

HOW DO FUNCTIONAL SALES AFFECT PRODUCT DEVELOPMENT AND ENVIRONMENTAL PERFORMANCE?

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Abstract

Functional Sales (FS) can be viewed from two perspectives: (1) as a business strategy, and (2) as an environmental strategy. The main purpose of this study has been to explore FS activities in manufacturing companies, and see how these have affected product development. Of particular interest in this regard has been the exploration of how companies' concerns for the environment have been taken into consideration in their FS development, and whether or not FS could be used as an instrument for achieving environmental benefits. Though the driving forces for offering FS were not environmental, to some extent FS does act as an environmental strategy in the investigated companies. Within the companies investigated in this study, the awareness of environmental benefits that were linked to offering FS varied greatly. The environmental benefits mentioned by the respondents in this study mainly related to usage-phase management of the product. Even though only a portion of the total number of products produced by these companies is included in leasing or FS offers, some factors promoting changed product design were found.

Keywords: functional selling, green product development, service engineering, sustainable product systems.

1 Introduction

Increasing the content of services and offering functional sales (FS) to customers can be viewed from two perspectives: (1) as a business strategy, and (2) as an environmental strategy.

Offering FS to customers is a business strategy that effects for example what objects are sold, the liability of the seller, payment and price setting, and the property rights relating to the product used (see Table 1 for a comparison of FS with more traditional selling). Creating value for the customer by fulfilling their needs is done through focusing on the functions that the customer desires or requires rather than on the product itself [1, 2]. The interest for FS to be used as an environmental strategy in companies has increased during the last years. The environmental potential is connected to new situations for companies that could lead to actions lowering the environmental impacts of lifecycle of products [3], which can be illustrated by the following points.

- The ownership of the product used for fulfilling the customer's need is not transferred to the customer. This could create economic incentives for example for the shared use of products, as well as for product reuse, refurbishment and remanufacturing, and

thereby close the material loops associated with the product. This could also promote new designs for these products.

- Economic incentives in the management of the product-usage phase could result in reducing the negative environmental impact of the product during its usage phase.
- The focus on fulfilling customer needs opens the gates to finding innovative ways of solving these needs through providing new solutions that are less material-intensive than previous solutions.

Table 1. Selling products versus selling performance (after Stahel [2]).

	Sale of product	Sale of performance
Object of sale	The object of sale is a product.	The object of sale is performance, and customer satisfaction is the result.
Property rights	Property rights and liability are transferred to the buyer.	Property rights and liability remain with the provider.
Seller liability	The seller is liable for the manufacturing quality.	The seller is liable for the quality of the performance.
Payment	Payment is due for and at the time of transfer of property rights.	Payment is due pro rata if and when the performance is delivered.

1.1 Objective

The main objective of this study was to explore FS activities within manufacturing companies, and to see how these have affected product development in these companies. Of particular interest in this regard, has been exploring how the concerns these companies have for the environment have been taken into consideration while developing FS, and whether or not FS could be used by companies as an instrument for achieving environmental benefits.

1.2 Method

This study is a complement to previous empirical studies performed in the same area of research (see for example [4, 5 and 6]). This study focuses particularly on the product development process in companies in the manufacturing sector undergoing a transition towards increasing the level of services and FS they offer to their customers.

The main method of data collection involved qualitative research interviews with for example product developers, business developers, and environmental managers. Six companies were included in the study. A total of 22 individuals were interviewed using semi-structured interviews. All interviews were subsequently transcribed, coded and analyzed (further detail about this study can be found in [7]).

FS is highly context specific, which is important to recognize before attempting to apply the results of this study. The following factors should be taken into consideration when applying these results: (1) the companies included here were all in the manufacturing sector, (2) their product development activities were located in Sweden, and (3) they all conducted business-to-business activities. This study included both large and small companies engaged in developing, manufacturing and selling products with a range of different characteristics. Rather than aiming to provide statistically rigorous generalizations about specific business sectors, product types and company sizes, the intention of this study was to explore a number of specific cases.

As the word *service* has a number of meanings, to avoid confusion it has been used in this paper to represent a business service or services to clients, such as financial services or maintenance services. When referring to a maintenance activity rather than a business service (for example a six-month lube and service), then *maintenance* has been used instead.

1.3 Companies in the study

Six manufacturing companies representing a range of different products were chosen for this study, and these have been presented in Table 2.

Table 2. The traditional sale of products developed by the companies in the study and examples of functional sales offers.

Company	Company size	Traditional sales	Examples of functional sales offers
Atlas Copco Tools	Large	Industrial and electrical tools	Pay-per-unit contract,
Duroc Rail	Small	Maintenance of railway wheels	Total responsibility for the railway wheels
ITT Flygt	Large	Submersible pumps	Pump capacity
Proton Caretec	Small	Homecare beds	Operational leasing with maintenance contract
Scania	Large	Trucks	Transport capacity, fleet management
Swepac	Small	Soil compactors	Operational leasing with maintenance contract

The environmental demands facing the companies in this study consist of legislative and customer demands. The degree of legislation and customer demand faced by each individual company in the study varied greatly. Nevertheless, several of the companies in the study saw environmental concerns as strategically important, and took specific actions in response to them. These actions related mostly to the development of their products and the implementation of ISO 14001 within their organization.

Important differences seen between the products offered by the companies in the study included the costs associated with using their products. The costs for using submersible pumps and trucks for example were a large part of the total costs to the customers. The greatest single negative environmental impact during the lifetime of these products was the energy consumed during their use. These products were also more capital intensive than the other products in the study. Proton Caretec for example had no energy costs for usage, though product transportation did have some negative environmental impact. Compactors provided by Swepac also showed low usage costs. Tools provided by Atlas Copco Tools included the cost of the pneumatic, electrical or battery power consumed during their operation.

Duroc Rail differed from the other companies in the study, as it already offered maintenance services to its customer. Duroc has also developed a new laser-cladding technique that had several large environmental advantages over previous solutions, and in order to disseminate this new technology in the marketplace, Duroc took full responsibility for the functionality of the targeted railway wheels. Duroc's customer was charged by the kilometer instead of by the number of maintenance operations performed.

2 Results

2.1 Sales alternatives

The forces driving companies to develop and offer FS to their customers were found to consist mainly of one or more of the following: (1) customer demand, (2) the desire to increase market share through differentiating products via adding services, and (3) the desire to get new technology into the marketplace. None of the respondents in the study claimed that achieving environmental benefits was a strong driving force for developing their new business concepts; which is in line with other published findings [see for example 8, and 9].

The companies in this study had all increased the number of options they had at their disposal for doing business. The traditional selling of products remained an option in all of these companies except Duroc Rail. All the companies had developed a number of selling alternatives that were responsive to their customers' needs. In other words, the solutions for different customers were customized in the actual sale situations, and developed in interaction with the customers according to their needs. The provider companies utilized a set of basic sales alternatives from which they and their customers could create suitable solutions. Different financing options could be added to the product in steps—such as capital or operational leasing. Various levels of maintenance could also be added to the product, and were preferred by some of the respondents when operational leasing was adopted—as the provider company is able to retain control of the status or condition of the product used. These sales offers could be extended further through adopting total responsibility for the functionality of the product, wherein the function rather than the product was offered for sale. Other ways of expanding business alternatives seen in the study included providing consultancy services to the customer, and assisting clients in the performance of their business activities. The provider could also provide the labor required to perform activities within the customer's operations; though this was only found to have been done by Atlas Copco Tools in a customized contract in a plant in Brazil.

Changing the way of viewing business

One of the respondents described a shift in the mindset of one of the companies. The respondent explained that company profits had been traditionally based mainly on the cost of the materials used by and paid for by the customer—for example the initial purchase cost of the product, and the subsequent costs for spare parts and maintenance. The problem with this type of business concept is that the opportunities for increasing profits based on traditional product sales are limited. Therefore providing services in addition to products becomes a viable alternative for securing profits and continued company growth. By providing services and moving closer to the customer in the value chain, the provider can utilize opportunities to lower the customer's operational costs and create value for the customer by acting in a consulting capacity to help develop the customer's business and thereby achieve mutual benefit. The profit for the provider is linked to the value created for the customer, instead of being based purely on the income generated from the sale of products and spare parts. The provider then profits from lowering the costs of the products used, and receives an incentive to be more frugal with materials and natural resources, as these impact directly on their profits.

2.2 Development of services and products in the investigated companies

The sales offers made to customers by the companies investigated here appear to have been developed stepwise. Maintenance contracts and financial services constituted the first steps in

the process before subsequently moving into adopting greater responsibility for total sales solutions and FS offers. Amongst the larger companies studied here, the development of services originated at a more local and sales-dedicated level. Varying customer demands in different markets have affected the way these local sales companies have developed their service offers geared to their customers. Services have been added to the physical products, including financial solutions, maintenance offers and training in the use of the physical products. The offers made to customers have been customized in the sales process involving the sales people and the purchasers. Centralization of service development has been conducted in order to build up knowledge about services, and to be able to spread that knowledge to other sales units in the company. The issue of centralizing the development of services seems to have been an important issue for the larger companies. On the one hand, local sales units in different countries were of course closest to their customers—therefore had the best knowledge of what the customers’ needs were—but on the other hand, standardized offers that could be evaluated and proven economically successful were required by the companies for use in other countries.

In the smaller companies, the development of services was undertaken centrally within the organization. In two of the smaller companies for example, the same people that developed the product also developed the services.

In line with the experiences of Brännström [10] and Brezet [11], the development of services and products in the larger companies was conducted by employees with different skills, expertise, and organizational niches. In the larger companies, interaction in the development of products was manifest in integrated teams pooling together skills and expertise from several functional areas in the company. The development of products and services were separate activities. In the smaller companies, the development of services and products occurred more closely, and in some cases was even performed by the same individuals. The development of services was more ad hoc than the development of products. In the larger companies, structured product development models were used for the development of products.

In some cases, new partnerships had to be formed to provide the solution for the customer. For example, at the time of this study Proton Caretec were seeking partners to help them deliver a total home-care solution that could provide all the products needed by the home-care patient. New financing and logistics partnerships have also been required to support the provision of FS. Scania for example formed a new IT company in order to develop and provide FS solutions for their customers.

Pricesetting was seen by respondents as becoming increasingly complicated with FS. To give an example, Duroc Rail required a large amount of knowledge about the real circumstances facing its customer in order to be able to set its price appropriately, and thereby achieve a win-win situation, wherein both parties benefited economically from their new contract. Respondents stated that FS requires an increased level of knowledge about customer needs and customer usage of the products involved.

2.3 Environmental considerations and effects associated with selling functions

The environmental effects of offering FS have not been measured in this study and therefore it has been difficult to state what the environmental effects have actually been. Moreover, at times it was also difficult to discern whether activities undertaken in the companies studied were due to offering FS, or due to other activities. An illustration of this is that Swepac and Proton Caretec participated in eco-design projects that had great impacts on the design of their products.

It is worth noting here that the companies in this study used environmental tools or took environmental considerations into account (or both) when developing their products, but did not utilize environmental tools when developing their services or FS offers. Several of the companies in the study claimed to have a strong environmental commitment that affected how their services were developed. It is however very difficult to state here the extent to which their environmental awareness and commitment has effected the development of their services.

Environmental benefits of functional selling - according to the respondents

A number of respondents saw relating environmental benefits to FS as a new way of thinking. The level of awareness of linking environmental considerations to offering FS varied amongst the respondents. A number of the respondents spoke about how FS-related actions could lead to positive environmental effects, but there were also other respondents who did not consider that environmental benefits could be achieved by offering FS. Services such as operational leasing with maintenance contracts were seen by some respondents as purely “paper products” that had no concrete effect on the environmental impacts of the company.

FS-related actions perceived by respondents to lead to environmental benefits were to a large extent, associated with better management of products, internalizing usage costs, and being able to optimize the engineering solution or the business activities for individual customers (see Table 3). Some respondents concluded that if selling services and offering FS were to increase in their company, then the environmental effects would have to be further evaluated and reconsidered.

Table 3. Functional sales related actions that lead to environmental benefits and how these are achieved.

FS-related actions that lead to environmental benefits	Environmental benefits are achieved by...
Internalizing maintenance.	Leads to the better management of products and strengthen incentives for modifying product development,
Internalizing usage costs.	Modifying product development to lower the usage costs and thereby lowering energy consumed during product use.
Choosing the product used.	Being able to choose the most suitable product for different situations.
How the product is used.	Enabling the product to be used by several consumers instead of just one.
Optimizing an engineering solution.	Optimizing the customer’s engineering solution and lowering the environmental impact, mainly the energy consumed.
Optimizing a business solution.	Optimizing the customer’s business operations and lowering the environmental impact, mainly the energy consumed.
Getting new technology out into the marketplace.	Being able to get new technology with higher investment cost, lower lifecycle cost but less environmental impact, out to customers.

Can selling functions lead to changes in product design?

One area of interest in this study was investigating whether or not FS gave rise to incentives for changing product design while striving to achieve environmental benefits. Mont for example, has stated that product design facilitating reuse, remanufacturing, upgrading and recycling is important for achieving environmental benefits and closing material loops, but also that it is important to develop alternative technical solutions [8]. There are numerous factors that affect how products are designed by the companies in the study. Even though only a portion of the total number of products produced by these companies is included in leasing or FS offers, some factors promoting change were found, while a lack of other factors for promoting change was also found. Institutional innovations are most likely to occur when making the transition from the traditional selling of products to offering services in FS [12].

The skills and expertise of maintenance personnel were found to be used to improve the quality of the existing products. Information from in-house personnel was considered to be more detailed and the communication channels more effective than when using external maintenance personnel. In some companies, maintenance personnel had begun to be involved in the development of new products. For example, in the new line of trucks undergoing development at Scania, maintenance personnel were involved in the product development process, in order to make maintenance and refurbishment of these products easier.

Functional thinking

Adopting a *functional* rather than a *solution* thinking mindset in product development could pave the way for innovative solutions. A functional thinking mindset can also be valuable when selling products not involved in FS. The R&D manager at ITT Flygt related that when developing new products, functional thinking was now much more systematic than it used to be. This meant that the company linked customer requirements to the functions needed for the product instead of to the solutions. Applying functional thinking when developing the total solution for the customer—including products and services—thereby opens the way for innovative solutions, and ought to be encouraged.

New situations—motivation for changing product design

According to the respondents, one effect of FS has been that products have become less price-sensitive. This has the effect that more effort can now be freed up and put into developing the product and innovative ways of solving customer needs, and refocusing on lowering the lifecycle cost of the product.

One company that had not offered FS previously, mentioned that having a test period for taking back products for refurbishment was valuable for them as a product developer. New knowledge about the product had been gained during this period, relating for example to the wear on specific parts and the overall fatigue of their products; both of which were useful in the subsequent design of new products. Maintaining responsibility for the product could therefore act as a new motivator for change in product design. A number of the companies in the study already had refurbishment and exchange programs for certain parts used in their products. These programs were not necessarily the result of offering leasing or FS.

Strengthened motivation for changing product design

According to the respondents, FS is most beneficial when products are easy to maintain, are fairly maintenance-free, and have few components. This also facilitates recycling. Keeping the lifecycle cost of the products down was also considered important. The motivation for this was perceived to be strengthened in FS.

One force seen to be driving changes in product design stemmed from the internalizing of environmental and usage-related costs [6]. The companies in the study highly prioritized facilitating maintenance and lowering the lifecycle cost of the product (LCC) when these costs were internalized. Having a low LCC was perceived as being more important than having a low initial investment cost for the product. The preexisting mindset in product development within a number of the companies, strove constantly toward a low LCC, or low total economy for the customer. The respondents claimed that internalizing costs only increased this driving force, and supported the existing product development strategy. At Scania and ITT Flygt for example, the LCC was of special importance, as their products had relatively high usage costs—mainly due to their energy consumption—and these companies had been focusing on lowering the LCC for years. For these companies, this also meant lowering the environmental impacts of their products, as the greatest environmental impacts during the lifecycle of these products occurred during their usage phase, mainly through the consumption of energy during their use.

Respondents from two of the smaller companies—Swepac and Proton Caretec—claimed that operationally leasing their products to their customers was a factor that affected the design of their newly developed products. Serviceability and weight were two examples of product attributes cited as being affected by having leasing as a sales prerequisite. One respondent at Swepac also stated that actions undertaken as a result of this prerequisite would have been conducted regardless of the way the products were sold. These two companies were also involved in specific eco-design projects with a consultancy firm, and much of their attention had been focused on environmental issues in the development process.

ITT Flygt included the energy costs of using their products in their product design, though this had only been done in a few customized contracts thus far. Nevertheless, they saw this as strengthening a preexisting force driving product design.

The increasing use of IT in products makes it easier for their providers to monitor such products, and thereby keep track of their condition status. This is important for lowering the cost of maintenance, and for securing the functional reliability of these products.

Low levels of motivation for changing product design

In a study performed by Fishbein and colleagues [9], leasing was shown to act as a motivator for closing material loops and changing product design, even though leasing was not developed specifically for environmental reasons. According to the same study, the volume of products taken back by their producers at the end of product lifetime was large; and that these companies were also soundly experienced in taking back their products. However, the motivation for closing material loops seemed to be weaker by comparison in the companies investigated in this study due to the following three factors: (1) leasing or FS accounted for only a small part of the business, and the volumes of products used in leasing or FS contracts in several of these companies was comparatively low; (2) some of these companies were only just starting to develop leasing or FS, and therefore had little experience in taking back their products; and (3) several of the companies in this study sold or intended to sell their products to for example Eastern European countries after the lease or contract period ended. This last point meant that they would lose control of the products after the contract period ended, and therefore would not experience the same level of motivation for changing product design as they would if they retained the end-of-life handling of their products. As pointed out by Fishbein and colleagues [9], this constitutes a “leakage” of the responsibility for the product.

The preconditions for achieving environmental benefits stemming from the economic value of the product at the end of its life, or for internalizing disposal costs (as defined by White

and colleagues in [6]) are therefore fairly weak in these companies. Even though the end of the product's life is often not managed by these companies, they have nonetheless increased the number of years that they retain the responsibility for their products. For example, one respondent from Scania pointed out that the resale value of a Scania product is greater after operational leasing when Scania has been responsible for maintenance activities than otherwise. Therefore it is in Scania's interests to keep the product in good condition, and to refurbish the product before selling it on. As mentioned previously, the economic value of the product is not determined at the end of the product's life here, but rather at the end of the leasing period, which to some extent has the same effect on driving changes in product design as having the responsibility for the product at the end of the product's life. Scania and ITT Flygt encourage the trading-in of their products, meaning that they always take back a number of products as they sell new ones. A number of the companies studied also had product refurbishment programs.

3 Discussion

When taking environmental considerations into account in FS development, both creating value for the customer and achieving environmental benefits need to be kept in focus. In order to achieve this combination, the following two fundamental ingredients have been proposed and described in this discussion: (1) addressing environmental considerations at the business-strategy, the solution and the product levels, and (2) ensuring interaction occurs between the development of services and products in order to create total solutions through FS.

Fishbein et al. concluded that environmental benefits could be achieved through having a well-developed leasing program, even when such a program has not been established for environmental reasons [9]. Driving forces stimulating product take-back systems, closed material loops and changes to product design can all be achieved through FS. The forces driving remanufacturing in several of the manufacturing companies in study presented in this paper are weaker than in the examples given by Fishbein and colleagues [9]. Companies with several selling options at their disposal—from the selling of product to the selling of functions—saw the need for having a large volume of products in FS contracts in order to establish the economical incentives for closing material loops.

In most of the companies studied here, environmental evaluation focuses mainly on the products. There is a need to integrate environmental aspects at the business development stage, thereby adopting a more holistic viewpoint and evaluate FS offers as well as the products from an environmental perspective. Environmental concerns should be raised and methods used to ensure that environmental issues become integrated into the business development process. Hart claimed that in order for industry to lead activities towards achieving sustainable development, environmental issues need to be considered at a strategic level, meaning that a bad concept should not pass its evaluation and thereby not be developed [13]. This is important, as the business development process is central to service and product development [10].

When developing FS solutions, the interaction between the developments of the products, services, maintenance activities and organizational considerations needs to be close-knit. In order to successfully create value for their customers, companies need to take advantage of the innovation potential of their products, their services and their delivery [14]. All three components need to be considered when seeking new ways to create value for customers, and value innovators need to view the total solution needed by the customer. Having a well-

structured business development process and the ability to create transparency between company activities is crucial for successfully developing market offers such as FS [10].

Several proposals have been made for combining environmental considerations into the process and creating value for the customer. Having an eco-integrated innovation team at a business strategy level when developing FS offers is just one such proposal [15]. Performing business and environmental evaluations in an early phase has also been seen as important [4, 15]. In line with the above perspective of creating value by focusing on the service, the product and the delivery [14], focusing on finding the innovation potential in the device concept, infrastructure and the user behavior have been avenues raised for finding the environmental benefits of innovations [16]. User behavior has been included in this perspective due to its importance, and several of the respondents in this study specifically mentioned the need for understanding the customers and the users, in order to be able to provide solutions that satisfy customer and user needs.

4 Conclusions

The companies investigated in this study have increased the number of options they can choose from when they conduct business. The manufacturing companies amongst these have added services such as financial and maintenance services to preexisting products, and created value for their customers. Though the driving forces for offering FS were not environmental, to some extent FS does act as an environmental strategy. As in most cases the technology used to fulfill customer needs was predefined, this meant that the development of alternative technical solutions was most likely not the result of these companies making the transition from selling products to also offering FS. Getting new technology out into the marketplace—which is often more expensive and has a lower LCC and environmental impact than older technology—was however perceived as a driving force for offering FS.

The environmental benefits mentioned by the respondents in this study mainly related to usage-phase management of the product, involving for example optimizing solutions, choosing the best product to use, and seeing that the product was actually used. Several products involved in this study consumed energy during operation. Lowering their energy consumption therefore leads to gives positive environmental effects.

Offering FS mainly strengthens the motivation for changing product design. Focusing on lowering the LCC was already a strong motivator for product development in a number of the companies studied. To some extent, this had the same driving force on product development as internalizing usage costs in FS. Facilitating product maintenance and refurbishing were also perceived to be valuable outcomes. Product control is often lost after the contract period ends, as the products involved are often then sold on traditionally. A new situation affecting product development was that the products used in FS offers became less price-sensitive.

When undertaking FS development that incorporates environmental considerations, both creating value *and* achieving environmental benefits need to be kept in focus. Within the companies investigated in this study, the awareness of environmental benefits that were linked to offering FS varied greatly. The level of knowledge about the potential environmental benefits of FS could be increased in these companies; as could the level of environmental evaluation of their services and FS offers (which was low or non-existent), so as to enable the full realization of the environmental potential of offering FS.

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