p. 563) who suggest, “Some of the moves towards more complete offerings could not have been possible without enhanced information technology (IT), which appears as a key enabler...”.

Managing increased customer-supplier interdependency

In order to increase the understanding of the relational consequences accompanied by integrated solutions (Oliva & Kallenberg, 2003); this paper explores the interdependencies between the suppliers and customers. Our analysis shows that with

increasingly advanced integrated solutions, the interdependencies change from sequential to more reciprocal. More specifically, it highlights the change in three dimensions: process knowledge, process performance, and process operations. Since the interdependencies become increasingly reciprocal with the new offerings, they are likely to be more complex to manage, i.e. more difficult and more costly to coordinate because they contain an increasing degree of contingency (Thompson, 1967). Thus, mediating factors, such as joint action and quality and scope of information exchange are likely to become increasingly important (c.f. Gulati & Sytch, 2007). This involves dyadic cooperation and coordination across organizations, the development of solutions to relational and operational problems, and detailed, accurate and timely information exchange. This may include performance guarantees, long-term commitment, customizing integrated solutions, and assessing the impact on the customer's core processes. The managerial implications are further outlined below.

When implementing integrated solutions, the customers lose knowledge about the process the integrated solution is targeting, become dependent on the supplier for the performance of the process, and in the case of a performance offering, lose ownership of the equipment. In many regards, the customers' lose both control and competence and have to consider the subsequent consequences if the supplier terminates the contract for supplying the solution. In addition, the supplier also increases its dependency on the customer. Consequently, joint action (Gulati & Sytch, 2007) becomes important; the partners need to establish *performance guarantees* and *long-term commitment*.

Our cases show that it is not always easy for customers to perceive and determine the value of the offering. Price calculations include a wide range of parameters, such as cost of labor, energy, service, repairs, and more specific process-related costs. Often, customers do not have previous knowledge about all of these costs and how they interrelate. In addition, they have no competitive offerings to compare (since no competitors currently exist). Therefore, the suppliers need to prove cost savings and/or increased performance, and convince customers about the new concept. The quality of the information exchange is of utmost importance, which is seen when the evaluation and *test periods* become extremely time consuming. Suppliers need to balance this activity of tailoring or *customizing integrated solutions* for each specific customer with the need to create repeatable integrated solutions in order to make the solution viable and to be able to sustain the business of integrated solutions.

Arguably, the customers would be more reluctant to lose control over processes that are to a high degree part of their core process. The integrated solution offering could hence be assessed according to how it *affects the customer's core process*. Consequently, a performance offering would be better when it is not directed towards customers' core processes.

Conclusions

Our findings show that firms developing integrated solutions need to combine elements from both goods- and service-logics. Arguably, the real challenge is therefore not to

transform manufacturing organizations into service-oriented firms that have abandoned the goods-centered logic completely, but to balance service-oriented and goods-oriented business logics, and investigate how they can co-exist. It is impossible for firms to disregard or only focus on one logic; instead it is a matter of interplay and timing between different business logics. The process is hence more complex and less clear-cut than previous research argues.

Our findings also show that the reciprocal interdependencies between customers and suppliers increases with integrated solution offerings. Performance offerings – which target a customer’s process and in which the supplier keeps the ownership of the equipment – create the highest degree of reciprocal interdependencies. Moreover, our findings suggest that the more the offering is linked to the customer’s core process, the more dependent the customer becomes on the supplier. Consequently, performance offerings might be more suitable for processes that are non-core to the customer, in line with the arguments in the outsourcing literature (e.g. Prahalad & Hamel, 1990; Quinn, 1999).

In the literature on services and integrated solutions, it has been a more or less axiomatic starting point that firms in the capital goods sector are pressed by declining margins in their sales of new equipment and by increasing competition on spare parts, and thus have strong incentives to add services, move downstream and possibly supply integrated solutions. Seven years ago, this was also the reality for the cases presented in this paper. The following years, however, demonstrated that rather than being a constant trend,

driving forces and incentives for developing integrated solutions change with time and are strongly related to business cycles. During the economic upswing in 2006, a number of internationally operating providers of capital goods, such as Alpha, Beta and Gamma enjoyed record sales and profits on their sales of equipment. This strengthened their internal focus on products rather than on integrated solutions. Beta, for example, saw clear decrease in demand from customers for integrated solutions and an increased demand for new equipment. Integrated solutions are likely to be more attractive for customers in times of recession when companies are less inclined to invest in expensive equipment.

It is clear that further research is needed that addresses integrated solutions, goods- and service-logics and interdependencies. Firstly, one limitation to our study is that we have only studied three firms. A quantitative study based on a larger number of participants would make it possible to discuss the findings in more general terms. This paper explores and develops theory rather than tests theory. Consequently it provides opportunities for other scholars to test the proposed frameworks and dimensions. For example it would be useful to attribute importance to the suggested dependencies, and this could only be done through a larger, quantitative and confirmatory study.

Secondly, the case study of Alpha and its in-between performance/operational offering was larger than the studies of Beta and Gamma. Although this focus provided us with in-depth insight over a long period of time, the Alpha case showed a combination of characteristics of performance and operational offerings, and studying more cases in-

depth, either operational or maintenance offerings could increase the understanding of integrated solutions offerings and their specific characteristics.

Thirdly, another limitation of our study is its focus on the suppliers. A more thorough study of the customers and how they perceive different types of integrated solutions could possibly further insight into integrated solutions and the interdependencies between suppliers and customers. This approach could for example contribute to the discussion on the importance of trust which is tightly linked with the partner's history of interaction (Gulati & Sytch, 2007; 2008). Moreover, as suggested by Gulati and Sytch (2007), it is important to consider moving beyond the dyadic view of interdependence and its implications to a network or system level of analysis.

Fourthly, more research into the drivers and opportunities for integrated solutions is needed. Instead of a continuous process from products to services to solutions, and from the goods-centered towards the services-centered logic, firms experiment concurrently with a number of offerings. Basic and advanced service agreements and integrated solutions co-exist along with the sales of tangible goods.

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Tables

Table 1 Integrated solutions in the capital goods industry: literature overview

Authors	Concept used	Draws upon literature within:	Emphasize
Brady, et al., 2005; Davies, 2003, 2004; Davies, et al., 2001; 2003; 2006, 2007; Davies & Hobday, 2005	<i>Integrated solutions</i> – products and services that address customers’ needs.	Resource based view – dynamic capabilities; system integration – vertical integration within the value chain.	Need for strategic changes: move downstream in the value chain; organizational changes: become a system integrator.
Foote, et al., 2001; Galbraith, 2002a; 2002b; 2005; Miller, et al., 2002;	<i>Solutions</i> – products and services that address customers’ needs.	Mainly empirical.	Need for organizational changes: move from being product centric to being customer centric.
Gebauer, et al., 2005; Gebauer & Fleisch, 2007; Gebauer & Friedli, 2005;	<i>Service provider</i> – products as an add-on to services. Installed base focus.	Service management literature and aspects of motivation and behavioral theory.	Need for behavioral and cultural changes that are service and customer oriented.
Hax & Wilde, 1999	<i>Customer solutions</i> – products and services that address customers’ needs.	Mainly empirical.	Need for strategic change.
Kumar, et al., 2006; Kumar & Kumar, 2004; Kumar & Markeset, 2007;	<i>Functional products</i> – the user buys the function, not the product. Installed base focus.	Service literature.	Need to take into account product design characteristics, customer’s organizational culture and geographical location.
Mathieu, 2001a; 2001b	<i>Product service</i> – a type of service which is independent from the company’s goods. Installed base focus.	Service literature.	Close relationship with clients, customization and people are identified as important dimensions for the development services.
Matthyssens & Vandenbempt, 1998	<i>Integral solution/‘one stop shopping’/ proactive total solution</i> – high degree of customization and a ‘proactive’ sensing of hardly explicit client specifications.	Service and strategy literature.	Identify explicit service quality; proactive, total solution; and timely, empathic design of new services as key success factors for competitive advantage.
Oliva & Kallenberg, 2003	<i>Operational services</i> - managing maintenance functions and operations. Installed base focus.	Mainly empirical – use the product-service continuum thought (service literature).	Need to isolate service operations from manufacturing and product placement operations.
Penttinen & Palmer, 2007; Penttinen & Saarinen, 2005	<i>Full-service</i> (based on Stremersch, et al., 2001) and <i>integrated solution</i> .	Draws upon bundling, service, transaction cost literature, social exchange theory and resource based view.	Construct a framework to identify strategic positions for firms.
Phillips, et al., 1999	<i>Product-service</i> - a comprehensive package of tangible goods, service and information.	Mainly empirical.	Identify trends that explain the product death. Need to organize around customers’ needs.
Shepherd & Ahmed, 2000	<i>Solution providers</i> – products and higher margin services that solve customer’s business rather than technological need.	New product development literature.	Need for organizational changes.
Stremersch, et al., 2001	<i>Full service</i> – products and/or services that address customers’ needs. Installed base focus.	Bundling and systems selling.	Need for long-term mutual commitment, involvement of top management, and of purchasing and

			maintenance departments.
Wise & Baumgartner, 1999	<i>Integrated solutions – products and services that address customers’ need.</i>	Mainly empirical.	Need to create new business models to capture profits at the customer's end of the value chain.

Note: The contributions marked in grey are considered to have an installed base focus. The unmarked contributions discuss integrated solutions from a perspective of changed strategies and organizational designs.

Table 2 Comparing the three logics

<i>Logics</i> <i>Dimensions for comparison*</i>	Integrated-solution-centered	Goods-centered *	Service-centered *
Offering:			
<i>Unit of exchange</i>	People exchange to acquire increase in process output/ performance/cost savings.	People exchange for goods. Sell manufactured good with highest possible margin.	People exchange for benefits of specialized knowledge and skills.
<i>Role of goods</i>	Goods are used to increase performance/ cost savings. Supplier keeps ownership.	Goods are the end-products.	Goods are transmitters of embedded knowledge and used as appliances in value-creating processes.
<i>Role of service</i>	Services are used to increase performance/ cost savings. Services get an internal role at the suppliers.	After-sales services, maintenance and spare parts – mainly reactive instead of proactive. Other types of services, such as ‘consultancy’ often included in the overhead of the sales of the goods.	Services are considered as the core of the offering and the application of knowledge and skills through deeds, processes and performances.
Supplier-customer relationship:			
<i>Role of customer</i>	The customer outsources part(s) of their operations.	The customer is the recipient of goods.	The customer is a co-producer of service.
<i>Supplier-customer interaction</i>	Increased dependence, customers make the supplier part of their ongoing operations.	Customers are acted on to create transactions.	Customers are active participants in relational exchanges and co-production.
<i>Determination and meaning of value</i>	Value is determined using the customer’s perspective. Value is perceived and determined by customer and producer.	Value is determined by the producer.	Value is perceived and determined by the customer.
<i>Source of economic growth</i>	Wealth is obtained for both supplier and customer through achieving cost savings / increasing performance of customers’ processes.	Wealth consists of owning, controlling and producing goods.	Wealth is obtained through the application and exchange of specialized knowledge and skills.

* Adapted after Vargo and Lusch (2004).

Table 3 Three integrated-solution initiatives in three industries

	Alpha and the Sludge case (% of dry sludge)	Beta and the Air case (m ³ compressed air)	Gamma and the Power case (kWh)
<i>Offering</i>	Wastewater treatment plants need dry sludge to decrease the costs associated with sludge handling. Alpha offers optimization of the dewatering process. Customers pay fixed installation fee and fixed or variable (based on cost savings) annual fee during a five-year period.	Large industrial customers use compressed air in a range of different applications. Beta offers increased efficiency and optimization of the air supply. Customers pay a fixed monthly fee based on consumption during a six-year period.	Power plants want to minimize responsibility and risks, and control costs. Gamma offers long-term power/heat supply at agreed quantity, quality and cost to new customers. Customer pays a fixed monthly fee and a variable fee for operational uptime. Gamma operates and maintains the plant.
<i>Goods</i>	New technology and goods (computer, sensors and software) enable optimization of customers' dewatering process. 'Old' equipment used in parallel during the proof of concept period. Initial focus on installed base.	New technology (software) used to scan and optimize the use of compressed air. New equipment installed, supplier keeps ownership. Old equipment taken over from customer and used as back-up.	Gas turbine in combination with condition monitoring system form basis for improved power plant efficiency. Prerequisite that customer buys new equipment.
<i>Services</i>	Service of the system as well as software updates included in the fixed price. Service of the decanter separate.	Supplier internalizes operational services.	Supplier internalizes operational services.
<i>Organizational structure</i>	Internal corporate venturing.	Internal project organization buys services and new equipment internally through the use of an internal bank.	Internal department, part of after sales organization.
<i>Customers</i>	10 customers and 4 test installations (2006).	2 customers so far (2006), other customers approached.	1 customer (2006).
<i>Supplier-customer interaction</i>	Supplier needs to explain, and show/test cost advantage. Supplier pays for the testing. Customer's optimization of the sludge process becomes more dependent on Alpha's knowledge and involvement. Supplier earns money and customer loses less money when customer's process is optimized. Customers need to trust that they get a good price from the supplier, and that they cannot run the equipment more efficiently.	Supplier needs to determine how much customers can save in close cooperation with customer. Customer's cost adapted to how much air they use, their activity, and supplier becomes dependent on customer's activity. Supplier and customer gain on an efficient production of compressed air. Customers need to trust that they get a good price from the supplier, and that they cannot run the equipment more efficiently.	Supplier and customer need to negotiate contract, need to build price on previous experience. Customer outsources its core activity. Customers need to trust that they get a good price from the supplier, and that they cannot run the equipment more efficiently
<i>Partners</i>	Software competence through close cooperation with a partner.	Installation competence through different sub-suppliers.	Operational competence through one sub-supplier.

Table 4 *Customer-supplier interdependencies in our three cases*

<i>Increased Interdependencies</i>	Air Case	Sludge Case	Power Case
Process knowledge	reciprocal	reciprocal	reciprocal and sequential
Process optimization/ performance	reciprocal	reciprocal	sequential
Process operations	reciprocal	reciprocal & sequential	sequential

Figures (please note that the figures are also included in a pptfile)

Figure 1 *Integrated solutions in the capital goods industry: Different categories found in the literature*

Note: The matrix is designed to suggest that an integrated solution may be less of a performance offering and more of an operational offering, not to suggest that the world can be neatly divided into four quadrants.

Figure 2 *Customer-supplier interaction and integrated solutions: increased interdependency*

Figure 3 *Categorizing our cases*

Figure 4 *Customer-supplier interdependency in our cases*