

# Sustainable Packaging Design for Consumer Electronics Products; Balancing Marketing, Logistics and Environmental Requirements

Renee Wever<sup>1</sup>, Casper Boks<sup>2</sup>, Irwan Pratama<sup>1</sup>, Ab Stevels<sup>1</sup>

<sup>1</sup> Delft University of Technology  
Faculty of Industrial Design Engineering  
Design for Sustainability group  
Landbergstraat 15, 2625 TS Delft  
The Netherlands  
[r.wever@tudelft.nl](mailto:r.wever@tudelft.nl)

<sup>2</sup> Norwegian University of Science and Technology (NTNU)  
Faculty of Engineering Science and Technology  
Department of Product Design  
Kolbjørn Hejes vei 2b  
NO-7491 Trondheim  
Norway  
[casper.boks@ntnu.no](mailto:casper.boks@ntnu.no)

## Abstract

*Packaging design for consumer electronic products is a challenge because contradictory demands from a distribution perspective and a marketing perspective have to be balanced. With several company departments involved and powerful external stakeholders this is a complicated matter. As the level of sophistication of data concerning a packaging's marketing performance is limited, decisions are often strongly based on beliefs. This is reflected in inconsistencies in packaging that is currently in the market. This paper will show these inconsistencies, discuss their cause, and propose a tool for assisting product managers in finding optimal packaging solutions. From a sustainability point of view the volume of packaging is very relevant due to its influence on transport efficiency. Therefore balancing distribution and marketing functions in a better way may yield considerable improvements in the environmental performance of the packaging.*

**Key words:** LCC, lifecycle optimization, packaging, physical distribution, retailing

## 1. Introduction

Packaging of consumer electronics (CE) products is a highly challenging field of design. The consumer electronics industry is a fast-moving industry, subject to

rapid price erosion of newly introduced products [1, 2, 3 p.66, 4 p.19]. Industrial practice shows that in many cases there is not enough time available to design a product's packaging after the product design is finished. Concurrent engineering of product and packaging is therefore essential. Packaging engineers, packaging designers, product managers, sales managers and suppliers all have to work closely together to deliver an optimal design in time.

Another challenge is the fact that the requirements which a packaging has to fulfill are different, or even contradictory, for each phase of the packaging lifecycle. Packaging used to be designed solely for the purpose of getting the right product to the right consumer in a proper condition. Nowadays however, packaging for CE products has to fulfill a multitude of functions, especially in the field of marketing. The increased importance of these marketing functions is due to a trend of commoditization in the CE market (see section 2).

The increased importance of marketing functions is relatively new in the CE industry, as it is a result from the relatively recent appearance of large retailers which display products in their packaging in self-service environments [3 p.185, 5, 6 p.32, p.81, p.165-166]. These retailers exist in two forms. The first group is known as Category Killers [3 p.65-66]. Category Killers are chains of price-oriented superstores with a large offering within a clearly defined market. Examples of Category Killers are Circuit City and Best Buy in the USA and MediaMarkt

and Saturn in Europe. The second group consists of large hypermarket chains, such as Wal-Mart in the USA and Carrefour in France. These hypermarkets have started to sell CE goods in their stores. Both types of store utilize a retail landscape where price becomes, more so than before, a major determinant of product choice [3 p.66, p.185]. This retail landscape is like a supermarket. It is characterized by high on-shelf competition, low importance of brands and low margins [3 p.73]. As these stores display products in their packaging, the sales functions of this packaging play a major role in attracting the eye of the consumer and communicating the unique selling points of the products. The fulfillment of these functions may well clash with the original functionalities for safe and efficient distribution. From the CE company perspective, the different requirements for the packaging are put forward by separate stakeholders, both internal and external, with product managers having to manage all their interests into an acceptable pack design. Until some decades ago there were just a limited number of CE brands in the market and numerous small retailers selling these goods to consumers. As a consequence original equipment manufacturers (OEMs) of CE goods were by far the most powerful player in the supply chain. They could dictate which products were sold, and retailers had to sell what OEMs were willing to supply them with. All this has changed. Although the number of CE brands hasn't changes drastically, the retailing of CE goods has seen some dramatic developments (as described above). New large retail chains represent significant buying power. They demand from OEMs that they supply their products in packaging that matches their retail format. OEMs cannot afford to alienate such retailers from them, hence they have to comply. Demands set by retailers are related to packaging sizes, and to being tamperproof (which means that shoppers are unable to remove the product from its packaging without the use of tools, which is done to prevent pilferage). This power shift in the value chain makes the job of the product manager even more complicated.

## 2. Paper outline

The increased level of complexity of modern packaging design for CE goods, in a changed supply chain, raises the issue whether additional support for product managers is required, and in what form such support would be most effective.

First, section 3 will discuss commoditization of CE goods with its consequences for packaging design. It will be demonstrated how new packaging requirements clash with classic packaging requirements, leading to a need for balancing these requirements.

Section 4 will utilize data from environmental product benchmarks to demonstrate that there is significant room in the current CE market for improvement in optimization strategies for design of product packaging. This room for improvement consists of two parts; first, there are inconsistencies within specific product categories, indicating that some products are over-packed. Secondly some products are in packaging with a focus on the wrong functionalities, thus causing sub-optimal performance.

To illustrate the points above, two business cases are put forward to illustrate the relevance of addressing new packaging requirements; one on packaging of electric shavers (section 5), a second one on packaging of webcams (section 6). These cases will facilitate the discussion on the need for additional support for product managers. The first case study will mainly illustrate the role of value chain issues, whereas the second case study will illustrate potential savings. In section 7, using the presented experiences, a tool is proposed that can assist in communicating about the packaging design, helping to reach an optimal design.

## 3. Background

Commoditization is the transformation of a non-commodity product into a commodity. Strictly speaking, a commodity is a product where consumers perceive no difference between the offerings of different suppliers or manufacturers, other than price. A typical example of a commodity would be flower or sugar. Hence CE products may currently not be a true commodity; however the term commoditization can be said to describe a process in which CE goods become like daily purchases in a supermarket. The term commoditization is widely used in literature [e.g. 3 p.65-66, 7, 8]. A commoditized product is characterized by low-margins, high competition and low importance of brands [7]. Another characteristic, in particular related to consumer electronics products, is the decreasing time between replacement purchases, due to technological developments and price decreases (for example in the case of DVD players) [1].

Within CE goods one can see a trend towards commoditization. The classic example in literature is IBM and the commoditization of computers [7, 9]. Commoditization can be understood as a development that turns luxury products into supermarket-like products. This is both reflected in the type of retail outlets where the products are sold and in the way people shop for such product; are they considered major family investment or are they more like impulse purchases. In such a supermarket-like environment marketing functions become increasingly important.

Commoditization is an unfavorable situation for OEMs, as non-commodity products have higher profit margins. To

be a non-commodity, products need to have some characteristics that make them stand out. Several OEMs try to make the brand experience more and more important, making sure their products are not a commodity, thus allowing higher margins [10, p.16]. Within consumer electronics the major examples of this would be Apple and Bang & Olufsen. When taking this approach, a significant part of this brand experience is in the packaging design [11].

Both the fulfillment of sales-functionalities and the fulfillment of experience-functionalities often lead to bigger packaging [5], either in an attempt to attract attention more easily or in an attempt to present the product in a nicer way. Typical sales-packaging will be bulky and with sophisticated finishing on the outside. Experience-packaging on the other hand, where the packaging needs to contribute to the feel-good about the product, will usually have sophisticated finishing both on the outside and the inside of the packaging. This leads to packaging that is voluminous, uses high quality materials, and high quality finishes (printing). From a purely environmental point of view, all are unfavorable (although not all to the same degree). Furthermore these design solutions clash to some extent with classic packaging functionalities (e.g. efficient distribution).

Within the CE field most packed products have such a low density that volume is the limiting factor in transportation [5], regardless of whether transportation is done by truck, plane or container (ships and trains). Combined with the knowledge that transportation contributes more to the total impact, both economically [5, 12 p.12] and environmentally [5], than the packaging materials by themselves, volume reduction becomes a major driver for packaging design. More so than materials and printing. As materials and printing can also be used to fulfill marketing functionalities, sensible design can help keep volume to a minimum. The design challenge then becomes finding the optimum, both from an environmental and a marketing point of view.

Furthermore, looking at the current market, the increase in volume is not always consistent within a certain product category. Some packages are unnecessarily larger than they have to be, even from a marketing perspective, thus costing more in materials and transportation. Both from an environmental and economical point of view optimization can bring significant savings. However to achieve these savings communication between the different stakeholders, both within the OEM and outside the OEM, is key.

#### 4. Current performance in the market

To demonstrate that there are inconsistencies in packaging design for CE goods data will be analyzed originating from the environmental benchmark program of Philips Consumer electronics [13, 14, 15]. This data consists of all kind of product aspects concerning energy use, potentially hazardous substances, weight, recyclability, and packaging and transportation. The benchmark studies are executed on a product level, by a standardized process. Hence it is possible to combine the product-level data on packaging in a meta-analysis. As argued in section 2, volume is an important aspect of packaging performance. One of the metrics used in the benchmark procedure is the volume index; the volume of the packaging divided by the volume of the product within. Figure 1 gives the volume index for 199 products. Products along the horizontal axis are typical distribution-packages, while products along the vertical axis are typical marketing-packaging (both sales and experience). Immediately the large spread in volume indices for marketing packaging becomes apparent, demonstrating the inconsistencies in the market. Examples were found of products with twice the volume index of their direct commercial competitors. The potential savings of taking away these inconsistencies will be documented in case study 2 (section 6). An approach for implementing this type of optimization into the product design processes will be proposed in section 7.

#### 5. Case study 1: Electric shaver packaging

The market for electric shavers is very competitive. For many years one of the world market-leader, Philips, held a patent on the triple-headed shaver. This triple-head is a clear consumer advantage. With the expiration of the patent competitors moved into the market of triple-head shavers, thus strongly increasing competition.

More or less simultaneously, retailers like Wal-Mart and Carrefour became increasingly important. As electric shavers are small, but valuable products they are very sensitive to pilferage. Hence retailers demand tamperproof packaging, as they display the products on open shelves, in a self-service environment. Furthermore they expect suppliers to adapt their packaging to their shelf dimensions. Due to the power of large retailers in the supply chain they can sustain such demands from OEMs. The importance of these retail outlets is most dominant in North America, much more so than in Europe.

These developments have resulted in a continuous increase in packaging volume, with box sizes growing with each new shaver launched. New pack designs had higher direct costs, and higher environmental impact, all in the pursuit of a better marketing performance.

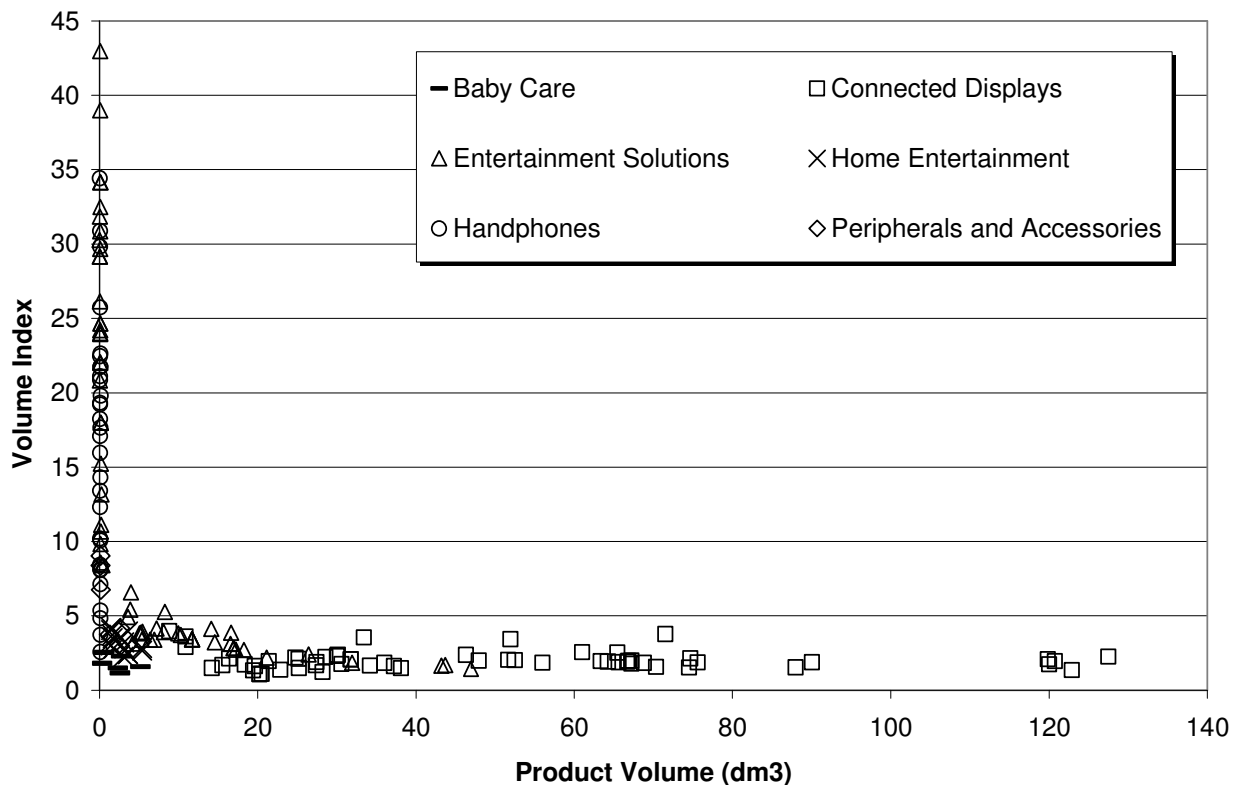


Figure1: Volume index of 199 products, of which approximately one third are by Philips. Data originates from the period 2002-2006. Figure is updated from [15, 16]. Products along the horizontal axis are typical distribution-packages, while products along the vertical axis are typical marketing-packaging (both sales and experience).

## 6. Case study 2: Webcam package

A second example is packaging for webcams. An interesting product in this category is the high-end webcam by Philips. Its original packaging has a volume index of 23.6. Furthermore, only the outside of the packaging has a high quality finish. Hence it can be concluded that this is clearly a sales-packaging. However, Philips sells a range of webcams. This particular model is the top of the range, retailing at about 100 euros. It is aimed at quality-oriented buyers. Here, a sales-packaging is not appropriate. An experience-packaging would be better.

Judging the performance of this packaging in the market one sees two things:

- The Packaging is mismatched. Its mix of packaging functionalities is not what the product needs.
- If it were the appropriate mix of functionalities, it would be considerably more voluminous as the average in this market segment. As such it is an example of the inconsistencies mentioned in section 2.

Hence, a redesign was made, showing that a smaller volume index can do. As a retail audit demonstrated, height is a relative constant in this market, conformed to the shelf height in the store. The depth of the packaging was close to optimal, so the volume reduction has to come out of the width. Within this project a redesign was made which has a volume index of 11.

Interestingly, while this study was performed as a case study, the actual Business Unit producing this Web Cam launched a redesigned packaging, which has a volume index of 17.7.

To illustrate the order of savings that can be obtained through this type of volume reduction a calculation was made for the shipping costs of these three packaging designs. It is limited to the container transport from China to Rotterdam (note that this is excluding the expensive truck transport from distribution centers to retail outlets). Based on the number of products per container, and the price per container, one can calculate the shipping price per product. For the original packaging this is €0,25, for the new packaging it is €0,18, and for the radical redesign it is €0,11. In a low margin industry these are quite significant savings.

## 7. Towards a tool

As the previous sections illustrated, changes in the CE market have led to the emergence of marketing functionalities in packaging. These functionalities often clash with optimization from an economic and environmental point of view. In optimization the priority should be on volume minimization, hence marketing functionalities should preferably be fulfilled through upgrading finishes (printing). If this is deemed insufficient more and/or higher quality materials may be utilized, and only as a last resort should the volume be increased. This goes for both sales-packaging and experience-packaging. It is important to make sure that a product gets a packaging with the required mix of functionalities (distribution, sales, experience), as a mismatch automatically results in a sub-optimal design.

A useful way of determining the dominant functionality of a packaging is to ask the following question (either about the packaging of the previous product generation, or a concept design for a new product): “Why isn’t the packaging smaller?” Here there are four groups of answers. The first group relates to “otherwise the product gets damaged”. This answer indicates a distribution-packaging. The second group of answers relate to “otherwise the shelf performance would go down”. This answer indicates a sales-packaging. The third group relates to “otherwise it wouldn’t look nice”. This answer indicates an experience-packaging, where feel-good is most important. The fourth and final group relates to “we had no time/money so we took a design from a related product or previous generation, and adapted it”. This answer is a red-flag for sub-optimal designs, as new product generations in the CE market often are more

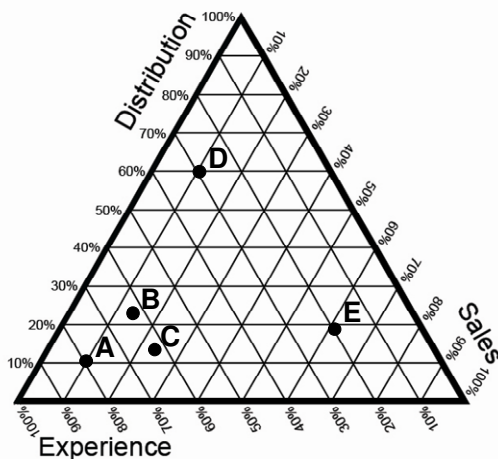


Figure 2: A triangular graph, representing the mix of the three types of packaging functionalities; distribution, sales and experience.

robust and smaller than the previous product. Hence, maintaining the previous packaging leads to a very unfavorable volume-index. However, this type of design re-use is quite frequent in the CE market.

Based on the answer on the question posed above the mix of the three types of functionalities (distribution oriented, sales oriented and experience oriented) can be determined. This mix can be represented in a triangular graph [11], as in Figure 2. A design team, consisting of product managers, sales managers and packaging engineers, should also be able to score the direct commercial competitor products. Hence the relative position to these products in the graph can be discussed, presenting arguments either why a packaging may be more voluminous, or why it should be less voluminous, than the competition.

Here products A, B and C could form a realistic market segment, where it can be argued that differences should be minor, but that the focus of packaging C would be more on front-face area, where a packaging A would have the strongest focus on high quality and original presentation of the product, both on the outside of the package as on the inside. Other positions in the triangle would justify other measures. Packaging E would be strongly focused on front face area, and have high finishes on the outside, but a rather plain inside of the package. Packaging D would be more like the classic, efficient brown cardboard box, but with some attention to experience (mainly printing, and not additional materials or volume).

## 8. Discussion and conclusions

Royal Philips Electronics uses the slogan “Technology should be as simple as the box it comes in”. This paper has illustrated that in the current CE market, there is nothing simple about the packaging. Customer Relationship Management (CRM) has been complicated now that the power in the value chain has shifted to these customers (large retail chains). Supply Chain Management (SCM) has been complicated by globalization; working with new packaging suppliers in low-wage countries. Internal Value Chain management has become more important as more disciplines have become involved in the design of the packaging.

In this challenging design environment the balancing of marketing, logistics and environmental requirements is complicated by the unequal level of sophistication of the available information. Logistics and environmental performance can be calculated, even in a single score. Marketing performance at best could be tested, but often time and budget are too limited to actually do so. In fear of dropping market shares, a ‘better save than sorry’ approach is taken for many products and the marketing

functionalities prevail, resulting in sub-optimal packaging design.

As demonstrated in this paper, a thorough market analysis, combined with an explicit determination of the required mix of packaging functionalities can assist in guarding against unnecessarily voluminous packaging.

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