Oversize Packaging and Sustainability:

The Case of ready-to-eat cereals in Portugal

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por

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Resumo

A embalagem continua a ser um tópico sub-pesquisado, nomeadamente no que concerne à otimização de tamanho vs conteúdo. O papel da embalagem é basilar para a organização económica dos alimentos e para a função logística das empresas sustentáveis. A presente pesquisa analisa o sobre-dimensionamento da embalagem no segmento de cereais de pequeno-almoço do mercado português, num estudo que analisou uma amostra de 109 embalagens de cereais. Uma parcela substancial das marcas de cereais de pequeno-almoço analisadas apresentou uma quantidade excessiva de embalagem (cartão). Os resultados demonstram que uma redução de 20% da altura da embalagem para todas as categorias estudadas é viável. Também é avaliada a percepção dos consumidores quanto à dimensão das caixas de cartão dos pacotes de cereais e as preferências dos consumidores em relação aos cereais para o pequeno-almoço.

Finalmente, uma reflexão sobre as consequências da embalagem supérflua e os benefícios de reduzir a quantidade da embalagem de cereais prontos-a-comer é apresentada nas conclusões.

Palavras-chave: embalagem; desperdício; sustentabilidade; embalagens de cereais; percepções dos consumidores; dimensões da embalagem; cereais de pequeno-almoço.

Abstract

Packaging remains an under-researched topic, namely packaging size optimization. Packaging is central to the economic organization of food and to the sustainable companies' logistics function. This research examines packaging oversizing in the breakfast cereal segment of the Portuguese market, in a study that analyzes a sample of 109 cereal packages. A substantial share of the ready-to-eat breakfast cereal brands analysed presented an excessive amount of package, which means they are oversized. The findings show that a reduction of 20% of package height for all the categories studied is a feasible. The consumers' awareness regarding carton box format oversizing on cereal packages and the consumers' preferences regarding breakfast cereals is also evaluated.

Finally, a reflection on the consequences of the superfluous package and the benefits of reducing the amount of ready-to-eat breakfast packages is presented in the conclusions.

Keywords: package size; waste; packaging waste; sustainability; breakfast cereal packaging; consumer perceptions; packaging oversizing

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Introduction

Packaging undertakes various critical functions. It contains, protects and preserves products, influencing selling operations (Tu, Yang, & Ma, 2015) and defining product quality (Gómez, Martín-Consuegra, & Molina, 2015). Packaging is a fundamental element of merchandising for various reasons: clients make purchasing decisions in just a few seconds; there is a greater trend toward self-service; the relationship between marketing and design is key to success; and contributes to identification and differentiation (Gómez et al., 2015).

In global terms, it is estimated that consumer packaging in 2010 was worth just over $395bn. Of this, food packaging is the largest segment, accounting for slightly over half of the total (51%), with a market value at $202bn. In respect of geography, Europe accounts for a third of the global packaging market, equal to that of Asia, Oceania, Africa and the Middle East combined, with North America accounting for just over a quarter and Central and South America with 5% (Dobson & Yadav, 2012). The UN estimates that each individual consumes approximately USD114 (107,310€) of packaging per year in the world [1] and according to "The Future of European Food and Drink Packaging to 2020" packaged food and drink consumption in Europe is projected to grow by 3% per annum to 953 billion packages by 2020[2].

[1] Source: The Future of Packaging - Long Term Strategic Forecasts to 2024, Smithers Pira

[2] Source: The Future of Global Packaging 2020, Smithers Pira

It has been stated that packaging is considered especially important in generating value added for products for immediate consumption that have similar characteristics (Gómez et al., 2015). Gómez et al. (2015), based on Lofgren and WI tell (2005), highlight the relevance of packaging in everyday commodities. Packaging acts as an important promotional medium and performs many sales functions and in the extremely competitive environment of retail stores, where the typical shopper passes by some 300 items per minute and makes 40–70% of all purchase decisions, according to Tu et al. (2015), based on Armstrong & Kotler (2013). For a products' overall success, packaging is a key strategic marketing tool, especially in the food industry, with its rapid structural changes (Tu et al., 2015) and is essential in consumer behaviour due to the influence on satisfaction and loyalty (Gómez et al., 2015). Some authors, such as Karimi et al. (2013), according to Gómez et al. (2015), also state that packaging is a useful marketing tool in consumer buying behaviour, attracting new customers and retaining existing ones. Acting as a 'silent salesperson', packaging influences the purchasing decision beyond the other aspects of merchandising such as lighting, music and colour. There have similarly been authors who emphasize the importance of packaging from a marketing perspective, even defining it as the fifth "P" of the marketing mix, according to Gómez et al. (2015), based on Peters-Teixeira and Badrie (2005) and Kotler and Keller (2006).

Ready-to-eat breakfast cereals packages represent in this context, a motivating topic, moreover given that the breakfast cereal industry in Europe is worth approximately six billion euros, according to CEEREAL, the European Breakfast Cereal Association (2015)[3].

Despite the overriding importance of packaging in maintaining quality and freshness and facilitating the movement of food along the value chain, a continuing debate befalls regarding the amount of packaging that is used in the

[3] Source: http://www.ceereal.eu/about-our-industry (CEEREAL, CEEREAL - Industry, 2015)

food industry in relation to packaging waste, the environmental impacts, as well as the role of packaging in reducing food losses and waste. Inappropriate processing and packaging (or lack of these) can contribute to 25 to 50% of food loss, especially in developing countries. The reduction of food loss and the prevention of waste has environmental benefits, given that each tone of prevented food waste contributes to avoiding 4.2 tons of carbon dioxide emissions that would have been generated by the waste (Opara & Mditshwa, 2013).

There is a general tendency for paper waste to increase in direct proportion to modernization as income increases. Moreover, the more modernized and richer the country, the higher is the total per capita amount of household waste, which means there is a direct relationship between the modernization and richness of a country and its production of household waste. In the 1970's the yearly amount of household waste was about 600 kilograms per capita in the USA and 250 to 350 kilograms per capita in Western Europe (Uusitalo, 1982). Dobson & Yadav (2012) reported that each household in the UK buys on average nearly 3 tonnes of products a year, which include, on average, 200kg of packaging. The European Union (EU) has stated, according to Rushton, Croucher, & Baker (2011) that 1.3 billion tonnes of waste are produced annually by its member states and that this figure is rising by 10 per cent every year. As a result, the EU and other national governments have produced legislation related to environmental issues (Rushton et al., 2011). The Retail Forum for Sustainability(2011)[4], based on Eurostat figures, stated that 3% of all the waste generated in the EU in 2008 was packaging waste. Eurostat figures of 2011 showed that packaging waste was increasing in several European countries, was

[4] Previous Environment Commissioner Stavros Dimas and Consumer Commissioner Meglena Kuneva, together with representatives of EuroCommerce and the European Retail Round Table (ERRT), launched the Retail Forum on 3 March 2009 (http://ec.europa.eu/environment/industry/retail/about.htm)

more or less stable in some others and very few countries had significantly reduced the waste production per capita, until this year (2011). Total packaging consumption in EU 27, according to the same source, was 161kg/capita in 2005, 165kg/capita in 2006 and 164kg/capita in 2007. Furthermore, more than two thirds of packaging waste consisted of food packaging (Retail Forum for Sustainability, 2011).

The estimated packaging market in European countries in volume is predicted to grow by around 2.1% per year between 2014 and 2018, to reach 1,043 billion packaging units (all4pack, 2016).

Given the importance of packaging, understanding how consumers evaluate food packages when making their purchase decisions and identifying important package attributes for consumer perception are relevant inputs for package design and communication strategies (Varela, Antúnez, Silva Cadena, Giménez, & Ares, 2014). In this sense, this work goals are related to three main topics: (1) packaging's role and importance for consumers, (2) the importance for the value chain and sustainability; (3) the extent to which a decrease of packaging size in breakfast cereals is beneficial for consumers, organizations and the environment and how it can be beneficial for them.

General objectives: This works' general objective is to determine the extent to which overpackaging on ready-to-eat breakfast cereals packages exists in Portugal.

Specific objectives:

a) To assess the impact of overpackaging in RTE breakfast cereals for consumers, their product perceptions and consequent product choices;
b) To understand the benefits of reducing RTE breakfast cereals packages for companies, their logistics costs and environmental responsibility;
c) To comprehend the effects of overpackaging in RTE breakfast cereals for sustainability;
d) To identify possible alternatives for the issue of overpackaging of RTE breakfast cereals.

Chapter 1
The ready to eat Cereal market

Cereals has been considered, according to Golub & Binkley (2005), an excellent product to study, since it is one of the largest grocery categories, purchased by nearly all households. Many cereals are important sources of whole grains and fiber and their consumption prevents digestive cancers and chronic heart diseases. Furthermore, consumers have a relatively high knowledge of the health aspects of various cereals (Golub & Binkley, 2005).

Cereal products are consumed in over 90% American households, and the average American eats about 160 bowls of cereal a year (L Zhang, 2013). Statistics show that "breakfast cereals rank the third in the list of grocery store items on which Americans spend their money", according to L.Zhang (2013), based on Hoffman (2005, p8). On the other hand, in Europe, according to Jeswani, Burkinshaw, & Azapagic (2015), based on CEREEAL - European Breakfast Cereal Association (2008), the breakfast cereal industry encompassed, in 2008, the production of 1 million tonnes of breakfast cereals per year. The UK, Germany and France were the main markets for breakfast cereals with a 50%, 20% and 10% share of the European market respectively, with an average of 2 kg of breakfast cereals being consumed per capita, annually (2011). In total, the European breakfast cereal industry produces 1.1 million tonnes of breakfast cereals per year (Jeswani et al., 2015).

In Portugal, a study led by Marktest[5] (Marktest, 2015) revealed that in 2014 over 4 million portuguese consumed breakfast cereals during the 12 months preceding the survey. This number corresponds to 49,7% of the portuguese mainlands' residents with 15 years and over, as illustrated in figure 1. This number is especially relevant, given that the Portuguese cereal market[6] had little expression until the year of 1986, with only a few local brands selling "corn flake" types of cereals.

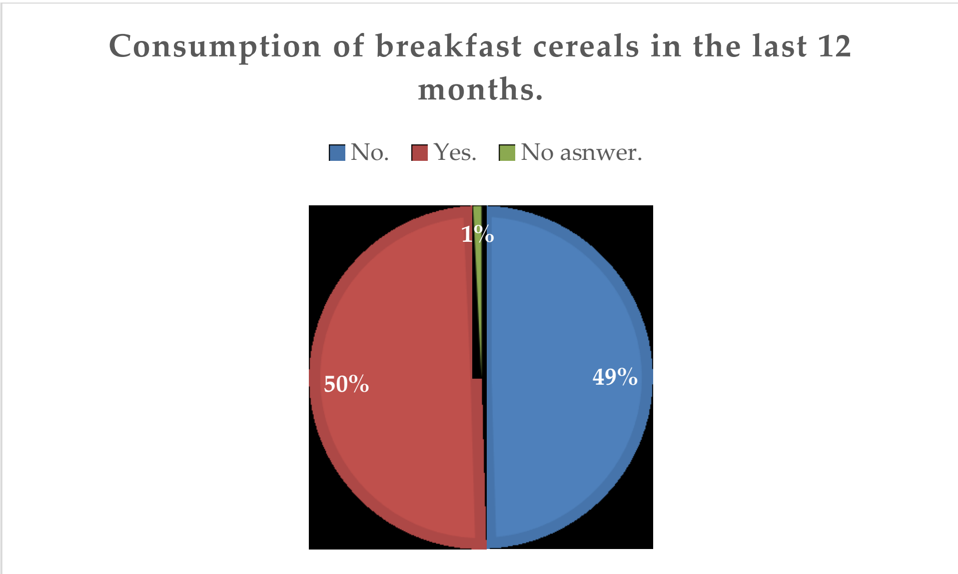

Figure 1 - Consumption of breakfast cereals by portuguese in the last 12 months (2014) (source: http://www.marktest.com/wap/a/n/id~1f49.aspx)

A Global Online ACNielsen Consumer Survey, conducted in June 2006, reported that by far the biggest reason for purchasing ready-to-eat meals is convenience, due to a lack of time to prepare a proper meal. In fact, 87 percent of the participants claimed it as their main and second reason for purchasing them

[5] Marktest Group's activities cover segments such as the measurement of media audiences, monitoring of advertising investments, regular studies (barometers) in the areas of Telecommunications, Banking, Insurance, Modern Distribution, Internet Panels and pricing and retail auditing studies (source: http://www.marktest.com/wap/)

[6] Until the year of 1986 only a few local brands were selling "corn flake" types of cereals in Portugal. In the year of 1986 Nestlé launched its Chocapic, Estrelitas, Crepitas and Corn Flakes brands in the Portuguese market (source: https://empresa.nestle.pt/conhecaanestle/nestle-em-portugal/datas-chave)

(AC Nielsen, 2006). Smithers Pira also confirms the convenience factor as an important one in the context of RTE meals[7] (Smithers Pira, 2015).

Concerning the evolution of the RTE cereal indutry, it changed from a fragmented industry at the turn of the century, to one of the most concentrated US industries by the late 1940's. In 1997 the U.S. market consumed approximately three billion pounds of cereal, leading to roughly $9 billion in sales. This growth was compelled by aggressive marketing, rapid introduction of new brands and fueled by vitamin fortification, pre-sweetening and the surge of interest in natural cereals (Nevo, Aviv, Economics Department, University of California, 1999). More than 200 varieties of breakfast cereals, corresponding to different tastes, forms and textures, from traditional breakfast cereals, served simply, with fruits or with chocolate, to oat flakes and the different types of mueslis are estimated to still be provided by the cereal and oat milling industry, according to CEEREAL[8] (CEEREAL, 2016).

On the other hand, WRAP[9], according to Form (2009) reports that 430,000 tonnes of breakfast cereals are sold annually in the UK and it is refered that these sales use around 60,000 tonnes of primary packaging and generate at least 20,000 tonnes of household food waste.

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[7] Source: http://www.smitherspira.com/news/2015/july/european-food-and-drink-packaging-market-to-rise

[8] Source: http://www.ceereal.eu/why-breakfast/breakfast-cereals

[9] WRAP - Waste and Resources Action Programme, founded in the year 2000 with the purpose of promoting sustainable waste management.

Chapter 2
Packaging

In 2009, the global packaging industry employed more than five million people worldwide. Thus, the benefits of packaging to individuals and communities, exceed the creation of meaning for products and brand positioning and the preservation, safety, and transport of products. ("Definition of Sustainable Packaging I. A Vision for Sustainable Packaging," n.d.). Packaging's contribution to economic, environmental and social sustainability is illustrated by the fact that in developing countries the lack of packaging or inadequate packaging in distribution causes 30% to 50% of all food to decay before it reaches the consumer. In Western Europe, where food is efficiently packed, only 2% to 3% of produced food fails to reach the consumer (ECR Europe; The European Organization for Packaging and the Environment, 2009). At the same time, it is recognized that the procurement, production, transport, and disposal of packaging can produce negative consequences for both the environment and societies around the globe (Sustainable Packaging Coalition, 2011) and that the largest contributor to packaging waste in the manufacturing sector is the food industry (CCME 1992b) (Labatt, 1997).

2.1. Packaging functions

One of the most accurate definitions of the activity of packaging, according to Albán et al. (2015) was given by Saghir (2004, p. 6): “Packaging is a coordinated system that prepares goods in a safe, efficient and effective way for handling, transportation, distribution, storage, retailing, consumption, as well as recovery, reuse or disposal combined with maximizing consumer value, sales and hence the organization’s profit”.

From the early twentieth century, packaging has functioned as a market device, helping to assemble and extend food markets and transforming consumer practices. Nonetheless, over that century, packaging also became a major source of solid waste, filling up landfills, littering streets and clogging waterways around the world. The rise of the waste crisis in urban governance from the mid-1960s has been directly connected to the proliferation of food packaging (Hawkins, 2012).

Historically, packaging was used primarily to prevent food contamination (Opara & Mditshwa, 2013) thus a good package has to protect the food from various physical and/or chemical deteriorative reactions (Min, Kim, & Han, 2010). However, packaging materials no only provide a means to preserve and protect, but also to merchandise, market and distribute foods and play a significant role in how products reach the consumers in a safe and wholesome form without compromising quality (Hawkins, 2012). Hence, packaging has a nature to be used for containment, protection, handling, delivering and presenting goods during the its journey from manufacture until consumption, assuring preservation (Dixon-Hardy & Curran, 2009). Preservation of the content is ensured by the incorporation of food packaging materials, by the manufacturer, that will act as a barrier to gases and water vapour. Oxygen and water vapour are major concerns in food packaging concerning shelf life, since the presence of oxygen in a packaged food is often a key factor that limits the shelf life of a product and oxidation can cause changes in flavour, colour, and odour, as well as destroy nutrients and facilitate the growth of aerobic bacteria, moulds, and insects. The capacity to protect foods largely depends on the permeability of the packaging material to gases and vapours. The protection of foodstuffs may be achieved with a single layer of polymer or the use of multi-layered films including different polymers, coating and metal foils. The main criterion to extending shelf life is to find a material that will balance the oxygen and carbon dioxide permeability and water vapour in a package (Raheem, 2013).

According to Otava, (2012), package requirements have escalated and thus package should not only protect, but also inform and it should send a message about the qualities and values of the company and ultimately packaging should sell. According to Zhang (2013), there are six major functions of modern food packaging, which are:

- Containment. Liquids, solids, and small-sized items usually need containment from a package to hold, protect, and carry;
- Security / Barrier protection. In packaging design, it is important to keep products inside free from invasions of unwanted oxygen, water vapor, and dust to extend the products shelf life. Special indicators and seals are needed to tell consumers effective storage time of the products;
- Physical protection. Packages should be able to protect products inside from being damaged during their transporting and handling process;
- Convenience. Packages need to have features that facilitate product transportation, display, as well as help consumers open, close, use, and reuse the product easily;
- Information. Packages and labels should provide necessary information about the product and handling instructions for consumers;

• Marketing. Packages need to communicate with consumers and convey product information to them through effective ways.

Abdalkrim & AL- Hrezat (2013), based on Lamb et al. (2004), consider recycling and reducing environmental damage as an additional function of packaging, which emphasizes the packaging's role and mission regarding sustainability. The other three most important functions of packaging are, from the authors point of view, containment and protection, promotion, to simplify the storage, use and the convenience of products.

In addition to the functions we have covered thus far, for organizations, packaging links the different stages, actors and areas within it as well as along the supply chain. Taken as a process through the supply chain, packaging serves the distribution system all the way to the consumer who expects to receive the products safely, in functional and labour-saving packages. If the packaging material is not re-used by the consumer, then legislation and directives require that the waste is collected and recycled for new packaging material or put to other uses. Figure 2 summarizes the packaging life cycle, illustrating the wide set of interactions in the economy involved with consumer-goods packaging, exhibiting the significant broader impact on the economy, the different businesses and users served and the key role in economic trade (Dobson & Yadav, 2012).

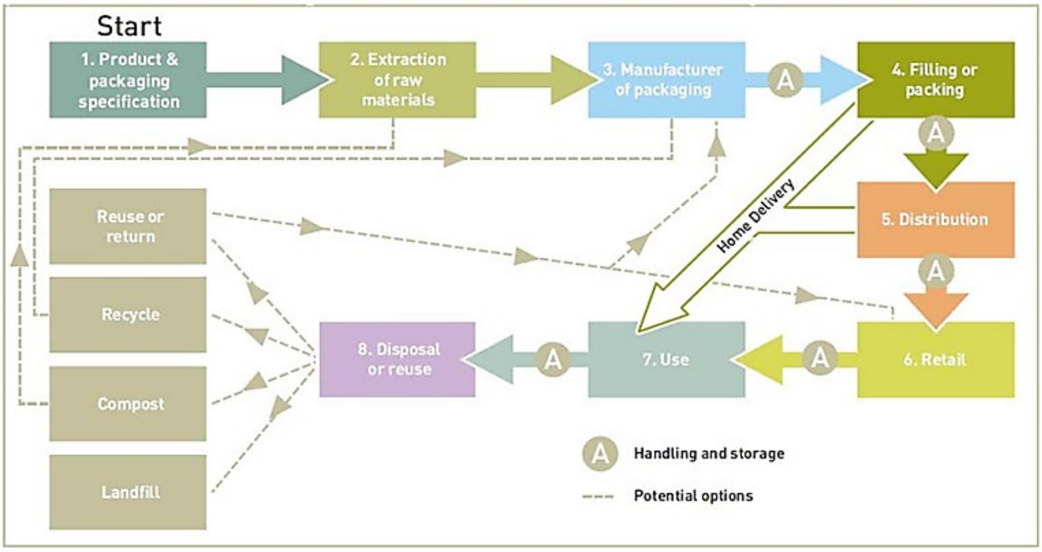

Figure 2- The Packaging Life Cycle (source: Dobson & Yadav, 2012)

Packaging has become a key marketing strategy, plays an important role in attracting consumers' attention, according to Varela et al. (2014) and is considered among the specific elements that catch consumer's needs and desires, affecting the buying and consumption behavior and building a sort of "means of dialog" within the market (Muratore & Zarbà, 2011). According to Farooq, et al., (2015) packaging can attract consumer attention towards a product and influence the consumer perception about that product. Sharing the same view, Adelina & Morgan (2007), referred by Farooq et al., (2015) defend that packaging is one of the most valuable techniques for marketers to capture customers and packaging elements can have an impact on consumer purchasing decisions. Once a consumer is attracted there are many possibilities that he may purchase the product.

In particular, package design strongly affects consumers' attention, sets up sensory and hedonic expectations and can even modulate future product experiences and its importance as a vehicle for communication and branding is growing (Varela et al., 2014). One reason for this is the fact that consumers may not think very deeply about brands before they go into the store. As Farooq et al.

(2015) refer, most of product purchase decisions are made at the spot. In fact, it is estimated that 73 percent of purchase decisions are made at the point of sale (Silayoi & Speece, 2007). Regardless of the impact that packaging has on consumers' purchasing decisions and behavior, it has a minimal amount of time to grab their attention. In a standard supermarket, a typical shopper might pass around 300 products per minute, which translates into less than one-tenth of a second for a single product to gain the attention of the customer and spark a purchase. This circumstance makes packaging design crucial. Furthermore, no matter the types of materials applied in the package design, there are six principles of effective packaging design, focused on the basic functions of food packages, referred by Zhang (2013) originally outlined by AlTai (2012), which are the following:

1. Visibility: effective packaging design for a specific product needs to make it stand out on store shelves;

2. Shopability: It is necessary to define and elaborate the uniqueness and benefits of a new product via packaging design and attract consumers' attention to buy it;

3. Differentiation: Consumers often make their purchase decision emotionally instead using of fact-based judgment, and their intuition is largely based on packaging design. Therefore, in order to stand out from other products, a specific package needs to look positively different from its competitors;

4. Messaging: Eye tracking studies show that consumers spend about 5 seconds analyzing a package. Therefore, it is important to use simple, clear claims on packages that reach out to consumers directly;

5. Consumption: Designers need to extend packages into new usage situations and attract consumers for repeat purchase;

6. Sustainability: Packaging design needs to take great consideration of package impact on the natural environment. Designing for sustainability can attract consumers' attention and increase product sales.

Packaging must provide the customer with the right clues and cues – both at point of purchase and during usage, as FMCG products are generally associated with low-involvement purchase decisions and consumers tend to make a buying decision in a very limited time and without the aid and direction of salespeople. A package must then perform many of the sales tasks for making an overall favourable and immediate impression. Furthermore, packaging is the only part of marketing communication which a consumer takes home after the purchase and is perceived as one of the product attributes, no matter its functional aspects. This emphasizes the packaging's role in communicating and reinforcing brand values over time and recognizes that packaging has the power to build, but also to break brand relationships (Dobson & Yadav, 2012).

Hawkins (2012) declared that packaging is central to the economic and cultural organization of food. It has become fundamental to extending shelf life, brand strategies, the qualities of food, and can hamper the relationship with the brand if it is unmanageable. For instance, the experience with the product can be negative if it cannot open conveniently, breaks easily, does not fit on shelves or in the refrigerator/freezer, or can cut or harm the consumer. There is, then, a "brand ambassador" role related to packaging, for products during extended usage, which is the case of ready-to-eat breakfast cereals. A major competitive challenge for producers in not just winning consumers but also retaining them over time. While consumers appreciate familiarity, consistency and continuity, they also appreciate novelty, difference and innovation to encourage experimentation and trying new things. Packaging plays, therefore, a critical role in the marketing mix, particularly in FMCG and its design is critical to the nature and intensity of competition amongst FMCG producers (Dobson & Yadav, 2012). Dobson & Yadav (2012) sustain that at the point of purchase, packaging serves the following key functions:

- Standing out in the crowd;
- Reaching out to the consumer to get noticed;
- Creating a powerful shelf presence so that the brand stands out from the crowd and is actually noticed is the first and most vital step for any product on a shelf;
- Communicating marketing information, giving reasons to buy; stimulating or creating brand impressions; providing brand cues: Value, Quality and Safety.

Based on Rundh (2005), (Dobson & Yadav, 2012) summarize the different functions of packaging and demonstrates how these link to particular business and marketing functions, as shown in annex I. These links demonstrate how packaging functions are closely related to the marketing mix (product, place, price, promotion): the protection and preservation function are related to "product", as well as the hygiene and safety factors; facilitation of distribution is related to "place" as well as the hygiene and safety; the containment of prices function is related to "price". The promotion of the consumer's choice, the visual information and associated appeal of the package are related to "promotion".

2.2 Types of package and materials used

Disregarding the type of product, it is possible to distinguish three types of packages: primary packaging or sales packaging, secondary and tertiary packaging. The Primary packaging is the one handled by the consumer, as it is the wrapping or container for the product as a sales unit. Secondary packaging or grouped packaging is used for larger cases or boxes that are used to distribute and display the primary packaged product to group the units together. Transit packaging or tertiary packaging aids to group the packages together to ease loading and unloading the product in bulk form and prevent damage, e.g., wooden pallets, board and plastic wrapping and containers. It does not include road, rail, air or ship containers. The primary packaging defines what the secondary packaging will be to protect the product and performs an influence on what the transit packaging will be and it can have one layer or many layers depending on the product. Before a product has been dispatched to the depot for delivery to the outlets, the producers of the product have to package the products in the primary package (Dixon-Hardy & Curran, 2009).

As far as ready-to-eat breakfast cereals are concerned, it's interesting to note that the product has two primary packages: the bag that contains and contacts with the cereals and the printed carton box in which the bag is stored. The basic functions of the bag inside include the protection and preservation of the product and the printed carton box is meant to physically protect the product and inform the consumer, affecting his purchasing decision and possibly resulting in the product sale (Ankan, 2011).

In terms of the materials that constitute the packages, the packaging material chosen for food products may either be rigid or flexible, in general. Rigid containers include glass and plastic bottles and jars, cans, pottery, wood boxes, drums, tins, plastic pots and tubes, which give physical protection to the food inside that is not provided by flexible packaging. On the other hand, flexible packaging is a group of materials that includes plastic films, papers, foil, some types of vegetable fibers and cloths that can be used to make wrappings, sacks and sealed or unsealed bag (Raheem, 2013).

Both flexible and rigid packaging materials, alone or in combination with other preservation methods, have been developed to offer the necessary barrier, inactivation, and containment properties required for successful food packaging, according to Raheem (2013). In terms of packaging units, the main packaging materials used in the world are flexible materials[10] (36%), paper and board (24%) and rigid plastic materials (20%) and the most used types of packaging are bags and sachets (875.59 billion units), bottles (810.32 billion) and cans (412.95 billion) (all4pack, 2016). As for cereals, most cereals and snack foods are contained in packages with paper-based materials made from wood fibers. Microflute corrugated paperboards[11] have unique characteristics including good strength properties, excellent shock absorbing ability, good aesthetic appearance, environmental advantages, and distinctive print properties. Flexible plastic films have been used for cereals in single packaging or multiserving size packages with other packaging materials. Typically, the majority of snacks is contained in flexible bags (Min et al., 2010). Packaging made from paper and paperboard is found at the point of sale (primary packs), in storage and for distribution (secondary packaging) (Kirwan, 2008). The poor barrier properties of plain paper make it unsuitable for long time storage, hence the protective properties of paper are usually improved by coating, laminating or filled with waxes and resins (Opara & Mditshwa, 2013).

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[10] Flexible packaging is made of plastic films, ply (one or multiple), graphics, and sealed generally with heat and/or pressure. (Rolando, 2010). Examples of flexible packaging include liners, pouches, seals, sample packets and bags (source: http://www.apndinc.com/flexible-packaging)

[11] Paperboard is thicker than paper and has a higher weight per unit area. Paper over 200g/m2 is defined as paperboard or board by ISO – International Organisation for Standardization, though some products are known as paperboard even though manufactured in a grammage less than 200g/m2 (Kirwan, 2008).

In the case of Kellogg Europe[12], the brand employs carton boxes and corrugated board, which are typically made of 80% and 98% recycled fiber, respectively (Jeswani et al., 2015). Cartons are printed and produced by carton suppliers and are delivered, unfolded and stacked on pallets, to the breakfast cereal manufacturers. The liners, also supplied by outside sources, must be durable and impermeable to moisture or moisture vapor and the adhesives used in cereal packaging are water-based emulsions and hot melts (Roy & Jeff, 1995).

Regardless of the material(s) companies choose for their food product, including RTE cereals, Raheem (2013) defends that the decision for packaging materials should take into account the advantages and disadvantages of the choice and what other attributes can be incorporated in the packaging material, based on the end use and properties of the food product.

2.3. Impacts of packaging waste on sustainability

Paper and paperboard account for about one-third of the total packaging market and can be found wherever products are produced, distributed, marketed and use. Today, we can find paper and paperboard packaging for food in supermarkets, traditional markets and retail stores, mail order, fast food, dispensing machines, pharmacies, and in hospital, catering and leisure situations. In fact, approximately 10% of all paper and paperboard consumption is used for packaging and over 50% of these materials that are used for packaging are used by the food industry (Kirwan, 2008).

[12] Kellogg Europe is one of the leading producers of cereals in Europe with a market share of over 35% (Jeswani et al., 2015).

The advantage of packaging material based on paper, according to Opara & Mditshwa (2013) is its high recyclability at relatively low cost. Despite this benefit, it is important to comprehend that fibers can withstand multiple recycling[15] but the process of recycling reduces fiber length and inter-fiber bonding, features related to sheet strength properties. Furthermore, some papers and boards cannot be recovered by nature of their use and hence there is a constant need for virgin fiber to maintain the amount and strength of fibers (Raheem, 2013). In practice, the proportion of fiber that is recovered and recycled varies between 40 and 60% (Kirwan, 2008).

From Figures 3 and 4 (Dixon-Hardy & Curran, 2009) it can be comprehended how much the board material represented in packaging waste weight in 2004.

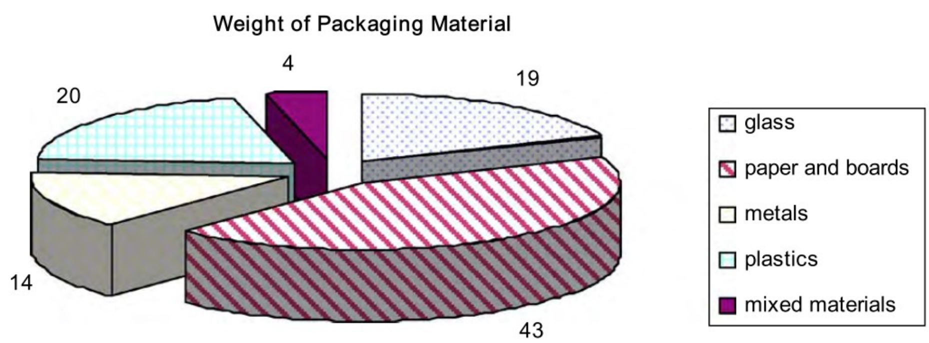

Figure 3 - Weight of packaging material waste in 2004 (Source: Dixon-Hardy & Curran, 2009)

[15] Recycling diverts materials from the waste stream to material recovery, which makes it different from reuse, a process that involves using a returned product in its original form. Recycling involves reprocessing material into new products and a recycling program entails collection, sorting, processing, entails manufacturing, and sale of recycled materials and products and in order to make recycling economically feasible, recycled products and materials must have a market (Raheem, 2013).

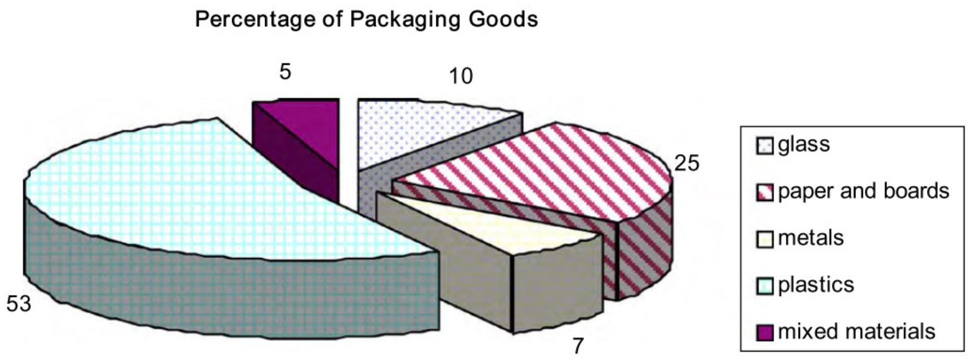

Figure 4 - Percentage of packaging goods by material in 2004 (Source: Dixon-Hardy & Curran, 2009)

The majority of the weight of packaging waste consisted of paper and board material, representing 43% (figure 3), even though it only accounted for a quarter of the packaging used for all products (figure 4).

Concerning the EU-28 Member States, statistics on packaging waste[16] show that 'paper and cardboard', 'glass', 'plastic', 'wood' and 'metal' are, in this order, the most common types of packaging waste, making paper and cardboard the most contributive material for package waste in this region, in 2013. As shown in figure 5, paper and paperboard accounted for 41% of the total packaging waste in 2013. Moreover, in total, 156.9 kg of packaging waste was generated[17] inn 2013, per inhabitant in the 2 European Union (EU) Member States thus an estimated 64,3 kg of paper and paperboard waste was generated in the same year, per inhabitant (Eurostat, 2016) and as a result, the majority of supermarket chains only recycle plastic, paper and cardboard, since these materials can easily be separated and baled, and then recycled and supermarkets are paid based on tonnage of material recycled (Dixon-Hardy & Curran, 2009).

[16] Source: http://ec.europa.eu/eurostat/statistics-explained/index.php/Packaging_waste_statistics

[17] In contrast to other waste statistics, the term 'packaging waste generated' means not the amount of 'packaging collected', but rather all 'packaging placed on the market'(Eurostat, 2016)

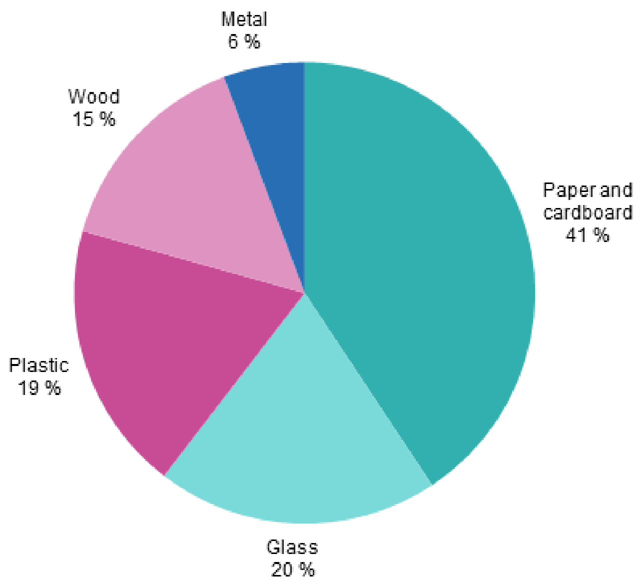

Figure 5 - Shares of packaging waste generated by weight, EU-28, 2013 (Eurostat, 2016)

There is serious concern regarding the increasing environmental degradation being experienced around the world and it is predicted that in the future, this will continue to act as a major constraint on future food production, contributing to reduced quantity, quality and affordability of food in many countries. The direct contributors to environmental degradation include greenhouse gas emissions, water waste, biodiversity, food waste and packaging (Forster, 2013).

At the Global Humanitarian Forum from 2009 it was estimated that every year climate change causes over 300,000 deaths and leaves 325 million people seriously affected. If the population continues to increase as predicted, these numbers will also increase (Forster, 2013).

Environmental inputs such as land, water, and energy are used at all levels of food production including agricultural production, food processing and packaging, distribution, retail and consumption (Forster, 2013). Thus, food systems contribute significantly to greenhouse gas (GHG) emissions, eutrophication and other environmental impacts (Jeswani et al., 2015). The impacts associated with the packaging stage of breakfast cereal production are high for depletion of fossil resources, freshwater and marine ecotoxicity, whereas the contribution of transport is significant for depletion of elements and fossil resources (23%), acidification (32%), ozone depletion (28%) and photochemical smog (24%) (Jeswani et al., 2015). In Australia alone, it has been estimated that 3 million tonnes of packaging is used each year (Sustainable Packaging Alliance, 2002).

As with other FMCG[18], there is a GWP[19] associated with the production and distribution of breakfast cereals. The GWP value accounts for the utilized ingredients, raw materials, packaging, production, logistics, retail sales, packaging end of life and product end of life and allows us to get a sense of the carbon footprint associated with a product. In the case of Kellogg's breakfast cereals, the average GWP is 2.64 kg CO2 eq. per kg of product (Jeswani et al., 2015). To get a sense of the dimension of this value we can compare it with the Danone's dairy division's GWP, which registered, in 2011, 1,570 kg eq CO2 /kg product (Danone, 2011). As figure 6 illustrates, Kellogg cereals' ingredients account for 48% of the total GWP and energy consumption at the production facilities is the second major contributor, adding a further 23% to the total and packaging and transport account for 15% each. The GWP of the process waste management is negative because of the credits for the avoided burdens from animal feed, fertilizers and recycling of different waste streams. The contribution of post-consumer packaging waste is small (1%) as most is either recycled or incinerated with energy recovery (Jeswani et al., 2015).

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[18] FMCG – Fast Moving Consumer Goods

[19] GWP – Global Warming Potential - is a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2). The larger the GWP, the more that a given gas warms the Earth compared to CO_2 over that time period (source: https://www.epa.gov/ghgemissions/understanding-global-warming-potentials) (EPA United States Environmental Protecion Agency, 2017).

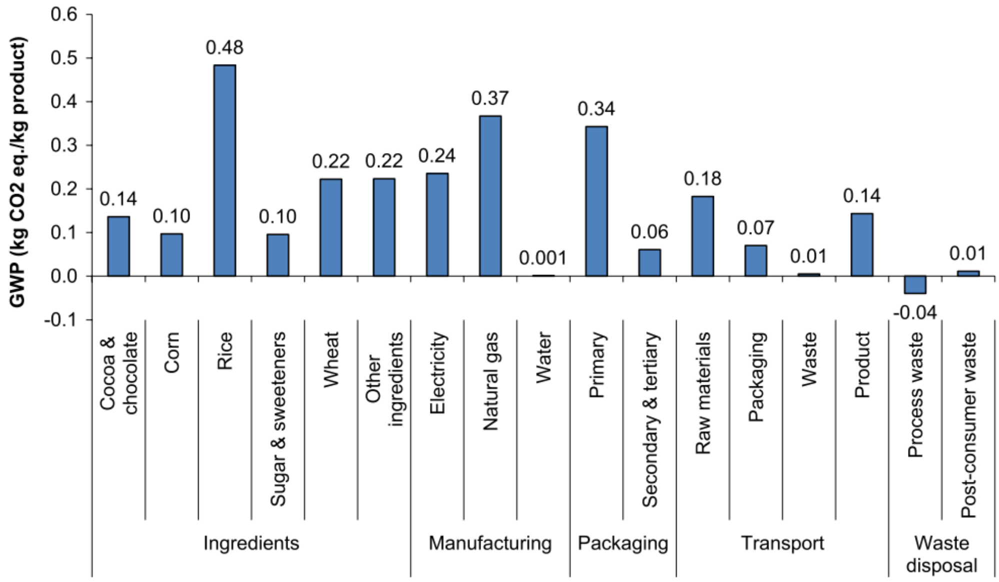


Figure 6 - GWP of Kellogg's breakfast cereals (excluding consumption) (source: Jeswani et al., 2015).

Specifically regarding energy inputs to food production, it is estimated that the food sector accounts for around 30% of the global energy consumption and the values increase with technological development and mechanization (Jeswani et al., 2015).

In most countries, household consumption accounts for more than 60% of all impacts of consumption and it is known that a doubling of wealth leads to 80% higher CO2 emissions. On the other hand, a notable share of about one-third of weight and one-half of the total volume of household's solid waste has its origin on packaging (Uusitalo, 1982). Household waste, especially in the form of large amounts of packaging waste, is, according to Uusitalo (1982), the most obvious environmental problem associated with a modernized consumption style. In fact, a remarkable share of modernized household's solid waste has its origin in container and packaging products, which alone constituted one-third of the total solid waste, by weight, in the USA, in 1977, as we can see below (figure 7).

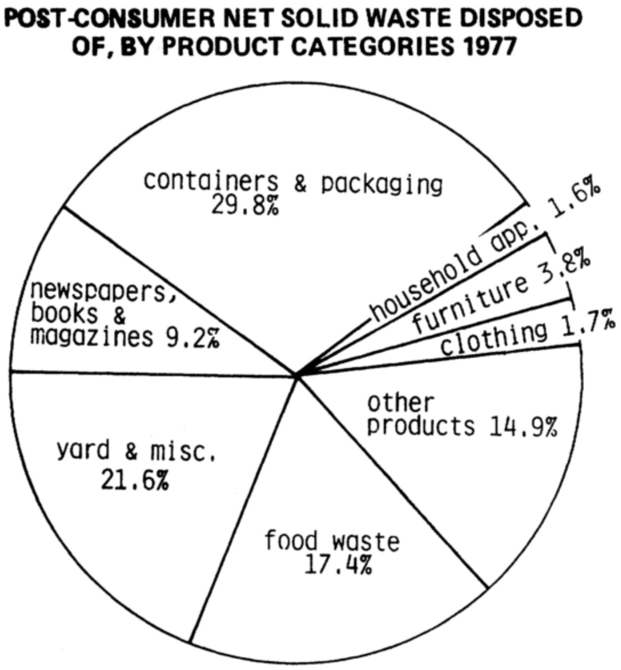


Figure 7 - Post-Consumer Net Solid Waste Disposed of, by product categories 1977 (source: Uusitalo, 1982)

The production of internationally traded goods, vital to economic growth, accounts for approximately 30% of global CO_2 emissions (Hertwich et al., 2010). As most packaged products are single-use, and turn to waste after use, and the product life cycle is very short , there is an unprecedented environmental threat. In China, the pollution caused by packaging waste has become the fourth-largest source of pollution, only followed to water pollution, lake and ocean pollution and air pollution (G. Zhang & Zhao, 2012).

Population predictions for 2050 make the household waste matter urgent and eco-friendly packages have an important role in this subject. Making a social commitment clearly visible in product packaging can be make the difference between a purchase and a pass for many consumers (Nielsen N.V., 2014). A difference that will, in this case, produce a major effect for everyone. Therefore, the development of green packaging, protection of the ecological environment and promotion of sustainable economic development have become the consensus in the world's packaging industry in many industrialized countries (G. Zhang & Zhao, 2012). Hertwich et al. (2010) denote that food must be made more sustainable, in order to tackle biodiversity loss and climate change in a serious way. One of the challenges for packaging is to remain attractive and consistent with brand concept and image as well as the retailers' store image, since packaging must be consistent with the product's advertising, pricing and distribution, while minimizing its environmental impact (Abdalkrim & Hrezat, 2013).

A decline in natural resources is happening on one side and an increase in the demand for resources is taking place on the other side. The world, particularly developed societies, sheds light on the quality instead on the quantity of living and hence sustainability became a megatrend (Meler, 2014). Food habits are more and more linked to safety-related aspects, such as, hygienic-health conditions, the use of environmental-friendly production techniques, organic raw materials, true controls throughout the production cycle, and its ethic-related ones, that is, sustainability and protection of the environment (Muratore & Zarbà, 2011). Holdway et al., (2002) denote that consumers are increasingly hostile towards wasteful, misleading and hard-to-use packaging and are aware of the ecological and social repercussions of the products they use. On the other hand, food safety issues, personal health and environmental concerns are major motivators for consumers to change their purchasing decisions (Wijesinghe & Chen, n.d.).

Research shows that "more and more consumers would rather buy goods and services from companies that are concerned for the environment, which is why company managers and owners have to add the ecological vector to the administration." (Kotler, 2011). Confirming this, a survey conducted in the U.S. indicated that consumers would choose a product from an environmentally friendly company if it cost the same as other available alternatives (Forster, 2013).

Moreover, in their third annual global online survey on corporate social responsibility, which featured 30,000 consumers in 60 countries, Nielsen N.V. (2014), reported that 55% of respondents said they would pay extra for products and services from companies committed to positive social and environmental impact (figure 8).

Figure 8 - Percent Willing to pay extra for products and services from companies committed to positive social and environmental impact (source: Nielsen N.V., 2014)

According to the Retail Forum for Sustainability (2011) to eight in every ten EU citizens the product's environmental impact plays an important role when deciding which products to buy (39% "very important" and 41% "rather important"). Additionally, a 2009 Eurobarometer survey[21] showed that 30% of EU citizens consider that minimizing waste and recycling would be actions having the greatest impact on solving environmental problems, stressing that the environmental impact of packaging waste is of great importance to consumers (Eurobarometer, 2014).

[21]Source: Eurobarometer survey on the attitudes of Europeans to sustainable consumption and production, July 2009, http://ec.europa.eu/public_opinion/flash/fl_316_sum_en.pdf

The sustainability concept has been defined in many different ways over the past decades, but has often set its focus on environmental concerns (Forster, 2013). It is a relatively recent notion and its true meaning is often linked with the emergency alert and warning about the negative effect of humans on their environment (Meler, 2014). The most widely known and used definition of sustainability is "the development that meets the needs of the present without compromising the ability of future generations to meet their own needs," as taken from the World Commission on Environment and Development. This definition emphasizes the importance of environmental quality and the conservation of nature's assets in consumption Sustainability has also been defined, in general, as consumption that can continue indefinitely without the degradation of natural, physical, human, and intellectual capital (Forster, 2013). Furthermore, the concept, according to Nordin & Selke (2010), involves addressing three principles of sustainability: economic, social and environmental factors and their interdependence in an organization's decision-making and activities. For packaging, Nordin & Selke (2010) defend that this means integrating the broad objectives of sustainable development to business considerations and implementing strategies that address social aspects as well as environmental concerns related to product/package systems and the entire life cycle throughout each stage of the supply chain.

Marketing has witnessed changes as sustainability is making its way in marketing practices. Nowadays, there is a tendency for changing marketing practices with regard to environmental protection, which has developed largely as a result of a peculiar consumers' pressure, especially in countries with developed countries (Katrandjiev, 2016). Thus, companies have to adopt sustainability in strategic marketing practices and marketing mix, keeping in mind that sustainability has become a requirement and does not remain as an option, because marketing is not limited to intra-personal and inter-personal needs and is getting extended towards the needs of future generations. This means creating, communication and delivering sustainability based value to customer. Thus, a company has to balance its marketing strategy in such a way that customer needs can be fulfilled after maintaining profitability, public interests and ecology Sustainability marketing can foster long-term relationship with customers, not only beneficial for business but also for society and ecology (Kumar et al., 2012). As Forster (2013) refers, the ultimate goal for companies is to get to the point where the lowest-priced product is also the product that does the least harm to the environment.

Conveying the heavy importance of sustainability for marketing, Kumar et al. (2012) refer that Peattie and Belz (2010) tried to mold the traditional 4P's (Product, Price, Place and Promotion) into 4C's - Customer solution, Customer cost, Convenience and Communication to include sustainability criteria into marketing strategy (Kumar et al., 2012).

2.4. Alternatives to paper and cardboard breakfast cereal packages

Even though some consumer product goods (CPGs) companies have taken measures to reduce the packaging material used for their breakfast products or even introduce new formats, in most supermarkets and grocery stores, the bag-in-box type of package is the most common type that can be found. Smaller specialty brands and retailers are the ones leading the way in alternatives to the bag-in-box, according to Sheaffer (2010). This is especially odd, when considering that in the case of the United States, for example, the cereal industry generates an annual revenue of more than $9 billion, with 80% generated by only four major manufacturers (Sheaffer, 2010), a revenue that could be invested in packaging efficiency improvements.

Among the alternatives that can be contemplated for manufacturers to improve the sustainability of a package, the reduction of the amount of materials used in the manufacture of product packaging can be considered, as well as minimizing the product-to-package ratio. Despite these options being considered the most efficient ways to enhance the sustainability of a package (Sheaffer, 2010), there are other ways of improving cereals packaging, both in a sustainable and profitable way.

Zip-Pak, a resealable packaging solutions provider, based in U.S.A., assigned an independent life cycle inventory to quantify the benefits of resealable flexible packaging compared to other alternatives, which confirmed that resealable flexible pouches (annex 2 and 3) had lower energy consumption, greenhouse gas emissions, and solid waste generation than bag-in-box cereal packaging. Furthermore, it was found that a 20-ounce bag-in-box cereal package consumed 85% more energy, generated 3.5 times more waste, and 2 times more greenhouse gas than the 21-ounce flexible pouch alternative. In the Wal-Mart's sustainability scorecard the resealable flexible pouch compared to the standard bag-in-box package scored 47% higher (Sheaffer, 2010).

Slide closures in packaging can also increase the package's sustainability. The slide closure consists of a slider clip, which can be applied to premade cereal pouches, creating a resealable package and allowing multiserve portions using the original package, eliminating the need for transferring cereal to a generic unbranded container. Other benefits of slider closures include, for cereal manufacturers, the lengthened exposure that their package-printed messaging could get, ultimately serving to strengthen the brand recall. This technology uses less material, reducing manufacturing costs and from a consumer perspective adds value to the purchase, since the cereal will remain fresh and crisp.

Moreover, sliders represent a decrease of the environmental footprint of packaging (Sheaffer, 2010).

Malt-O-Meal [22] tested resealable packaging and its packaging technology manager for Malt-O- Meal, Mick Kaschmitter commented on its benefits, stating that the new design reestablished the brand as an innovator within the industry and saved money, adding that sales of bagged cereals have increased over 25% and that the new brand's package design has been a worth-while investment (Sheaffer, 2010). Besides these corporate benefits, flexible packaging can be effective in helping brand owners build a close relationship with consumers. For consumers, convenience can draw an initial sale and then retain consumer brand loyalty (Abdalkrim & Hrezat, 2013). It is then accurate to state that innovative packaging can provide a breakfast cereal company with a technological advantage and at the same time lower its costs and help retaining clients. In spite of all benefits, the industry has not widely adopted this kind of packages.

Regarding iconic packaging, Dobson & Yadav (2012) refer that a change in packaging represents a strategic challenge, since packaging has to move with times in a way that retains consistency with the brand heritage. The aim, then, is to find the right balance between change and consistency.

On the other hand, there is an opportunity for cereal brand managers to meet the demands for convenience and sustainability, while differentiating their products through innovation in packaging. Brand owners have to deal with pressure from retailers to reduce packaging materials and the overall environmental impact of products throughout the supply chain (Sheaffer, 2010).

Demographic factors, such as an ageing population and an increasing number of people living in smaller households, changes in household size and composition, reflect changes in consumer lifestyle. Thus, easy open/reclose and

[22] Malt-O-Meal is the largest producer of bagged cereals in the United States (source: Sheaffer,2010).

efficient dispensing can be packaging features appreciated by an aging population and smaller packs would also be more popular with small families (Dobson & Yadav, 2012). In addition, researchers have shown that the use of appropriate packaging can contribute to reducing food losses and waste, and maintenance of product quality and safety (Opara & Mditshwa, 2013).

2.5. The impact of package attributes on consumer perceptions

Consumers usually invest seconds evaluating food products and do not attend to all the information included on food packages. Attentional mechanisms select part of the information for further processing, while the rest of the information is not processed and consumers are not even aware it is there. Attention (degree to which consumers focus on stimuli within their range of exposure) is a pre-requisite for information processing and a key step in the consumer decision-making process. Both bottom-up and top-down processes mediate consumers' attention towards the different elements of a food package. Bottom-up attention is a rapid and automatic form of attentional capture that depends on the characteristics of the stimulus (such as its color, size, shape, saliency of the element from the background in which it is enclosed) and occurs even when the consumer is not specifically searching for it, whereas, on the other hand, top-down attentional capture depends on the consumers' interest and motivations and requires consumers to voluntarily search for specific information. Thus, if a certain package element does not automatically catch the consumers' attention (bottom-up process), he will not use it for making choices unless it is relevant and the consumer will try to find that component on the package (Varela et al., 2014). Consumers, besides not being able to capture all the information of packages at the point of sale, value certain package characteristics in different phases of the decision-making process. For example, color and size are relevant at the moment of purchase, while information about product use is more important during use. On the other hand, according to Silayoi & Speece (2007), the consumer's intention to purchase depends on the expectation of the product's capacity of satisfying the consumers' needs and when a consumer has not though much about the product, it is determined by what is communicated at the point of purchase. In addition, consumers are more likely to spontaneously imagine aspects of how a product looks, tastes, feels, smells, or sounds while viewing product pictures on the package (Underwood, 2001). Consequently, the package becomes a critical factor in the consumers' decision-making process, and the way consumers perceive the products through the communication elements in the package is key to the success of many food products marketing strategies (Silayoi & Speece, 2007). The redesign of the iconic Tropicana orange juice cartons in 2009[25] (annex IV) resulted in consumer resistance, prompting the brand to abandon its new look for the consumer-preferred traditional package (Sheaffer, 2010) and illustrating the considerable power that packaging exerts at the point of purchase for FMCG.

According to Yan et al. (2014), package size can have a significant impact on quality judgments and these authors have provided empirical evidence regarding the impact of different sizes of packaging products on consumers' quality judgments, with their findings showing that the size–quality relationship is mediated by differences in perceptions of unit price (price per unit volume) associated with different package sizes. Furthermore, Yan et al. (2014) quote

[25] Tropicana launched the new packaging for Tropicana Pure Premium in January 2009, with sales revenues reaching more than 700 million dollars per year. Two months later, sales dropped by 20%, resulting in a loss of 30 million dollars for Tropicana. (Source: http://www.thebrandingjournal.com/2015/05/what-to-learn-from-tropicanas-packaging-redesign-failure/) (The Branding Journal, 2015).

studies (e.g. Mathur & Qiu, 2012 and Yan et al., 2014) that revealed that a product in a smaller package is rated more favorably than the equivalent product in a larger package. This effect is justified by the fact that the smaller package is associated with a higher unit price, despite having a lower overall price (Yan et al., 2014). On the other hand, Makanjuola & Enujiugha (2015) cited a Chandon and Ordabayeva (2008) study that observed that changes in size look smaller when the product changed in all dimensions (height, width, and length) than when it changed in only one dimension and a study by Wansink and Van Ittersum (2003), on which children and adults pour and consume more juice when given a short, wide glass compared to those given a tall, slender glass, but perceive the opposite to be true. Research has also demonstrated that package size can accelerate usage volume. Pornpitakpan (2010) refers that a reason large packages might encourage greater use, compared to small packages, is because consumers would be less concerned about running out of the product. Thus, this might be a reason for a consumer preference for bigger packages over smaller. Besides, products from large packages are generally less expensive (per unit) than those from small packages, so they may be used in greater volume. Today, one of the key challenges faced by packaging technologists, designers, and marketers is to maximize the size impression of their products to the consumers. There is a double-win situation associated to certain package shapes: there are packages that may be more likely to be chosen because they are perceived to be bigger and in that form, they may be consumed faster (Makanjuola & Enujiugha, 2015).

The materials used in packaging have also an influence on the consumers' discernments and consumer perceptions regarding certain materials could change the perceived quality of a product and this applies to packaging as well (Dobson & Yadav, 2012). Zhang (2013)'s study on organic cereal packaging design found that different physical materials used in packaging trigger different sensory and emotional responses from participants, and color variations in packaging lead to differences in participants' emotional and sensory responses to organic food prototypes. In terms of physical materials, rough cardboard can provide stronger sensory and emotional perceptions of warm, healthy, and organic, while smooth cardboard gave participants stronger perceptions in sweet, comfortable, and likeliness in purchase. In Brown's (1982) study, referred by Zhang (2013), on packaging materials and perception of tastes, wrappers of different materials gave subjects different perceptions of freshness for the bread inside. Furthermore, bread of different freshness (fresh, one day-old, two days-old) wrapped in the same material created the same perception of freshness in subjects, confirming, that different packaging materials can create different sensory and emotional perceptions among consumers.

On the other hand, Pornpitakpan (2010) cites Folkes et al. (1993), that postulate that the greater the discrepancy between the package potential and actual fill amounts, the greater the perceived scarcity of the product is. As the fill amount decreases, people perceive supply as smaller, thus using a lower amount and consumers may perceive that they are using up more of a product when a smaller supply is available (Pornpitakpan, 2010).

Consumers' perceptions are also influenced by color. Consumers learn color associations leading them to prefer certain colors for certain product categories,. Using color on packaging as a cue can foster a potentially strong association, especially when it is unique to a particular brand. However, it is important to consider that people in different cultures are exposed to different color associations and develop color preferences based on their own culture. Marketers, therefore, must consider color as part of their strategies, but always with the conscience that simply taking the colors of a particular logo, package, or product design from one market to another should only be done under a thorough understanding of how colors and color combinations are perceived in each location (Silayoi & Speece, 2007).

In the context of sensory and emotional reactions a positive effect can be achieved by manipulating one or more packaging variables, including packaging color and using clear packs that allow the view of food (Silayoi & Speece, 2007). Indeed, Zhang (2013) study "Creating a better product experience in organic cereal packaging design", determined that different transparency styles may bring different sensory and emotional responses to consumers. A clear plastic package may bring stronger senses than the other two plastic packages tested, in relation to attributes such as "crunchy, crispy, fresh, healthy, warm, and organic", because participants could see the actual product through clear plastics and had a direct feeling of what was inside. Opaque plastic packaging with a clear window brought associations like "sweet, tasty, good value, comfortable, enjoyable, and likeliness" in purchase. On the other hand, the full opaque plastic packaging prototype was the least favored in the study because it made them feel unsure about what they would get. Furthermore, according to the participants' feedback, opaque plastic packaging has been widely used in many conventional food packages, which made some participants associate it with cheap and unhealthy commodities. In contrast, the opaque plastic with a clear window package prototype allowed to see the product inside and was the favorite choice (Zhang, 2013).

Visual imagery on the package is another essential attribute. Pictures on the package can be a strategic method of differentiation, enhancing access to consumer consciousness, because pictures are extremely vivid stimuli compared to words and are also quicker and easier for consumers to process in a low involvement situation. As visual packaging information may attract consumer attention and set expectations for content, a well-produced product image is likely to evoke memorable and positive association with the product (Silayoi & Speece, 2007).

It is the combination of the shape, material, and style of packaging when united with marketing dress such as logos and recognizable colors and graphics that can have a deep and lasting impact on consumers, according to Dobson & Yadav (2012). In their viewpoint, this is especially accurate when consumption of the product takes place over a prolonged period, requiring frequent visits to the shelf or cupboard, which is the case of ready-to-eat breakfast cereals.

Concerning the consumer's relationship with packaging, Grant et al. (2015) denote that it is short-lived, with the focus of the consumer's desire being the product contained in the package. Consumers are, according to the authors, almost unaware of the functioning of packaging and once separated from the product, they see it as waste with its original function quickly forgotten. Some authors even consider that consumers and the public, generally, tend to have a love-hate relationship with packaging, since they recognize its key importance in protecting goods and being an information provider, but are concerned about costs and the environmental impact and because of that, sometimes perceive packaging as unnecessarily, excessive or wasteful (Dobson & Yadav, 2012). It is not surprising then that in a symposium devoted to "Plastic Packaging of Foods Problems and Solutions" it was advocated that consumers need to be provided with packages that are economic, convenient and environmentally sound (Raheem, 2013).

2.6. Companies' value chain

Over the last few years, the importance of packaging concerning its role as a link in the entire supply chain and coordinating all participants in the process, has been recognized (Gámez Albán et al., 2015) and new design requirements have been added associated to these functions. These new requirements were meant not only to improve the differentiation of the product (commercial function), but also to improve the efficiency of the product at a logistic and production level (the logistic function), since packaging is among the key elements that can support the implementation of efficiency and sustainability-oriented strategies (J García-Arca et al., 2016). Conveying the protagonism of packaging in the logistics function, García-Arca et al. (2014, p. 330) introduced the concept of sustainable packaging logistics as "[...] the process of designing, implementing, and controlling the integrated packaging, product and supply chain systems in order to prepare goods for safe, secure, efficient and effective handling, transport, distribution, storage, retailing, consumption, recovery, reuse or disposal, and related information, with a view to maximizing social and consumer value, sales, and profit from a sustainable perspective, and on a continuous adaptation basis"(J García-Arca et al., 2016).

In a logistical operation, the concept of package is of a product that is stored and transported. Thus, packaging should rather help than be an obstacle to the logistical operation This also indicates that packaging is a part of the total logistics function, and that the design and use of packaging has an impact to other functions such as production, marketing and quality control, as well as for the total logistics cost and performance (Rushton et al., 2011). In fact, Gámez Albán et al. (2015) cite Wagner (2002) who recognizes package size as a key aspect in the supply chain strategy and its effectiveness in reaching customers with what they need.

Package size can have an impact on the following costs, according to (Gámez Albán et al., 2015):

- Costs of handling and carrying inventory of outer packs at the production plant;
- Cost of handling outer packs at distribution centers and retail stores;
- Cost of handling inner packs at distribution centers and retail stores;
- Cost of opening an outer pack or an inner pack at Distribution Centers and retail stores;
- Transportation cost;
- Cost of packing material;

Consequently, both direct costs (purchasing and waste management) and indirect costs (packing, handling, storage, transport and losses) are involved in the selection of the "best packaging" for a product, which is usually linked to considerations involving cost reduction. In fact, a change in packaging can have a considerable impact in indirect costs for companies. Supermarket chain Sainsbury removed a layer from its garlic bread by replacing a cardboard carton and a plastic inner sleeve with a polypropylene film pack, thus achieving a reduction on its packaging weight by 70% and improved transit pack efficiency by 20% (Holdway et al., 2002).

Chapter 3

Regulations applied to RTE breakfast cereals

The requirements of any packaging system consist of those relating to the marketing, technical performance and legal requirements (Grant et al., 2015). Thus, the amount of packaging which companies decide to use is largely influenced by the cost of materials and manufacturing efficiency and, in some extent, societal pressure and public policy, which can move companies to minimize their impact on the environment (Hurley et al., 2010) by making pressure for packaging practices changes and making environmentally sound packaging mandatory. Such pressure and responsibility already occurs in the car industry, since car manufacturers are more and more responsible for their products from manufacture to disposal, a scenario enforced by legislation in Europe and the United States (Holdway et al., 2002). Consequently, it has been recognized more and more that environmental issues are everyone's responsibility, 'the polluter must pay' and manufacturers must consider the long-term effects of their products including the possibility of recycling all or part of the product (Rushton et al., 2011). It is not unreasonable to think that this liability applied to the car industry could not be extended to the packaging industry. In addition, there is an increasing interest form governments in the environmental aspects of packaging, as they are seeking to curb waste and increase the recovery and recycling rates (Dobson & Yadav, 2012). Rigorous environmental initiatives that set targets for packaging waste reduction or ban certain packaging materials from landfill sites are affecting firms at all levels (Labatt, 1997). Since 1972, the EU has enacted hundreds of pieces of legislation that have introduced, among other things the minimum standards for waste management, water, and air pollution (Rushton et al., 2011).

Specifically, packaging waste is legislated by the European Packaging and Packaging Waste Directive '94 (European Parliament and Council, 1994/62/EC) that outlines how to manage packaging and packaging waste in order to minimize the production of packaging waste. Its main aim is the promotion of reuse, recycle or recover packaging so that less packaging waste is sent to landfill. Nevertheless, the directive was amended in 2004, (European Parliament and Council, 2004/12/EC) foreseeing from then forward responsibility on what occurs to packaging at the end of its life cycle (Dixon-Hardy & Curran, 2009). Moreover, the Directive focuses on material reduction, also affirming that the entire life cycle should be considered (Wever, 2010).

Most member states of the EU implemented the EU Packaging Directive by using a similar system to the German 'Green Dot' system, which sustains that all manufacturers are held responsible for take-back of every package they put on the market. Companies can, nevertheless, transfer this obligation to a waste treatment organization, by paying a fee (Wever, 2010). According to Dobson & Yadav (2012), the packaging directive sets down requirements on the amount of packaging material that should be recycled, targets for energy recovery, for re-use and recycling of packaging, covering all packaging placed on the market within the EU as well as all used packaging, whether disposed of at industrial or commercial sites or coming from private homes. In the last decade, the EU-15 trend indicates that while GDP[26] grew, packaging consumption grew at a much

[26] GDP – Gross Domestic Product

slower pace than GDP growth and packaging disposal to landfill reduced significantly (Retail Forum for Sustainability, 2011).

Furthermore, all packaging placed on the EU market needs to comply with the Essential Requirements (Article 9 and Annex II of the PPWD[27]) that specify that packaging weight and volume must be reduced to the minimum necessary for safety, hygiene and consumer acceptance of the packaged product. These requirements also designate that packaging should be designed, produced and commercialized in such a way that it permits its reuse or recovery, including recycling. Member States have the obligation to ensure that all packaging placed into the market complies with these Essential Requirements and companies have the responsibility of demonstrating compliance with these standards (Retail Forum for Sustainability, 2011).

CEEREAL – European Breakfast Cereal Association, has published the "Pack-fill standard" (2016), a document which "sets out provisions for CEEREAL member companies with regard to responsible packaging practice and current packaging legislation" and is only applied to breakfast cereals packed in cartons. Specifically, this document sets a minimum target fill level and industry obligations to minimize packaging waste and "may serve to inform regulatory and enforcement authorities with regard to how the industry meets the needs of consumers through adherence to responsible packaging practice." (CEEREAL, 2016).

Concerning the packaging process of ready-to-eat cereals, the Pack-fill standard delineates two types of breakfast cereal product: biscuits and "loose" breakfast cereals. Breakfast cereal biscuits are, according to the document, manufactured to a predetermined physical size, wrapped in a sleeve and closely packed in cartons to completely fill the box, whereas loose breakfast cereals are

[27]PPWD - Packaging and Packaging Waste Directive

packed into cartons in bag-in-box, where a poly-cereal liner is filled with cereal and inserted into a pre-formed carton or direct fill. Concerning the air that most ready-to-eat cereals bags include, it is stated that this occurs due to a result of high-speed packing. This has, according to the same source, the advantage of protecting the product.

Regarding the purpose of the cartons on which bags of RTE cereals are inserted, CEEREAL states that they provide rigidity, protect the product and that bag-in-box packaging allows high-speed packing of products with differing bulk densities and shapes and that this benefits the consumer. Other remarks made by the Pack Fill Standard include the following:

- The interrelation between pack size, shape and board usage and waste are considered complex and thus there is no single optimum shape of cereal packages;
- Packs should be the optimum size and shape for ensuring maximum pallet fill, allowing fewer journeys for product distribution;
- By adopting best practice, a minimum pack fill value of 70% should normally be achieved for all products at time of filling. 100% pack fill is unattainable due to the intrinsic nature of the products and the capabilities of the packing process;
- Levels will rarely exceed 90% because of the tolerances required for high-speed packing lines; the pack fill will therefore usually range between 70% and 90%;
- For both cases, the pack fill percentage is given by: (Product Height x 100) / Carton Height, considering carton height as the internal height taken from the carton specification.

CEEREAL member companies have, according to CEEREAL, voluntarily agreed to conform to the advice, guidelines and standards stated in this document, even though it is not possible to discern if any sort of penalties is applied to the members who do not follow them and there is no data regarding the compliance of the established guidelines. On the other hand, it seems contradictory that, in the same document it is mentioned that "(…) there is no single optimum shape of cereal packages (…)" and: "Packs should be the optimum size and shape". Hence, it is unclear what is considered by CEEREAL an "optimum size and shape" of cereal packages.

Chapter 4
Methodology

Data collection was divided in two phases: the first, aimed at determining the characteristics of breakfast cereal's packages; and the second, aimed at examining the extent of oversize packaging practices. With an exclusive focus on paperboard cereal boxes, the present study only considers bagged RTE cereals. Hence, hot cereals have not been considered in the conducted research. The ready-to-eat cereals (RTEC) segment includes staples (e.g. corn flakes), children's cereals, and health products (e.g. muesli). In this research only the second category was studied.

In the first phase, five major retail chains[28] were contacted and permission was obtained to collect data in local stores.

The data for the 109 packages of RTE breakfast cereals targeted to children and families was collected between November 2016 and January 2017 at three supermarket chains stores in Portugal, for both store brands and manufacture brands. Packages were examined and data was collected on the following variables: (1) brand; (2) type of cereal; (3) package dimensions and (4) product weight. All this information was organized and recorded in a database.

In the second phase, eighteen cereal packages were randomly selected to evaluate the level of oversize packaging and determine how much the secondary package could be reduced (maintaining the same quantity of product). The feasible reduction was then measured in terms of package dimension and weight.

[28] Retail chains contacted: Continente, Pingo Doce, Lidl, Intermarché and SuperCor.

The research process to measure the feasible reduction in breakfast cereals packages is detailed in table 1.

Table 1 - Process for measuring the feasible reduction of cereal packages

1	First, I opened the carton package (secondary package).
2	Then I took the primary packaging off the carton bag.
3	The third step of the process is the withdraw of the air contained in the cereal's primary package (plastic bag).
4	Following step 3, I folded the cereal's plastic bag, leaving it completely full of cereals.
5	Then, I placed the plastic package inside the carton box, maintaining the plastic box folded.
6	Step 6 of the process was cutting off the part of the carton box which was not filled with the plastic package.
7	In the following step, I weighted the cereal package that remained after the cut and measured this remaining cereal box.

After conducted the process described on the eighteen selected cereal bags, the data described in table 2 was gathered:

Table 2 - Calculated metrics/ data for the sample of eighteen cereal packages selected

Calculated data	**Definition**
Total weight	Weight of the carton box without its content
Valuable weight	Weight of the carton box and content which is left after undergoing step 6 (table 1)

Extra weight and percentage of extra weight	Weight of the cut carton in step 6 (table 1)
Extra height and percentage of extra height	Height of the carton that is cut in step 6 (table 1)
Extra volume and percentage of extra volume	Volume of the package which was cut out in step 6 (table 1)

The cereal box of Estrelitas 375 grs., is presented as an example:

Table 3 - Calculated metrics for "Estrelitas" cereal carton package

Calculated data	**"Estrelitas" cereal box (gr)**
Total weight	50
Valuable weight	38
Extra weight and percentage of extra weight	12; 24%
Extra height and percentage of extra height	8,2; 29,8%
Extra volume and percentage of extra volume	0,1913; 29,8%

In order to make data comparable, package information was grouped according to the type of cereal. This aggregation was executed, due to the differences in the weight/volume ratio among some types of cereals - for instance, *muesli*'s ratio is significantly different from *puffed corn* or *wheat balls* ratio[29]. Moreover, ready-to-eat cereals are typically grouped by cereal form rather than the type of grain used (Roy & Jeff, 1995).

[29] The correspondence of names between the english category designation and the portuguese names can be found in appendix I .

In addition to the study carried out on package oversize evaluation a questionnaire (annex 2) was also conducted to assess the consumers' perceptions regarding overpackaging in RTEC and questions regarding the consumers' preferences for breakfast cereals. The self-administered anonymous online questionnaire was answered by a convenience sample of 263 subjects. A hyperlink to the online questionnaire was sent to this subjects and the entire sample completed it. The data collection stage happened between the 25th February to 1st of March 2017.

Chapter 5

Results of research

The most frequent product categories in the sample are *chocolate wheat flakes,* such as “Chocapic” (Nestlé) and “Chocos” (Kellogg’s), *whole grain flakes & fruit* such as “Especial Silhueta Frutos Vermelhos” (Continente) and “Special K Frutos Vermelhos” (Fitness Fruits) and *muesli*, such as “Cruesli 4 Nuts” (Quaker) and “Muesli” (Continente). Tables 4 and Table 5 present the distribution of the RTEC sample by product category and weight and figures 6 and 7 present the their graphical representations.

Table 4 - Breakfast cereal categories

Type of cereal	Number of packages	Percent
Whole Grain Sticks	3	2,8%
Pillows	7	6,4%
Rings	3	2,8%
Puffed Rice	5	4,6%
Chocolate Wheat flakes	12	11,0%
Cereal Grains with Chocolate	1	0,9%
Cookie Crisp	1	0,9%
Corn Flakes	6	5,5%
Stars	8	7,3%
Whole Grain Flakes	8	7,3%
Whole Grain Flakes & Chocolate	3	2,8%
Whole Grain Flakes & Fruit	15	13,8%
Wheat Squares	4	3,7%
Puffed Corn	4	3,7%
Muesli	16	14,7%
Chocolate Wheat Balls	6	5,5%
Puffed Wheat Grain	5	4,6%
Clusters	2	1,8%

Total	109	100%

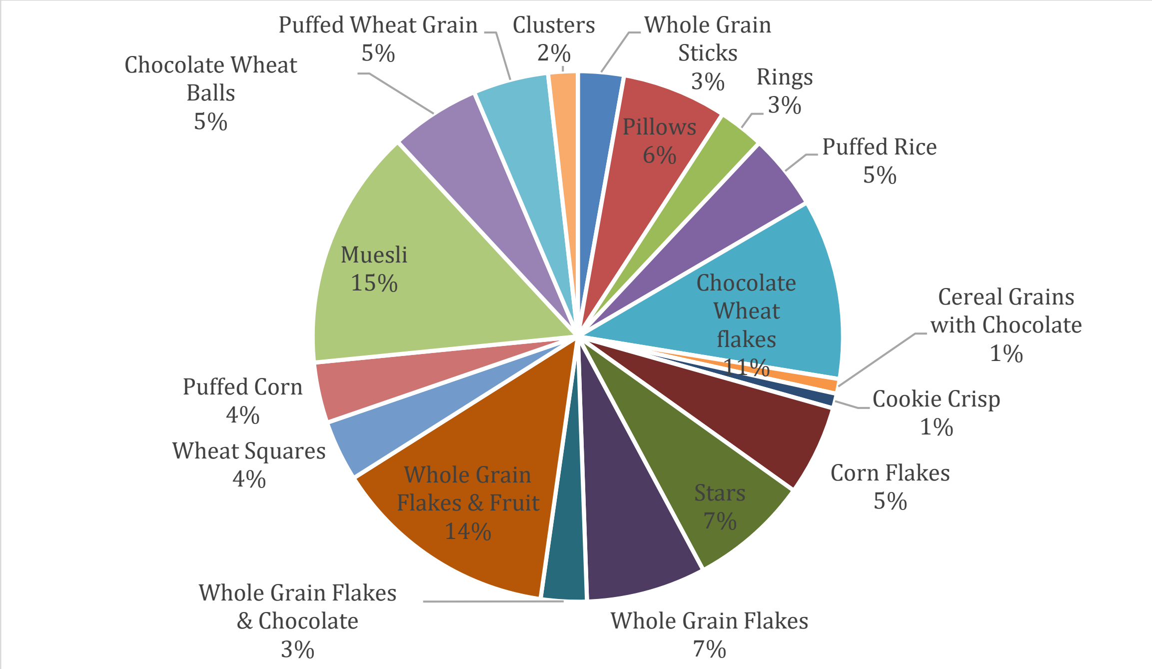


Figure 6 - Breakfast cereal categories (%)

Table 5 - Cereal package net weight

Net Weight (gr.)	Number of packages	Percent
300	6	5,5%
325	4	3,7%
375	51	46,8%
425	2	1,8%
450	1	0,9%
500	26	23,9%
600	2	1,8%
625	7	6,4%
750	9	8,3%
1000	1	0,9%
Total	109	100,0%

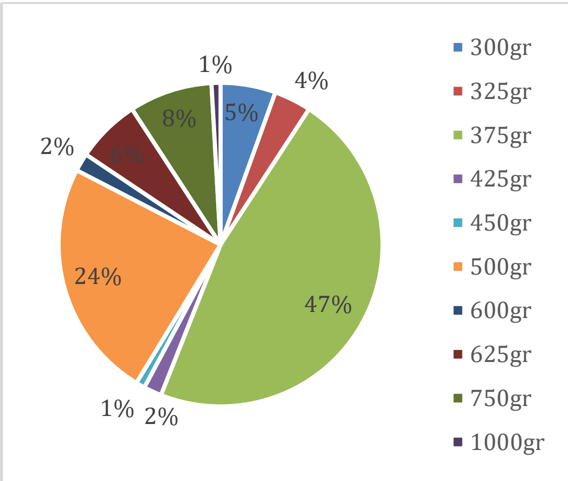


Figure 7 - Weight of cereal packages in the sample

Although the breakfast cereals offer in supermarkets is available in different sizes, the most common breakfast cereals packages in the Portuguese market are the ones containing 375 gr. and 500 gr., as represented in figure 10. Packages dimensions do vary among product categories, however, a significant number of packages of different brands and product categories with the same dimensions was found in supermarkets, suggesting the existence of some market standardization (Table 6).

Table 6 - Statistics on package dimensions

Number of Packages	Package dimension	Mean	Std. Deviation	Mode	Minimum	Maximum	Range
109	Height	26,8	3,0	27,5	20,0	34,0	14,0
109	Width	19,0	1,2	19,2	12,8	24,0	11,2
109	Depth	6,1	1,5	5,2	4,0	12,5	8,5

To evaluate the effective use of the package capacity, the weight/volume ratio grouped by product category is presented in figure 8, which shows a high dispersion of values; in some cases, such as the *Whole grain flakes*, the maximum value more than doubles the minimum.

The *whole grain flakes*, *wheat squares* and the *chocolate wheat balls* categories exhibit the smallest dispersion. *Cereal grains with chocolate* and *cookie crisp* cannot be considered since only one product exists in the category. The *Clusters* cereals' sample consist of Nestlé's two flavor varieties, "Clusters Amêndoas" and "Clusters Chocolate". Conversely, the categories that present the highest dispersion are *whole grain flakes & fruit*, *muesli and pillows,* as we can see in figure 11.

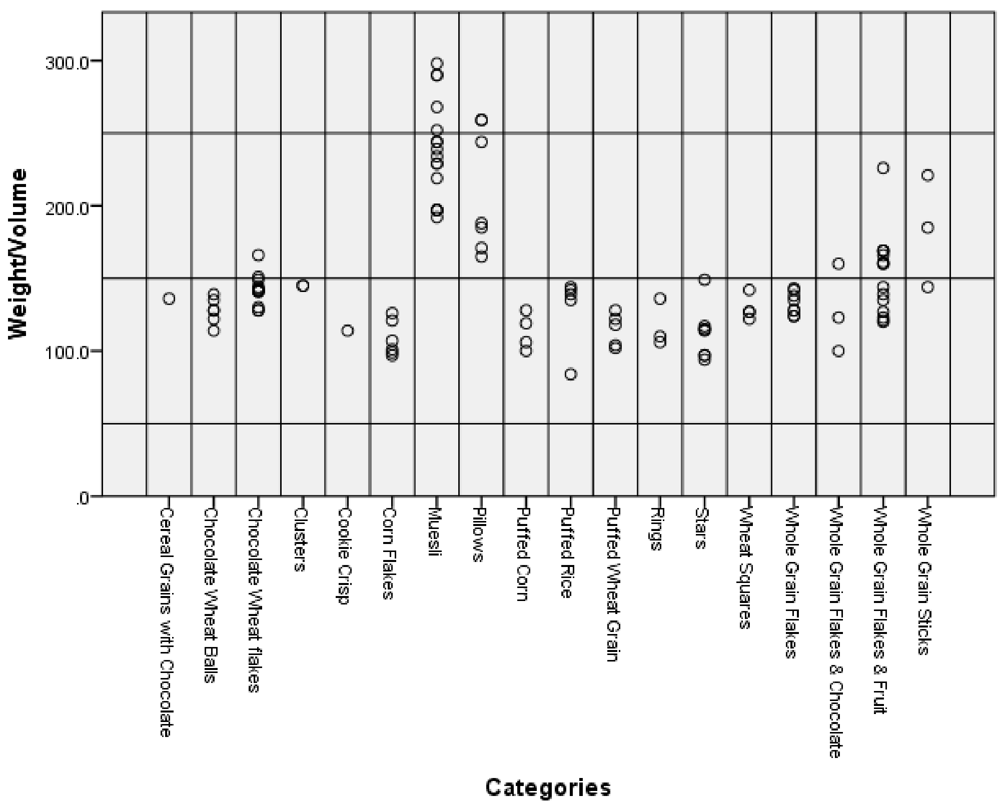


Figure 8 - Weight/Volume ratio per category (Gr/lit)

Table 7 - Descriptive statistic for the Weight/Volume Ratio (Gr/lit)

Type of cereal	Weight(Gr)/Volume(Lt)					
	Count	Minimum	Maximum	Range	Average	Std. Dev
Whole Grain Sticks	3	144,8	221,1	76,3	183,8	38,2
Pillows	7	165,2	259,0	93,9	210,4	41,9
Rings	3	106,8	136,6	29,8	118,0	16,2
Puffed Rice	5	84,8	144,8	60,1	129,2	25,1
Chocolate Wheat flakes	12	128,3	166,1	37,8	142,4	10,6
Cereal Grains with Chocolate	1	136,6	136,6	0,0	0,0	0,0
Cookie Crisp	1	114,6	114,5	0,0	0,0	0,0
Corn Flakes	6	97,0	126,2	29,2	108,9	12,1
Stars	8	94,7	149,6	54,9	113,0	17,6
Whole Grain Flakes	8	124,7	143,5	18,8	133,3	7,7
Whole Grain Flakes & Chocolate	3	100,8	169,1	68,3	128,0	29,9
Whole Grain Flakes & Fruit	15	120,2	226,5	106,3	153,1	27,7

Wheat Squares	4	122,5	142,1	19,6	129,7	8,5
Puffed Corn	4	100,1	128,8	28,7	113,5	12,9
Muesli	16	193,0	299,0	106,0	239,8	36,2
Chocolate Wheat Balls	6	114,2	139,1	24,9	128,1	9,0
Puffed Wheat Grain	5	102,2	128,3	26,1	115,2	11,4
Clusters	2	145,6	145,6	0,0	145,6	0,0

In the categories with the lowest dispersion, in the case of the *Whole grain flakes*, the minimum ratio weight/volume is achieved by Continente (124,72), whereas the maximum is achieved by Nestlé "Fitness" (143,5). On the *Wheat squares* category, "Golden Graham's" cereals (Nestlé) represents the minimum value and, strangely, "Cini Minis" also a Nestlé brand, registered the maximum. In the *Chocolate wheat balls,* there is also a curious fact, since the minimum weight/value is registered by Continente's "Bolas com chocolate" package of 625gr and the maximum by the same cereal brand on the 375gr package.

On the other hand, in the highest dispersion categories, the *Whole grain flakes & fruit* category achieves 120,2gr/l as the minimum value of "Special K Frutos Vermelhos" from Kellogg's and Pingo Doce's "My Time Maçã e Canela" retailer cereals registered the maximum value of 226,5gr/l. Quaker's "Cruesli" registered the minimum gr/l of its category, while Jordan's "Muesli" cereal brand is listed as the maximum value in the *Muesli* category and in all the cereals studied. In addition of including the cereal with most space usage, *Muesli* is the category with the highest space utilization, since it has the highest average (239,8gr/) of the sample categories, followed by the *Pillows* category. Regarding the *Pillows* group, Kellogg's "Trésor" cereals have the minimum value and two cereals from Lidl, register a tie on the maximum value, with both "Crownfield Nougat Pillows" and "Crownfield Vanilla Pillows" having the same space utilization (both 259,04gr/lit).

Of all the cereal brands included in this study, Lidl cereals are the ones with the highest volume used, with its Mueslis and Pillows packages. In fact, six Lidl cereals are included in the top 10 space usage cereals of the sample, (figure 9) and only one breakfast cereal producer, Jordans, has a cereal brand in this rank.

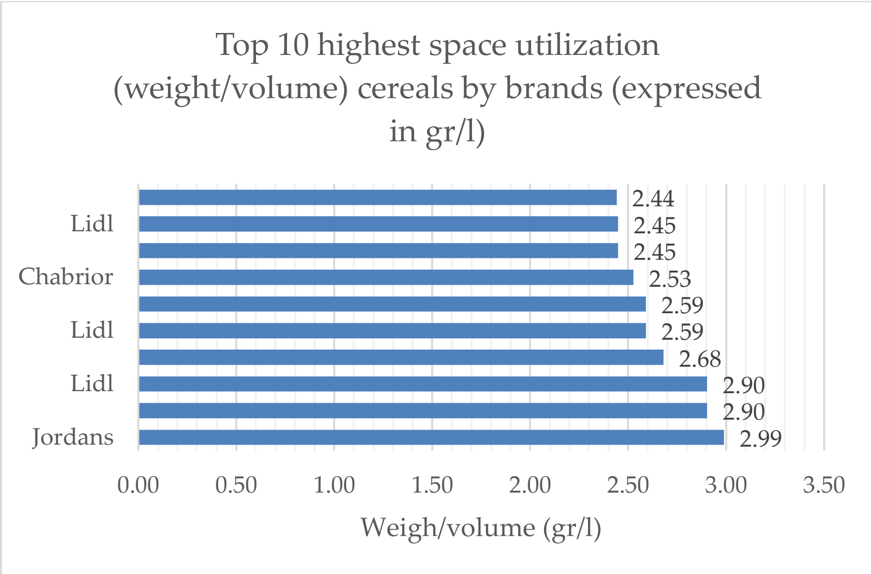


Figure 9 -Top 10 highest space utilization (weight/volume) cereals by brands (expressed in gr/l)

Regarding the rest of the categories, the *Whole grain sticks* Kellogg's cereal has the maximum value and the minimum corresponds to Lidl's cereal brand. Dia's "Yoohoo" cereals have the minimum value of the *Rings* category and "Cheerios" (Nestlé) the maximum. In the *Puffed rice* category Lidl's cereal has the maximum value and Kellogg's "Rice Crispies" has the minimum value. *Chocolate wheat flakes*'s "Crownfield Flakers Choco" (Lidl) registered the minimum value of its category, whereas Continente's cereals registered the maximum value. Lidl's flakes have the minimum gr/l value of the *Corn flakes* category and Kellogg's "Frosties" the maximum. In the *Stars* category, "Estrelitas" (Nestlé) cereals register both the maximum (625gr package) and minimum (365gr package) values in different package sizes. "Fitness" registers the maximum space utilization of the *Whole grain flakes & chocolate* and Dia's brand the minimum. As for *Puffed corn* cereals, Nestlé brand has the minimum value and Dia's "Totters" the maximum. Kellogg's "Smacks" registered the minimum value of the *Puffed wheat grain* category, whereas the Lidl's brand registered the maximum.

Nestlé's cereals registered the lowest values of space utilization in the sample, with 4 Nestlé cereals in the top 10 lowest spaced utilization rank (figure 10) with three "Estrelitas" cereal packages, of different content weights, being a part of this rank, alongside Kellogg's "Rice Crispies".

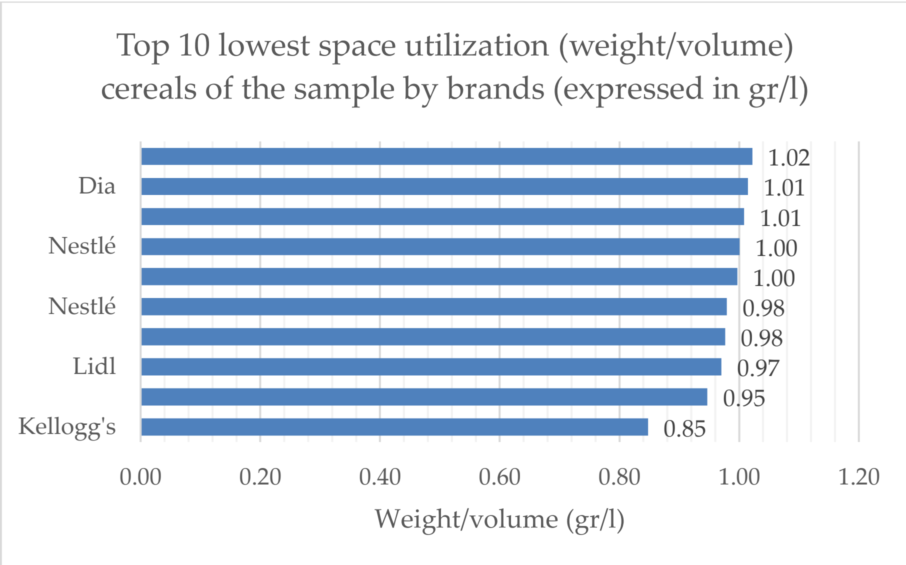


Figure 10 - Top 10 lowest space utilization (weight/volume) cereals of the sample by brands (expressed in gr/l)

Regarding the categories performance, the *Stars* category has the lowest space utilization in the sample and *Muesli* has the highest, with 7 muesli cereal brands part of the top 10 highest average of weight/volume (fugure 11), followed by the pillows category with 3.

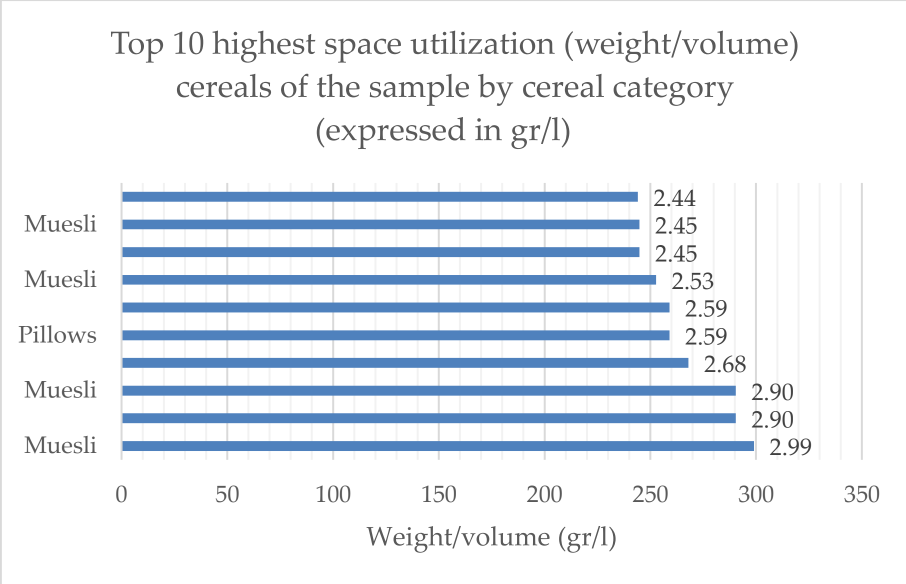


Figure 11 - Top 10 highest space utilization (weight/volume) cereals of the sample by cereal category (expressed in gr/l)

These findings indicate that a significant share of the RTE breakfast cereal brands analysed may present an excessive amount of package, which means they are oversized. This conclusion can also be observed through the analysis of the range of the weight/volume ratio, displayed on figure 11.

Having verified the existence of package oversize through the observation of the weight/volume ratio dispersion, a test with a sample of 18 packages was conducted to assess the amount of feasible reduction. Three criteria were contemplated in order to assess the feasible reduction: (i) extra weight, (ii) extra height and (iii) extra volume (tables 7,8 and 9).

Table 8 - RTE cereal package extra weight

	Extra Weight (gr)					Percent of Extra Weight			
	N	Min.	Max.	Average	Std. Dev.	Min.	Max.	Average	Std. Dev.
Pillows	3	12.0	23.0	15.667	6.351	0.170	0.400	0.280	0.115
Chocolate Wheat flakes	1	13.0	13.0	13.000	.	0.183	0.183	0.183	.
Stars	2	12.0	12.0	12.000	0.000	0.170	0.240	0.205	0.049
Whole Grain Flakes	2	11.0	17.0	15.500	2.121	0.288	0.256	0.304	0.023
Whole Grain Flakes & Fruits	6	10.0	22.0	14.167	4.401	0.233	0.293	0.261	0.025
Muesli	3	11.0	20.0	14.667	4.726	0.217	0.303	0.255	0.044
Chocolate Wheat Balls	1	7.0	7.0	7.000	.	0.152	0.152	0.152	.

Regarding the weight (table 7), the packages sampled indicate that a maximum saving of 40% could be achieved in the case of one brand of *pillows* (Dia's "Choco Pillows"). In this cereal category, an average of 28% of extra weight is feasible, whereas the category that presents the highest average of weight saving is the *whole grain flakes* category (30%). The minimum saving, 15%, concerns a brand of *chocolate wheat balls* ("Nesquick" by Nestlé) which is the category with the lowest average of feasible weight saving (15%), followed by chocolate wheat flakes (18%). In fact, all the cereal categories can undergo a weight reduction of at least 15%.

The analysis of the height reduction (table 8) reveals that the major reduction was, once more, associated with a package of *pillows* (48%), for a retailer brand Choco Pillows" (Dia). The minimum height reduction of the sample is associated with Lidl's "Crownfield Nougat Pillows" (20%). *Whole grain flakes* present the highest average of feasible reduction (9,90cm) and the minimum feasible reduction average is of 6,5cm for *chocolate wheat flakes* and *chocolate wheat balls*. A reduction of at least 20% of height is possible for any category.

Table 9 - RTE cereal package extra height cereal

	Extra Height (cm)					Percent of Extra Height			
	N	Min.	Max.	Average	Std. Dev.	Min.	Max.	Average	Std. Dev.
Pillows	3	6.000	13.000	8.733	3.743	0.200	0.481	0.336	0.138
Chocolate Wheat flakes	1	6.500	6.500	6.500	.	0.203	0.203	0.203	0.034
Stars	2	6.500	8.200	7.350	1.202	0.250	0.300	0.274	0.000
Whole Grain Flakes	2	9.300	10.500	9.900	0.849	0.344	0.400	0.372	0.026
Whole Grain Flakes & Fruits	6	7.000	10.500	8.233	1.211	0.280	0.396	0.327	0.041
Muesli	3	7.000	10.000	8.167	1.607	0.283	0.400	0.332	0.061
Chocolate Wheat Balls	1	6.500	6.500	6.500	.	0.236	0.236	0.236	.

Regarding the extra volume (table 9), a minimum reduction of 0,599l is feasible for a brand of *pillows* and a maximum reduction of 1,552l is feasible for a brand of *whole grain flakes & fruits* (Chabrior's "Fruits et Fibres"). *Whole grain flakes* present the highest average of extra volume of 36% and *chocolate wheat flakes* present the minimum (20%).

Table 10 - RTE cereal package extra volume

	Extra Volume (lit)					Percent of Extra Volume			
	N	Min.	Max.	Average	Std. Dev.	Min.	Max.	Average	Std. Dev.
Pillows	3	0.599	1.298	0.844	0.393	0.207	0.481	0.336	0.138
Chocolate Wheat flakes	1	0.849	0.849	0.849	.	0.203	0.203	0.203	.
Stars	2	0.811	0.913	0.862	0.072	0.250	0.298	0.274	0.034
Whole Grain Flakes	2	0.998	1.036	1.017	0.027	0.344	0.382	0.363	0.026
Whole Grain Flakes & Fruits	6	0.618	1.552	0.847	0.351	0.280	0.396	0.327	0.041
Muesli	3	0.618	0.910	0.773	0.146	0.283	0.400	0.332	0.061

Chocolate Wheat Balls	1	0.724	0.724	0.724	.	0.236	0.236	0.236	.

5.2. Questionnaire results

The results of the questionnaire applied to 263 subjects on overpackaging of RTE cereals and consumer preferences regarding these products are now presented.

Regarding the first question "Who consumes breakfast cereals in your household?"[30], 83% of the respondents answered that they eat this type of food or that others consume it in their house (figure 12). Thus, more than half of the respondents either eat or have someone in their houses who eats RTEC. Only 17% reported not to have any one who consumes breakfast cereals in their household.

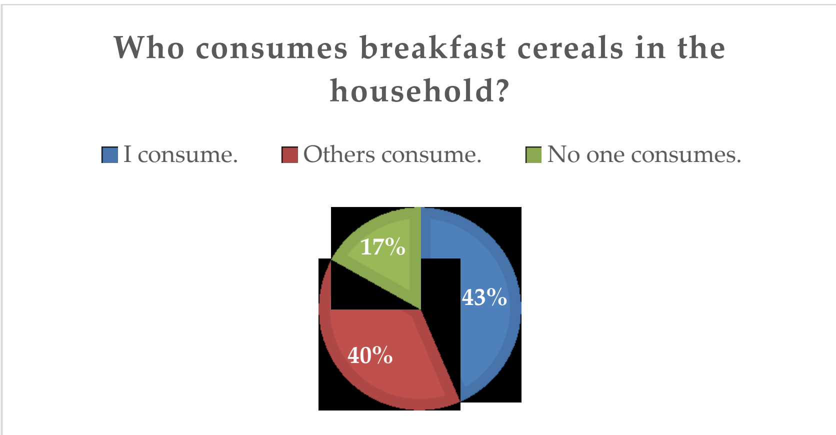


Figure 12 - Analysis of the consumption of breakfast cereals in the respondents' household (%).

[30] This was a multiple-choice question, respondents were allowed to choose more than one factor simultaneously.

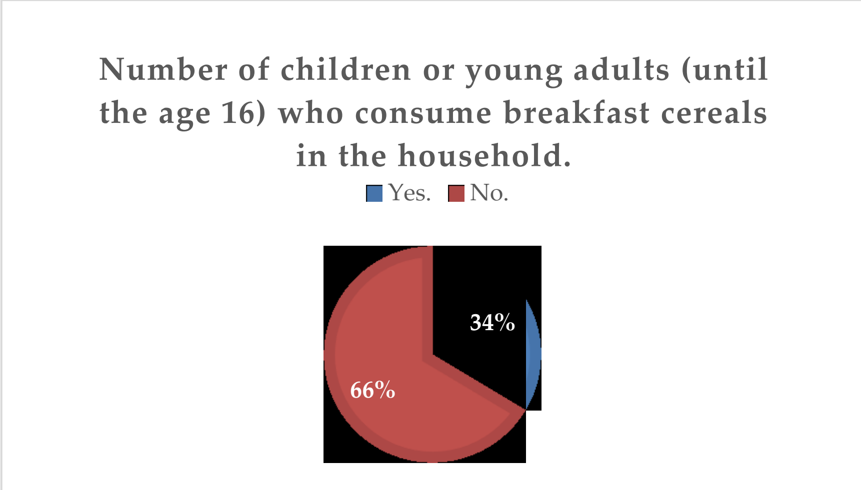


Figure 13 - Analysis of the respondents who have children and young adults (until the age 16) in their households, who consume breakfast cereal (%).

When asked whether in their household there are children and young adults, until the age of 16, who consume breakfast cereals (figure 13), 66% responded negatively and the remaining respondents (34%) affirmatively.

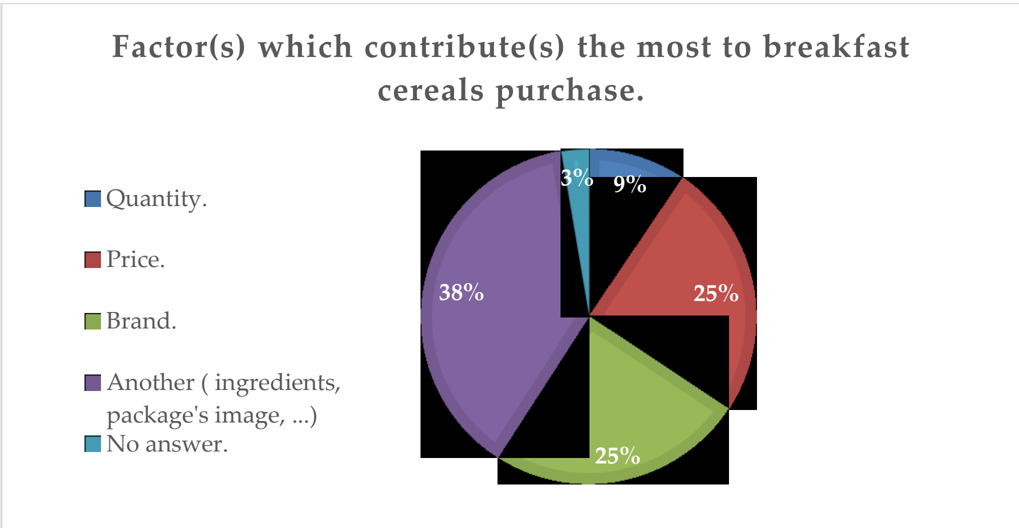


Figure 14 - Analysis of the respondents' preferential factors regarding their breakfast cereals purchase (%).

Concerning the factors that weight the most on the breakfast cereal choice of the respondents[31] (figure 14), ""Another (ingredients, package's image, ...)" was the selected factor of 38% respondents, followed by the brand and price, which have the same weight for the sample of respondents (25% each). Thus, the respondents report to make their breakfast cereal choices mostly based on the product's characteristics, such as the ingredients and package image, revealing that the quantity of product is only relevant for a minority (9%).

Figure 15 illustrates the selection of the different packaging attributes that influence the breakfast cereal purchase decision of respondents who state having children and young adults in their households and the ones who didn't (Q2). "Another (ingredients, package's image, …)" was considered an important factor for breakfast cereals purchase for 100 respondents who don't have children or young adults in their households and for 46 respondents who have. 18 respondents who don't have children or young adults and 18 respondents who have, selected "Quantity" as an influential purchase factor.

[31] This was a multiple-choice question, respondents were allowed to choose more than one factor.

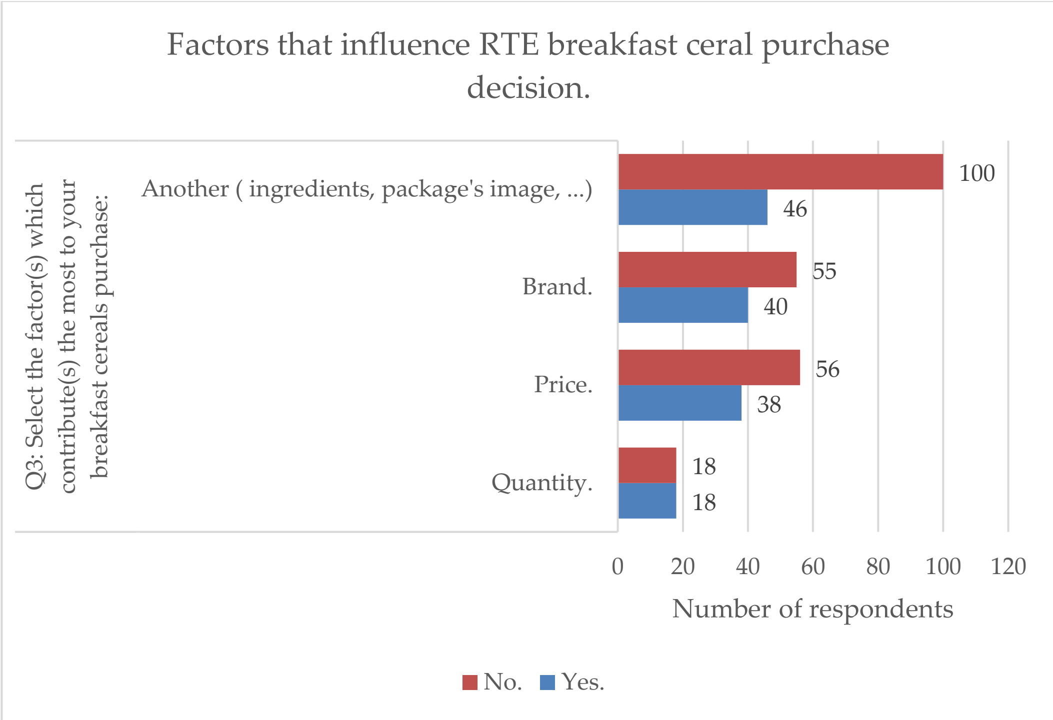


Figure 15 - Analysis of the respondents' opinion concerning the preferential factors on their breakfast cereals purchase – comparison between the respondents who have and who don't have children and young adults (until the age 16).

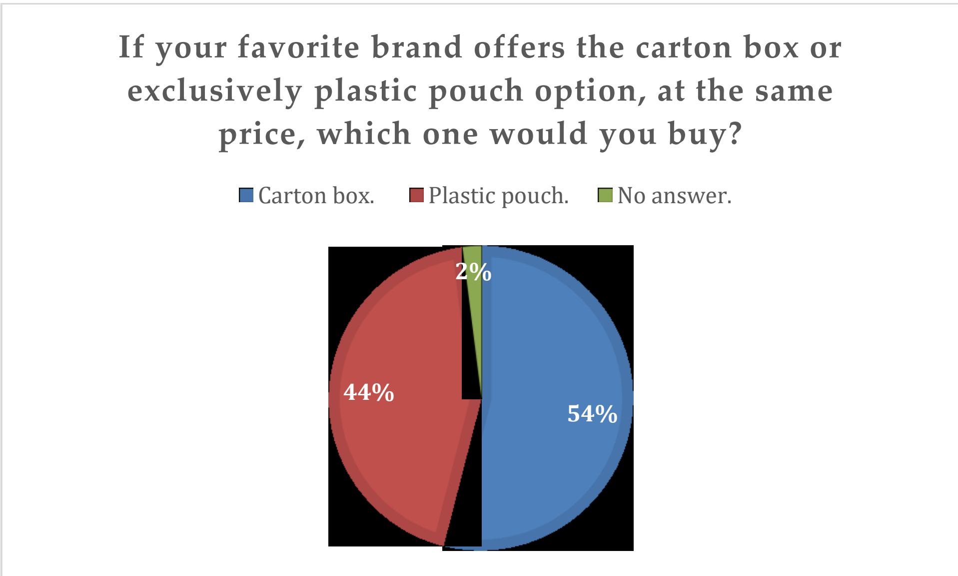


Figure 16 - Analysis of the respondents' packaging formats preferences (%).

Regarding the respondents' preferences on the design of RTEC (figure 16), there is almost an even division between the typical carton box (54%) and the plastic pouch format (44%), with the first option revealed itself as the preference for more than half of the sample. To verify the relationship between these results and the existence of children or young people in the household, an analysis on the preferences of the respondents who answered question Q1 affirmatively was made, showing, that even the sample of respondents who have children or young people in their household prefers the carton box format (figure 17). In the category of respondents who do not have children and young adults (until the age 16) in their household, the preference is also the carton box (figure 18).

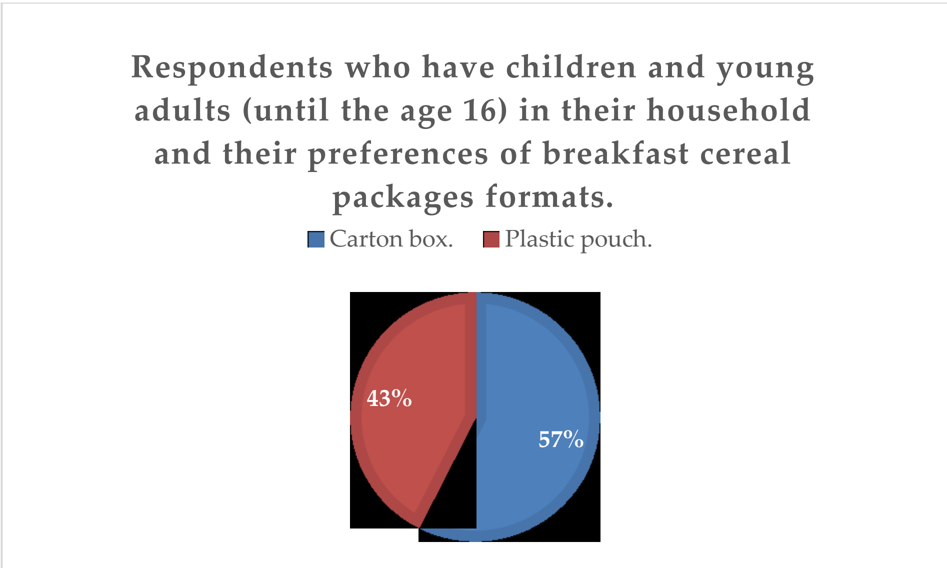


Figure 17 - Analysis on the preferences of breakfast cereal package formats (carton box or plastic pouch) of the respondents who have children and young adults (until the age 16) in their households (%).

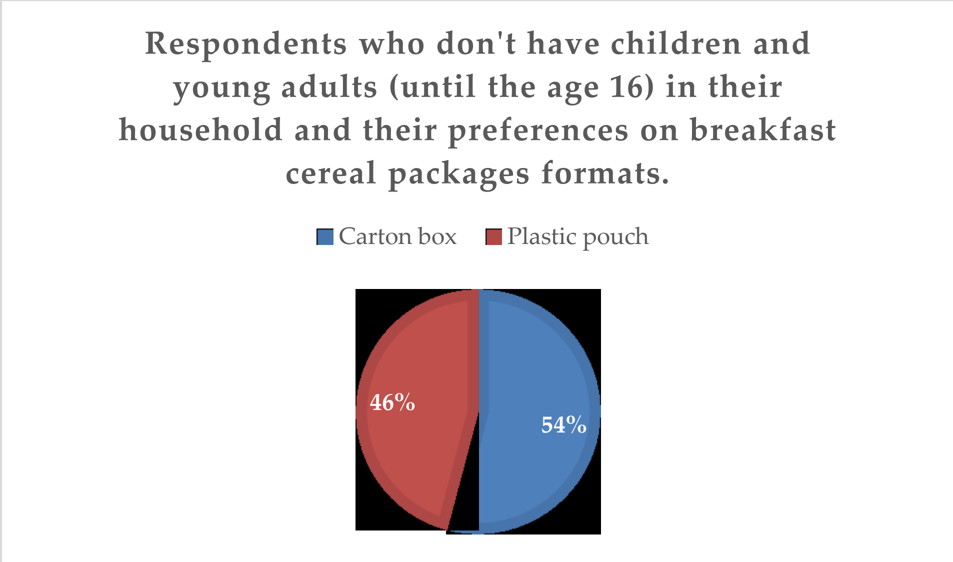


Figure 18 - Analysis on the preferences of breakfast cereal package formats (carton box or plastic pouch) of the respondents who have children and young adults (until the age 16) in their households (%).

As displayed in figure 19, the majority of respondents (76%) considers carton boxes to be oversized, when contrasted to the product content and only 15% declared to not consider it. Less than 1/5 (8%) of the respondents declared never having observed this characteristic.

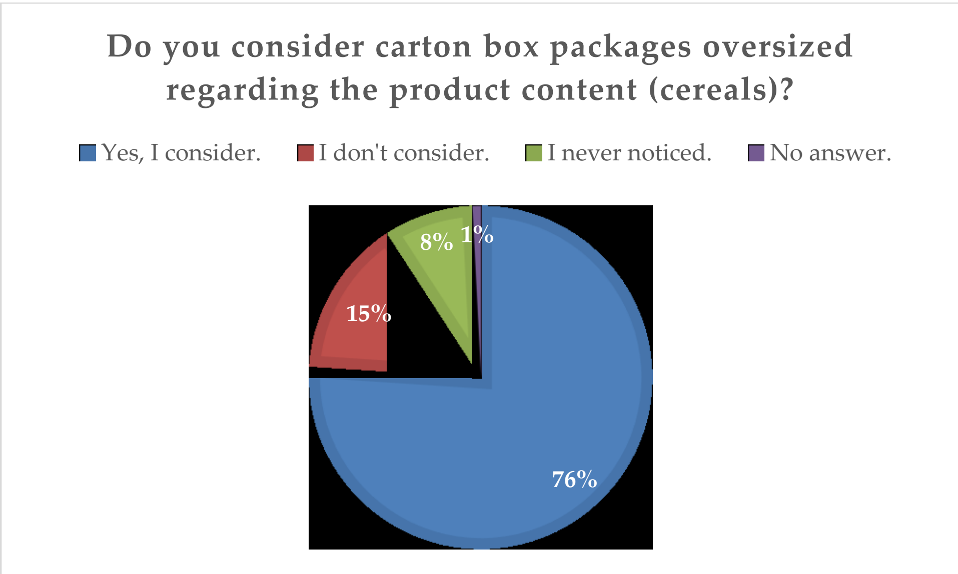


Figure 19 - Analysis on opinion of the respondents regarding carton box packages' size, when contrasted with the product content (cereals) they bear (%).

An analysis was made to determine the number of respondents whose opinion is that carton boxes are oversized (Q5), and who have in their household children and young people, until the age 16 (Q2), which is presented in figure 20. 130 respondents (49,4%), almost 50% of the sample, consider carton boxes to be oversized and don't have children or young adults in their households[32] and 70 respondents (26,6%) are individuals who consider carton boxes oversized and have children or young adults in their households.

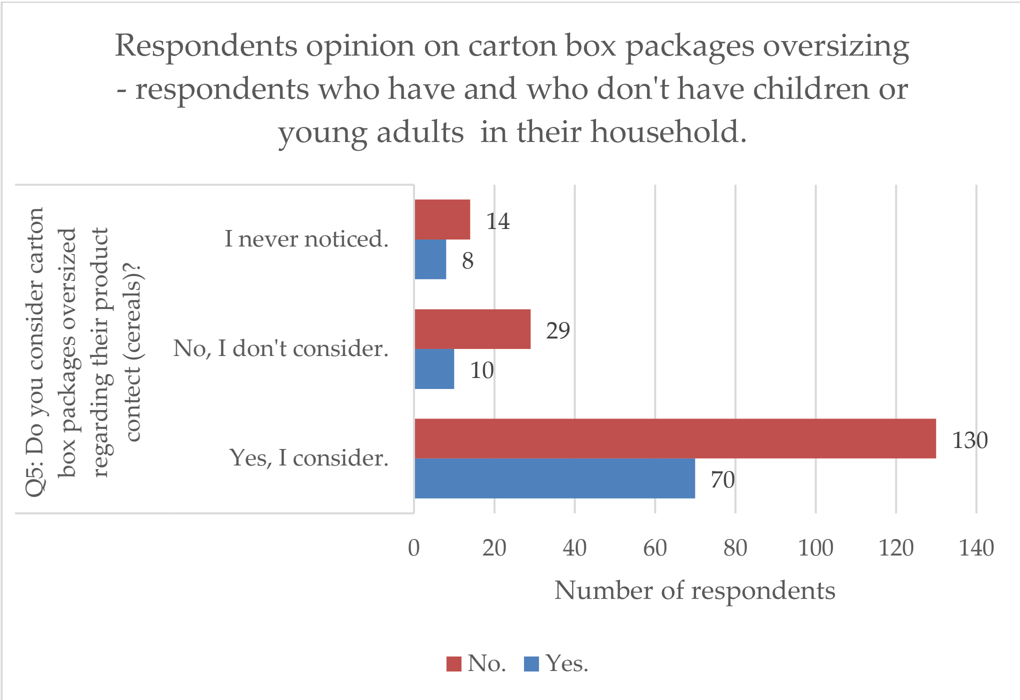


Figure 20 - Analysis of the respondents' opinion concerning the oversizing of carton boxes – comparison between the respondents who have and who don't have children and young adults (until the age 16) in their household.

[32] 2 respondents didn't answer question Q5, thus the total number of respondents of this question is 261.

On the other hand, the number of respondents whose opinion is that carton boxes are oversized (Q5) and prefer the plastic pouch (Q4) was 197 (figure 21)[34]. 109 respondents (41,4%) prefer the plastic pouch format, and 88 respondents (33,5%) favour the carton box format. On the opposite side, the respondents who don't consider carton boxes oversized and those who responded that they have not notice this fact, favour, in their majority, the carton box format (20,5%) with a remaining 7 respondents (2,7%) favouring the plastic pouch format for breakfast cereals package.

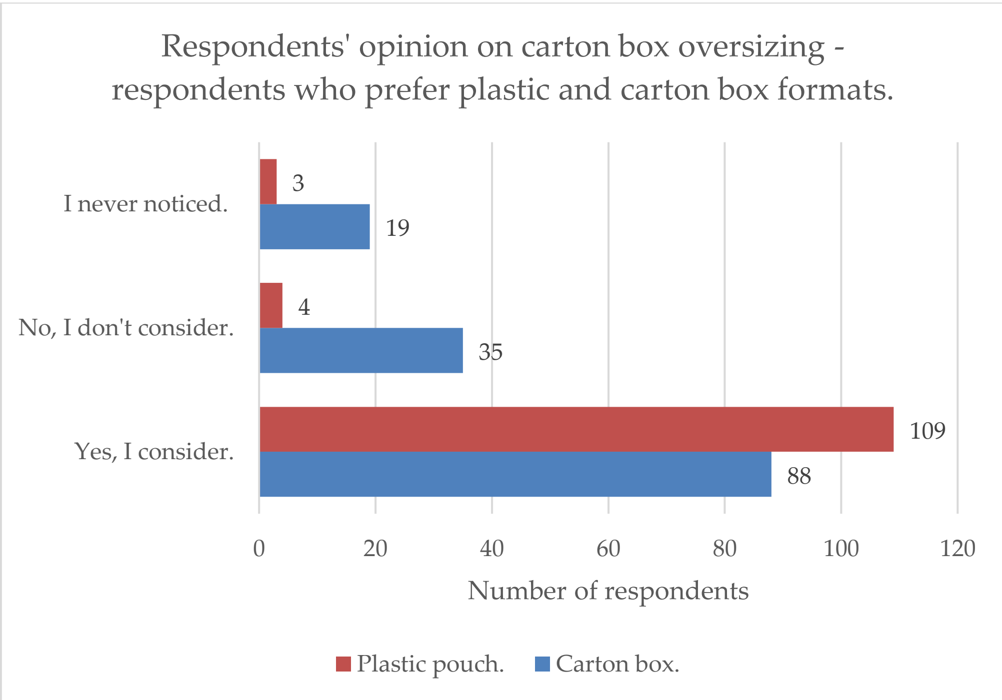


Figure 21 - Analysis of the respondents' opinion concerning the oversizing of carton boxes – respondents who prefer plastic pouch format or carton box package format or their breakfast cereals.

[34] 5 respondents didn't answer the question Q4.

In terms of sample characteristics, the respondents have an average household of 3,23 persons, the mode of the number of persons per household is 4 (figure 22). To check for a possible relationship between the respondents' households size and the respondents' preferences regarding cereal packages formats, an analysis between the two results was made[36] (figure 23). Interestingly, as the household diminishes, the preference for plastic pouch format changes. Respondents with households of 7, 6 and 5 individuals prefer the plastic pouch format and respondents with smaller households, of 4, 3, 2 and 1 persons prefer the carton box format.

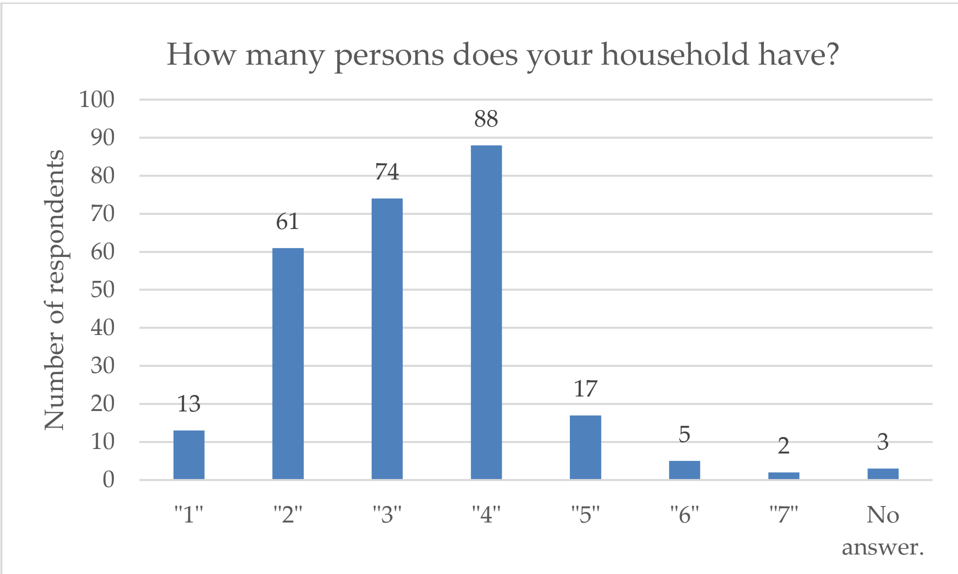


Figure 22 - Analysis of the number of persons per household.

[36] A total of 8 respondents didn't answer questions Q7 and Q4.

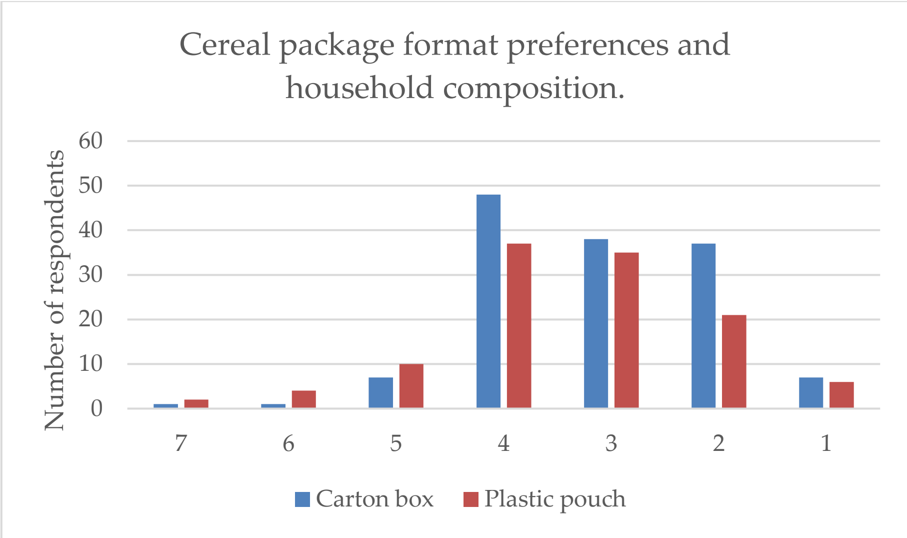


Figure 23 - Analysis of cereal package format preferences and the respondents' household composition.

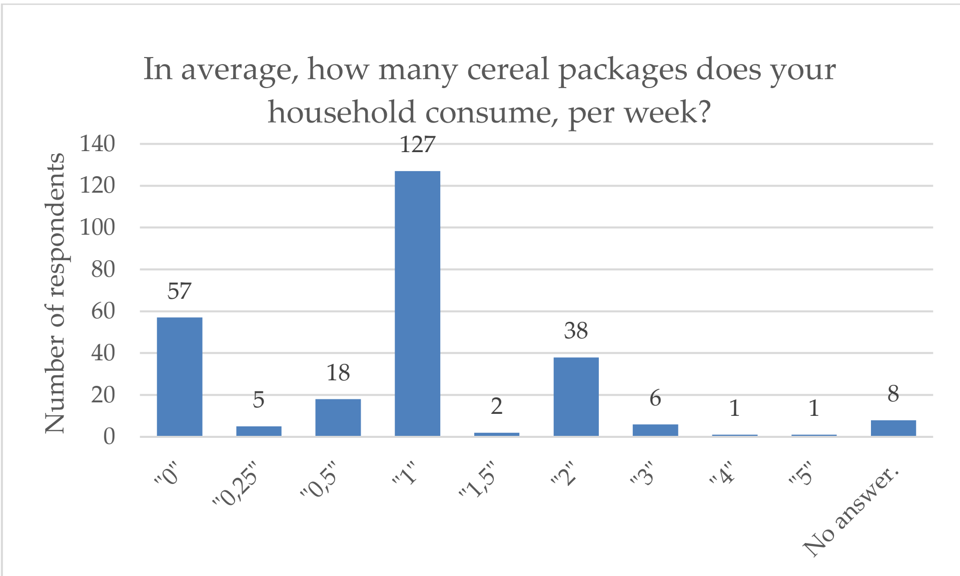


Figure 24 - Analysis of the average number of cereal packages consumed, per household, per week.

Regarding the average consumption of cereal packages in each household, a large part of the sample, 127 (48,2%), respondents answered “1” (figure 24), which means that almost half of the sample consumes or has someone in their household who consumes a package of breakfast cereals on a weekly basis. The average of cereal packages consumed by household per week by the respondents is 0,95 cereal packages with a standard deviation of 0,77. The maximum value enunciated by the respondents was “5” and 57 (21,7%) respondents declared to have an average consumption of 57 cereal packages per week. Figure 25 shows the cereal package format preferences distribution, according to the consumption of cereal packages in different household sizes. In all categories, the preference is the carton box format, except “0,25”, “1,5”, “4” and “5”.

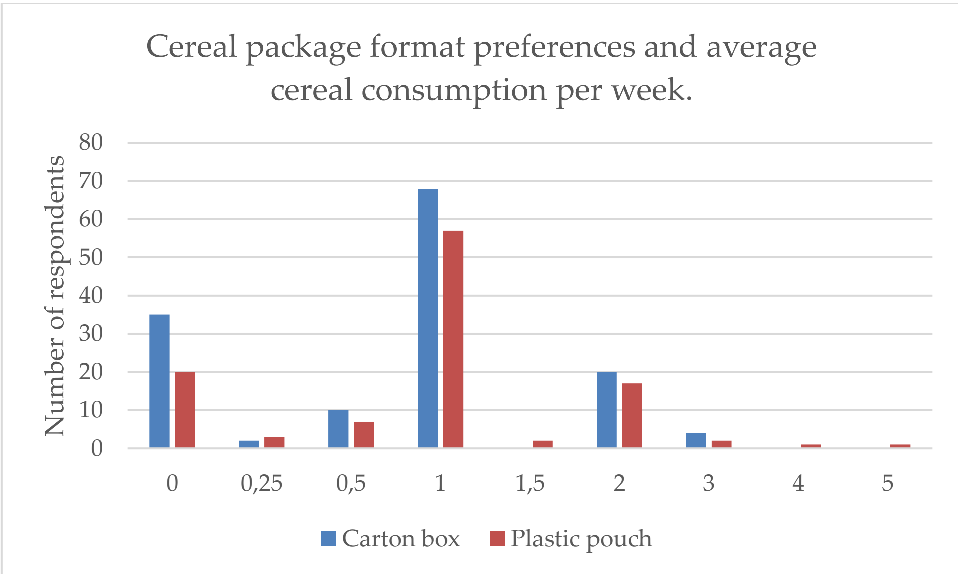


Figure 25 - Cereal package format preferences and the respondents’ average cereal consumption per week

Chapter 6

Conclusions

The results of this study on RTEC breakfast pakage size show the existence of package oversize in the cereals selled in the Portuguese market, where the carton box format is still the most common format. Moreover, it concluded that at least seven cereal categories of cereals can undergo a reduction of 20% of their height and 15% of their weight.

Both producer and retailer cereal brands do not use the full capacity of the carton box of cereals packages. In the same cereal category, Nestlé cereals registered the maximum and minimum weight/volume and the same happened with Continente, whose "Bolas com chocolate" cereals registered, for different sizes available on the market, the maximum and minimum package capacity.

German retailer Lidl has the most space-efficient cereal packages of the sample, with 6 of his cereal brands in the top 10 package capacity cereal of the 109 different cereals studied, whereas Nestlé has the lowest package capacity use.

Cereal consumers appear to be aware of the fact that carton boxes are oversized. 76% of the respondents surveyed consider that packages are oversized regarding the amount of product they contain. Nevertheless, more than half of the respondents revealed a preference for the carton box format, a preference that crosses all types of households.

Most respondents who considered carton box cereal packages oversized are respondents who would prefer to buy the plastic pouch format, if their favourite cereal brand offered that format. As expected, the respondents who don't consider carton box cereal packages to be oversized revealed they prefer the carton box package even if a plastic pouch format of their favourite brand was available at the same price.

Most respondents who considered carton box cereal packages oversized are respondents who would prefer a plastic pouch format, in case their favourite cereal brand offered them the possibility to buy it. As expected, the respondents who don't consider carton box cereal packages to be oversized revealed they would prefer the carton box package even if a plastic pouch format of their favourite brand was available at the same price.

The importance of the elements contained in the package in the moment of the purchase was also confirmed, since "Other (ingredients, packages' image,…)" was the factor selected by most respondents as influential to their breakfast cereal purchase, followed by "price" and "brand", both considered the second most important factors when the respondents buy breakfast cereals. With over 50% of purchasing decisions being made at the shelf, or point of purchase (Abdalkrim & Hrezat, 2013), these results convey that a combination of sensory stimuli of the packaging alongside price and brand information is what pushes the respondents to buy this type of product, almost ignoring the content quantity of the packaging.

6.1. Study implications for consumers, companies and the environment

New packaging solutions implemented by the breakfast cereal producers, such as plastic pouches can help provide added convenience for consumers and reduce the environmental impact. Even though traditional bag-in-box formats are typically made of recycled fiber (Jeswani et al., 2015), resealable flexible pouches require less energy, produce less greenhouse gas emissions, and solid waste than bag-in-box cereal packaging (Sheaffer, 2010). The implementation of energy-efficiency measures, assuming that energy use at the manufacturing plants can be reduced by 15% through implementation of various energy-efficiency related measures, and the replacement of 20% of carton boxes with standalone HDPE[39] bags are estimated to result in a GWP reduction of 2% to 3%. A reduction of up to 5% in the freshwater and marine ecotoxicity[40] would also be achieved through the packaging improvements aforementioned (Jeswani et al., 2015). Moreover, intelligent packaging solutions for food can contribute to reduce food waste (Tu et al., 2015) and cause minimization of packaging waste issues at various levels (i.e. domestic, councils, public environment) (Sustainable Packaging Alliance, 2002) and present advantages of an appropriate design of packaging in relation to the improvement of the efficiency of the logistics system (Jesús García-Arca, Prado-Prado, & Antonio-García-Lorenzo, 2006)

The impacts of the manufacturing, packaging and transport of breakfast cereals is significant, thus they should also be targeted for improvements. and the impacts from packaging could be reduced by improving the design and by using alternative packaging formats, such as standalone plastic bags or pouches instead of carton boxes (WRAP, 2009).

By improving packaging in terms of size, cereal producers can achieve cost reductions regarding handling and carrying inventory of outer packs at the production plant; handling outer packs at distribution centers and retail stores; handling inner packs at distribution centers and retail stores; opening an outer pack or an inner pack at Distribution Centers and retail stores; transportation; and packaging material (Gámez Albán et al., 2015). Consequently, there are many advantages arising from the improvement of package design in relation to the improvement of the efficiency of the logistics system (Jesús García-Arca et al., 2006.). The replacement of a cardboard carton and a plastic inner sleeve with a

[39] HDPE - High density polyethylene
[40] Ecotoxicity – fact or quality of being toxic to the environment (source: Oxford Dictionary)

polypropylene film pack can trigger a reduction on packaging weight by 70% and improve transit pack efficiency by 20% (Holdway et al., 2002).

On the other hand, more efficient use of packaging associated with a reduction of size could mean more product usage, since as the fill amount decreases compared to the packaging, supply is perceived as smaller and thus making consumers use a lower amount of the product (Pornpitakpan, 2010). Hence, with so many benefits, the question remains on why pouches have not yet been implemented in cereal products.

Furthermore, imposed legislation on packaging considers that environmental issues are everyone's responsibility and that manufacturers must contemplate the long-term effects of their products. Even though there is an imposition of a minimum pack fill value of 70% from CEEREAL, the consequences for cereal manufactures and retailers are unclear, regarding its infringement.

6.2. Study limitations

Regarding the survey, for more robust results the number of participants'should increased. The participants in the study were limited to the researcher's friends, family and work mates. As for their cultural background, more than half of them is from Porto region, in Portugal, which limits the diversity of the study. Since participants for this study are general grocery store consumers over 24 years old, it is suggested that future studies recruit participants from a more diverse cultural and educational background and increase the diversity of participants' demography to ensure statistical accuracy of the findings.

To ensure statistical validity of the study on overpackaging, the number of cereal packages analysed should also be increased to provide also insight on the existence of asymmetries between producer and retailer brands.

A final limitation relates to estimation of cost savings associated with the calculated feasible reduction of 20% of the height of breakfast cereals that was not grasped and neither the cost reduction value for manufacturers linked to a switch from carton boxes to plastic pouches. This value could be calculated by assessing the cost of producing one carton box for a cereal manufacturer. A manager from the Cereals Manufacturing and Engineering department of Nestlé was contacted (annex III), however, unfortunately, the cereal package supplier suggested by this contact person wasn't able to provide the researcher the requested information.

6.3. Suggestions for future investigations

Several interesting avenues can thus be pursued in order to further the understanding of how a change in packaging format in the cereals industry could affect sustainability and the production of packaging waste.

Nielsen Analytics sustains that in the United States, the birth place of breakfast cereals, the sales of ready-to-eat cereal have been declining at a combined annual growth rate (CAGR) of 1.5 percent for the past five years (Nielsen, 2014), whereas sales of less traditional breakfast food such as granola and yoghurt bars are growing. Given this fact, it would be interesting to compare the packaging of the breakfast products that are increasing in demand, namely the space utilization of their packaging and find the reasons why some cereals, such as granola, are sold in pouches and not in carton boxes.

For consumers, a reduction of breakfast cereal packages size could mean a reduction on the cereal package's price, thus it would also be interesting to validate the effects of RTEC pricing of the ready to eat packaging optimization and the preference of consumers.

References

Abdalkrim, G. M., & Hrezat, R. S. A.-. (2013). The Role of packaging in Consumers' Perception of Product Quality at the point of purchase. *European Journal of Business and Management*, *5*(4), 14.

AC Nielsen. (2006). Consumers and Ready-to-Eat Meals: A Global ACNielsen Report December 2006. *Online*, (December).

all4pack. (2016). *Packaging: Market and challenges in 2016*. *Packaging: Market and challenges in 2016*. Retrieved from https://www.all4pack.com/The-Packaging-sector/Discover-the-packaging-sector/Packaging-market-challenges-2016

Ankan, A. (2011). Industrial Packaging, 34–37.

Danone. (2011). *Danone 2011 Sustainability Report - Srategy and Performance*.

Definition of Sustainable Packaging I. A Vision for Sustainable Packaging. (n.d.).

Dixon-Hardy, D. W., & Curran, B. A. (2009). Types of packaging waste from secondary sources (supermarkets) - The situation in the UK. *Waste Management*, *29*(3), 1198–1207. https://doi.org/10.1016/j.wasman.2008.06.045

Dobson, P., & Yadav, A. (2012). *Packaging in a market economy: The economic and commercial role of packaging communication*. *Norwich Business School*. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Packaging+in+a+Market+Economy:+The+Economic+and+Commercial+Role+of+Packaging+Communication#0

ECR Europe; The European Organization for Packaging and the Environment. (2009). *Packaging in the Sustainability Agenda: A Guide for Corporate Decision Makers*. *… Europe and the European Organization for Packaging …*. Retrieved from http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Packaging+in+the+Sustainability+Agenda+:+A+Guide+for+Corporate+Decision+Makers#1

Eurobarometer. (2014). *Attitudes Of Europeans Towards Waste Management And Resource Efficiency*. Retrieved from http://ec.europa.eu/public_opinion/flash/fl_316_sum_en.pdf

Farooq, S., Habib, S., & Aslam, S. (2015). Influence of Product Packaging on Consumer Purchase Intentions. *International Journal of Economics, Commerce and Management*, *III*(12), 538–547.

Form, V. (2009). *Efficient use of resources in breakfast cereal packaging design*.

Forster, A. (2013). Sustainability : Best Practices in the Food Industry. *UW-L Journal of Undergraduate Research*, 1–9.

Gámez Albán, H. M., Soto Cardona, O. C., Mejía Argueta, C., & Sarmiento, A. T. (2015). A cost-efficient method to optimize package size in emerging markets. *European Journal of Operational Research*, *241*(3), 917–926. https://doi.org/10.1016/j.ejor.2014.09.020

García-Arca, J., González-Portela Garrido, A. T., & Prado-Prado, J. C. (2016). "Packaging Logistics" for improving performance in supply chains: The role of meta-standards implementation. *Producao*, *26*(2), 261–272. https://doi.org/10.1590/0103-6513.184114

García-Arca, J., Prado-Prado, J. C., & Antonio-García-Lorenzo. (2006). Logistics improvement through packaging rationalization: A practical experience. *Packaging Technology and Science*, *19*(6), 303–308. https://doi.org/10.1002/pts.723

Golub, A., & Binkley, J. J. (2005). Consumer Choice of Breakfast Cereals. *Agricultural Economics*.

Gómez, M., Martín-Consuegra, D., & Molina, A. (2015). The importance of packaging in purchase and usage behaviour. *International Journal of Consumer Studies*, *39*(3), 203–211. https://doi.org/10.1111/ijcs.12168

Grant, T., Barichello, V., & Fitzpatrick, L. (2015). Accounting the Impacts of Waste Product in Package Design. *Procedia CIRP*, *29*, 568–572. https://doi.org/10.1016/j.procir.2015.02.062

Hawkins, G. (2012). The Performativity Of Food Packaging: Market Devices, Waste Crisis And Recycling. *Sociological Review*, *60*(SUPPL.2), 66–83. https://doi.org/10.1111/1467-954X.12038

Hertwich, E., Van der Voet, E., & Tukker, A. (2010). *Assessing the Environmental Impacts of Consumption and Production. Priority Products and Materials*. *A Report of the Working Group on the Environmental Impacts of Products and Materials to the International Panel for Sustainable Resource Management*.

Holdway, R., Walker, D., & Hilton, M. (2002). Eco-design and successful packaging, 45–53.

Hurley, R. A., Galvarino, J., Thackston, E., Ouzts, A., & Pham, A. (2010). The Effect of Modifying Structure to Display Product Versus Graphical Representation on Packaging. *Packaging and Technology and Science*, *23*(May), 253–266. https://doi.org/10.1002/pts

Jeswani, H. K., Burkinshaw, R., & Azapagic, A. (2015). Environmental sustainability issues in the food-energy-water nexus: Breakfast cereals and snacks. *Sustainable Production and Consumption*, *2*(August), 17–28. https://doi.org/10.1016/j.spc.2015.08.001

Katrandjiev, H. (2016). Ecological Marketing , Green Marketing , Sustainable Marketing : Synonyms or an Evolution of Ideas ?, 71–82.

Kirwan, M. J. (2008). Paper and Paperboard Packaging Technology (p. 265).

Kumar, V., Rahman, Z., Kazmi, a. a., & Goyal, P. (2012). Evolution of Sustainability as Marketing Strategy: Beginning of New Era. *Procedia - Social and Behavioral Sciences*, *37*, 482–489.

https://doi.org/10.1016/j.sbspro.2012.03.313

Labatt, S. External influences on environmental decision making: A case study of packaging waste reduction., 49Professional Geographer 105 (1997). https://doi.org/10.1111/0033-0124.00061

Makanjuola, S. A., & Enujiugha, V. N. (2015). How consumers estimate the size and appeal of flexible packaging. *Food Quality and Preference*, *39*, 236–240. https://doi.org/10.1016/j.foodqual.2014.07.020

Meler, M. (2014). SUSTAINABLE MARKETING FOR SUSTAINABLE DEVELOPMENT, (June), 230–248.

Min, S. C., Kim, Y. T., & Han, J. H. (2010). Packaging and the Shelf Life of Cereals and Snack Foods, 339–352.

Muratore, G., & Zarbà, A. S. (2011). Role and function of food packaging: What consumers prefer. *Italian Journal of Food Science*, *23*(SUPPL.), 25–29.

Nevo, Aviv, Economics Department, University of California, B. and N. (1999). Measuring Market Power in the Ready-to-Eat Cereal Industry.

Nielsen N.V. (2014). *Doing Well By Doing Good*.

Nordin, N. and, & Selke, S. (2010). Social Aspect of Sustainable Packaging. *Packaging and Technology and Science*, *23*(May), 253–266. https://doi.org/10.1002/pts

Opara, U. L., & Mditshwa, A. (2013). A review on the role of packaging in securing food system : Adding value to food products and reducing losses and waste. *African Journal of Agricultural Research*, *8*(22), 2621–2630. https://doi.org/10.5897/AJAR2013.6931

Otava, A. (2012). The effects of packaging in the supply chain, (February).

Pornpitakpan, C. (2010). How Package Sizes, Fill Amounts, and Unit Costs Influence Product Usage Amounts. *Journal of Global Marketing*, *23*(4), 275–287. https://doi.org/10.1080/08911762.2010.504518

Raheem, D. (2013). Application of plastics and paper as food packaging materials

- An overview. *Emirates Journal of Food and Agriculture*, *25*(3), 177–188. https://doi.org/10.9755/ejfa.v25i3.11509

Retail Forum for Sustainability. (2011). Packaging optimisation, (November), 1–12.

Rolando, T. (2010). Rigid vs . Flexible Packaging : Which Has the Edge in Being Green ?

Roy, N., & Jeff, S. (1995). *Emission Factor Documentation for AP-42 Cereal Breakfast Food Final Report*.

Rushton, A., Croucher, P., & Baker, P. (2011). *The Handbook of Logistics and Distribution Management: Understanding the Supply Chain*. https://doi.org/10.1016/j.tre.2007.02.001

Sheaffer, E. (2010). Thinking Outside of the Cereal Box : An Innovative Solution for Package Resealability, *55*(4), 184–185.

Silayoi, P., & Speece, M. (2007). The importance of packaging attributes: a conjoint analysis approach. *European Journal of Marketing*, *41*(11/12), 1495–1517. https://doi.org/10.1108/03090560710821279

Sustainable Packaging Alliance. (2002). *Towards Sustainable Packaging A Discussion Paper*. Retrieved from http://www.sustainablepack.org/database/files/filestorage/Towards Sustainable Packaging.pdf

Tu, Y., Yang, Z., & Ma, C. (2015). Touching tastes: The haptic perception transfer of liquid food packaging materials. *Food Quality and Preference*, *39*, 124–130. https://doi.org/10.1016/j.foodqual.2014.07.001

Uusitalo, L. (1982). Environmental impact and changes in consumption styles. *Journal of Macromarketing*, *2*(2), 16–30. https://doi.org/10.1177/027614678200200203

Varela, P., Antúnez, L., Silva Cadena, R., Giménez, A., & Ares, G. (2014). Attentional capture and importance of package attributes for consumers' perceived similarities and differences among products: A case study with breakfast cereal packages. *Food Research International*, *64*, 701–710. https://doi.org/10.1016/j.foodres.2014.08.015

Wever, R. (2010). Design for Volume Optimization of Packaging for Durable Goods. *Packaging and Technology and Science*, *23*(May), 253–266. https://doi.org/10.1002/pts

Wijesinghe, J. C., & Chen, J. (n.d.). *Environmental Marketing as a Tool of Competitive Advantage : A Study Based on Organic Food in China*.

Yan, D., Sengupta, J., & Wyer, R. (2014). Package size and perceived quality: The intervening role of unit price perceptions. *Journal of Consumer Psychology*, *24*(1), 4–17. https://doi.org/10.1016/j.jcps.2013.08.001

Zhang, G., & Zhao, Z. (2012). Physics Procedia Green Packaging Management of Logistics Enterprises, *24*, 900–905. https://doi.org/10.1016/j.phpro.2012.02.135

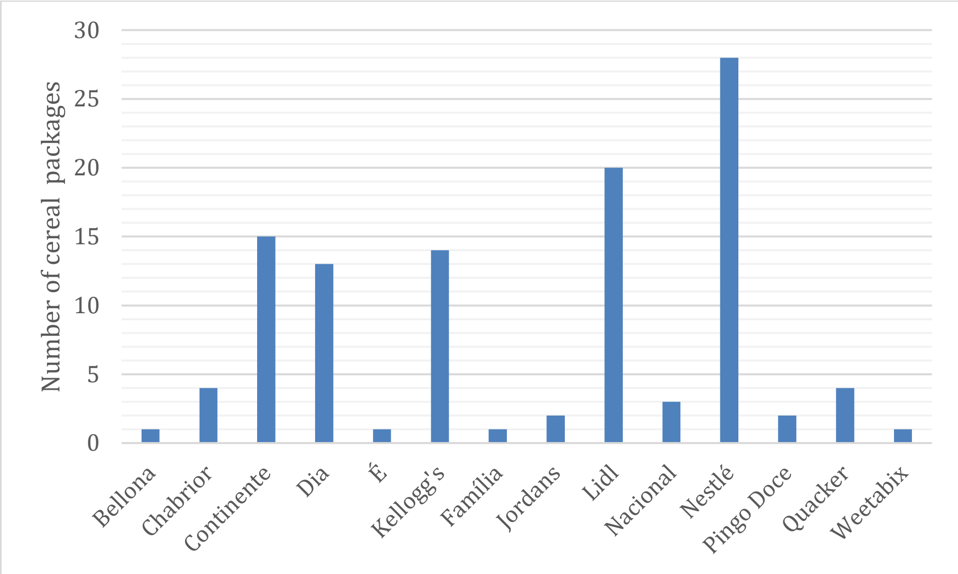
Zhang, L. (2013). *Creating a better product experience in organic cereal packaging design*.

Appendix

Appendix I – Portuguese and english cereal categories studied designations and correspondence

Cereal Category – Portuguese designation	**Cereal Category – English designation**
All Bran (fibra)	Whole Grain Sticks
Almofadas	Pillows
Argolas	Rings
Argolas chocolate	Chocolate rings
Arroz tufado	Puffed rice
Bolas milho	Corn Balls
Bolinhas	Balls
Chocapic	Chocolate Wheat Flakes
Cookie crisp	Cookie crisp
Corn Flakes	Corn Flakes
Estrelitas	Stars
Fitness	Whole grain flakes
Fitness cholocate	Whole grain flakes & Chocolate
Fitness frutas/Fitness amêndoas	Whole grain flakes & Fruit
Golden Grahams	Square Wheats
Milho tufado	Puffed Corn
Muesli	Muesli
Nesquik	Chocolate Wheat Balls
Trigo tufado	Puffed Wheat Grain

Appendix II – Composition of the sample of cereal packages studied



Appendix III

To: Teresa Santos Ribeiro
Cc: mario@ccouto.com
Subject: RE: Fornecedor caixas cereais Nestlé Portugal - dúvida

Olá Teresa,

Eu não tenho, e nem sei que possa ter esse tipo de dados, na minha rede de contactos.
Em Avanca temos diversos fornecedores de cartão. Recordo-me por exemplo da Norgraft Packaging…mas não me recordo do nome de mais nenhum.
O que podes fazer é pedir dados á Nestlé Portugal…talvez estejam abertos a ajudar…

Encontras o um formulário na página internet :
https://empresa.nestle.pt/contactus

Espero ter ajudado.
Cpts,

Nestlé

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Annex

Annex I - Packaging and marketing functions (Dobson & Yadav, 2012)

Functions of packaging	Functions of marketing
Packaging protects Packaging must be able to withstand robust physical handling during distribution so that the goods are received by consumers in the same function they left the factory	Physical distribution and storage Product quality
Packaging preserves Use packaging forms and materials that will preserve the product from deterioration	Physical distribution and storage Product quality
Packaging facilitates distribution Well-designed packaging and effective packaging methods are key elements in ensuring that goods reach their destination in optimum condition	Physical distribution and storage Supply chain management
Packaging promotes customer choice Packaging enables and promotes brand identification and competition	Promotion and selling Marketing communication
Packaging sells Packaging is integral to the sales process. It displays and describes the product it contains; leaving the consumer to choose which product is best suited his or her taste. This, together with the visual appeal of the package, is often a decisive feature in the purchasing situation	Promotion and selling Marketing communication. Design
Packaging informs and instructs Packaging communicates additional messages to the consumer	Marketing communication
Packaging provides consumer convenience Changing lifestyles have created a demand for packages that offer time-saving features and easy efficient handling	Standardization/differentiation and distribution. Customization
Packaging help contain prices Consumer goods would be more expensive if it were not for cost-effective packaging. The packaging of products in packs of various sizes allows the consumer to purchase the most convenient quantity	Pricing
Packaging promotes hygiene and safety Improvements in standards of hygiene and medical care in hospitals are in large a measure due to the use of pre-packed medical products for usage and disposal. The same goes for food products	Physical distribution and storage. Promotion
Packaging is innovative In many cases, the packaging industry responds to new demands which arise for specifically packaged foodstuff products	Packaging/package development Customization Package design in relation to relevant market demand/need

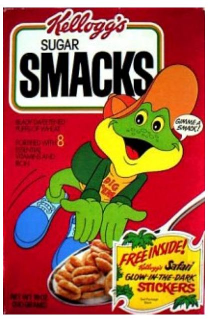
Annex II - Nestlé Fitness cereal's Pouch, available in retailer stores in Portugal (source: http://www.chocolate-brands.com/index.php?route=product/product&product_id=312)

Annex III- Malt-o-Meal cereals stand up pouches with resealable closure (source: http://www.bluemaize.net/bags/malt-o-meal-cereal-bags)

Annex IV - Tropicana packaging before and after the brand decided to renew it (source: http://www.thebrandingjournal.com/2015/05/what-to-learn-from-tropicanas-packaging-redesign-failure/)

Kellogg's Frosted Flakes, 1956 and 2012

Kellogg's Corn Flakes 1952 and 2012



Kellogg's Smacks in the 1980s and 2017

Annex V - The evolution of ready-to-eat cereal packaging targeted to children (source: http://flavorwire.com/) *(Temple, 2012)*