Understanding the material recovery by material flows in food retailers: Jumbo supermarket, a Chilean case linking consumption to materials

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Introduction

The Rome Declaration (World Food Security, 1996) define: "*Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life*". According to Atkin et al. (2015), the impact of foreign multinational food retailers increased the household welfare mainly driven by a reduction in the cost of living and providing access and availability to high diversity of food with a right spatial distribution is achieved throughout city (Guy et al, 2015), a contribution to food security. However, a big challenge for the food sector today is related to reducing the food wasted. Each year a third of all that is produced, is wasted, including about 45% of all fruit and vegetables, 35% of fish and seafood, 30% of cereals, 20% of dairy products and 20% of meat. In developed countries, consumers and retailers throw away between 30% and 40% of all food purchased, whereas in poorer countries between 5% to 20%. The carbon footprint of food produced and not eaten is estimated at 3.3 gigatonnes of CO2 (Scholz et al. 2015). These numbers don't include the product's packaging discharged as containers and wrapping. Both environmental impacts, food loss and waste could be high in a life cycle analysis (Brancoli et al. 2017). In this context, different countries have deployed policies such as Extended producer responsibility (EPR) and Chile is not an exception. Under EPR, manufacturers and brand owners as well as supermarkets with their own brands are responsible for the food waste and waste of products they make or sell, and any associated packaging, when they become waste. In South America, CENCOSUD is one of the largest and most prestigious retail conglomerates with active operations in Argentina, Brazil, Chile, Peru and Colombia. Their operations are spread across different lines of business, such as supermarkets, home improvement, department stores, shopping centers and financial services. Today, Jumbo & Santa Isabel are the supermarket brands with 944 stores with a total of 2,411,304 sqm of selling space with high sells volumes with the challenge to deploy strategies to reduce the food waste, and the packaging waste linked to them to achieve the goals of Chilean EPR. Therefore, the aim of this study was assess the main materials discharged that can be recovered by material flows analysis linking production (material's packaging) and consumption.

Material and Methods

In Chile, Jumbo & Santa Isabel have 245 stores with a total of 577,547 sqm of selling space concentrating above of 30% of market and distributed throughout the country. The main competitor is Walmart-Chile with a 34% of market. We took a sample of 2,500 of most sold products. These products were included according to priority products (packaging) in the Chilean EPR to assess its contribution with metal, plastics, paper, cardboard, aluminum, wood and composite materials. To assess the weight of packaging and contribution with different materials, each product was weighted with and without packaging. Each packaging was characterized according to its composition, building a database labeled by type of product (use), category of groceries and sells volumes. Data from Jumbo and Santa Isabel were analyzed regarding to Units Sold of Products (Imported and Own Brands) and packaging's compositions. Based on products with existing information, mass balances were determined for estimating the generation of total volumes determining the main materials to be recovered.

Results and Discussion

According to packaging analyzed, the glass was the most important material produced instead plastic. The second one was paper and cardboard because are present in wrapping of products, but no one involved in packaging directly.

Table 1. Comparison between main materials in packaging in 2016.

Material	Jumbo & Santa Isabel (Ton)
Glass	1,782 (31%)
Paper & Cardboard	1,068 (19%)
Metal	859 (15%)
PET	706 (12%)

The main categories of "Food" and "Beverages were linked to glass, paper & cardboard, metal and PET production. The rest of type of materials present in the packaging were not relevant (Fig.Nº1). The main units sold to correspond to products of essential use in unitarian packaging such as flour, cooking oil, sugar, mayonnaise. The best-selling products correspond to own brands correlating to the main materials present in packaging to be recovered. Those materials are plastics such as PET, High-Density Polyethylene (HDPE), Low-Density Polyethylene (LDPE) and Polypropylene (PP); paper and cardboard. All materials are recoverable and could be replaced by aluminum or glass. The glass material is not a big volume, but its weigh could be a problem in operations.
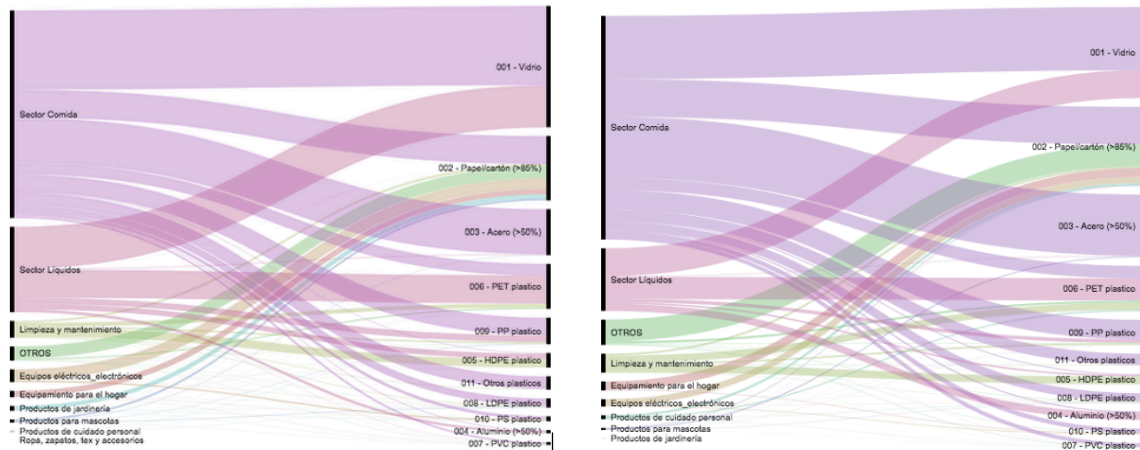

Figure 1. Sankey diagram linking categories of sold consumed products and materials present in packaging.

Conclusions

The materials discharged that can be recovered are strongly linked to consumption driven by income (food budget). Indeed, the consumption is linked to cooking behaviour and customs. Against common sense, the most important materials to be recovered are glass and paper & cardboard meanwhile plastics are below of aluminium and metals. The main materials are related to "Food & Beverages" category. But, as "Food" category is a big classification, the contribution to wastes is reduced just few products. These food products are related to high demand according to cooking uses and unitarian packaging e.g. flour, cooking oil, pasta, sugar. Perhaps, these materials are linked to budget allocated to dairy cooking uses. Finally, the strategy to reduce food wasted and wastes (packaging) needs to be focused on highly demanded products linked to cooking behaviour. The analysis of composition of packaging will be key to determinate and forecasting how much materials food retailers can recover as well as which containers and wrapping they need innovate. This result shows the relevance of composition and weigh of packaging of every food product as well as the feasibility to be recycled and recovered as well.

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