# LINKING THE PACKAGING INNOVATION PROCESS TO LOGISTICS AND SUPPLY CHAIN PERFORMANCE IN THE FOOD INDUSTRY

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**Introduction**

Packaging has a major impact on supply chain performance, as it affects all activities in logistics. It has both economic and climate impacts. Packaging affects the climate directly, e.g. packaging material, and indirectly, e.g. amount of product waste and transport efficiency. The World Economic Forum recognize the high impact packaging have for sustainable development throughout supply chains and in transport systems. In its report entitled Supply Chain Decarbonization (Doherty and Hoyle, 2009), they assessed the possible commercial opportunities to lower the CO2 emissions in supply chains. They concluded that new packaging initiatives is a top three area with high impact and implementation potential among all various supply chain decarbonization options.

Any effort to mitigate the climate impact of packaging must apply a systems approach acknowledging the complexity of packaging (Hellström et al.; 2017; Verghese et al.; 2012). Packaging design involves the consideration of numerous needs, requirements and constraints; several of them often go beyond the packaging itself. The complexity of packaging design involves (Pålsson, 2018): 1) the multiple roles of packaging and its functions, 2) packaging as a system of components, 3) the intra‐ and inter‐ organisational requirements and needs, 4) the dynamic diversity of requirements from the end consumers or users, 5) the variety of distribution channels, and 5) extending the packaging lifecycle beyond the initial use. Moreover, all these needs and requirements are constantly in transformation. New materials, methods, technologies and market opportunities are continuously changing and evolving.

Companies that cope with the complexity of packaging in a dynamic manner can improve supply chain performance. To do so, an effectual packaging innovation process is key. Current research has put emphasis on packaging development and concept development processes, but only to limited extent addressed the packaging innovation process. The purpose of this paper is to first develop a conceptual framework that links the packaging innovation process to logistics and supply chain performance. The second part of the purpose is to examine to what extent brand owners in the food industry consider these links.

## Methodology

A conceptual framework linking the packaging innovation process to logistics and supply chain management performance is developed from innovation, packaging and performance literature. To capture the need and characteristics among brand owners regarding packaging innovation, we have collected empirical data from and analysed the food industry where packaging has significant environmental impacts. We have previously conducted a case study at a global company in home furnishing, but this paper focuses on the food industry. A survey of six companies in the food industry. This industry represents approximately 50% of the money spent on consumer packaging, was carried out. The survey instrument was developed by the two researchers based on theory and expertise. The instrument was tested on two industry representatives, and then refined. The aim of the survey was to capture the current packaging practices as well as the needs, characteristics and potential of packaging innovation. To complement the survey, a semi-structured interview was carried out with one represent of a large food company. The use of a survey of the food industry was chosen because of the vast number of food companies with a variety of characteristics (size, type of products, etc.).

## Conceptual framework of the packaging innovation process

Packaging is handled and managed in all logistics and transport activities, which means severe economic and environmental impacts on supply chain performance. Since the packaging innovation process determines the packaging solutions in a firm, this process should be carefully designed to obtain high logistics and supply chain management performance. In this paper, we apply a model for innovation from Chiesa et al. (1994) to packaging innovation. This model includes four core processes, three enabling processes, and their outcomes in terms of impact on competiveness and climate (Figure 1). The core processes are defined as those in which the firm transforms its packaging innovation capability into customer value. *Concept generation* is the organisational capability to generate new packaging concepts. It involves the level of inventiveness and creativity in the organisation. *Packaging development* is the processes and the organisational capabilities to develop effective and efficient packaging solutions, and transfer new solutions to manufacturing and distribution. *Process innovation* is about continuous improvement and creating and implementing innovative processes related to packaging. *Technology acquisition* refers to capabilities to source, implement and discover innovative technologies, which can improve the packaging.

The enabling processes supports the core processes. They are defined as those that convert resources and strategic visions into guidance for innovation. *Leadership* affects innovation goals and determines the culture and innovation climate in a firm, which is essential for all processes related to generating and implementing packaging innovation. *Resourcing* includes human resources and funding opportunities for new ideas for packaging. Finally, *systems and tools* refer to the infrastructure of IT systems and tools of the firm that can support packaging innovation. The outcome of these seven innovation processes determines the packaging performance in terms of packaging innovation, climate impact and competitiveness, which are essential parts of the supply chain performance.

Leadership

Supply chain

performance: Competitiveness and climate impact

Resourcing

Systems and tools

Technology

acquisition

Process innovation

Packaging

development

Concept generation

Figure 1: Core (grey area) and enabling processes in packaging innovation, and their outcome

As the model shows, the climate performance and competitiveness of the firm depend on the outcome of seven processes and their interactions. Thus, we link the processes and their sub-processes to the climate performance, which helps us to explain and improve the climate performance of packaging. In other words, by improving the different processes and sub-processes related to packaging innovation, the impact on the climate and competitiveness from packaging can be improved. The impact on the climate from packaging is measured by packaging material, product waste and damage, and logistics and transport efficiency. Each of the processes in Figure 1 should be measured, which requires an understanding of their sub-processes.

## Packaging innovation practices of the brand owners

A survey of six brand owner companies of varying size in the food industry was conducted to capture an overall view of the packaging innovation practices, and the their environmental impact. The respondents were selected to have packaging and environmental knowledge in the companies. In the smaller firms, the CEO or a business development manager answered, while the large companies were represented by a packaging developer, packaging development manager and a project manager. Table 1 shows background data of the companies and the respondents. All companies have their head office in Sweden. The two largest companies use packaging in all materials in Table 1, but they did not specify the proportion of each material. Among the other four companies, plastic and corrugated board dominated, followed by carton board, and some metal and wood packaging.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Position** | **Employees** | **Turnover****(billion SEK)** | **Plastic** | **Corrugated****board** | **Carton****board** | **Metal** | **Wood** | **Glass** |
| Project Manager | 10 000 | 37 | Yes | Yes | Yes | Yes | Yes | Yes |
| Packaging Development Manager | 1500 | 5 | Yes | Yes | Yes | Yes | Yes | Yes |
| Packaging Developer | 1000 | 3.5 | 80% | 10% | 5% | 5% | 0 | 0 |
| CEO | 300 | 1 | 75% | 15% | 10% | 0 | 0 | 0 |
| Business Development Manager | 120 | 0.5 | 92% | 1% | 5% | 0 | 2% | 0 |
| CEO | 34 | 0.054 | 35% | 45% | 30% | 0 | 0 | 0 |

Note: Percent of number of packages in different materials

Table 1: Background information of the respondents

## Core processes

There are four core processes for packaging innovation. The empirical data related to the core processes from the survey and the interview focus on the packaging development process. As a result, the practices related to concept generation, process innovation, and technology acquisition are only addressed briefly. In the packaging development practices, a majority of the companies (80%) develop a packaging solution in parallel to the product development, whereas 20% do it afterwards. In this packaging development process, 50% of the companies outsource the entire packaging development and 33% parts of it, whereas only 17% have mainly in-house packaging development. This means that practices outside the food companies (i.e. those of the packaging providers) have impacts on the packaging’s climate performance. Thus, to improve the supply chain performance of packaging would require both updated specifications from the food companies and from the involvement of the packaging providers.

Packaging affects the climate directly by the packaging material and indirectly in the usage phase. The latter refers to the effects of packaging on transport and handling efficiency, and on product waste (INCPEN, 2003). Figure 1 shows the share of companies that consider the different climate effects of packaging. Currently, the companies tend to focus on the direct impact of the packaging material, particularly the amount of packaging material used. They also consider the fact that different materials have different environmental characteristics and different recycling characteristics. However, it is less common to consider effects in the usage of packaging. These effects are often greater than the direct effects. The areas measured also seem to be lacking details, such as modularisation, stackability, and a reduction in the use of mixed materials. Accordingly, these insights indicate a challenge for the firms to establish the total climate impacts of packaging. Thus, they seems to be struggling with getting detailed measures of packaging impacts and to link the measures to actions for improvement in their current packaging innovation processes.

Origin and production of packaging material (e.g. transport

distance of empty packaging, green energy in production)

Effects on product waste/damage

Effects on transport efficiency

Recycling characteristics of different packaging materials (e.g. recycling share, recycling efficiency)

Different materials have different environmental characteristics

Amount of packaging material

0

20

40

60

80

100

Percent of companies

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Figure 2: Areas that the companies consider when analysing the environmental impact of packaging

## Enabling processes

Leadership for packaging innovation sets overall innovation goals and creates the culture and innovation climate. To capture the willingness for innovation climate for sustainable packaging solutions, we surveyed the motives for climate-effective packaging in the food industry. Figure 3 shows the different motives. The companies stated the following motives for climate-effective packaging, in the order of importance: 1) Improved brand, 2) Improved competitiveness, 3) More satisfied customers, 4) More satisfied co-workers, 5) Increased sales, 6) Increased market share, and 7) Reduced costs.

Reduced costs

Increased market share

Increased sales More satisfied co-workers More satisfied customers Improved competitiveness

Improved brand

0%

20%

40%

60%

80%

100%

Percent of companies

Figure 3: Motives for the companies to reduce the climate impact of packaging

The motives indicate that the food companies are driven by branding, incentives from co-workers and customers, and economic measures. According to one respondent, the environmental impact of packaging is very important and, “*We look at how this can be communicated outward in different ways. The packaging is part of the product and the consumer wants to know [the environmental impact of packaging]. It is part of the brand. There is value to communicate this.*” Several motives refers to the economic performance of the company, which can be interpreted as a need to combine the climate and economic measures of packaging innovation.

The enabling processes *resources* as well as *systems and tools* have a number of barriers. The results show that it is important for the companies to reduce the climate impact of packaging, but they clearly lack analysis tools for this purpose. They are also hindered by limited resources, lack of packaging knowledge and climate data (Table 2). However, none of the companies perceive that they need more knowledge about how to calculate the environmental impact from packaging in order to evaluate its environmental impact. The companies (67%) in the study would prefer to combine climate and economic packaging evaluations to improve the innovation process of packaging.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Employees | Resources (time) | Packaging knowledge | Management support | Information/data |
| 10 000 | x |  |  |  |
| 1500 | x | x |  | x |
| 1000 | x | x |  | x |
| 300 |  | x |  | x |
| 120 | x |  | x |  |
| 34 | x |  |  |  |

Table 2: Barriers for addressing the climate impact of packaging in the packaging innovation process

## Outcome

The food companies in the study emphasised that it is increasingly important for them to reduce the climate impact of packaging. An indication is that the medium-sized and big companies (>300 employees) have ongoing projects related to the environmental impact of packaging. The interview respondent described the situation as, “*Historically, there has been a lot of focus on the product’s environmental impact. In the last three years, packaging has become more important. It will be more important in the future.*”

According to the food companies in the survey, detailed measures should include packaging material- related issues, and to some extent the usage phase. Currently, the food companies tend to focus on the packaging material. This focus is related to the fact that the companies already are doing so when it comes to analysing the climate impacts of packaging. On a regular basis, the companies would like to analyse hazardous substances, resource depletion, and human health, and to some extent climate change and air pollution. In the interview, the respondent emphasised that, “*Climate change is the type of measurement we are interested in.*” The inclusion of the essential usage phase in the measures requires clear explanations and descriptions of its importance for the food industry.

## Conclusions and implications

This paper has developed a conceptual framework, which describes and links seven sub-processes within packaging innovation to logistics and supply chain performance. The analysis shows that by carefully designing the packaging innovation process and understanding its impact on logistics and supply chain performance, firms can strategically address and operationally design and select packaging solutions to minimise their cost and climate impacts – directly from the packaging material and indirectly from transport and product waste. The empirical analysis shows that awareness of the sub-processes in packaging innovation, their internal linkages, and linkages to logistics and supply chain performance have considerable potential to affect firms positively early in the developing phase and increase performance. However, the current awareness in the investigated firms is limited and even less implemented.

The conceptual framework developed in this paper links the packaging innovation process to logistics and supply chain management performance. The framework increases the understanding of an underdeveloped part of supply chain management. The empirical data support the need for more research on this topic.

The initial understanding of the sub-processes within the packaging innovation process, and their linkages to logistics and supply chain performance create a structure for firms to consider these innovation opportunities. The empirical data in this paper are limited to a survey of six food companies and one complementary interview. While the enabling processes and the outcome in the innovation model were well covered in the study, the empirical data related to the core processes focused on the packaging development process. Future research should address the other three processes further.

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