Value Adding Services in Packaging – A Value for all Supply Chain Actors?

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Abstract

Consumer packaging has become increasingly important as a value adding product service system, since packages shape the consumer's experience of product use as well as accelerating and affecting the first purchase decision. Recent research in food packaging has resulted in technological innovations that provide information on the real shelf life and expiration of food products as a service to users. These product-service innovations present an added value to consumers and also a clear benefit from a sustainability perspective, but are they beneficial for all actors of the supply chain?

This paper presents a study with the purpose to elaborate the value different actors' experience from the added service of one technical food packaging innovation. The paper starts by explaining the technological innovation and its potential service addition. The business opportunity of this integrated product service system is then elaborated, with a special focus on the service needs from the different supply chain actors.

Keywords

Packaging innovation, value adding service, product-package-service system, supply chain actor, consumer value

1 INTRODUCTION

Customer orientation and value added products and services are acknowledged by most organizations and regarded as prerequisites for successful business. The value added is perceived by the consumer when experiencing the fulfilment of a desired need in the use and purchase of such a product-service system. Product-service systems can be defined as made up by combined service units and physical objects. It can be regarded as innovations that focus on the value of utility of the combined product and service, rather than focusing on the value of selling the physical product [1]. The product-service view then links to the strategic direction the providing organisation takes in relation to their customers.

A product-service system that has become increasingly important as value adding is consumer packaging, since packages shape the user's experience of product use as well as accelerating and affecting the first purchase decision. Löfgren et al. [2] point out the importance of a package to add value to the consumer in the first moment of truth, i.e. in the purchasing situation, and in the second moment of truth, i.e. in the usage of the product at the point of consumption and recycling. With this value adding perspective, there is strategic evidence that viewing packaging as a central value carrier and as a product service system, from the perspective of the users, will benefit producers [3].

From a company perspective, food packaging can be regarded as such a strategic product service system since it adds value to consumers both in the first and the second moments of truth. In the food industry, the package is the interface between the product and the consumer and adds values in terms of information, usability, marketing, functionality and recyclability, among others. With the role of food packaging as a value adding element and interface to the product, the package also has a function of adding values to other actors of the food supply chain. Such values could be information, handleability, stackability, etc., in the different parts of the chain.

One example of value added services is related to food consumers' quest for assurances that the food they buy and eat is safe, i.e. being able to trust the food companies along the supply chain [4]. The trend among consumers for fresh products has resulted in chilled food, particularly prepared chilled food, now competing more and more with their frozen counterparts. These new trends and lifestyles place strict requirements on new food products for a safe and quality controlled distribution. In order to highlight safety and quality, temperature control is an important issue in chilled food distribution [5]. Good temperature control from production to retail sales is the basis for maintaining quality and safety in chilled foods. The issue in distribution of temperature sensitive food is to store, handle and transport products at a minimal charge by keeping as much as possible of the original quality and shelf life [6]. In order to succeed in this, all activities have to take place under temperature-controlled forms, referred to as "the chill chain". Being the interface between the product and the consumer, the package relates to both marketing and logistics, while at the same time serving the functions of protecting and preserving the product in for example the chill chain [7].

Some value adding service functions of food packaging systems for securing food quality, especially for the chilled food category, have lately been introduced as concepts. These concepts are derived from recent research in food packaging. The research has come up with technological innovations that provide information on the real shelf life and expiration dates of food products as a service to consumers and other supply chain actors. But is the value delivered to all actors of the supply chain and how is this added value perceived?

The purpose of this paper is to present a study that elaborates the value different actors experience from the added service, in a product-service system based on a technical food packaging innovation for securing food quality throughout a food chill chain. The paper starts by elaborating on theory on food packaging, supply chain, service value, and food quality aspects. Thereafter the technological innovation and their potential service additions are explained. The business opportunities of this integrated product service system are then elaborated,

with a focus on the service needs from the different supply chain actors.

2 PACKAGING; A PRODUCT- SERVICE SYSTEM

In the user perspective, food products and its' packaging are perceived as integrated systems, throughout the life-cycle from production, consumption to recycling [3]. The system view of consumer products and its packaging is highly relevant, since the package is the bridge between products and the supply chain environment. Even though the product and the package usually are regarded as artefacts, these integrated product package systems provide value to the users during the entire life-cycle. The product and its' package can therefore be regarded as a product-service system. Product- service systems are defined as the combined service units and physical objects, and are innovations that focus on the value of utility of the combined product and service [1]. A service-centred view is according to Vargo and Lusch [8] inherently customer oriented and results in service provisions, rather than in economic exchange, as with traditional sales of product artefacts. In a product service system the service is embodied in the utility of artefacts, and the service is dependent on the artefact to enable the service delivery [9].

From a value adding perspective, packaging plays a central role in the marketing and sales of consumer products and has an equally important role in the handling and transportation of the same [10]. Thus the package can be regarded as the interface between the product and the different users in the supply chain from production to consumption and recovery. According to Johnsson [11], a more dynamic integration between packaging and logistics also has a potential for major advantages. When the package and logistics systems support each other, it is possible to influence costs and effectiveness in the whole logistics process by considering the package as a prime element. In the development of consumer packages, companies thus need to consider the needs of the different actors of the supply chain in order to create solutions that meet these needs and provide added services, and regard the product and its' package as a product-service system. This requires the developers to work differently from those who develop conventional products, in the way that they need to take into account the entire organisation of the system when developing a product-service system, such as food packaging [1].

2.1 Packaging and service development in the food supply chain

The primary consumer packaging is the most vital extension of a company towards the consumer and therefore a strategic tool for producers in the marketing, sales and brand recognition of food products [12; 13]. It has been shown that packaging solutions that attract retail outlets and end users will create a "demand-pull" effect, which leads to a change in market position and market segment value [14; 15]. In the development of consumer packages it is a matter of creating ones that attract the consumer and draw attention to the retail shelf, for the first moment of truth, while providing superior functionality and convenience in the second moment of truth, in order to make the consumer repeat the purchase [2;16]. Consumer purchasing decisions are strongly influenced by the consumer's attitudes and perceptions of the brand security and safety. Value adding services in the area of food safety and control contribute to producer and consumer welfare. Since all food items are packaged, the package serves as the interface between the consumer and the product and thus also becomes the carrier of the added values that the producers want to put forward to the consumer, in for example food safety and quality concerns.

In addition to food safety concerns, consumer demands on food products have driven the market towards more convenience and differentiation in a market with widely spread consumption patterns [3]. This differentiation and convenience have driven development towards more mixed foods and also toward more chilled foods. Mixed and chilled food place higher demands on food safety since these products are more sensitive to microbiological deterioration. The process of guaranteeing food safety is a challenge but also an opportunity to deliver an extra service to actors of the supply chain, through the package.

2.2 Food supply chains

When it comes to food products, packaging is a valuable aid in providing safe food to consumers. Food supply chains are both time critical due to temperate storage requirements and dynamic due to variance in raw material supply and quality. Even though food safety has a high priority on the food producers' agenda, the food industry has become global and more complex. This means that there are longer distances from the production of food to the consumer. This certainly places higher demands on food safety matters and on the process of guaranteeing safe food to consumers.

Although complex, food supply chains can be generalised into certain steps from crop, to production and consumption. Typical steps in these complex food supply chains are agriculture, food manufacturing, food wholesaling, food retailing and, food service and catering, as illustrated in Figure 1.

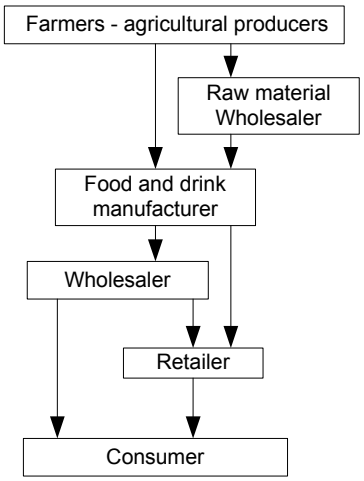

Figure 1: A generic food supply chain based on scheme from [17] and from input in the study

The generic supply chain in Figure 1, shows the different steps in a supply chain, but supply chains differ depending on the number of actors in the different steps. They also differ in the balance of power between different actors of a supply chain. In the UK, for example, the retailers have great power and in Sweden the power has shifted from a tradition of having very strong producers to a strong and powerful oligopoly on the retail level.

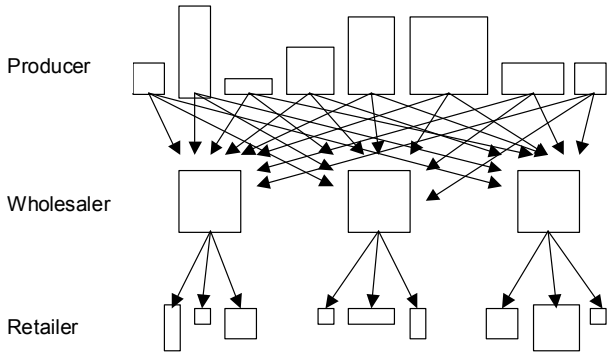

Figure 2: Swedish food chain

Figure 2 shows a generic view of the Swedish food industry and how it can be characterised as having many producers, very few wholesalers and many retail outlets. The retailers however are linked to the wholesalers and are usually under the same ownership even though there are some small independent retail stores still. The producers deliver to all wholesalers, while the wholesalers deliver to only a few retailers [4].

2.3 Food quality and shelf life

The shelf life of food products is an indicator of the level of quality. All food products in Sweden have to be marked with either "best-before date" or "last date for consumption". The latter is used for more sensitive food like fresh meat, fish and chicken [18]. The best-before date is set so that the food, if stored under the right conditions and in an unbroken package, will be possible to consume some additional time after the set date [19].

Since food producers have to add a safety margin to the best-before date, this results in an unnecessary waste of food, both by the consumers in their home and at retail locations. The majority of consumers tend to throw away food when the best-before date has expired, irrespective of if the food has gone bad or not [20]. Consumer behaviour in retail stores also creates waste. Since consumers buy products with the longest remaining shelf life irrespective of whether the product is going to be consumed the same day or not. This generates waste of products with shorter shelf life since they remain on the shelves.

The two most important factors concerning the shelf life of a product are time and temperature. Most of the deteriorating changes that take place in food are temperature dependent and occur at a slower rate at lower temperatures [21]. When temperature is infringed upon, the shelf life is affected leading to an uncertainty of the quality and food safety.

There have been some initiatives on the market to make indicators for detecting products that have been exposed to higher temperatures than stipulated. These indicators, however, have only been able to indicate if a product has been exposed to higher temperatures, but not how long. They usually shift in colour if the product has been exposed, but they really do not say much since the exposure is also dependent on time.

3 INNOVATION DESCRIPTION

The method used in this study, is to describe a packaging innovation for temperature control that was invented and launched by a start up company. This packaging innovation can be regarded as a product-service system, since the innovation is made up of a combined physical object and a service unit providing value to different actors of the food supply chain [1]. The innovation was based on an idea from one entrepreneur and one investor. They both had extensive previous experience from the food and packaging industry. The investor further saw a business potential in this idea, which is why he got involved from the very beginning.

The research approach in this study is explorative and based on interviews with the innovators and the actors throughout different food supply chains, observations and document studies. The company and the ideas have been followed from a research perspective over the years from its start up in 2002, until the present state when the company has been put on hold.

Even though the company is on hold, there is an ambition for a restart most likely in another industry, such as the pharmaceutical one. The approach of study has been from a service perspective in relation to the value the package innovation has added to the different actors in the supply chain.

3.1 The packaging innovation

The packaging innovation is a tag originally aimed for application on food packaging. The idea from the inventor was to develop an active tag for food quality measurements that could be used for chilled distributed food.

The tag consists of an electrical circuit combined with an enzymatic liquid solution that can be activated when applied to a package. This combined enzymatic solution and electrical circuit is seen as a biosensor. After application the active tag accumulates the temperature and time exposure data of the product in temperatures above the one stipulated for the chill chain.

The tag can then be read by a handheld scanner and the measurements show the accumulated time and temperature exposure for a product from production to consumption. This tag is able to measure the "real shelf life" of a chilled food product, rather than the fictive shelf life stamped on the package as a best-before date by a food producer. It can help actors of the supply chain to measure the temperature exposure the product has had from production to retail, which assists the actors in identifying products that need to be taken off the shelf or sold earlier due to an expiring shelf life.

Since the sticker is also based on an RFID circuit and a bar code, it can help companies with traceability matters in addition to temperature exposure control, which is yet another added value of the tag. The tag has the biosensor hidden under the RFID and bar code sticker as shown in Figure 3.

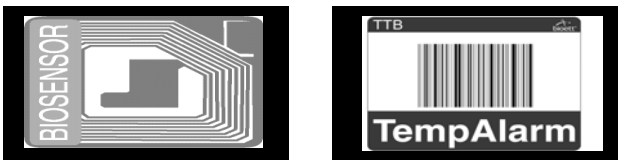

Figure 3: Temperature circuit and tag.

3.2 The innovation process and actor involvement

In the idea phase, prior to starting development, initial discussions with producers and retailers proved the innovation's business potential, since these actors could see the added value in having this type of intelligent sticker on a package.

The producers appreciated the added value of being able to secure temperature at storage right after production. They also saw an opportunity to trace the supply of products throughout the food supply chain by being able to get information about all temperatures from production to retail via an internet portal. The RFID tag with the bar

code was also seen as value adding due to its properties to store all relevant data for the product in addition to the temperature data from the active circuit.

The distributors also saw the value of detecting products that have been exposed to a higher temperature than stipulated: by this detection they could redirect the orders and start distributing the products with the least shelf life first.

On the retail level the added value was considered to be the knowledge about the temperature exposure of products resulting in knowing when to take products off the shelf if their exposure was too high. The added service could also be used to put products on the shelf in another order than when they need to rely on the best-before stamp only.

During the development of the tag, all actors from producers, distributors to retailers acknowledged the potential value of better chill chain control; it was clear that the Swedish food industry was eager to engage in the development of this innovative product for increased packaging value in the supply chain. In the development phase, they all shared information among each other and to the innovators in order for them to better meet the needs of the different actors.

The actors were greatly involved in the test phase and three food producers on the consumer market participated in field trials. The producers received tags to put onto their packages and also received handheld scanners at their production facilities, at distribution centres and at the retail level. All actors engaged in the gathering of data from the different locations and all were positive about the added service the tag provided. They were also satisfied with the internet interface where they could follow up on their batches and transports.

Several actors benefitted from the trial period and new knowledge about the supply chains of chilled food was gained throughout the chain. Prior to the ability to measure temperature exposure over time, knowledge about the weak points of the chain was limited for all actors.

The tag was never exposed to final consumers, since the value added to them was a point of debate among the actors involved. It was not clear to them how knowledge among consumers would affect business and the trust in different brands, retail stores and producers.

3.3 The implementation phase

After the successful trial period, the project came into the implementation phase. During the trial period the actors had chosen products that were easy to control, since they were easy do demarcate. The products in general constituted only a small portion of the portfolio, but on the other hand they constituted a high value and were therefore selected due to their sensitiveness to temperature exposure.

The critical phase of the project started when the implementation was to commence and the actors were asked to put this into operation on a larger portion of the assortment. Suddenly, the interest from the actors disappeared. The investor tried with the producers (i.e. the starts-up company's potential immediate customers) to identify the value to the other actors of the supply chain. This co-operative effort aimed to find a way for the distributors and retailers to contribute to the investment in such a system. However, these actors could not see enough potential to invest and relied heavily on the producer to take on the entire investment. This resulted in the engaged actors withdrawing from the project when the system was supposed to be implemented. The main arguments were that they could not justify the added cost for the system.

4 ANALYSIS

The added service from this packaging innovation showed clear acceptance from the involved actors of the supply chain from producer to retailer. Thus, from the different users this was regarded as a product-service system. All actors could foresee the added value of the application during the innovation process up until the trial period. But when the implementation phase started and costs were incurred for this added value, no actor of the chain was willing to continue.

It was clear that all the actors involved had benefitted considerably from the knowledge gained in the test phase, but when the implementation was to start there was a clear expectation that the next actor in the chain should take on the extra cost and thus responsibility of securing food safety throughout the chain.

In order to get the involvement from all actors in the implementation phase, the innovator company tried to make estimations of the amount of food wasted in the supply chain due to temperature failures and exposure of packaged food. This was done to enable the calculation of possible gains by adding the sticker and thus reducing waste. However, no actor wanted to share their waste numbers in this stage of the innovation process, since it was regarded as a business secret and a risk to share among the other actors. It proved to be easier to share values on the selected trial products since they constituted such a small part of the entire portfolio. The trial products were also easy to control, which made it quite harmless to share information about from a business perspective. Even though all actors could agree that they had increased their knowledge about food waste related to temperature exposure in the tests and that they saw a need and benefit from being better informed in the area, they still showed reluctance to the system on a larger scale.

The problems identified in the implementation phase indicate a problem of sharing risks, costs and also potential value among supply chain actors. It further indicates a problem of taking overall responsibility for a chain problem. The power aspect is relevant in the analysis of this discussion. Comparing the Swedish food industry with other industries denotes the oligopoly in the food industry as a hindrance for co-operation, while other industries with several actors in each step show greater ability to co-operate in order to create customer value as a common ground and shared responsibility throughout the chain [22]. The transfer of power from the several producers in the Swedish food industry to the few wholesalers and retail chains has further intensified the difficulties of sharing problems as well as business opportunities along the chain. The investor in the innovating start-up company certifies that the innovation exposed the insufficient overall chain responsibility in the important area of securing safe food and reducing waste of non-expired food.

Another problem identified with the innovation is that it consists of an extra item that has to be placed on the package. This result in an extra direct cost per package which in isolation might not be a main problem and could also be defendable related to the added value it gives to the actors. But it also results in indirect costs of machinery, handling time, and time for reading the values at different locations in the supply chain. The added service as such is certainly requested from the different actors and its value is appreciated, however the cost is hard to justify for an individual actor. If the tag was

integrated in the package, the indirect costs would be less and the added service would be of higher value in relation to the investments. Compared to an applied tag that might be seen just as an extra object, an integrated tag might be regarded as a product-service system with a value added service integrated to an already existing and needed object.

Neither the consumer nor consumer organisations were part of this project. The actors involved had different opinions whether the packaging innovation and its added value to consumers could be beneficial from a business point of view or not. However, the innovation as such surely gives an added value even to consumers, since increased knowledge about the product quality would certainly add value to a consumer. Since the temperature measurements from the stickers were readable from a handheld scanner, potential business opportunities for integrating this method into handheld scanners that already exist in larger retail chains are obvious. By scanning the tag the consumer could potentially obtain information about the real shelf life rather than the fictive shelf life stamped in the best-before date. Another opportunity would be to get the information on the receipt when the products are scanned at the cashier. In relation to such an implementation it would also be good to inform consumers about the amount of food that is wasted due to consumer behaviour in relation to the best-before date. If consumers were more informed and had more knowledge they might buy products with a shorter shelf life depending on when the products were supposed to be consumed. This proves the potential environmental benefits of the product-service system described in this case. Furthermore, consumers who have knowledge about the real shelf life through the sticker information might be better off because they will not be throwing away edible products in their homes.

5 CONCLUSIONS

It can be concluded that the added service from the presented packaging innovation showed clear acceptance from the involved actors of the supply chain from producer to retailer. The different actors appreciated a value addition from and the application was regarded as a product-service system. It can further be concluded that the Swedish food industry and the actors in such a supply chain all are eager and interested in participating in the development of new innovations for added value in the entire food packaging supply chain. However, when the innovation comes to the phase of implementation and commercialisation, none of the actors are willing to take an overall responsibility to share the costs or the risks of implementing a new innovation for value added services. Rather they rely on the next actor of the chain to take on responsibility. Thus, there is no system for sharing costs, risks and potential value gains among the actors of the food supply chain.

Even though there are obvious potential values in introducing a system all the way to the consumer, the actors are hesitant unless they can see a clear business potential for the own business.

The innovation presented shows apparent benefits from an overall supply chain and food distribution perspective in the way it can help identify product failures early in the chain and thereby decrease product waste through better logistical planning (i.e. products with the least shelf life should be first off the shelves). The system also provides value added services to all actors of the chain in the way it increases the knowledge among actors to handle shelf-life issues in another way, which also will reduce product waste.

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