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Exploring the environmental impacts of olive packaging solutions for the European food market

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ABSTRACT

Reduction of packaging waste has been a European target for more than 40 years. However, packaging is indispensable for protecting what it carries. In this study, an analysis of the European regulations on packaging and of their resulting effect on recycling performance was performed by means of a literature survey and the national results published in the European Database, Eurostat. Based on these data, two series of five Life Cycle Assessments (corresponding to the national situation of five European countries: France, Germany, Italy, Spain, Sweden) were conducted on three olive packaging solutions: doypacks, glass jars and steel cans. The results highlight the influence of national household waste collection rates and selected technologies for waste treatment (recycling and incineration) on the environmental performance of packaging design. A qualitative analysis of user expectations by means of a questionnaire demonstrates that the environmentally better solution (doypack) was not aligned with user expectations. The loss of food introduced by the better packaging solution is also a reason to question its value. The authors conclude that it is important to increase waste collection rates and recycling in order to actually improve packaging sustainability. They also conclude that eco-design of packaging cannot be considered only in terms of the materials employed: the contribution of the consumers' behavior is also a determinant criterion in the design of food packaging.

1. Introduction

1.1. Food packaging context

Packaging is an essential way of ensuring that consumers obtain food products that correspond to their food quality and safety expectations. The goal of food supply chains is to deliver products to a large number of consumers in safe conditions. Packaging has a central role in making this possible (Sonneveld, 2000). The basic functions of packaging for the food supply chain are: to contain, protect, conserve, transport, stock, distribute, display the brand image, communicate, fulfill practical needs and provide information on the composition, preparation, and traceability mode of stocking and end-of-life management. Of all these functions, the central ones are protection and conservation to maintain food quality and decrease food waste. Since food and drinks represent 20–30% of the environmental impact of consumption in the EU (Williams and Wikström, 2011), it is necessary to particularly consider and reduce the environmental impact of these products.

The amount of waste reported varies from country to country. In the United Kingdom, around 11 million tons/year of unconsumed food is thrown away (WRAP, 2010), while 64 million tons/year is wasted in the United States (Jones et al., 2002). Some of this waste is due to the inadequate design of food packaging (Williams et al., 2012), yet other studies show that the environmental impact of packaging is low in comparison to the environmental impact of the food itself (Hanssen, 1998; INCPEN, 2009). These studies support initiatives to increase the impact of packaging to better protect food and thereby reduce the losses associated with it (Williams and Wikström, 2011). All this supports the necessity to focus research on food packaging and is why it is of particular interest in this study.

The greatest potential for the reduction of food waste in the developed world lays with retailers, food services, and consumers (Lebersorger and Schneider, 2011). In fact in developed countries, cold chain management, efficiency of logistics and (physical and biological) protection of food by packaging have reduced the loss

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rate in the consumption steps according to the FAO Report (Gustavsson et al., 2011). At the same time in these developed countries, food products and packaging standardization (size, shape, color) have generated a high amount of avoidable waste. In contrast, the absence of these conditions (i.e. transport, processing, packaging and storage in developing countries) leads to high losses of fresh food products such as milk, seafood and vegetables. For this reason, the ability of the package to reduce the environmental impact due to loss of the food itself is the first aspect to take into account when designing it.

Different countries have different systems for handling waste. The actual performance of the end-of-life equipment for packaging waste treatment on the national level varies considerably. This heterogeneity is explained in part by the national preferences of waste treatment type used: recycling or incineration. Another difference is that some countries give priority to the collection and treatment of industrial packaging (secondary and tertiary) over collecting from households. Finally, the performance of industrial units of incineration and recycling are not the same in all European countries.

The approach in the EU Packaging Directive allows Member States to choose the means to achieve the objectives. Consequently, Directive 2006/12/CE (OJEU, 1975b) confers on Member States the responsibility for implementing the collection and treatment of end-of-life waste. Member States are also required to develop policies for waste prevention. Indeed, certain parameters such as population density of waste per square kilometer can positively or negatively influence the impact of a type of organization on waste collection or recycling process (Lundie and Peters, 2005; Eriksson et al., 2005). The only way to resolve the dilemma of comparing different systems is to adopt the Life Cycle Assessment (LCA) (AFNOR, 2006) or other holistic approaches to analyze each situation and identify the best solution in each specific context from a systems perspective.

The differences found in the deployment of the EU Packaging Directive and in the industrial infrastructures that exist in the different Member States, as well as the differences in waste handling and amount of waste in those states, has led to formulating the following research question for this study:

How well do the packaging systems in different European countries perform environmentally?

The first two recommendations of the Packaging Directive relate to anticipated waste production and re-use of products in the final phase. However, the monitoring of waste packaging collection and recycling rates may not fully reflect the efforts conducted. Other perspectives should be considered in defining the ability of packaging to meet the Directive recommendations. Based on previous work (Abi Akle et al., 2013), the authors hypothesize that an analysis of consumer behaviors and expectations towards packaging is another way to examine packaging performance when it comes to waste aspects. This perception is expressed in our second research question:

How do consumers' preferences and behaviors correspond with regulation-driven environmental design of packaging?

The purpose, based on the research questions, was to carry out a literature study to compare situations in different EU countries. Then, LCAs were performed on a particular product in three different packaging solutions. This was followed by a consumer questionnaire for the same packaging solutions in order to compare them. The authors show that the deployment of regulations is not sufficient to achieve a universal eco-design in all European countries.

1.2. A holistic approach to the packaging system

In addition to the product itself, three levels must be taken into account when designing a packaging system (Jönson, 2000; Saghir, 2004): primary, secondary and tertiary (Fig. 1). The primary packaging, or sales unit, contains the product and displays all the social functions required by B2C relations. The secondary packaging, or distribution unit, ensures that the sales unit is transported safely and in such a way as to facilitate shelf stocking. The tertiary packaging, or loading unit, facilitates loading and transport on pallets. All these levels are interrelated: redesigning one will affect the others.

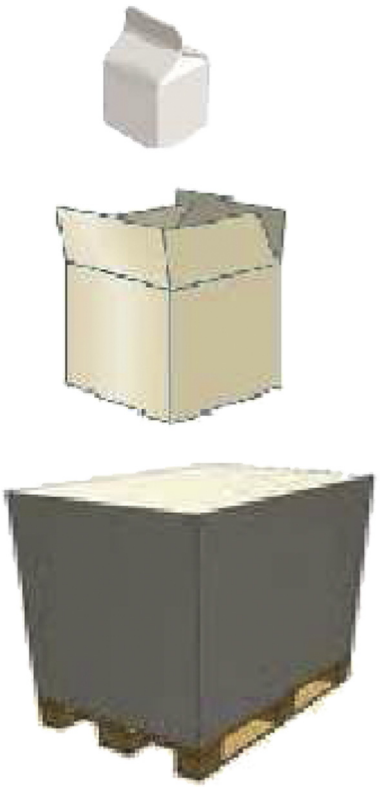

Fig. 1. The three packaging levels.

The integrated development of these three levels is essential to enable the optimization of the physical, economic and environmental performances of the whole system. The packaging design team must be able to integrate the technical constraints of transport, distribution and consumer preferences to reduce

- the number of products damaged in transit
- the volume and weight being transported, and
- the handling of the packaging system by different actors throughout the supply chain.

The design of food packaging can be a highly complex exercise because the product and its packaging must satisfy a large number of constraints and expectations. Its usability is also an important factor of interest to end users. Packaging also often plays an essential role in attracting the consumer. Finally, price is known to be a crucial element in the purchasing decision. The promises conveyed by the packaging must truly attract and express the qualities of the product that is to be consumed.

1.3. European waste management policy

Originally, environmental regulations on packaging were created through the more general text of the Directive on Waste Management (OJEU, 2006) and the Directive on Hazardous Waste (OJEU, 1975a), both of which were adopted in 1975. The development of regulations that followed centered on emissions resulting