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The influence of packaging attributes on recycling and food waste behaviour – An environmental comparison of two packaging alternatives

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ABSTRACT

This paper analyses how user behaviour influences the environmental comparison of two different packages for minced meat - a lightweight tube and a tray. The direct and indirect environmental effects are evaluated using simplified LCA. A number of packaging attributes with regard to food waste and recycling behaviour are analysed for the packages, and then used for the scenario calculations. The results show that the tube is the superior environmental alternative when only the direct effects are considered. When indirect effects and user behaviour are included in the comparison, the tray is the better alternative due to higher recycling rates and, most importantly, less food waste during the process of emptying. However, the environmental impacts due to the food waste in the tube may be compensated for, if the longer shelf-life of the tube results in lower wastage in the households. It is concluded that indirect environmental effects and user behaviour should be included in environmental assessments of packaging to obtain meaningful results.

1. Introduction

This paper analyses both the direct environmental impact and the indirect one which is dependent on the behaviour of consumers in households, for two different types of packaging for minced meat. The behaviour analysis includes the recycling or otherwise of the packaging, and also the amount of food waste occurring due to the packaging attributes. The aim is to demonstrate the importance of consumer behaviour and packaging attributes on packaging life-cycle assessment (LCA).

The user behaviour may have a profound influence on the outcome of an LCA of a product supply chain (Polizzi di Sorrentino et al., 2016). Several studies show that measures undertaken to reduce the indirect impacts are often, by far, more important than those undertaken to reduce the direct ones (e.g. Silvenius et al., 2013; Williams and Wikström, 2011; Wikström et al., 2014; Humbert et al., 2009; Büsser and Jungbluth, 2009). However, the environmental concerns about packaging which dominate legislative regulations are still mostly the *direct* environmental impacts - the production of packaging materials and end-of-life treatment (e.g. The European Council Directive 94/62/EC). These direct environmental impacts which also dominate consumer perceptions about packaging (Plumb et al., 2013) can be addressed not only by minimizing the packaging material impact (e.g. removal of excessive packaging, smarter product packaging, light-weighting, concentration of liquid products, refill packaging (Mariesse et al., 2013), but also by developing the necessary recycling infrastructure.

However, measures to decrease the direct environmental impact without considering indirect effects may strain the gnat but swallow the camel, to use a Biblical allusion, or in the worst case, result in an increase in the indirect environmental impacts, by increasing food waste, for example. Therefore, more attention should be directed to the indirect environmental impacts of packaging, which are related to user behaviour. In packaging LCA, it is particularly important to consider how consumer behaviour is influenced by packaging attributes. About one-third of the food waste is generated in European households, and this does not include the food wasted upstream at retailer-sites or in food-processing units due to low consumer tolerance for imperfections, etc (Fusions, 2014; LEI, 2013). Moreover, packaging attributes influence how consumers participate in recycling (Langley et al., 2011). While user behaviour is indisputably important in packaging LCA, modelling its relationship with packaging attributes is challenging, as it is affected by several factors.

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A strong driver for user behaviour is the set of prevailing attitudes and social norms. (di Sorrentino et al., 2016). The individual attitude towards environmental responsibility and the social norms about wasting food and participating in recycling, are probably more important than packaging attributes. The infrastructure to recycle packaging: storing facilities at home, distance to recycling facilities, etc., also influence behaviour (e g Martin et al., 2006; Perrin and Barton, 2001). Households that experience economic stress may not invest in time to recycle (Martin et al., 2006) and in households where food is a minor part of expenses; food waste may be a relatively smaller issue. Hage et al. (2009) observed that the importance of effect of attitudes on user behaviour decreased when the recycling systems were improved; thus underlining the interdependence among different factors. The degree of complexity is also valid when one attempts to understand why consumers waste food (Aschemann-Witzel et al., 2015).

In this backdrop it can be understood and agreed that the correlation between packaging attributes and behaviour is difficult to determine, quantitatively. A first step is to identify packaging attributes that may influence behaviour and indirect environmental impacts (Williams et al., 2008; Lindh et al., 2016). A second step is to calculate the potential influence of packaging attributes on indirect environmental impacts vis-à-vis the direct ones - for instance, smaller packaging size versus less food waste (e g Silvenius et al., 2013; Wikström et al., 2014). The degree of importance of packaging attributes varies depending on the environmental impact of the contents, the packaging itself, the levels of food waste and the degree of recycling (Williams and Wikström, 2011). Therefore, it is important to perform calculations for individual products, and avoid generalisations. Thirdly, the influence of packaging attributes on behaviour can be explored in consumer studies, providing data that can be used to model scenarios in packaging LCA.

In this paper, we have used information from published consumer studies to examine the influence of packaging attributes on food waste and recycling behaviour for two different types of packaging for minced meat - tube and tray. They are both made of plastics. Light-weighting is one alternative for packaging developers to reduce the direct environmental impact, demonstrated by the tube studied in this paper. However, as will be shown, it is important to study the effect of changes in packaging attributes very closely to avoid unexpected negative environmental impacts.

2. Method

2.1. Packaging attributes influence behaviour

By taking a service perspective, the focus can move from the product itself, to the process it is used for (Vargo and Lusch, 2004; Edvardsson et al., 2005). The product can be described by attributes that provide pre-requisites for a service to occur and be experienced. The product attributes can script consumer behaviour (Jelsma, 2006). The consumer interaction with the product depends on the design of the product, consumer preferences and experience, and the context of the consumer (Löfgren, 2005). This means that to design a package that helps the consumer to reduce food waste and duly recycle the packaging, it is necessary to get insights into how consumers think and act, and the context of the situation in which the decision to recycle or not, is made. Some circumstances that may hinder recycling behaviour are longer distances between households and sorting bins, packaging attributes and stress (Langley et al., 2011). All these factors which are perceived as obstacles to recycle, will lower the tolerance to invest in time to clean, separate and sort packaging.

Based on literature studies, the following attributes concerning food waste and recycling behaviour are examined in this paper:

Easy to empty. If there is food left inside the packaging, it will take more time to clean it and this may be perceived as disgusting. In studies that examine waste bins, often, there is food left in the packaging (Juul, 2012; Langley et al., 2011; Plumb et al., 2013). This attribute influences packaging waste handling and the amount of food wasted.

Easy to clean. Even if the package is properly emptied, some combinations of food and packaging will leave food residues on the surface of the package. Again, experience of time stress and disgust can result in the packaging being consigned to the waste bin (Langley et al., 2011).

Easy to separate into different fractions. Can also be experienced as too time-consuming and there can be uncertainties regarding how to separate (Henriksson et al., 2009).

Easy to fold. Space for sorting bins in households are normally limited, hence the space occupied for the recycled package is important (Martin et al., 2006).

Information on how to sort. Uncertainty regarding the type of material or how different materials should be separated is a common reason behind packaging materials ending up in the waste bin (Henriksson et al., 2009). Lack of knowledge about how clean the packaging must be in order to be recycled is also an obstacle. Generally, it seems that consumers do not invest time to scan the packaging for instructions (Langley et al., 2011). This may be due to confusion regarding the different symbols used, instructions that are difficult to find or read, unclear instructions or rules of thumb. It can also be so that everyday sorting is habitual (Henriksson et al., 2009) and users are reluctant to spend a little time to look up the information carefully. How perceptible the information on the packaging is, plays a key role here; the use of smaller-size fonts at the bottom will not attract attention.

The attribute *preserve content* (in this case the time period between than packaging date and the expiration date) can have a strong influence on food waste, if food is discarded on or after the expiry date. (Lindh et al., 2016; Plumb et al., 2013).

Mass: Langley et al. (2011) reported that the perceived value of the packaging influenced waste handling. The perceived value depended on the packaging material (glass had a higher value vis-à-vis plastics), mass (the more the material, greater the value) or packaging functions like resealability. However, it is difficult to determine if the low perceived value of plastics in the study mainly depends on material type or that plastic packagings have lower masses. In our study, we use this attribute, assuming that higher the mass of the packaging, greater is the likelihood that it is recycled.

Containing the desired quantity: The amounts of minced meat in the two packages compared in this paper, are equal. Therefore, this attribute is not included in the analysis. However, this is often very important when an analysis of food waste is carried out (Lindh et al., 2016).

The authors of this paper have discussed, judged and motivated the qualities of these attributes, for the two types of packaging analysed. The influence of these attributes on behaviour and environmental impacts are discussed in relation to the model results.

2.2. Formulae

A model that takes into account consumer food waste and recycling behaviour in food-packaging LCA has been presented earlier (Wikström and Williams, 2010; Wikström et al., 2014). The main difference between this model and most others, is that the functional unit in this one, is “eaten food” instead of “delivered food” and the environmental burden of production and waste handling of wasted food is included. A short summary of the model is presented hereunder.