Developing integrated solutions: a network perspective

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Abstract

Firms traditionally focused on selling products, spare parts and services face difficulties with increasing competition and declining margins. They are hence turning towards new strategies where products and services are integrated into so-called integrated solutions. Evidence on the challenges connected to this development is sparse in the literature, but there are indications that internal factors as well as external relationships play an important role. In this paper we use the network perspective to uncover some of the complex issues related to integrated solutions, such as how and to which extent the business network and its actors facilitate or impede the development. Two case studies of one more and one less successful R&D project within the same firm operating in the capital goods industry are used to illustrate challenges and possible success factors for the development of integrated solutions. The paper shows that close co-operation with and involvement of end-customers, and integration of other external actors' competencies are important factors that need to be taken into account when developing integrated solutions. In addition, internal factors such as influences on the established organisation and production process are important to consider.

Keywords: integrated solutions; network theory; capital goods

Introduction

Increased focus on integrated solutions

An increasing number of firms are recognising the need to integrate products and services in new business offerings in order to stay competitive. Firms are turning towards new strategies that involve combining products and services. With these 'integrated solutions' - as they are referred to in this paper - firms are focusing on customer needs and actual outcomes of their products and services (Davies 2003). Hence, this new strategy implies increased focus on customer processes and operations, and challenge traditional business models for selling products, spare parts and support services. Although many firms have recognised this as an opportunity there is only sparse insight into how integration of products and services could and should be carried out, the challenges connected to this integration, the extent of the service offering, and the factors to consider when deciding on the product-service mix (Oliva and Kallenberg 2003). Literature on this topic is also sparse, but there are indications that companies need to integrate an extended set of competencies, such as technical, market, consulting and partnering competencies (Davies 2003; Windahl et al. 2004). One important challenge in developing integrated solutions is hence related to the cooperation between internal business units and departments. Evidence from industrial service development studies indicates that cross-functional cooperation between technicians and service personnel is one critical success factor for new service development (e.g. Edvardsson, Haglund and Mattsson 1995; Matthysens and Vandenbempt 1998). When developing integrated solutions, the former service content must not be seen as 'only' a support service or stand-alone after-sales offering but as an integrated part of the total offering. Hence, the service and product development as well as the development of the business must be handled in an integrated manner, something that puts high demands on cross-functional cooperation. Linkages and communication channels must be altered in order to achieve a co-ordinated joint process to develop integrated solutions (Windahl et al. 2004). A second major challenge in developing integrated solutions is related to the actors in the business network. As former "product providers" become "solution providers" a different degree of insight into the problems and applications of customers is necessary, implying a need for customer involvement and long-term relationships (Galbraith 2002). In addition, partnerships are often formed with companies providing complementary products. The development of these integrated solutions hence involves high interaction and sometimes-blurred boundaries between the actors. Customers as well as suppliers have important latitude on the development of these integrated business offerings. It is therefore interesting to consider the development of integrated solutions from a network perspective. As Ritter, Wilkinson and Johnston (2004, p. 181) argue, "[Intra- and inter-organisational] subjects have been researched separately, but the network approach demands and integrated understanding of these. This is particularly true with the recent trend in outsourcing, as formerly internal relationships progressively become inter-organisational relationships".

With this paper we aim to contribute to the sparsely investigated area of developing integrated solutions. To our knowledge the concept of integrated solutions has not been investigated by using a network perspective. We intend to show that the network perspective can provide valuable insights into and uncover some of the complex issues related to the development of integrated solutions. We focus on the challenges connected to the development of integrated products and services in the capital-goods industry, and more specifically the implications related to the business network. Important questions we address are how relationships in the business network can both enable and prevent the development of integrated solutions. Two case studies of one more and one less successful project in the capital goods-industry are used to illustrate challenges and possible success factors connected to the development of integrated solutions. Our main focus is on the business network. However, as external and internal aspects are intertwined the internal organisation cannot be left out completely. As also Ritter (2000) remarks the capability of capturing, coping with and managing relations in the business network is dependent on how well the internal competences and organisation is adjusted to mirror the business network.

The paper is organised as follows. In the next section, we continue with a review of the literature on integrated solutions as well as network theory. We try to abstract important aspects of the business network theory for our analysis of the development of integrated solutions. Next, two case studies performed in the capital goods industry are presented, analysed, and discussed using the network perspective. The paper concludes with a general discussion about the implications of our study and some conclusions.

Theoretical perspectives

Integrated-solution innovation

An increased emphasis on value creation and the necessity for firms to develop new business offerings in order to distinguish themselves from competitors have led to a growing interest in the area of integrating services and physical goods into 'solution' offerings. There is a shift in emphasis from production to use, output to input, and past to future, that widens the scope of what an offering is, what characteristics a firm needs to build into its offerings, and what competences are required of the firm (Normann 2001). Especially traditionally product-focused manufacturing companies face a major challenge to develop these more market-oriented strategies (Ames 1970; Brown 2000; Mathieu 2001; Oliva and Kallenberg 2003). New capabilities, metrics and incentives are needed, and the emphasis shifts from the transaction to a more long-term relationship with the customer (Davies 2003; Grönroos 2000; Gummesson 1994; Normann 2001; Oliva and Kallenberg 2003).

Although there is a growing interest in integrating service and product perspectives, existing research has not focused very much on the relationship between manufacturing and service business (Grove, Fisk and John 2003; Oliva and Kallenberg 2003). Instead, as Lovelock and Gummesson (2004, p. 37) point out, "The 'goods versus services' debate of the 1970s and early 1980s was useful and fruitful in highlighting the crucial but neglected role of services in management and marketing, yet the very nature of that debate obscured the necessary synergies between manufacturing and service business, and much work remains to be done to develop an understanding of the mutual interaction and interdependence between goods and services." The need for exploration of the relationship between manufacturing and services was recently emphasised in a discussion between ten leading services scholars (Grove, Fisk and John 2003). It was argued that there was a need to focus future research on issues like the importance of services in a manufacturing context, and the process of how firms move from manufacturing organisations to providing integrated solutions (ibid). From a manufacturing perspective there is sparse insight into how integration of products and services could and should be carried out, the challenges connected to this integration, the extent of the service offering, and the factors to consider when deciding on the product-service mix (Oliva and Kallenberg 2003). Research into integrated solutions provides an opportunity, but also indicates a necessity, to address and possibly integrate the two fields of service and product innovation studies (Grove, Fisk and John 2003). Nie and Kellogg (1999, p. 352-353) argue that: "Only when we acknowledge and understand the differences [between operations management and service operations management] can we begin to march into the next level – integration of manufacturing and services: how can manufacturing learn from services and how can services learn from manufacturing."

Much work has been done on service development but the field of developing business-to-business services is rather neglected in the literature. New service development literature is often focused on the service industry in consumer market contexts (de Brentani 2001; Jackson, Neidell and Lunsford 1995). Not necessarily are findings in this body of literature with a consumer-centric focus also valid in the business-to-business industry. There are some exceptions however. Edvardsson (1997) presents a framework for the service development process that has emerged from studies in, among others, the development of services like high-speed trains, telecom services, 'smart card' services, a job vacancy computer system, and a cleaning concept. He sees services as part of the wider product concept, and they can hence consist of a commodity or a service or of a combination of these. Edvardsson (1997) argues that the service offer, the service process and the resources and structure of the service system cover the most essential aspects in the development of new services.

The above-mentioned studies consider service development in an industrial context but they do not explicitly consider integrated solutions. Rather, services are to an important extent seen as self-contained offerings. The concept of 'solutions' is however not new. In the seventies, based on a study of 500 'industrial distributors', Hannaford (1976 p. 139) discussed systems selling, which he defined as 'the concept whereby products and services are blended together by a seller so as to perform a complete function for a buyer'. More recently, Davies (2003; 2004) identifies important capabilities associated with successful suppliers of solutions. The results are based on research conducted across six different sectors, railway, mobile communication systems, flight simulation, corporate networks, infrastructure and construction, and consultancy. He argues that *system integration* is a core competence for solutions providers, which includes the design and integration of systems composed of internally or externally-developed hardware, software and services. But in order to offer complete

solutions, firms might need to develop competencies such as *operational services*, *business consulting* and *financing services*. In addition, he states that "the biggest challenge will be developing capabilities to integrated different pieces of a system increasingly by an external network of specialised component suppliers, subcontractors and service provider" (Davies 2004, p. 753). Other authors have identified this as partnering competence, such as building alliances and partnerships with suppliers, partners and customers (Shepherd and Ahmed 2002; Windahl et al. 2004). However these studies do not focus specifically on how actors in the business network influence the development of integrated solutions. In this paper we use a network perspective to uncover some of the challenges related to the business network. In the next section an overview of the literature on business networks is provided.

The network perspective

The role and importance of networks and relationships in value creation and delivery are increasingly discussed in the marketing and business literature (Ritter, Wilkinson and Johnston 2004). "Relationships enable companies to cope with their increasing technological dependence on others and the need to develop and tailor offerings to more specific requirements" (Håkansson and Ford 2002 p. 133). As suppliers of integrated solutions to a certain extent become part of the customer's ongoing operations, it is unavoidable that the creation of integrated solutions has a major impact on relationships in the business network.

In theories about business networks it is argued that business relationships are connected to each other. As a consequence, the firm, its interactions and relationships cannot be understood without reference to the wider network (Håkansson and Ford 2002). Such networks consist of the firm's set of relationships such as with suppliers, customers, competitors or other entities. Strategic networks are composed of long-term inter-organisational ties that are of strategic importance to the firm (Gulati, Nohria and Zaheer 2000). These networks provide the firm with considerable potential advantages such as access to information, resources, markets, and technologies. However, although the business network opens several opportunities, it also incurs several restrictions on a firm's latitude. Håkansson and Ford (2002) refer to this as the paradoxes intrinsic to the nature of business networks. First, firms within the network are not free to act according to their own aims. Instead these actions can only be understood within a structure of significant counterparts and relationships. As such, Håkansson and Ford (2002) claim that a firm's opportunities and limitations are related to the resources invested in relationships as well as to the firm's internal capabilities. A second paradox is that although relationships can be considered as outcomes of a firm's strategy and actions, the firm's actions and results can also be seen as an outcome of what happens in the business network. The network perspective is about influencing and being influenced at the same time. A third paradox presented by Håkansson and Ford (2002) concerns a firm's control over the network. Firms try to control the network for their own aims. However, the more control is achieved the less effective and innovative will be the network. A self-centred view of the network could be more harmful than rewarding. Managing networks therefore involves initiating and responding, acting and reacting, leading and following, influencing and being influenced, planning and coping, strategising and improvising, forcing and adapting (Ritter, Wilkinson and Johnston 2004).

In their network theory Håkansson and Snehota (1995) describe the network as a set of business relationships, links between activities, resources and actors. In addition, three different functions of the relationship are identified, the function for the dyad (external relationships), the function for the individual firm (internal relationships) and the function for the third parties (network). Hence, not only customer relationships contribute to a firm's performance, but a range of different types of external partners such as suppliers, universities, research institutions, consultants and competitors can play an important role to a firm's innovation success (Ritter 1999). Ritter (1999) argues that a firm's degree of network competence has a positive impact on its interaction with these external partners and that network competence is an important input factor for a firm's innovation success. Network competence is defined as "the degree of network management task execution and the degree of network management qualification possessed by the people handling a company's relationships" (Ritter 1999, p. 471). A distinction is hence made between the *tasks* that need to be performed in order to manage a firm's technological network and the *qualifications* that are needed in order to perform these tasks. Ritter and Gemünden (2003) also argue that a firm can positively stimulate the development of network competence through availability of resources, network orientation of H&R management, interdepartmental communication and openness of corporate culture. Resources can be financial, physical, personnel or informational and enable the firm to execute network management tasks. A

network orientation of human resources management may help to enhance network competence by developing the right human resources. Interdepartmental communication and openness of corporate culture makes information available to those dealing with external relationships and provides condition for developing the necessary flexibility, spontaneity and responsibility in inter-organisational relationships.

Creating integrated solutions is very much a question of combining value activities of multiple actors in order to form 'value-creating' end products (Anderson and Narus 1999; Doz and Hamel 1998). Although one firm may be driving the development, as we will illustrate in our empirical study, several other actors in the business network influence the development of integrated solutions. Taking into account a firm's embeddedness in the network and its connections and dependencies on other organisations is therefore likely to provide a more complete picture of the challenges connected to developing integrated solutions. Embeddedness refers to the broader contextual setting of a firm (cf. Halinen and Törnroos 1998), i.e. the firm is part of a flow of value-producing activities in a business network with relations and dependence on spatial, social, political, market and technological structures, both horizontally and vertically in the value chain (ibid). On a resource and activity level, connections and dependencies are important. Different types of dependencies typical for the industrial context have been considered, including buyer-seller interdependence, functional interdependence, product complexity and buying process complexity (Webster 1991).

The question remains therefore, how and to which extent the business network and its actors facilitate or impede the development of integrated solutions. In order to gain more insight into this, in the next sections we analyse two in-depth cases of integrated solutions development from a business network perspective.

The two case studies

The comparative case study of two R&D projects at 'Alfa'

A comparative case study of two R&D projects at a large international firm with a long history in manufacturing serves to illustrate the inter-firm challenges connected to the development of integrated solutions. The firm, to be referred to as Alfa, is an international specialist in centrifugal separation, heat exchange and fluid handling, operating in the capital-goods industry. The firm manufactures a range of products such as high-speed separators, decanters (centrifuges) and filters, plate and spiral heat exchangers, and pumps. The customer base includes the gas, petroleum, energy-generation, marine, processing, food and beverage, biotech, pharmaceutical, water and wastewater industries. The two R&D projects presented in this paper concern the wastewater treatment and dairy industry respectively and illustrate two different ways for a manufacturing firm to approach the development of new solution-based strategies. Several external actors played a prominent role in both projects. The IDCS project concerns the development of an intelligent decanter control system for optimising the sludge dewatering process. The development of this project started out as skunk work, but was turned into a legitimised venture within the organisation. So far this venture is seen as very promising for developing future business. In contrast, the IQPX-light project which concerns the development of 'intelligent separators' for milk separation was terminated before the machine was released on the market.

The studies of the IDCS and IQPX-light projects were carried out between January 2002 and December 2003 as part of a research project following the firm's development towards integrated product-service strategies (Windahl 2004). A case study method was chosen to study the two projects, despite all its limitations. The case studies share the same organisational context, which enables the exploration of variations among them (cf. Dubois and Gadde 2002). Twenty-four interviews were carried out including eight interviews with people directly involved in the IDCS-project and four interviews with people directly involved in the IQPX-light project. The interviews of one and half to two hours each were conducted in a semi-structured manner with open-ended questions; they were recorded and later transcribed and analysed. Findings and results of the studies were checked and discussed with the interviewees on several occasions. Public and internal written material, memos from meetings, and ongoing contact with key informants, supplement the interview data. We realise that the projects cannot be evaluated in simple success/failure terms, but the studies arguably represent the reflected experience of developing integrated solutions. Hence, the general validity of

the findings cannot be determined with the confines of this paper, but in this stage of research, the projects will service to illustrate important characteristics of developing integrated solutions, an until now, hardly explored area.

The development of IDCS (Intelligent Decanter Control System)

IDCS is a decanter control and adjust system optimising the sludge dewatering process. This system consists of software, a computer, sensors with a control box, a centrate tank and cables. The system makes is possible to increase process performance which provides the customer with considerable cost savings. Alfa started the development of IDCS in the early 1990's. Coincidentally, at the same time Dutch legislation was implemented encouraging incineration of sludge. This in its turn resulted in a search for optimal dewatering solutions, an activity taken on by a Dutch research organisation. Together with this research organisation, Alfa continued the development of IDCS in the late 1990s. This resulted in the end of 2001 in a pilot installation at a customer's site in The Netherlands. During the pilot installation, Alfa was able to follow, analyse and improve the system and its benefits. It took about a year to make the system successful at the pilot site and achieve a cost benefit for this customer.

The development of the system up until this successful pilot installation had not been a smooth ride for the people involved from Alfa however. In the early stages of the project, internal support was lacking and necessary resources to carry out the project were missing. In fact, the project was basically carried out as a skunk work. One highly motivated employee, supported by his closest boss put much effort into the project. Also some people that had been involved earlier in the development of the control system performed some tasks. When the project in the Netherlands started no financial resources were available. Consultants involved for software development had to agree to postpone the bill one year. At one stage a decision was even taken to stop the project but this did not prevent the people involved to continue.

In parallel to the development activities, there were ongoing discussions on the future strategy of Alfa. An important focus of these discussions was how Alfa could 'climb the value chain'. For this reason it was attempted to coordinate similar developments of other 'integrated solutions' e.g. IQPX-light, but without any bigger success. In January 2002, these internal discussions reached top management and business consultants were appointed to investigate potential growth opportunities approaching "functional sales" (defined in the consultant report as selling products, services and parts but take responsibility and base additional revenues on process efficiency gains from smart applications and process expertise). Finally, top management decided to give priority to the sludge treatment and the IDCS project. A pre-launch took place in the Netherlands in 2002, and in January 2003, IDCS became a venture separated from the traditional organisation and with a General Manager of its own. The system is licensed to the customers' installed base. This license includes a fixed installation cost per decanter and an annual fee for the use of the computer and the software. The annual licence fee varies depending on capacity (dry solids/hour) and cost savings made. Results until now show that the use of the system provides customers with a substantial cost reduction.

The development of IQPX (Intelligence, total Quality, Performance, eXpandable) – light separators

IQPX is a newly developed separator providing variable capacity and thereby replacing a range of separators with different capacity. The product is also a physical platform for enabling 'intelligent' functions. The initial development project included the development of the separator as well as these 'intelligent' control functions. However, as the project progressed the project brief was adjusted and the control functions were excluded. At that point of time the project name was adjusted to IQPX-light.

The development of the intelligent features for controlling and adjusting the separators was initiated in the middle of the 1990s. Although discussions on features and business possibilities were intense and consultants were involved to analyse and explore the possibility to take on responsibility for the customers' processes by offering an 'integrated' service rather than a product, it was decided to exclude the controlling and adjusting features from the project and instead focus on the development of the separator first. A main reason was that it was felt that the project had become to complex to handle. Therefore, although the potential was recognised, the development of control and adjust functions was postponed until later.

Simultaneously the competence centre for the dairy application, involved in the early discussions about new business offerings, became part of another firm, referred to as Beta, after a reorganisation in 2000. Hence, when the IQPX-light project officially started in January 2001, the project team was staffed with employees from Alfa as well as Beta. One consequence of the new organisation was that Beta became the channel to the end-customers (dairy plants) actually using the separators. The project was driven within Alfa by people from a central research department and from the division with the technical responsibility for the separators. This division however, does not have the commercial responsibility for customer Beta. Although people from the division holding this responsibility were informed about the ongoing development in the project and invited to meetings, little interest was shown and meetings were not attended.

The main objective with the project for Alfa was to supply Beta with a machine with flexible capacity. In this way Alfa would be able to decrease the number of products in its product portfolio. A second objective was to prepare the machine to provide the possibility to include control systems on the machine in order to improve maintenance strategies, decreased power and water consumption as well as improve availability and reliability. This increased functionality was packaged into a business offering and Beta was to approach the customers, i.e. the dairy plants. Hence, as one of the project members from Alfa explained, “the money for us would not have been in the dairy industry where we sit in the backseat with Beta driving the car, producing value for customers and finding out what they want. Instead we could have learned and used that knowledge when approaching our own applications.” These possible future customers included breweries, wineries and olive oil producers.

By August 2001 the development of the machine was finalised. Beta launched it at an exhibition, the stand saying, “Do not buy a separator – buy separation!” Nine potential orders were identified. Beta initiated two orders for a customer in Germany. In 2002, however, these orders were cancelled due to the end customer’s financial problems. For reasons not completely clear to Alfa, other potential customers also turned the IQPX-light machine down and ended up buying conventional machines. At the end of 2002 the project was put on hold. The project leader’s contract ended and the motivation to continue the project was low.

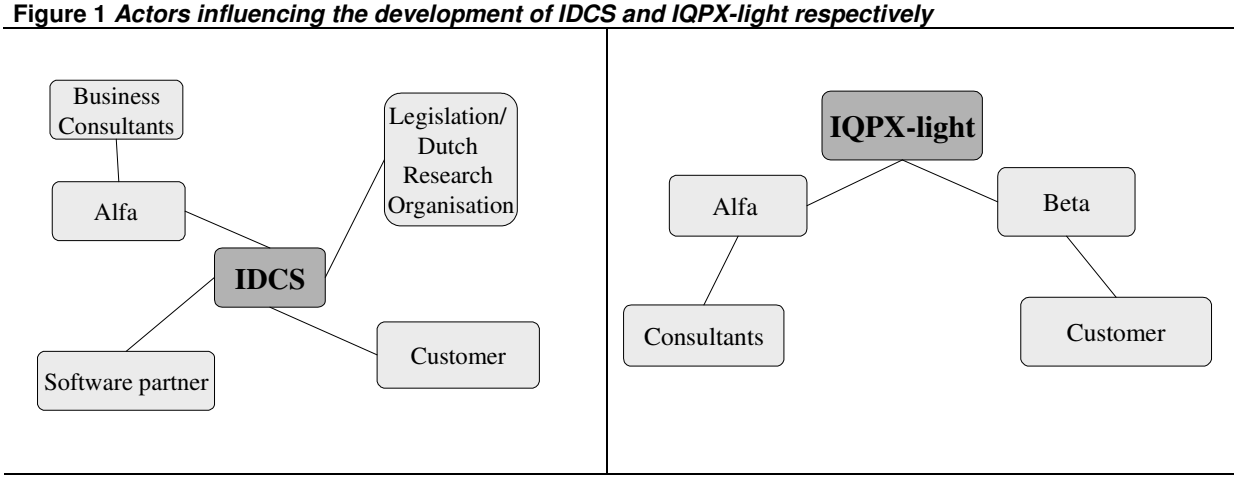
Challenges connected to internal and external relationships

The projects in the business network

The two different projects approached the development of solutions from different perspectives. In *IDCS*, the focus was on process performance and optimisation, and a new product was developed together with the customer. In addition the research institute supported the project and most likely strengthened its credibility among customer and partners in the Netherlands. The close cooperation with the software partner was crucial; Alfa did not possess software competence on its own and was hence highly dependent on this relationship. In addition, although the project lacked support from top management initially, their support was important towards the end of the development of IDCS when the launch of the system was prepared. Business consultants probably encouraged top management to proceed with the development of IDCS as they identified opportunities within the field of integrated solutions. In *IQPX-light*, the existing product was changed in order to prepare for improved process performance and eventually a change in business model. The change of the existing product required new routines for Alfa’s manufacturing process and included the development of a new specification system. In this project Alfa’s customer Beta was highly involved but potential end-customers were not. IQPX-light was to be sold and marketed to the end customer by Beta. This complicated Alfa’s control of the activities taking place at the end-customers and made it difficult to understand why the machines were turned down. In addition, the people with the commercial responsibility did not participate in the project; neither did the top management support it.

Figure 1 illustrates the actors in the network and is followed by a discussion on how both the external and internal relationships influenced the developments.

Figure 1 ***Actors influencing the development of IDCS and IQPX-light respectively***



External relationships influencing the development

The IDCS-project achieved a match between the customer needs and the offering. Wastewater plants need dry sludge to decrease the costs associated with sludge handling and Alfa matched the customer need by offering optimisation of the dewatering process through the use of IDCS. In the development of IDCS, Alfa developed detailed process knowledge about the dewatering process and increased general knowledge about its interaction with other processes at the wastewater treatment plant. This knowledge was in turn complemented and integrated with software development. These processes were highly dependent on close interaction with one customer and a software partner. The close cooperation with these actors enabled the demonstration of important cost savings, and based on this a commercial approach could be outlined. In addition, business consultants advised management to proceed with the development and organise the project in a separate venture, an advice supported in the literature by Oliva and Kallenberg (2003). These authors question however whether the success of isolation must be considered as due to an additional managerial focus, or as a way to deal with internal resistance to new business concepts and strategies.

The IQPX-light project took only the first step towards a match between the customer needs and the offering, i.e. excluding the 'intelligent' features. This exclusion created confusion for the end-customers and probably made it harder to distinguish the advantages with having an IQPX-light machine. The dairy industry saw potential in being able to regulate the cream concentration and an 'intelligent' machine would increase the control of the process. Even though Alfa had a close relationship with Beta, the distance to the end-customers was never overcome. Alfa did not have the direct contact with end-customers. Beta was the channel to the market and as a consequence Alfa appeared to not have a complete understanding of the customers' needs.

Internal relationships influencing the development

In the IDCS-project dedicated individuals from the beginning of the process and a highly supportive top management towards the end were important for the launch of IDCS. Only a few dedicated people at Alfa were involved in the project until success was achieved; however these people included not only technological but also commercial aspects at an early stage. IDCS did not change the production process; instead a totally new product was added to the 'old' machine which 'only' required new sub-suppliers of sensors and computers. To some extent, the development of IDCS was more dependent on external relationships than internal co-ordination between business units.

The development of IQPX-light however, was more influenced by the lack of strong internal relationships and coordination and involvement at both Alfa and Beta. IQPX-light changed the traditional machine and this implied a bigger change for the factory and the manufacturing/production process. The division of commercial and technical product responsibility also complicated matters. Arguably, the internal organisation was not able to meet the challenges in dealing and gaining insight into the demands of the customer and its end-customers since the commercial responsibilities were not included in the development. In that sense, Alfa was not able to mirror the external business network internally (cf. Ritter 2000). The technical department 'owned' the product and did not succeed

in persuading the commercial unit to participate. Instead they were focused on getting the machine ready. There was hence a lack of internal coordination and involvement between the technical, commercial and production aspects. In addition, this made Beta question Alfa's ability to support and service the machine once in place. Furthermore, the responsibilities between Alfa and its customer Beta were not clearly outlined, Alfa included features in the IQPX-light machine that used to have resided under the responsibility of Beta and this turned out to not be internally supported at Beta.

Comparing the projects as to the challenges when developing integrated solutions

In the case of IQPX-light, the links between the actors in the network were not clearly outlined or non-existent and in the end the project was put on hold. In the case of IDCS, different actors in the network were highly involved and the development of IDCS has so far proved to be successful. Both driving and impeding factors for the development of integrated solutions can be identified. As for driving factors, new legislation encouraged the development of new solutions and several parties in the market became interested. Arguably, the involvement of the research institute supported the importance and credibility of the project. In addition, the close cooperation with and early involvement of customers increased the knowledge about customer needs, which enhanced the knowledge about the operational and market needs of customers and facilitated the outline of new business agreements. Increased scope of supply facilitating system integration can also be achieved easier through cooperation with suppliers and partners, as was the case with the software development in the IDCS project. As for impeding factors, the lack of involvement and coordination between different internal units can hinder a joint technical and market approach. As also Ritter (2000) argues, capturing, cooping with and managing interconnected relationships requires information to flow inside the firm. In addition, in our study altering the existing production process proves to be more complicated than adding new products.

In the IDCS project, through cooperation and involvement, the actors in the network had a picture of the intended direction and outcome of the project. Håkansson and Ford (2002) argue that change should be achieved through the network, something that the IDCS project succeeded with during the development phase. Whether or not IDCS continues to be successful remains a question. The IQPX-light project was not able to achieve change through the network. Even though the people involved in the IQPX-light project were enthusiastic and strongly believed in the new concept, they did not manage to involve the commercial department and the credibility towards Beta was undermined. In Table 1, the comparison of the two projects is illustrated and summarised.

Table 1 Comparing the developments in the IDCS- and IQPX-light projects*

	IDCS	**IQPX-light**
Market demands	Alfa matched the customer need by offering optimisation of the dewatering process through the use of IDCS, decreasing the cost significantly.	Alfa and Beta developed a machine that was *eventually* going to offer customers 'intelligent' control over the process.
Customer involvement	One customer was involved in the development and testing of the product.	Alfa developed the product together with Beta; end-customers were not involved in the development.
Internal coordination and external partners	The project was run as a skunk project at the customer's plant until it achieved success. The software was developed in close interaction with the partner.	There was a lack of internal coordination between the commercial, technical and production aspects. In addition, the responsibilities between Alfa and Beta were not clearly outlined.
Top management support	Dedicated individuals from the beginning of the process and a highly supportive top management towards the end were crucial for the launch of IDCS – i.e., creating the venture.	Dedicated individuals never had support from the top management. Beta questioned Alfa's ability to support the product. Beta in turn did not have internal support for the project.
Development approach	Parallel development of physical product and business approach. Both technological and commercial aspects were discussed at an early stage.	More focus on getting the machine ready than on business approach.

* Using Edvardsson's (1997) framework for service development

Discussion and conclusions

The analysis shows that the network perspective is valid and useful for analysing the development of integrated solutions; challenges with the development are connected to the relationships and interactions between the actors in the network. In both our cases, actors in the business environment influenced the development of integrated solutions to a great extent. It appears to be important to not only focus on customer requirements but also on the requirements of the wider business network, in order to capture the entire process and offer performance related solutions. Customers but also research institutes, governmental agencies and end customers influence the development. One general conclusion is therefore that studies on integrated solutions would benefit from a network perspective, as this perspective provides important and useful insights. Firm should consider opportunities and challenges related to the business network. The ability to manage, use and exploit inter-organisational relationships is likely to increase the success of the development of integrated solutions (Ritter and Gemünden 2003). Or as Håkansson and Ford (2002, p. 135) explain, "a change in a [business] network always involves changes in both firms and relationships" and "a company seeking change is always dependent on the approval and actions of others to achieve the change..." In addition to the inter-firm network, the paper shows that it is of importance to address the intra-firm network, by developing an organisation in which technical research and development, service development, and marketing are addressed integrally. This requires not only commitment but also active involvement from top management.

The paper also shows that internal coordination is important for the credibility towards external relationships. In one of the projects, the disinterest of the people with commercial responsibility impeded the project. In the other project, when a corporate venture was created, people and business units were purposely left out as they were considered to be able to jeopardise the project. Although this could be a way to overcome internal resistance or increase focus (Oliva and Kallenberg 2003), it is likely that the venture will be integrated with the firm's other activities in a longer-term perspective, and, in that case the need for internal coordination might jeopardise the integrated solution. It remains to be seen if the business in the venture will be 'strong' enough to survive in, or influence or even change, a more traditional product-focused approach.

Close collaboration and involvement of (end-) customers is identified as a factor contributing to successful development of integrated solutions. Customer involvement is also proposed as a success factor in other studies of industrial service development (e.g. Mathyssens and Vandenbempt 1998; Oliva and Kallenberg 2003). In addition, resistance to change and poor information sharing across the network actors have been identified as critical problem areas (Coles, Harris and Dickson 2003). It is questionable however, whether or not the involvement of only one customer, as was the case in the IDCS-project, is advantageous in a long-term perspective. Although the involvement in the development convinced this specific customer, other customers that were not involved and that operate in different contexts and geographical markets are not necessarily equally easy to persuade. Also, it would be too costly and time consuming to involve every customer to the same extent. Long-term implications for actually *delivering* integrated solutions can therefore not be outlined based on our study.

Another limitation is our focus on a single firm, Alfa. Although some interviews have been carried out at Beta, we performed our analysis mainly from the perspective of Alfa. Including the perspective of the other actors in the business network will most probably uncover additional challenges and provide a more complete picture of the important issues. Our study has mainly showed that the business network and issues related to managing this business network internally provide opportunities as well as constraints when a firm is trying to develop integrated solutions.

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