

A SERVICE PERSPECTIVE ON PRODUCT DEVELOPMENT – TOWARDS FUNCTIONAL PRODUCTS

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ABSTRACT

Functional products are understood as a combination of hardware, software and services. Based on interviews with employees in manufacturing firms the notion of functional product development is described. The purpose has been to explore the differences between a service perspective and a core product perspective and highlight changes in the management of product development processes that are motivated by the notion of functional products. Exploring the differences between the two perspectives has identified a gap of how the product is viewed at the business level and technical development levels. The integration of services into the hardware development process in the form of a customised product or product life cycle has been highlighted. Internal and external communication about needs has been identified as useful.

INTRODUCTION

Manufacturing companies have started to move from offering the core physical artefact to functions that the physical product provides. One objective for manufacturing companies is to develop physical artefacts that support activities in the customers' processes. For example, ABB Robotics has focused on the design, manufacture, sale and delivery of industrial robots. Now the vision is to provide enhanced productivity and systems for rationalisation (Echeverri and Edvardsson, 2002). Consequently, intangible aspects in the form of services increase in offerings from manufacturing companies, i.e. a total service offer (Ravald and Grönroos, 1996; Grönroos, 2000).

Product development literature (Pugh, 1991; Ulrich and Eppinger, 1995; Roozenburg and Eekels, 1995) focuses traditionally on the development of physical artefacts whereas services are seen as add-ons. Hence, services as such are not a new to manufacturing companies though they are treated separately from hardware and are present in aftermarket activities. From the standpoint of service literature this can be described as a core product perspective (Grönroos, 2000). Another perspective is the service perspective, where the physical artefact is one of several elements in strategic relationships (Grönroos, 2000). According to Normann (2001), some manufacturing companies have gradually adapted their business foundation to a service perspective, while a majority have broadened the core product perspective to encompass services as aftermarket activities. The word 'aftermarket' indicates that physical artefacts are central for the company and that services are seen as complementary or add-ons to the core solution (Normann, 2001).

However, service literature focuses on development of services, whose differences compared to physical goods are apparent (Edvardsson, Johnson, Gustafsson and Strandvik, 2000). One difference is, "*Whereas goods are manufactured, services are performed*" (Berry, 2002, p.65). Service performance is a process where the customer is present and contributes to the outcome. Accordingly, the physical artefact is "...*just one element in the total, ongoing service offering. For a manufacturer, the physical*

good is a core element of the service offering, of course, because it is a prerequisite for a successful offering” (Grönroos, 1996, p. 9).

In a business-to-business environment, Swedish manufacturing companies have identified increased service contents in their offerings as a means to increase their competitive strength (Fransson, 2004). In this context, the notion of functional products has gained interest among researchers and industry interested in the product development knowledge area. Functional products as a concept are not new in the academic world, and are also of interest for food and process industries.

Nevertheless, in the research area of product development, functional products have been defined as a combination of hardware, software and services (Brännström, Elfström and Thompson, 2001). In Alonso-Rasgado, Thompson and Elfström (2004) functional products are described as “... *comprising hardware combined with a service support system*” (p.515). The service support system is defined as all service support required in keeping the hardware operable. Service support systems are described as much more than the maintenance of the physical artefact, e.g. decision-making, operations planning, remanufacture and education (Alonso-Rasgado et. al, 2004).

Similarities between the creation and evolution of physical products and services have been identified by Bitran and Pedrosa (1998). Fransson (2004) has recognised that there are differences between the *industry and technologist view* versus the *service research and service perspective*, concluding that more research is needed. Krishnan and Ulrich (2001) compared competing paradigms of product development in academic communities, i.e. marketing, organisations, engineering design and operations management. How products are viewed differ between the perspectives. Marketing regards a product as “...*a bundle of attributes*”, while organisation considers it to be “... *an artefact resulting from an organizational process*”. Engineering design sees the product as “... *a complex assembly of interacting components*”, and finally, operations management, defines a product as “...*a sequence of development and/or production steps*” (Krishnan and Ulrich, 2001, p.3). These divergent views also insist on different performance metrics, decision variables and success factors (Krishnan and Ulrich, 2001).

Still, the differences between a core product perspective and a service perspective have obtained limited attention from the product development area. To understand the changes needed for functional product development, distinguishing some characteristics between these two perspectives is necessary. Product development emphasises trade-offs, i.e. optimisation, and standardisation, while the service strand emphasise the customer point of view and interaction, implying that customers should be handled individually. Combining these two perspectives could be seen as a clash resulting in a confused situation, while understanding their differences makes it possible to manage a transformation from a focus on the core solution, i.e. physical artefacts, to a focus on functions. The challenge is that this transformation urges new methods and new ways of thinking.

Thus, the purpose of this study is to explore the differences between a service perspective and a core product perspective and illuminate what changes in the management of product development processes are motivated by the notion of functional products.

The study presented in this paper focuses on the hardware and service parts in product development and, especially, the conceptual development phase, on an overview level of abstraction. The study is conducted in industrial manufacturing companies in a business-to-business environment and is limited to that area of

application. In a traditional business-to-business situation, the roles customer and supplier exist. In this new collaborative situation all involved are best off as partners (Grönroos, 1996), not as competitors. Therefore, customer and supplier in this paper refer to the interacting partners in a business relationship and not a hierarchic order. A underpinning thought for the study is that the perspective and view on the concept product, held by those people who are engaged in the product development process, have an impact on the process as such as well as the outcome of the process.

Disposition of the paper

The next section presents the methodology used in this study. After this, characteristics of services are presented, as well as the view on the concept products. The service perspective and the core product perspective are also outlined, followed by a presentation of the notion of functional products as presented in literature. Next is the studied case described, i.e. the notion of functional products as talked about by the interviewees. In the discussion section, the theoretical framework is applied to issues found in the empirical study. Finally, the paper ends with conclusions, managerial implications and suggestions for further research.

METHODOLOGY

The generated and gathered data composed of both primary and secondary sources. Primary sources were interviews conducted with employees of Swedish manufacturing companies, i.e. the empirical base yielding a description of the notion of functional products. Secondary sources were literature, such as books, articles and dissertations, i.e. the theoretical base used as a framework for the study.

The choice of the theoretical framework for this study not only emerged from previous studies defining functional products as a combination of hardware, software and services, but also from empirical results highlighting both service and hardware issues. The empirical base consisted of three Swedish manufacturing companies engaged in industrial product development.

Due to the study's explorative nature, qualitative data were of interest. Qualitative data is based on interpretations, understandings or experiences (Mason, 1996). Qualities or a combination of qualities are searched for, the search for qualitative data is useful in studies of processes where the research phases take place concurrently (Gummesson, 2000). Interest in development processes of functional products is evolving in both academia and industry, where theory and practice take place concurrently. Qualitative data usually appears in the form of words rather than numbers (Miles and Huberman, 1994). Accordingly, talking with people makes sense.

The interviews conducted in this study were a mix of group interviews and individual interviews, i.e. four group interviews and two individual interviews. A total of 19 persons from different departments at the companies were interviewed. The interviews lasted from 1.5 to 3 hours; the longer for one of the group interviews. The interviews were semi-structured (Mason, 1996), i.e. the informants could freely formulate their answers, but not freely choose the issues to talk about. Instead of following a predefined interview guide, a set of themes were in focus. The interviews focused on the themes products, ideas about functional products, and product development. The interviews attempted to uncover interpretations, experiences and understandings of the interviewees regarding these issues. The approach in the interviews has been to start a dialogue accordingly; the interviewees were encouraged to expound their views.

Qualitative data in fairly open-ended interviews is interpreted along the way. Data are summarised and reflected upon during the conversations with interviewees and the choice of relevant data and interpretations are integrated. The generated empirical data has been read in a non-cross sectional way, a practice guided by a search for the particular and the holistic (Mason, 1996). The non-cross sectional indexing starts by simply reading the material and looking for particular ideas, similarities and differences, in this study similarities and differences about the notion of functional products. This data processing method is also regarded as a cyclic process, where the material is read several times. The first analysis step yielded an overall description of the notion of functional product development that is presented in this paper.

THEORETICAL FRAMEWORK

Services and the two perspectives based mainly on service literature will now be outlined. Products and product development based on literature from the traditional product development area are also presented. The theoretical section ends with a presentation of functional sales and functional products.

Services

How to define services has been discussed from the 1960s to the 1980s, and though the debate has petered out though no clear definition has been agreed upon. Nevertheless, it is still argued that the logic of services is different from producing hardware (Edvardsson et.al, 2000) and that services are produced and consumed otherwise than hardware (Gummesson, 2002). A comparison of differences between the two concepts seems useful. Frequently mentioned differences between services and physical goods are summarised in Grönroos (2000), some of which are presented in Table 1.

Physical goods	Services
Tangible	Intangible
Production and distribution separated from consumption	Production, distribution and consumption simultaneous processes
A thing	An activity or process
Core value produced in factory	Core value produced in interactions
Transfer of ownership	No transfer of ownership

Table 1. Differences between physical goods and services (Grönroos, 2000, p.47)

“Service research has traditionally focused consumer markets” (Bovik, 2004, p.4). Accordingly, the term consumption is used, but not by manufacturing firms in a business-to-business environment. However, terms like production and delivery are derived from manufacturing and do not fit well in a service context (Grönroos, 2000). Physical artefacts are produced in a production process, while services are processes by themselves. Delivery implies physical good being moved from one place to another, but services can not be delivered this way (Grönroos, 2000). Services are produced and used just as needed and at a time and place of the customer’s choosing (Edvardsson et.al, 2000). Services are co-produced in relationships, networks and through interaction (Echeverri and Edvardsson, 2002; Gummesson, 2002). In service literature, business relationships are about *“... what firms can do for customers in the form of a total service offering, rather than what it can do to customers with existing products...”* (Grönroos, 1996, p. 6].

Even though a service is not a thing, a customised solution of a machine, or almost any physical product, can be turned into a service (Grönroos, 2000). *“A machine is still a physical good, of course, but the way of treating the customer with an appropriately designed machine is a service”* (Grönroos, 2000, p.45).

Gummesson (2002) argues that core services do not exist, and that services can be stored in physical artefacts. Bitran and Pedrosa (1998) have recognised a mix of tangible and intangible aspects as essential for services, which they argue confuses the distinction between services and physical artefacts. Norman and Ramirez (1998) argue that clearly distinguishing physical artefacts and services is impossible, since all physical artefacts bring services important to the value of the artefact.

Services can be made visible or remain invisible (Echeverri and Edvardsson, 2002). Examples of invisible services are how a company manages and handles invoicing, quality problems, complaints, offers documentation, handles queries and offers customer training on how to use machines (Grönroos, 2000). To make invisible services visible means that the supplier can achieve payment for them. Of course, revenue and customers are important for companies to be viable; focusing services is to consider more aspects to achieve payment for. Hence, from the service point of view, the physical artefact is not the only price carrier (Fransson, 2004). In service literature, financial outcomes *“... are not something to be maximized but something to learn from as firms try to serve customers better and improve their performance”* (Vargo and Lusch, 2004, p. 6).

Products and product development

Traditionally, product development literature focuses on engineering areas, such as mechanical, electrical, software or construction areas (Ullman, 2003). Consequently, literature on product development views the concept product as a physical artefact (Pugh, 1991; Ulrich and Eppinger, 1995; Roozenburg and Eekels, 1995). Computer software, control systems and/or microprocessors have become a part of the physical artefact. The term product is interpreted as consisting of two inseparable parts, hardware and software. The view of the concept product as a physical thing is embodied in the product development literature. *“It is an acknowledged fact that all products are manufactured...”* (Pugh, 1991, p. 148). Ulrich and Eppinger (1995) define products as *“... something sold by an enterprise to its customers”* (p.2), but narrows the focus on the concept product to stand for something that is *“... engineered, discrete, and physical”* (Ulrich and Eppinger, 1995, p. 2). Consequently, the definition of product development will be affected. Product development *“... is the set of activities beginning with the perception of a market opportunity and ending in the production, sale and delivery of a product”* (Ulrich and Eppinger, 1995, p. 2), with the narrowed focus this is - production, sale and delivery of a physical artefact. The view of design will also be affected. *“Products are artefacts conceived, produced, transacted and used by people because of their properties and the functions they may perform. Product design is the process of devising and laying down the plans that are needed for the manufacturing of a product.”* (Roozenburg and Eekels, 1995, p. 3).

The development of physical artefacts was previously known as the ‘over-the-wall’ design process (Ullman, 2003), i.e. the activities were disconnected. Information about the artefact was passed on from one activity to another. The perceived market need was passed on from marketing people to design engineers, who interpreted the information and transformed it into a manufacturing specification. This specification was thereafter passed on to the production units, who interpreted the information and

built what they thought the design engineers wanted (Ullman, 2003). Today, an increasing complexity in modern technology makes it rarely possible for individuals to design and develop a major new product (Ullman, 2003). A design team or development team is required, thereby introducing problems of organisation and communication (Andreasen and Hein, 1987). In an integrated product development process, these design teams are recommended to be multifunctional (Prasad, 1996) and cover a sufficient diversity of knowledge (Ulrich and Eppinger, 1995). The working tasks within the organisational functions of marketing, design and production should be carried out concurrently in a parallel interactive process (Roozenburg and Eekels, 1995; Andreasen and Hein, 1987; Prasad, 1996; Hartley, 1992).

Ulrich and Eppinger (1995) describe a generic development process divided into a sequence of five steps or activities. The steps are (1) concept development, (2) system-level design, (3) detail design, (4) testing and refinement and (5) production ramp-up. Identification of service issues is part of step two. Design issues are decided upon and experimental prototypes are built and tested before the second step.

The identification and investigation of user needs represents the initial activity of the development process. Ulrich and Eppinger (1995) hint at effective customer interaction, i.e. to go with the flow, and letting the customer provide you with interesting and important information about their needs. Needfinding, as presented by Patnaik and Becker (1999), also encourage this strategy, i.e. let customers guide the flow and collect data in a variety of different forms in iterative stages to fine-tune results. In short the Needfinding process can be described as a process to acquire qualitative information on customers, i.e. experiences, interpretations, understandings (Mason, 1996). It is important to look beyond the immediately solvable problem, practically uncover needs and not to impose solutions (Patnaik and Becker, 1999). A focus on needs rather than on specific solutions renders all possible solutions open for consideration and the avoidance of limiting possibilities too early (Patnaik and Becker, 1999). *“Because people’s needs endure longer than solutions, companies should focus on satisfying those needs rather than on producing a particular product. [...] focusing on needs encourages companies to continue innovating better ways to serve those needs, independent of current solutions”* (Patnaik and Becker, 1999, p. 38). Furthermore, interaction with customers will help *“...the development team develop a personal understanding of the user’s environment and point of view”* (Ulrich and Eppinger, 1995, p.36].

Roozenburg and Eekels (1995) describe the concurrent product development process not only as a whole, but also by dividing it into two development processes, the technical and the commercial. The goal of the technical development process is to produce a number of products according to a particular design. The goal of the commercial development process is profit; for profit to be calculated, the costs of development, production, distribution and sale of the product must be known. The product as such *“... forms the link between the technical and commercial development process.”* (Roozenburg and Eekels, 1995, p. 21).

In general terms, the management of the development process of a new product can be seen as balancing efforts toward four key objectives, (1) development speed, (2) product cost, (3) product performance and (4) development program expense (Smith & Reinertsen, 1991). Good trade-offs between these four objectives are considered as the art of managing product development (Smith & Reinertsen, 1991).

Service perspective vs. core product perspective

Four different characteristics of strategic perspectives are outlined in Grönroos (2000) - (1) Service perspective, (2) Core product perspective, (3) Price perspective and (4) Image perspective. Using a price perspective implies that services are given low priority and differentiation is done by being the cheapest alternative or one of the cheapest alternative available. Through an image perspective differentiation is achieved by creating a brand image around the core product, and the brand is communicated to customers by advertising and marketing. These perspectives are not the focus in this study. However, the service perspective and the core product perspective are.

Service perspective characteristics are:

“The firm takes the view that an enhanced offering is required to support the customer’s value-generating processes, and that the core solution (a physical product, service or combination of goods and services) is not sufficient to differentiate the offering from those of competitors. Physical product components, service components, information, personal attention and other elements of customer relationships are combined into a *total service offering*. The offering is labelled a service offering, although the core solution may be based on a physical product, because all elements of the offering are combined to provide a value-generating service for customer. Developing such a total service package is seen to be of strategic importance and therefore given highest priority by management.” (Grönroos, 2000, p. 7. Italics in original).

Core product perspective characteristics are:

“The firm concentrates on the development of the core solution, whether this is a physical product or a service, as the main provider of value for the customer’s value-generating processes (the customer’s use of solutions to create value for himself or for an organizational user). Additional services may be considered necessary but not of strategic importance, and therefore they have a low level of priority. *Hidden services*, especially non-billable ones, are not recognized as value-enhancing services. The firm differentiates its package from others through providing an excellent core solution.” (Grönroos, 2000, p. 7. Italics in original).

According to Grönroos (2000), the shift to a service perspective is partly customer-driven, partly competition-driven, and partly technology-driven. Customers are looking for better value, the competition is becoming fiercer and increasingly global and information technology in particular enables the creation of new services.

Identifying relationships to other companies as strategic service relationships insist on new organisations structures and business models. The traditional company structure and business model might be “...replaced by clusters of companies or by strategic alliances between companies which form the basis for creative, customer and technology driven, effective and competitive value-creation systems” (Edvardsson and Modell, 1996, p. 8). Besides person-to-person relations service interactions occur between person-to-machine, person-to-object, and person-to-environment (Bitran and Pedrosa, 1998). Controlling individual actions in these interactions is impossible, but they can be encouraged to behave in a certain way by, e.g. technology (Bitran and Pedrosa, 1998).

A service perspective and a core product perspective can be seen as complements to each other, though they are totally different intellectually (Normann, 2001). A service perspective is an ‘outside in’ perspective where the business begins at the customers, whereas a core product perspective is an ‘inside out’ where the business

begins inside the company with a core solution (Normann, 2001). Grönroos (2000) advocates a shift in perspectives, i.e. to abandon one in favour for another. Yet, Normann (2001) argues that companies seldom abandon old models because they are not completely irrelevant.

Vargo and Lusch (2004) use a resource-based view to distinguish the traditional goods-centered logic from the emerging service-centered logic. In the former, the primary unit of exchange is goods, whereas in the latter the exchange is based on acquiring the benefits of knowledge and skills or services. What is exchanged in total service offerings is not straightforward when “... *products are replaced by management of resources such as personnel, technology, knowledge and time so that the firm can take care of needs, wants, desires and expectations of its customers and other partners*” (Grönroos, 1996, p. 8). These new tasks are not completely predictable and could encompass a variety of different situations that need to be managed individually (Normann, 2001).

Functional sales and functional products

In the context of manufacturing physical artefacts in a business-to-business environment, literature about Functional Products (FP) handles the concepts in different ways and from different views.

In Ölundh (2003), the word product refers exclusively to physical products or goods, but not services. Functional sales are presented as identical to leasing (Ölundh, 2003), i.e. the ownership of the product is not transferred in a sale, the product is rented. The ideas about remanufacture play an important role in Ölundh's (2003) environmental perspective. However, there is inconsistency in drawing a parallel between FP and leasing since it does not imply that the company providing the physical product also develops it; thus, remanufacture is not doable.

Ölundh (2003) defines functional sales as “...*business concepts that effects what object is sold, the seller liability, payment and price setting as well as the property rights of the product used. Important is that both the property rights and liability of the product used remains with the provider*” (p.9). The use of the word object is confusing in relation to functional, since functions do not seem to be an object, a thing. Ölundh (2003) writes that the phrase “*Sales of Functions*” better captures the basic thoughts. This phrase refers to “...*what is actually being sold to the consumer rather than implying that the sale is functional*” (p. 5). What is sold appears to be functions. To specify what function is, was not considered relevant in her thesis, “...*as it is the consumer who defines the desired function or need that the provider is attempting to fulfil*” (p. 5). Although not considered relevant, a function seems to be customer needs, but the inconsistency is that a provider can not *sell* customer's needs.

Ölundh (2003) discusses functional thinking, defining it as a part of a mindset that should replace solution thinking and be valuable when selling products. Hence, function and functional can be related to both conceptual design and business development. Ölundh (2003) concludes; “*Functional thinking should also be applied when developing the total solution for the customer, including products and services, and thereby opening the way for innovative solutions*” (p.86).

Persson (2004) and Chakrabarti and Bligh (2001), however, describes functional reasoning used to clarify what task, effect or functions a component or system should perform. Functional reasoning is usually applied to engineering problems and is helpful in dividing and structuring problems into less complex sub problems. In this context, function and functional are related to hardware development.

Brännström (2004) proposes a lifecycle model for functional products. The model comprises of three parallel development processes are present as well as the interaction between them. Each of these development processes - service, software and hardware process - passes through four stages and contributes in a combined effort to *optimise* the outcome, i.e. the functional product. However, the model has been criticised by service researchers.

In Fransson (2004), points out that the lifecycle model shows the production of services as preceding the delivery of the functional product, though services is said to be a part of the functional product. Fransson (2004) points out that a shift in focus, from the properties of physical artefacts and goods as a carrier of all values to co-production of immaterial values such as accessibility, usefulness and reliability, has started. Functional offerings are in this context a possibility for suppliers to care for specific activities in the customer's processes. Fransson (2004) has arranged functional offerings on an ascending scale where traditional transactions of physical artefacts are the base and traditional service offerings the second step. Steps three and four distinguish incomplete and complete functional offerings. The final step is total service offerings, where the provider uses the physical artefact in the customers' processes. Fransson (2004) concludes that it is worth striving for total service offerings. Persson (2004) highlights the total offer level as where "... *services are integrated with hardware and software...*" (p. 4) and concludes that the supplier has to inform the customer of possible new solutions. Nytomt (2004) concludes that modelling and simulation are an important part of the reliability of hardware supporting services.

Remanufacture can play an important part in FP provision (Alonso-Rasgado et. al, 2004). If FP is based on hardware of high total capital expenditure with a long lifecycle it is possible that the remanufactured hardware - which is more about being upgraded than dismantling of every component - can be re-used by another customer. The suppliers' ownership of the physical artefact, remanufacture and focusing on providing availability to hardware functions places new requirements on the reliability of components in the physical artefact, thereby affecting design activities in the product development processes. It should be possible to replace components of limited life without affecting the core of the hardware, as well as consider the rate of technological advance (Alonso-Rasgado et. al, 2004).

EMPIRICAL FINDINGS - THE STUDIED CASE

When talking with people from industry, FP as a name or as a brand seems to not be important, even though the idea is. The idea of FP occurs under different names or brands. For the sake of simplicity, FP will be used in the text below to highlight when the interviewees are talking about this new business concept. The issue of recognising and defining FP for the company has been talked about. Due to FP as an evolving situation, it is not obvious how FP affects the company. The change from the development and selling of tangible physical artefacts to the development and offering of intangible services is understood as a huge leap. For this transformation some challenges have been mentioned; new methods for engineering design, new supporting organisational structures, new business models and new ways of thinking.

However, some characteristics for the notion of FP are recognised. One key characteristic is that the FP remains in the ownership of the supplier. The structure of the ownership of FP is also thought of as a consortium. In line with not selling the physical artefact, remanufacture becomes interesting for those companies that have a physical artefact with a long lifecycle. For those who do not have, the function

provided of their physical artefact in the customers' development processes are in focus. Since the physical artefact is not sold, the recognition of FP as selling added value of some kind is mentioned. Thus, another characteristic of FP is the value-added content. To be able to add value to the development process of FP, close business-to-business relationships have been recognised as a prerequisite. A close business relationship and value-adding aspects make the interest in being involved in all parties' product development processes apparent. To be involved as early as possible means that it is possible to influence the final solution, this is to interact with the party when decisions are made.

The interest for offering FP is recognised as an additional business opportunity. The need for managing several business models has been talked about; (1) traditional transactions, i.e. selling physical artefacts and adding services, (2) partnerships, i.e. hierarchical customer-supplier relationships and (3) FP, where a business model with an inside perspective has been presented, that is the companies are partners co-producing added-value to an ultimate customer as well as to each other. It has been said that it is necessary for the companies to act in all these business situations at the same time. The importance of knowing which of them suits which customer or the maturity of the customer needs to be understood. When to leave one stage in the business model and to take a step closer to FP business has been mentioned as an issue to gain more understanding of.

Product development is described as occurring both inside and outside the company. The inside concept is used to describe that the core solution derives its origins from internal development processes. The outside development is an outsourced activity. The inside and outside metaphor are also used to describe sales or offerings. An inside perspective has been described as focusing the business from the company's standpoint and looking no longer than the company borders. The outside perspective is said to be the customer point of view and to see the company with his or her eyes.

DISCUSSION

The mix of intangible and tangible elements in products is recognised from a service point of view and a product development point of view. Products consist of hardware and services, but the focus deviate both views. In product development literature, the concept product is understood as consisting of physical artefacts and services, but the focus is on physical artefacts and vice versa in service literature. This focus on either services or hardware is problematic in FP development, which needs to focus on both.

The word product in FP is, perhaps due to evolving within product development area, understood as being a physical artefact (e.g. Ölundh, 2003). The characteristic of FP as remaining in the ownership of the supplier and the interest for remanufacture indicates the product part as being understood as a physical artefact. Only a *thing* can be remanufactured. In Fransson (2004) the offer of FP are differentiated from traditional sales by the idea that it is the provider who uses the physical artefact in the customers' processes and thus the service content is high in FP. In a service process the customer is present and a co-producer (Echeverri and Edvardsson, 2002; Gummesson, 2002), but in this total offer as suggested by Fransson (2004), it can be argued that no customer is present in the use of the product, thus the service has to precede the total offer, i.e. in the development of the physical artefact.

It seems like a good idea to discuss the functional part of FP. Functions and functional are not only related to customers' needs (Ölundh, 2003), but also to hardware development (Persson, 2004; Chakrabarti and Bligh, 2001). Viewing

functions as related to hardware development agrees with a core product perspective or an inside perspective. The focus is on functions describing the effects required for the physical artefact. Viewing functions as customers' needs is in accordance with a service perspective where a customised design of the physical artefact or the life cycle of that artefact is a service (Grönroos, 2000). The services are *integrated* (Persson, 2004) into the development of the physical artefact and the product becomes a specific customised solution. Hence, depending from which perspective the product developed is viewed, the functional part can diverge. These diverged views have an impact on the realisation of the development of FP.

Interpreting functions as customers' needs indicate an interaction with customers in a relationship; close business-to-business relationships are recognised as a prerequisite for FP development. The need for collaboration can make the knowledge created and used in FP development processes as being the product as such. In the studied case an interest in being involved in all the product development processes of the parties has been mentioned and interpreted as an interaction in the in phases where it is possible to influence the final solution. The functional product will not be decided upon beforehand by the provider; instead of handing over requirements describing a specific solution the parties will collaborate in the design phases and the outcome of that collaboration will be a FP. The content of needs that people can not readily articulate increases in a FP collaborative development process, i.e. qualitative information on customers. A Needfinding approach (Patnaik and Becker, 1999) can be particularly useful to uncover the needs of all parties and keep all possible solutions open for consideration to avoid early limitations of possibilities.

The novelty of the concept FP seems limited when based on FP defined as a *combination* of the parts hardware, software and services. Adding more services to support the physical artefact is not new to manufacturing firms. It can be argued that manufacturing companies have started to transform into service companies and this is a new situation for those companies. After the transformation the manufacturing company has become a service company. Service companies as such are nothing new, neither is the transition (Echeverri and Edvardsson, 2002). Defining supporting services as services to keep the physical artefact operable (Alonso-Rasgado et.al, 2004) indicates a broadening of a core product perspective to encompass more services, not a change into a service perspective. From a service perspective, it is the identification of what to support that is confusing. A service perspective begins at the customers (Normann, 2001), thus it is the customer's value-generating processes that should be supported. A core product perspective begins with an excellent solution (Normann, 2001), thus it is the physical artefact that should be supported. FP understood as an *integration* of the parts hardware, software and services into a encompassing whole places the emphasis on the novelty in FP as a concept considering a service perspective as well as a core product perspective. Interesting questions are; Can this be achieved and if so, how?

The manufacturing companies have described an outside and inside perspective from two different levels of the firm, (1) from a business level, i.e. offerings or sales, and (2) from the product development level, i.e. the design of the physical artefact. On the business level the service perspective is apparent and inherent to the understanding of how to do business and in the essence of the product offered. The customer's point of view is recognised as important at this level. On the product development level, an outside perspective is an outsourced activity, whereas an inside perspective is a core solution whose origins derives from internal development processes. Thus, on the product development level the core product perspective is

apparent and inherent in the understanding about the product. The product as such is the link between the technical development process and the commercial development process (Roozenburg and Eekels, 1995). However, if the business views the product as a total service offer and the development views the product as a physical artefact, a gap has been identified. The recognition of both a service perspective and a core product perspective in the studied case indicate the occurrence of both views in manufacturing companies, though on different levels, by different departments of the firm or by different people. It becomes possible to argue that FP as a concept understood as functional sales or total service offerings has started, while FP *development* is lacking behind.

CONCLUSIONS

The purpose of this paper was to explore the differences between a service perspective and a core product perspective to shed light on what changes in the management of product development processes are motivated by the notion of functional products. A description of how employees at three Swedish manufacturing companies talk about FP has been presented. Some FP characteristics have been identified:

- FP remains in the ownership of the supplier
- FP has value-added content

Hardware, software and services can be seen as parts building up the notion of FP, to understand the whole FP concept through deduction of the parts and investigating them in isolation make the novelty of the ideas difficult to understand. The function part in FP is understood as the customers' needs (Ölundh, 2003), while the product part can be understood as the result of the processes to meet those needs. Therefore, the FP development process might be understood as customers' needs transformed into a product, where the product is the result of the transformation process as such. A Needfinding process (Patnaik and Becker, 1999) has been recognised as useful for uncovering needs and to keep all possible solutions open for consideration to avoid early limitations of possibilities. The integration of services into the hardware development in the form of a customised product or product life cycle has been argued here. Thus, it can be concluded that customisation urges communication with customers or all parties involved.

Exploring the service perspective and a core product perspective has identified a gap in how the product is understood. On a business level a product is understood as a total service offering, whereas on a technical development level the product is a physical artefact. According to Roozenburg and Eekels (1995) the product constitutes the link between these two levels; it can thus be concluded that the identified gap hinders FP development and motivates the management of product development processes for FP to encompass efforts that support communication about the product in and between companies.

MANAGERIAL IMPLICATIONS

Managers in manufacturing companies, with backgrounds in a core product perspective, concentrate on the physical artefact as the product to offer and to develop. The notion of FP is understood as a transition from a focusing on the core solution, i.e. physical artefacts, to a focusing on needs. Today, the product in manufacturing companies is understood as a tangible thing supported by intangible services. In FP development the product as such becomes initially intangible, and perhaps also finally intangible, since it is not determined beforehand. This situation

requires managers to develop the capability to enable communication of the product. The use of Needfinding processes to uncover needs indicates that managers have to trust the design team to go with the flow and let the customers provide the team with useful information. It is important to not manage the design team in details on a micro level towards a specific solution. Needfinding is likely to consume resources during the early phases of the product development process and managers must be able to have an overview of the whole process to understand how resources can be saved. Due to FP development as a co-development process between companies where all involved are partners, managers have to understand all the partners' points of view and feasible decisions must be communicated via both internal and external communication.

FURTHER RESEARCH

To sum up, FP as a concept is described differently from different perspectives. The academic world is, from the view of different research areas, striving to gain a deeper understanding of the concept and its implications. Studies have shown how to package all service elements into a more encompassing offer (Brännström, 2004; Fransson, 2004) and how it should be sold (Ölundh, 2003). Since limited research is done about how to design and develop physical artefacts to compose a service element in an enhanced offer, this issue is suggested for further research.

Views not considered in this study are price perspective and image perspective (Grönroos, 2000). A suggestion for further research is to examine these perspectives in relation to the development of FP.

In this study, the integration of services into hardware development has been recognised as an interesting approach requiring collaboration between companies. A suggestion for further research is to study cases involving multifunctional collaborating design teams to find out how partners interact in such processes. In this context several levels of interest can be seen. Firstly, the collaboration as such has been recognised as interesting. Secondly, the changes on product development processes that are motivated by multifunctional views are also interesting. Thirdly, a study to understand how information and communication technology can support FP development in distributed teams has started and could give valuable input to the above.

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