Creating value through integrated product-service solutions: Integrating service and product development

Nicolette Lakemond
Linköpings universitet
Dept. of Management and Economics
SE-581 83 Linköping
Sweden
nicla@eki.liu.se

Thomas Magnusson
Linköpings universitet
Dept. of Management and Economics

Abstract

The paper reports on a case study of the interaction between Service and Product development at a manufacturer of power generation systems. Following a recent acquisition by a large multinational group, the company has undergone a thorough organizational restructuring and a strategic reorientation. Amongst others, this has resulted in a greater focus on the Service business, and increased organizational differentiation between Service and Product development. However, the increased differentiation seems to counteract the company's ambition to deliver integrated product-service solutions. The company management has responded to these problems by developing complementary engineering competencies within the Service division and complementary service competencies within the Product Development department. The case study shows that the formation of a separate Service unit may be useful to strengthen the identity of Service in the organization. But the study also shows that explicit measures are necessary to co-ordinate Service and Product development in a company that has an ambition to provide integrated solutions.

Keywords: Integrated solutions, Service development, Product development, Organization, Capital goods

Introduction

Many traditional manufacturing companies encounter a need to increasingly add value to their products by complementing services to their manufactured products. In general, there is a shift in emphasis from production to use, a shift that widens the scope of what a business offering is. Customers no longer only require a product; they also wish to purchase the associated service over an extended period of time. This shift implies consequences for the competences that are required and the internal organization of the supplier. Especially for traditional manufacturing companies with a strong product-focus, this shift implies many challenges (Ames 1970; Brown 2000; Mathieu 2001; Oliva and Kallenberg 2003; Wise and Baumgartner 1999).

Although an increasing number of firms are recognizing the need to integrate product and services in order to stay competitive, there are only a few studies describing the transition from being a product supplier to becoming a provider of integrated product-service solutions. Little is known about the challenges and problems connected to this. Furthermore, most studies on this subject are performed from a service marketing perspective. In the innovation and product development literature studies on this subject are rather sparse (Windahl et al 2004). In our study we intend to illustrate some of the challenges facing traditional product manufacturing companies in the transition for becoming suppliers of integrated product-service solutions. More specifically we focus on how the interplay between service and product development. This paper analyses the interplay between service and product development within an organization. Our analysis focuses on relations between the two organizational units, how they interact, how and to which extent service aspects are taken into account in (new) product development activities, and how field experiences are communicated back into the organization. On the basis of the current situation, we further discuss future challenges and business opportunities related to service and product development integration. The study makes a case disclosing some of the complex aspects connected to the transition and it may be used to abstract some general themes for further research.

After this introductory section, we draw on literature to elaborate some organizational aspects of the development of integrated product-service solutions. We further briefly describe our research methods. This is followed by a presentation of the company, and a description of its service division and product development department. Thereafter three sections outline different problems related to service and product development integration at the company; the first discuss how service aspects are considered in new product development activities, the second focus on the handling of defect reports and product modifications and the third provides a more general discussion about the effects of organizational separation between Service and Product development at the company. The concluding section presents our main findings and outlines some possible routes for further study.

Organizational aspects of integrated solutions

Integrating products and services provides several business opportunities, but does also include some major challenges. The shift in business offering alters the way in which products are designed, packaged and delivered. Suppliers of integrated product-service solutions must be able to deliver, manage and maintain their products as part of ongoing long-term service agreements (Ivory, Thwaites and Vaughan 2003). According to Davies (2003), the change process can be depicted as a value stream consisting of four different stages: Manufacture, Systems Integration, Operational Services and Service Provision. Additional services, such as business consulting and financial service, may support these four main value-adding stages. The first two stages are related to upstream design and production of physical hardware, the product, whereas the two latter are related to downstream maintenance and operation of the product, i.e. to services. Firms may either start from a base in manufacturing, integrating forward by adding capabilities in Operational Services and Service Provision, or they may start from a base in services and integrate backwards by adding capabilities in manufacturing. In either case though, capabilities in systems integration is essential for a move towards integrated solutions. This thesis is also supported by Shepherd and Ahmed (2000). Their study within the computer and electronic industry sector showed that the development of “solutions innovations”, comprising hardware and software as well as services, rests on technical competence, integration competence and market/business competence. Whereas the traditional product-focused companies tended to rest heavily on technical competence, the “solutions-focused” companies

needed a more balanced competence profile, with more emphasis on integration and market/business competence.

One important challenge in the transition towards integrated solutions is to manage the interplay between service development and product/technology development effectively. On the one hand, new technology and product generations may provide opportunities for new types of offerings. For example, new products may include control systems that enable enhanced 'serviceability' and optimised performance though continuous monitoring. Another example is the development of upgrade packages that may be offered as retrofits to equipment that currently is in operation. At the same time, these features provide an opportunity to include a process responsibility into the product offering. On the other hand, new market offerings, integrating product and service solutions, require the development of a different type of products and features. Ivory, Thwaites and Vaughan (2003) claim that as in the past suppliers of capital goods earned their revenues from selling their equipment, nowadays equipment may only account as little as 10% in the total business offering. Therefore service aspects, like costs associated with performing maintenance and long-term reliability, need to be taken into account in the development process alongside with the identification of business opportunities. This requires a major shift in focus, and this shift is not always easy to establish.

According to Oliva and Kallenberg (2003), creating a separate organization to handle the service offering is necessary to effectively manage the transition from a manufacturing-oriented to a service-oriented company. This is because information systems make the service business more transparent and because the use of a dedicated sales-force and specialised service technicians makes it possible to break with traditional "product-centric" cultures. Thus, isolating the Service organization from product development and manufacturing operations is claimed to be a critical success factor for the transition from a product-centric into a service-oriented company. This recommendation reflects a classic contingency theory proposition that companies operating in diverse and dynamic environments should aim for a higher degree of differentiation between organizational units (Lawrence and Lorsch, 1967). However, it fails to recognize the need for additional integrative measures. Following Lawrence and Lorsch's contingency theory proposition, in order to be effective, a greater organizational differentiation must be followed by a greater emphasis on organizational integration. Isolating the service from product development and manufacturing is likely to support the development of specific organizational routines and thus result in a more focused and effective service organization. But to what extent will it support the development of integrated product-service solutions?

Research methods

The research reported in this paper is part of a research program that investigates technology and business development for integrated solutions. Our empirical data is derived from a case study at a manufacturing firm, which currently is in a process of strategic reorientation towards integrated solutions. The case study approach was used because case studies are particularly useful for studying contemporary events and for investigating "how" and "why" questions (Yin, 1984). Case study research generally relies on theoretical and not statistical sampling; cases are chosen for their specific merits. A prime selection criterion is how useful the particular cases are for replication or extension of emergent theories (Eisenhardt, 1989). In our case, we saw a possibility to observe and enfold the transition from being a product supplier to becoming a provider of integrated product-service solutions in real-time. Thus our ambition has been to use the research findings to elaborate on organizational challenges that other firms in similar situations may face.

The case study builds on a total of 12 semi-structured interviews with key informants from the product development department and the service division at a manufacturer of power generation systems. All interviews were conducted in October and November 2004. The informants were selected in discussions with company representatives with the aim of providing a comprehensive picture of problems in the interplay between Service and Product development. They hold different positions, such as Service Product Manager, Chief Engineer, Service Support Manager, Product Support Manager, Product Manager and Director of Service Business and Product development. An interview typically lasted about 1.5 hours and was recorded on tape and transcribed.

The analysis entailed a search for common themes, i.e. aspects of the interplay between service and product development that have been mentioned by several informants and that have been pointed out

as particularly important or problematic. Whenever possible, we have had an ambition to elaborate these aspects using both service and product development perspectives. The case study findings were summarized in a report, i.e. a “case description” (Yin, 1994), which later was presented to a group of five managers representing both service and product development at the company. This exercise was useful to validate the empirical data and, since there were ample opportunities to discuss various findings and hypotheses emerging from the study, it also resulted in a deeper understanding of the case. During the analysis, case study findings were also contrasted with theoretical prepositions, which were formulated on the basis of a literature study.

Our analysis is performed from a single company perspective. The transition process to integrated solutions and resulting changes and challenges a company faces, however, may reflect the altering demands in the market as well as changed internal circumstances. Our case covers a description of the internal organization and external competitive and market situation. The description and analysis of the interplay between Service and Product Development therefore reflects the internal company response to internal and external circumstances. From a network perspective it may be argued however, that in order to understand the interplay between Service and Product Development a wider and more thorough business network analysis must be performed (Håkansson and Ford, 2002). In this paper we have chosen to demonstrate the intraorganizational challenges a company may face when changing from a product to an integrated solution provider in detail. Although these challenges may be induced by internal circumstances and external events and actors we believe that this intraorganizational focus may be helpful in identifying new possible routes for further study.

The company

The company, which is located in Sweden, has a long history in developing gas turbines and steam turbines for power generation and industrial applications. Configuration and installation of complete power plants are also vital part of the business, as well as service and maintenance. They claim to offer integrated turnkey solutions as well as complete power generation systems. Service concepts are focused on life-cycle costs and they are developed jointly with customers. These concepts mainly serve to minimize life-cycle costs and increase the operating economy of the power plant. Current conditions of a plant and its components may be determined using on-line diagnostics systems for monitoring vibration and fatigue. The model program consists of four different gas turbines, which all are in the medium size range (15–50 MW). During 2003, a large multinational group acquired the company, an acquisition that also included a business in smaller size gas turbines. As a result, the company is now part of the business segment “Power generation–industrial applications”, within the group. This business segment, as well as the complete group, has its headquarters in Germany.

Previously the company was operating relatively independently, with little involvement from group management. However, the new owner has signalled potential gains from a higher degree of integration between the operations in Sweden and operations at other companies within the power generation division. Thus a thorough restructuring of the organization has been initiated. The new company organization is divided into five different divisions: Service, Industrial Steam Turbines, Industrial Gas Turbines, Power Plants and Oil & Gas. Internally, these divisions are often referred to as “pipes” or “silos”, indicating a strict division of responsibility and authority. Industrial Gas Turbines is the largest division, as it incorporates product and business development, as well as marketing and sales, manufacturing, packaging and project management (each order is carried out in a specific order project). The Industrial Steam Turbine division has a similar responsibility for steam turbines, but the Steam Turbine division is significantly smaller.

A delivery and installation of a new gas turbine often comprises some kind of agreement on scheduled maintenance, repair, and possibly performance monitoring, upgrading etc. of installed products. The Service division is responsible for servicing and maintaining machines in the field, as well as for marketing and sales of services. Service takes over responsibility for a machine after the guarantee period is ended, a period which generally lasts two years. The Power Plants and Oil & Gas divisions develop and sell solutions, which are specifically adapted to the needs of electric utilities and independent power producers, and to the needs of oil and gas industries respectively. Thus these divisions function as internal customers, which purchase equipment from the Industrial Steam Turbine and Industrial Gas Turbine divisions. In recent years the oil and gas industry segment has grown in importance, and this has justified the establishment of a specific unit that serves this market. Oil and

gas industries may for example use gas turbines to drive compressors, which are used to pressurize pipelines.

The new organizational structure of the company is similar to the structure of other operating units within the business segment. Consequently, any line manager at the company has a corresponding colleague, who holds a similar position in (for instance) U.K., where smaller sized gas turbines are manufactured. The top managers of the five divisions report economic results directly to their division managers at the Power generation segment head quarters in Germany. This is a major difference from the previous organization, in which managers within the organizational sub-units reported to the local CEO. This means that the identity of the company as being a relatively independent and self-contained company has been weakened through the recent restructuring of the organization, whereas the group and divisional identity has been strengthened. Since the restructuring resulted in Service becoming a separate division, the identity of Service has also become stronger. Furthermore, the new group management has signalled a greater strategic emphasis on after-market and services. In the corporate strategy, the Service division is described as the "EBIT machine", whereas the product divisions (Gas turbines and Steam turbines) are described as the "Competence machine" and the Systems/Solutions divisions (Power plants and Oil & Gas) are described as the "Growth machine".

The Service division and the competitive situation

The Service division at the company is divided into four different teams that cover different geographical regions. A number of support units complement these teams. Among them is a newly established R&D/Engineering unit, comprising of about six engineers. This unit, which currently is employing personnel, is going to assist the Service division in technical problem solving, as well as in the development of new service and maintenance concepts, product upgrades and retrofits etc. For example, new service and maintenance concepts may be developed as a result of recent developments in condition monitoring systems (CMS), which enable continuous monitoring and control of operating gas turbines. A Business and Product development unit within the Service division is responsible for initiating and managing such development initiatives.

Only a handful companies produce medium size industrial gas turbines. These companies operate on a worldwide market and they tend to concentrate their service operations to their own fleet of machines. One could say that there is a "gentlemen's agreement" among gas turbine manufacturers that they only service their own machines and let other manufacturers take care of their machines. Furthermore, company's fleet of installed medium and large size gas turbines is relatively small and it has been difficult for independent competitors to justify investments in developing the specific know-how required for being able to service and maintain these machines. Therefore competitors have not yet entered this market. Altogether this means that the company hitherto has controlled about 95% of the market for service of their gas turbines. The favourable market situation has meant that service and maintenance has developed into a very profitable part of the business. The situation is somewhat different for producers of smaller gas turbines, because these machines are produced in larger quantities, making the service market more attractive to enter and resulting in an intense competition on the market for service and maintenance.

In the early 1990s, the Service organization was focused on ad hoc service, basically offering repair and spare parts in the event of machine failure. But during the 1990s, particularly some Dutch independent power producers initiated a gradual shift when they started to consider service and maintenance already at the point of sale. These customers, compared to many of the traditional customers, did not possess the specific competencies that traditional electric utilities had and they were not willing to take risks. Rather they covered these risks with extensive service contracts. These new demands resulted in a focus on the development of maintenance programs and standard service contracts.

The Service volume has increased rapidly during the last 10 years. There has been a five-fold increase in aftermarket sales for the Service division and the Service demand on the installed base are expected to double in the coming ten years. Taking into account the recent increases in sales of new gas turbines, the expected volume will increase even more. The oil and gas industry has developed into an important market segment for new gas turbines and this implies additional challenges for service concepts. Customers in this market segment are very focused on availability

and reliability. Instead of offering service on site these customers rather demand that the machines are served 'off location' while offering the customer a new or replacement machine in order to minimize downtime. Although service concepts have not yet been adjusted to this new type of customers, oil and gas customers are an important opportunity from a service perspective, as these customers are willing to pay for service solutions. Altogether, this points at a three to five-fold growth of the aftermarket and service volumes during the coming 10 years and at a nearby exponential growth of the market since the early 1990s. In general, this may look as a very positive scenario for the company. But the down side is that as the service market expands, it becomes more attractive for competitors to enter. Thus it is likely that Service will face more intensified pressure from competition in the future, potentially resulting in reduced prices and margins. This illustrates a need to further differentiate the service offerings, to reduce costs and to develop new and competitive service concepts.

Product development: organization and process

Industrial gas turbines are technologically complex machines; product and technology development is a core activity. To be able to develop gas turbines, engineering expertise in areas such as material technology, fluid dynamics, combustion technology, thermodynamics, and static and dynamic stress analysis is vital. Individual gas turbine models are present on the market for several decades and a machine may also stay in operation for several decades. Projects directed at the development of completely new machines are rare; often development projects refer to upgrades of existing models, where recent technological advances are implemented in order to improve the performance of the machine.

During the last ten years, two major product development projects have been executed by the company's development organization. One of these is a development of a completely new gas turbine and the other one is an extensive upgrade of an existing smaller machine. Development projects are also directed at minor modifications, which may be initiated by malfunctions, defects or improvement possibilities on existing machines. Additionally, there are often some specific adaptations associated with each order project, on request of the particular customer. Another possibility is the development of Service products, i.e. products that may be delivered to the customer after the initial commissioning of the machine. Normally the Service division initiates the development of such products.

The Product development department, which is a part of the Industrial Gas Turbine division, is divided into six different organizational units: Future Technology, Core components, Package, Product Management, Engineering support, and Chief Engineers Office. Future Technology is a small unit, presently employing four engineers who monitor pre-commercial technology developments and advancements that are made, e.g. at universities and research laboratories. The Engineering Support units offer specialized support in technological areas such as Materials, Component Testing, Instrumentation & Emissions, and Vibration & Acoustics. The Core components unit is the largest of these units, employing about 90 engineers, and it comprises the bulk of the company's engineering expertise. An industrial gas turbine basically consists of three sections or "core components": a Compressor/Rotor, a Combustor and a Turbine, and the engineers within Core components are grouped according to these sections. Product development projects thus mainly enlist personnel from this organizational unit. The Chief Engineers Office within the Product development department is responsible for assigning project managers and establishing review groups for product development projects.

A stage-gate process for product development projects has been developed on the basis of experiences from recently executed major development projects. It is now being implemented in the organization; line managers and project managers within the product development department have received information and undergone some educational activities. The main stages in this process are Project initiation, Design, Sales preparation, Design implementation and Validation. These stages are also divided into sub-stages. At the end of each sub-stage there is a review-point, at which a group of specialists review the project results according to pre-defined schemes, which includes issues such as functionality, manufacturability, serviceability etc. In total, the product development process comprises ten sub-stages with review-points at the end of each stage, and six decision gates that every project has to pass.

The Product management unit holds a key function within the Product development department. This unit entails product teams who control different issues associated with the four gas turbine models. For each of these models, there is a small team that includes a product manager, a product development manager and a product support manager. The product manager has an overall responsibility for the product. The product development manager oversees and coordinates ongoing development projects related to the specific gas turbine model. Serious faults and problems, which are detected on machines in the field, are reported directly to the product support manager, who decides on further measures depending on the seriousness of the problem and how urgent it is to take corrective action. Thus the product support manager has a central role to follow up field experiences from installation, operation, service and maintenance. The Product management unit also entails a Service support team that employs 12 engineers. This group serves as a prime contact point for service personnel who need to get in touch with development engineers, thus functioning as a coordinator between the Service division and the Product development department. The Service support team also administers fault reports and modification orders on machines in the field. Present in the Product management units is also a Product Design group, which controls product standards for the gas turbine models. Any deviations from these standards have to pass through this group. Such alterations may be initiated in response to customer or order specific demands. The Product development department also entails a "Package" unit, which fills a similar function as a product team within the product management unit, but for auxiliary equipment. Thus the Package unit is responsible for systems such as fuel, lubrication and control systems, which often are similar for the different gas turbine models.

Service aspects in new product development

Although there is a growing consciousness of the increasing importance of service sales and the need to develop new service concepts, even within the company's service division, opinions differ on how to meet this challenge. Within the product development department there is still a very strong focus on functionality and performance parameters such as efficiency and investment cost. But there has also been an increased focus on availability and this means that it is important to improve serviceability in order to reduce downtime for service. There are, however, differing opinions regarding the priority of service aspects in product development. A manager at the service department asserts that although availability and short downtimes may be considered as important issues in the product specification, it does not necessarily affect the product design accordingly:

> "I feel that if they would develop a new turbine today, serviceability would be very low down on the list (of priorities). I have that feeling because suddenly they (the Product development department) may write a specification for a machine, stating that it should deliver that much power, that it should be environmentally friendly, and that it should be possible to exchange the machine in 24 hours. But if you write like that, you do not take the design into consideration. In 24 hours the machine has to cool down, and you have to replace it and take it into operation again. That is a large procedure to manage in 24 hours (…). After that they would design a machine that is similar to other machines in our program, and it takes three days to exchange those machines. In that case I would say that service aspects have not been properly considered in the design."

However, even though the change process may be perceived as slow, it seems as if service is getting more and more influence on product development. Service aspects have been incorporated as review checkpoints in development process instructions, managers representing service have participated in development project reviews and engineers from service have been invited to participate in major product development projects. A manager in the Product Management unit refers to his experiences from a recently completed major development project:

> "Service was invited to participate in the project at an early stage. They had a man in the project almost from the start, I think. It was one of the first disciplines outside the core team that was engaged in the project. (…) He (the project manager) wrote project assignments to Service (…) and I think Service responded very well. They assigned their own steering committee, which included the service manager, the installation manager and the service engineer who participated in the project."

The manager further asserts that the incorporation of a service engineer as an observant within the project and having a service steering committee reviewing the project meant that service and maintenance aspects continuously were considered. He further claims that the early incorporation of Service in the project meant that the serviceability of the final product clearly was better than it would have been without these measures. Specifically, he points out the modular design, which makes it easier to dismantle the gas turbine and the location of the inspection hatches, which allows for easy inspection of the machine, as prime results of this collaboration.

While an incorporation of service aspects in product development has been initiated, it is likely that a more intensified interaction will be needed to capture future business opportunities. A manager at the product development department points out the possibilities associated with recent developments in Condition monitoring systems as an imperative to further strengthen the product development-service interaction. Condition monitoring systems may be used to control parameters such as the load on the machine and the number of starts and stops. These parameters, which affect the tear on different parts of the machine, can be used to calculate so called “equivalent operating hours”, which in turn, may be used to tailor service and maintenance according to the specific operating conditions of the individual machine, so called “Condition based maintenance”. But this assumes that product development has detailed and accurate models that show the relationships between operating conditions and maintenance requirements. According to a product development manager, the organization has not reached this position yet, and he further claims that a corresponding work has to be done at the Service division, where it is necessary to develop and introduce new service concepts. Most likely, service contracts that enable the organization to profit from condition based maintenance will have to rely on long-term service agreements, in which the company takes an overall responsibility for service and maintenance at fixed prices.

Handling defect reports and modification orders

One of the most important issues that have to be handled effectively between Service and Product development is defect reports and modification orders. This is particularly important for newly developed machines and for machines that are taken into operation in new kinds of applications. Here it is important to give feedback to product development, since early operational experiences may be used to adjust and improve the design. Everybody in the company may write a defect report if a technical defect or an improvement possibility is discovered. Service personnel have an important role in this process since they have daily field contacts. Service personnel often encounter technical problems, which they need to discuss with engineers at the Product development department. For a service engineer who identifies a technical problem, there are a two alternative ways to approach Product development. He may either contact the Product Support Manager who is responsible for the machine in question directly, or he may contact the Service Support team. One of the reasons that this structure has been established is to avoid that service personnel take direct informal contacts with engineering specialists within the product development department, something that may be very disturbing for the engineers. But even though this formalized procedure has been more emphasized, there seems to be a need to further clarify and promote the formal structure and information routes between Product development and Service in the handling of defects.

The response and attention devoted to a defect report depends on the kind of problem reported and its potential consequences. Often the product support manager initiates some kind of investigation, which may result in a development project in order to solve the problem. In this project a technical solution is developed, which is described in a modification order. The modification order may necessitate design changes and adjustments of the product standard, as well as modifications of existing machines in the field. If the modification order should result in adaptations of existing machines, the service division is responsible for implementing these changes. Amongst others, this entails pricing of the modification, and information and promotion activities directed at potential customers. However, a manager in charge of a component team within the Core Components unit claims that the feedback of modification orders back to the service division does not work properly:

> “If we have had a problem and we have solved it, it would be nice if the modifications were introduced on the machines that we already have sold. The customer should be able to buy it at an affordable price, or even get it as a kind of goodwill. We could profit from that as well, since we sell more turbines if they have good operating statistics.

> They will not be able to present such statistics unless this procedure works, and I think that it does not really work today. Many modifications get lost somewhere along the way."

From a product development perspective, the Service division is perceived as somewhat disparate. There has not been a natural contact point for communicating modification orders back to Service. This is a prime reason why an R&D/Engineering unit recently has been established within the Service division. The idea is that this unit can become a central speaking partner for the Product development department and distribute modification orders to appropriate personnel within the Service division.

Organizational separation of service and product development

Although informal contacts still exist, the relocation of Service and Product development into different divisions, reporting their economic results separately to the corporate headquarters, has resulted in a greater distance between Service and Product development and has prompted increased formalization of the interrelationships. It has become more important to be clear about responsibilities and to keep track of internal costs. A Service Director explains:

> "When we first saw how the organization was supposed to look like, it seemed like a step backwards for us. Previously we belonged to the same organization, we were part of the gas turbine division and within Service we thought that was great. Seen from a customer perspective, we represented a single entity. So, separating the Service business was a step backwards. Obviously, you do not feel this on a daily basis because you still talk to the same people. But when it comes down to money, the internal arguments tend to start."

Within the company, there are some concerns that the separation of Service from Product development may cause that each unit starts focusing too much on their own business, possibly making the complete business offering to the final customer sub optimal. Additionally, there are concerns that the separation will obstruct the flow of information and make communication between Service and Product development less efficient. Yet others claim that the new organizational structure constitutes an imperative to further develop the interrelations between Product development and Service and make them more professional.

Traditionally, Service has had a relatively low status within the organization. The tasks accomplished by Service have seemed relatively simple compared to the advanced engineering work performed at the product development department. Though, the internal image of Service has slowly improved during the last years, as it has become obvious that the entire organization gains from the positive economic results that Service has delivered. Furthermore, the recent restructuring and strategic reorientation of the organization, as well as the technical competence that currently is being built within the Service division, has signalled that Service apart from being a profit maker also may develop into a centre of valuable knowledge. As a result, Service may gain a higher status within the organization and consequently more influence in product development. A raised technological competence within the Service division as well as more clarity in its organizational interface to the Product development department are held as key issues among for an effective and efficient interaction between Service and Product development. In this respect, high hopes are attached to the newly established R&D/Engineering unit within the Service division.

The new R&D/Engineering unit is supposed to provide technical support to the Service division, assisting Service personnel in technical problem solving and being active in the development of new Service products. This unit should further explore the possibilities of condition monitoring and condition based maintenance and provides input to product development on how the new technical possibilities should be exploited, something that will require in depth knowledge on how machines are affected by different operating conditions. The R&D/Engineering unit may also take part in product development projects and the unit also holds a key function in receiving modification orders and redistributing them to the affected personnel within the Service division. The final responsibility has not been fully clarified yet but, most likely, coping with such a broad array of tasks will be a challenge for this rather small organizational unit. For this reason, it seems important to make a clear distinction between the responsibilities of the R&D/Engineering unit and the Product development department; which tasks

should be dealt with within the Service division and which tasks should be assigned to Product development? In order to justify the establishment of the R&D/Engineering unit within the Service division, it seems important to assign some qualified engineering tasks to this unit. In turn, this is a critical step to strengthen the engineering expertise within the Service and to raise the internal status of Service within the organization. But this must be balanced against the risk of developing parallel engineering competencies in Service and Product development and blurring the division of responsibilities between the two organizational units.

Conclusion

Following the recent acquisition, the company has undergone a thorough restructuring and strategic reorientation. The ambition has been to integrate the company with the larger corporate structure. This means that new organizational units and boundaries have been created. One of the effects of the restructuring is that Service and Product development now belong to two different divisions within the corporate structure. However recent business strategies emphasizing the application of condition monitoring systems, condition based maintenance, long term service contracts, upgrading of existing machines and integrated solutions suggest that effective and efficient interaction between Service and Product development is becoming even more important in the future. Several measures have also been taken by management in order to support Service/Product development interaction in the new organization. A service support unit has been formed within the Product development department and an R&D/Engineering unit has been established within the Service division and these units have been given central roles. Much effort has also been spent in order to clarify roles, responsibilities and routines, something that has increased the formalization of the Service/Product development interaction.

According to the formal development process, serviceability is being considered at project reviews and Service is also invited to participate in major development projects. The desired result is that products should be consciously designed to make service and maintenance easier. Another aim is to raise the awareness among engineers and project managers at the Product development department about how product design decisions influences service costs. But further steps may be taken and this constitutes one of the most important future challenges for the Service division. In order to benefit from condition monitoring and condition-based maintenance, the machines should be designed to fit with new service and maintenance concepts. This however requires that service and a maintenance program are designed simultaneously with the product, something that requires that Service takes a more active part in, and becomes more of an integrated part of, product development projects, right from the start. Our analysis points at a need to clarify the Service organization vis-à-vis the Product development department; this seems especially important in order to improve the organization's ability to handle modification orders. It also points at a need to further promote product development structures and processes for the Service division, showing that Service can and should influence the product design. Additionally, Service needs to gain a higher status within Product development. In order to make this happen it seems crucial to further define and enhance the engineering competence within the Service division and to clarify which role Service should have in future product development activities.

On the basis of a case study at a firm, which currently is going through a transition from being a product-focused manufacturer to a supplier of integrated product-service solutions, this paper has pointed at some general themes, which may be of interest for further research. Our analysis confirms the thesis that isolating service operations from other businesses may be useful as a means for traditionally product-focused firms to strengthen their focus on Service operations (Oliva and Kallenberg 2003). Increased organizational differentiation may serve a purpose to strengthen the service business and push the service organization to become more effective and efficient. But our findings also indicate that separating Service from Product development implies that additional measures are required to co-ordinate these organizational units, especially if the company has an ambition to deliver integrated product-service solutions. For a supplier of integrated solutions, systems integration constitutes a core capability (Shepherd and Ahmed, 2000; Davies, 2003). This capability rests both on a broad systems engineering expertise and on organizational structures that support interaction between different disciplines and departments. Thus, for a supplier of integrated solutions, the recommendation to create a separate organization to handle the service offering is incomplete. There will be a need to complement the increased specialization and organizational differentiation with

additional structures to achieve a sufficient level of integration. Based on our case study findings we have further elaborated on how the development of complementary competencies, i.e. Service competencies within the Product development department and vice versa, may be used as a means to make interaction between organizational units more efficient. Additional case studies in different empirical settings will show if and to what extent this measure can be presented as a general recommendation.

References

Ames, Charles B. (1970), "Trapping vs. substance in industrial marketing", *Harvard Business Review*, 48 (4), 93-102.

Brown, Stephen W. (2000), "The move towards solutions providers: Goods-dominated companies find their core competencies include service offerings", *Marketing Management*, 9 (1), 10-11.

Davies, Andrew (2003), "Integrated solutions: The changing business of systems integration," in *The business of systems integration*, Andrea Prencipe et al., eds., Oxford: Oxford University press, 333-368

Eisenhardt, Kathleen M. (1989), "Building theories from case study research", *Academy of Management Review*, 14 (4), 532–550

Håkansson, Håkan and David Ford (2002), "How should companies interact in business networks?", *Journal of Business Research*, 55 (February), 133-9.

Ivory, Chris J., Alfred T. Thwaites and Roger Vaughan (2003), "Shifting the goal posts for design management in capital goods projects: 'Design for maintainability'", *R&D Management*, 33 (5), 527-538.

Lawrence, Paul R. & Lorsch, Jay W. (1967), *Organization and environment: managing differentiation and integration*. Boston, Massachusetts: Harvard University

Mathieu, Valérie (2001), "Service strategies within the manufacturing sector: benefits, costs and partnership", *International Journal of Service Industry Management*, 12 (5), 451-475.

Oliva, Rogelio and Robert Kallenberg (2003), "Managing the transition from products to services", *International Journal of Service Industry Management*, 14 (2), 160-172.

Shepherd, Charles and Pervaiz K. Ahmed (2000), "From product innovation to solutions innovation: a new paradigm for competitive advantage", *European Journal of Innovation Management*, 3 (2), 100-106

Windahl, Charlotta, Pierre Andersson, Christian Berggren and Camilla Nehler (2004), "Manufacturing firms and integrated solutions: Characteristics and implications", *European Journal of Innovation Management*, 7 (3), 218-228.

Wise, Richard and Peter Baumgartner (1999), "Go downstream: The new profit imperative in manufacturing", *Harvard Business Review*, September-October, 133-141.

Yin, Robert K. (1994), *Case study research: design and methods*. Thousand Oaks, California: Sage Publications